JARQ 45(4), 371−376(2011) http://www.jircas.affrc.go.jp

REVIEW
Basic Principles for Sustainable Participatory Irrigation Management

Hiromasa HAMADA[1*] and Madar SAMAD[2]

[1] International Water Management Institute (IWMI) Southeast Asia Office (c/o National Agriculture and Forestry Research Institute (NAFRI), Ban Nongveingkham, Xaythany District, Vientiane, Lao P.D.R.)

[2] IWMI South Asia Office (c/o ICRISAT, Patancheru, 502324, Andra Pradesh, India)

Abstract

Participatory irrigation management (PIM) is an approach in which farmers participate in all stages of irrigation development through to operation and maintenance, and is implemented in many developing countries. Irrigation management transfer (IMT), a program of transferring the management of irrigation system from government to local user groups, has also been promoted. However, in most cases these approaches have not been successful, because, for example, of the unfair cost sharing and financial weakness in farmers' organizations. This paper summarizes the current problems of PIM/IMT, proposes basic principles for sustainable PIM, which can be applied to IMT, through a review of the previous studies, and discusses future areas for the sustainable use and management of irrigation systems. The key issues that have contributed to the failure of PIM/IMT are a lack of awareness among farmers of the role and necessity of water users' associations (WUA) and the inherent weakness of WUA. We propose the following principles for functional sustainable irrigation management: (1) The roles of WUA and governance are clear and adequate; (2) Through participation in WUA, farmers are guaranteed that their demand for water is supplied in a timely manner; (3) Farmers receive financial benefits through the use of water, which then allows them to cover the costs of water and associated services; (4) All members are treated equally with respect to water allocation, cost sharing, and decision-making; and (5) Information on the financial status and transactions are disclosed to members of WUA in a transparent manner. These principles are simple but can be applied to all irrigation systems.

Discipline: Irrigation, drainage and reclamation

Additional key words: Equity, Irrigation management transfer, Transparency, Water users' association

Introduction

In the 1950s and 1960s, there was significant global concern over the capacity of agricultural production systems to produce enough food for rapidly growing populations, especially in developing countries. Episodes of severe food scarcity were frequent, especially in the populous countries of southern Asia. The world community responded to the perceived threat in various ways. A major strategy was the rapid creation of new irrigation schemes. These efforts reached a peak in the mid-1970s, when the world's stock of irrigated land was increasing by about 2.5 percent per annum[2]. Many irrigation facilities were planned, constructed, and managed by the government. Invariably, farmers were not consulted in the design or the management of the irrigation facilities. There is clear evidence to show that the spread of irrigation has been a major contributor to the success of the green revolution in Asia and the remarkable increases in agricultural output. By the early 1980s, however, there was widespread dissatisfaction with the performance of irrigation projects, particularly in the large government-managed canal systems, casting doubts on the efficacy of bureaucratic management in the irrigation sector. The 1980s saw the beginning of a search for a new type of relationship between the managers of the irrigated agriculture sector and farmers. With regard to irrigation, this trend led to efforts to promote a participa-

Corresponding author: hamadah@affrc.go.jp
Received 9 November 2010; accepted 2 February 2011.

tory approach to management, involving water users' associations (WUA) and nongovernmental organizations in operation and maintenance. WUA have been promoted and established widely by international agencies, governments, NGOs, and farmers. The main reasons for adopting a policy of participatory irrigation management (PIM), as a way for farmers to participate in all stages such as initiation, planning, design, execution, operation, maintenance, and repairs, are to reduce the unnecessary financial and managerial burdens of governments and to stimulate a more productive and self-reliant irrigated agriculture[6, 8]. In the 1990s, irrigation management transfer (IMT), a program of transferring the management of irrigation system from government to local user groups was also promoted[24].

Many reports on PIM and IMT have been published. Vermillion (1997) evaluated the impact of IMT in 29 case studies, concluding that the impact of IMT reforms cannot be drawn clearly because of a lack of systematic sampling and the limited extent of "before and after" analysis[25]. Usually the main subject of research on IMT is the evaluation of its impact on issues such as finance, operation, maintenance, and agricultural productivity, with the result that some issues were improved and others were not[3, 5, 20]. With regard to PIM, there have been case studies on irrigation management by WUA[15, 17, 19]. However, little research on evaluation of sustainability has been published[14, 22]. The main reason is that factors for sustainable management have not been clear. It is, therefore, necessary to clarify the basic principles for sustainable PIM, which can be applied to IMT, because the final goal of PIM and IMT is sustainable irrigation management by farmers' groups.

This paper summarizes the current problems of PIM/IMT, proposes the basic principles for sustainable PIM through reviews of previous studies, and discusses future areas for realization of sustainable management.

Current problems of PIM/IMT

It is essential for sustainable PIM/IMT that participating farmers meet their obligations for the operation and maintenance of the irrigation system. However, it has often been reported that fee collection rates were not 100%, and in some cases less than 60%, indicating unfair cost sharing and financial weakness. The reasons for the low collection rates were numerous and included a lack of awareness among farmers to pay fees, a lack of capacity of farmers to pay, no sanctions against farmers who do not pay for water use, and a lack of capacity to collect, and transparency of the account conditions in the WUA, whose roles include planning water allocation, delivering water, collecting fees, managing the account, and repairing irrigation facilities[6, 8, 10]. Other unfair factors among participating farmers were reported to be: (1) farmers in upstream areas dominate use of water (e.g., Chao Phraya Delta)[23]; (2) large-scale farmers govern WUA (e.g., India and South Africa)[4, 7]; and (3) female farmers can not participate in WUA (e.g., Kenya)[27].

It is also important that the activities of WUA, such as decisions on water allocation, water supply, and maintenance of facilities, are clear, and farmers understand them and fulfill their obligations. In some cases, however, farmers did not understand the activities of WUA resulting in no significant changes in agricultural performance or in economic return after IMT (e.g., Indonesia and Central Asia)[26,28].

Moreover, a lack of technical capacity in WUA for the maintenance of irrigation facilities, such as pumps, is a problem for sustainable management. In Laos, pump irrigation schemes were developed along river systems where irrigation water can be directly lifted from the rivers. However, due to difficulties in repairing fixed pumps in Laos, broken pumps were abandoned, resulting in a decrease in irrigation area[18].

In summary, the causes of problems in PIM/IMT are: (1) a lack of awareness among farmers of the necessity of WUA; and (2) weakness of WUA (poor management, weak finance and lack of technical capacity, etc.).

Basic principles for sustainable participatory irrigation management

It is necessary to clarify the basic principles for sustainable PIM. Ostrom (1992) proposed eight design principles for long-enduring, self-organized irrigation systems[13]. Yoder (1994) indicated 11 characteristics of successful locally managed systems referring to Ostrom's principles: (1) interrelationship between construction and management (clarification of the water management roles of the organization); (2) ownership and membership; (3) security of the irrigation supply; (4) strong organization (authority vested in the system members makes it possible to modify its rules and adapt its procedures to changing conditions, such as water shortages); (5) representation (all irrigators have a voice in making decisions); (6) monitoring; (7) resources mobilization (to contribute labor and other essential resources to keep systems maintained and operating); (8) communication; (9) accountability; (10) accounts and records; and (11) conflicts and sanctions[29]. The factors for successful PIM indicated by Yoder are summarized

as: (1) clear roles of WUA; (2) members' awareness of PIM; and (3) suitable practice of irrigation and association management. Abernethy et al. (2000) analyzed four irrigation systems in the Niger River valley according to these principles and concluded that these irrigation systems did not appear to be sustainable[1].

Meizen-Dick (1997) indicated that participation would be enabled by a legal framework, ownership, and financial viability by review of irrigation programs in the Philippines, Sri Lanka, Pakistan, Senegal, the United States, and Mexico[11]. Onimaru et al. (2003) proposed a new policy for establishing a water users' organization in the Chao Phraya Delta in Thailand, which took into consideration the clarification of roles of the organizations and the improvement of farmers' motivation[12]. Ounvichit et al. (2006) introduced the intake-based irrigation cost sharing of the centuries-old, self-organizing *Muang Fai* irrigation system in northern Thailand[14]. Sato et al. (2007) discussed the principles and methods for PIM, including the goals of irrigation management and obtaining farmers' cooperation in implementing water management systems. In addition, the principles for role sharing by government and farmers were discussed. They stressed that equal water allocation can realize maximum yield, which is the major target of governments in water management, under some simplified conditions: i.e., there is no water conveying loss and the amount of irrigated water dominates the yield[21]. Pant (2007) analyzed conditions for successful irrigation management in India and proposed a format for assessing WUA performance based on these conditions (Table 1)[16]. Teamsuwan and Sato (2009) analyzed the history and status of three water users' organizations (WUO) in the Chao Phraya Delta, concluding that a pump irrigation project was regarded as a successful case in terms of long-term management. It entailed upfront electricity costs, which gave farmers added impetus to organize a management system and budget. In contrast, the farmers in the gravity irrigation projects lacked the impetus to realize a necessary common management budget. They proposed a way to create willingness in farmers to pay the fees and to participate in WUOs[22].

Using these results, a relationship between government and WUA and basic principles for sustainable management were proposed (Fig.1). Because it is inevitable that problems that WUA cannot solve occur, governments need to support these areas[21].

As mentioned previously, the causes of PIM/IMT problems are a lack of awareness among farmers to WUA and its weaknesses. It is essential for sustainable PIM that the roles of WUA are clear and sufficient. Usually, some farmers do not pay for water use, which means that they can get water without participation. This results in a decrease in WUA membership and a shortage in the water management budget. It is necessary to realize that the only farmers who participate in WUA can get the guaranteed amount of water in a timely manner. If they do not participate, they cannot get any water. The benefits from irrigation are also important. Farmers receive benefits from using water and pay service fees resulting in the stable financial conditions of the WUA. Sato et.al (2007) stressed that equity in water allocation, cost sharing, and decision-making among members is essential for sustainable PIM. They also mentioned that WUA requires financial transparency[21].

The definition of PIM by the World Bank is the involvement of irrigation users in all aspects and at all levels of irrigation management[6]. However, the requirements for sustainable PIM are not mentioned. It is important to propose the basic principles for sustainable management. If an irrigation project meets all the principles, it will be sustainable. Reported unsuccessful cases did not meet some of the principles, indicating that there is room for improvement. The proposed principles for sustainable PIM are common in any irrigation project: e.g., surface water irrigation and groundwater irrigation.

Future approaches to realize the principles

1. Scale of irrigation

It is necessary to collect more information on successful cases of sustainable PIM. One approach involves considering the scale of irrigation. The realization of basic principles in small-scale irrigation would be easier than in large-scale irrigation, where more information would have to be collected on successful cases. However, the definition of the scale of an irrigation project is not clear, with the result that scale is not often considered in analyses of PIM/IMT. Ouvichit et al. (2008) defined that small-scale irrigation is where irrigation users know each other and their leaders personally know every water user. In such a system, all users are thoroughly familiar with the field conditions and other information such as account conditions, and these cases tend to be successful. On the other hand, in large-scale irrigation systems where it is not possible for all users in the system to know each other, it is difficult not only to reach agreements among members on water allocation and cost sharing but also to operate and maintain irrigation facilities technically[15]. Most reported cases of large-scale irrigation systems have experienced problems such as unequal water allocation and cost shar-

Table 1. Format for assessing WUA performance

	Level of performance				
	Excellent		Average		Very poor
	(5)	(4)	(3)	(2)	(1)
Activities					
A. Level of participation					
Leadership					
Membership awareness about WUA status					
Productive meeting					
Voluntary physical/labor contribution					
Voluntary financial contribution					
Social audit/Transparency					
B. Operation and maintenance					
Removal of silt and weeds					
Repairs/maintenance of structure					
Protection of structure					
Dispute management					
C. Water management					
Adequate and timely water supply					
Information about water distribution					
Efforts to save water					
D. Financial management					
Fund generation					
Utilization of maintenance and operation fund					
Recovery of irrigation fee (when applicable)					
Financial audit					
E. Organizational linkage					
Horizontal links with other WUAs					
Vertical linkage					
Information and communication					
Discussion with competent authority					

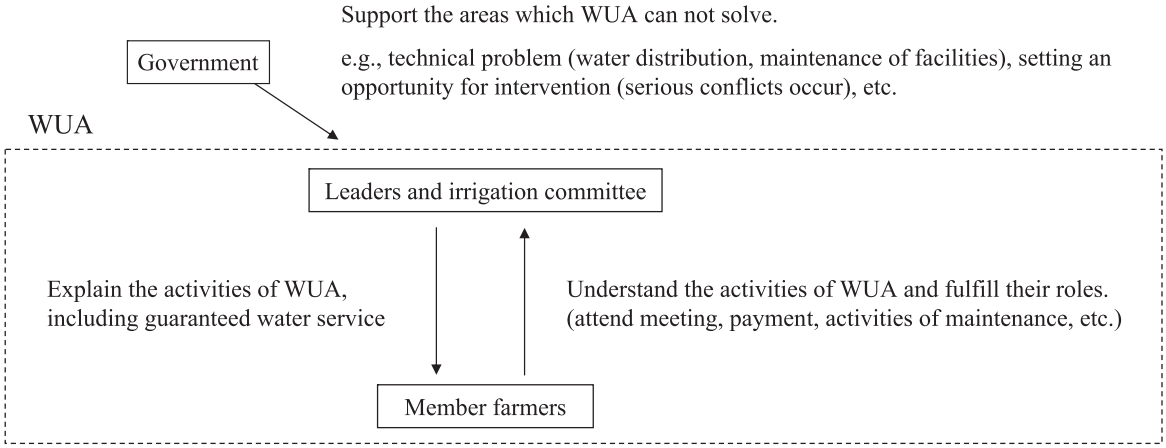
From reference 16 (Some parts are revised.)

ing[6, 10, 23, 28]. With regard to small-scale irrigation, Ounvichit et al. (2006) reported the cost sharing and sustainability of the Pongsak *Muang Fai* irrigation system. *Muang Fai* is a surface water irrigation system in northern Thailand, including weirs and ditches. Farming areas in a Pongsak *Muang Fai* irrigation system are about 15 ha, comprising 24 ownerships plots; this indicates a small-scale irrigation system. The members share the cost based on farm intakes, and transparency in cost distribution supports the sustainability of the system[14].

For the realization of sustainable PIM, it is essential to collect more case studies in the small-scale irrigation systems mentioned by Ounvichit et al. In addition, it is necessary to analyze the management of large-scale irrigation projects and compare them with small-scale irrigation projects, to summarize problems in each project, and to propose solutions. Sustainable PIM in large-scale irrigation is difficult because problems vary depending on the regions. Continuous research on case studies is required.

2. Cases of water shortage

The basic principles presuppose that there was sufficient water to distribute the guaranteed amount of



Basic principles for sustainable management (Precondition: Sufficient water to distribute to members)

1) The roles of WUA and government are clear and adequate.
2) After participating in WUA, they get the guaranteed amount of water in a timely manner. (If not, they cannot get water)
3) Farmers receive tangible benefits from using water, and which then allows them the ability to pay service fees for water.
4) All members are equal in water allocation, cost sharing and decision-making. The management of WUA is based on the agreement of their members.
5) Information such as the account status of a WUA is disclosed to all members.

Fig.1. Relationship between government and WUA, and basic principles for sustainable management

water. However, water shortages are inevitable because of erratic rainfall. They hinder the guaranteed water service to farmers resulting in conflicts among farmers. It is necessary to prepare against water shortages. Because case studies on measures against water shortage in developing countries have not been published, we will use a Japanese case. The Toyokawa Irrigation Project is managed by five organizations, including the government and farmers' organizations. The Japan Water Agency (JWA), which is a government organization has established a Water Saving Committee (WSC), which consists of 14 members from the five organizations. Water allocation in the case of water shortages is adjusted by the WSC so that all members of the organizations receive an equal amount of water[9]. The Japanese system was established after a long period when conflicts among farmers repeatedly occurred. Features of the system are: (1) participation of farmers in the decision-making process at all levels; (2) farmer organizations that give every farmer the opportunity to express his opinion; and (3) a clear role sharing system.

Conclusion

This paper summarized the current problems of PIM/IMT, proposed some basic principles for sustainable irrigation management, and discussed future approaches. The causes of problems are: (1) a lack of awareness among farmers to the necessity of WUA; and (2) the weakness of WUA. Our proposed principles for sustainable irrigation management are as follows:

(1) The roles of WUA and government are clear and adequate.
(2) Farmers understand the necessity of irrigation. After participating in WUA, they can get the guaranteed amount of water in a timely manner.
(3) Farmers receive tangible benefits from using water, which then allows for the ability to pay service fees for water.
(4) All members are equal in water allocation, cost sharing and in the decision-making process. The management of WUA is based on the agreements of their members.
(5) Information such as account status of WUA is disclosed to all members.

These are simple proposals, but can be applied to all irrigation systems. The next steps are to propose a method of evaluation of the basic principles and to apply it to various fields.

References

1. Abernethy, C. L. et al. (2000) Farmer-based financing of operations in the Niger Valley irrigation schemes. *IWMI Res. Rep.*, **37**, 1−36.
2. FAO : FAOSTAT, FAO Statistic database. http://faostat.fao.org/.
3. FAO (2007) Irrigation management transfer, Worldwide efforts and results. *FAO Water Rep*., **32**, 1−53.
4. Faysse, N. (2004) An assessment of small-scale user' inclusion in large-scale water user associations of South Africa. *IWMI Res. Rep*., **84**, 1−37.
5. Giordano, M. A. Samad, M. & Namara, R. E. (2006) Assessing the outcomes of IWMI's research and interventions on irrigation management transfer. *IWMI Res. Rep*., **106**, 1−28.
6. Groenfeldt, D. & Svendsen, M. (2000) *Case studies in participatory irrigation management*. World Bank Institute, Washington, D.C., pp.1−157.
7. IWMI-TATA (2003) Water policy briefing. IWMI-TATA water policy program, **6**, 1−7.
8. JIID (2007) *Guideline for on-farm irrigation development and management in Monsoon Asian Countries*. JIID, Tokyo, pp.1−281.
9. Kono, S. et al. (2007) Participatory system for successful water management in the Toyogawa Irrigation Project, Japan. The 4th Asian regional conference & 10th international seminar on participatory irrigation management, Tehran, Iran http://www.irncid.org/pim2007/Articles.aspx?ID=4&Cateld=7.
10. Maleza, M. C. & Nishimura, Y. (2007) Participatory processes and outcomes: The case of national irrigation system management in Bohol, Philippines. *Irrig. and Drain*. **56**, 21−28.
11. Meinzen-Dick R. (1997) Farmers participation in irrigation, 20 years of experience and lessons for the future. *Irrig. and Drain. Syst*, **11**, 103−118.
12. Onimaru, T. et al. (2003) The present situation and problems of the establishment of water users' organizations in Chao Phraya Delta. *Trans. of JSIDRE*, **225**, 119−126.
13. Ostrom, E. (1992) *Crafting institutions for self-governing irrigation systems*, Institute for contemporary studies, San Francisco, pp.67−79.
14. Ounvichit, T. et al. (2006) Cost sharing and sustainability of Pongsak Muang Fai irrigation system. *Paddy Water Environ*., **4**, 81−88.
15. Ounvichit, T., Wattayu, S. & Satoh, M. (2008) Participatory management structure of large-scale people's irrigation system: The case of the Soprong *Munag fai* system, northern Thailand. *Tonan Ajia Kenkyu*, **46**, 145−162.
16. Pant, N. (2007) PIM/IMT: Conditions of success in large canal systems of India. The 4th Asian regional conference & 10th international seminar on participatory irrigation management, Tehran, Iran http://www.irncid.org/pim2007/Articles.aspx?ID=4&Cateld=7.
17. Perera, L. R. et al. (2007) Towards establishing a system of monitoring and evaluation for participatory irrigation management and development program in Cambodia. IWMI report to AFD, Colombo, pp.1−35.
18. Phengphaengsy, F. (2005) Sustainable irrigation project in Laos, Effective water management of pump irrigation projects in the Mekong River and its tributaries. Tokyo University of Agriculture and Technology, Master thesis, pp.9−18.
19. Samad, M. & Vermillion, D. (1999) Assessment of participatory management of irrigation schemes in Sri Lanka: Partial reforms, partial benefit. *IWMI Res. Rep.*, **34**, 1−31.
20. Salas, S., M. A. & Wilson, P. N. (2004) A farmer-centered analysis of irrigation management transfer in Mexico. *Irrig. and Drain. Syst*., **18**, 89−104.
21. Sato, M., Kono, S. & Onunvichit T. (2007) Principles and methods for participatory irrigation management and role sharing between government and farmers. The 4th Asian regional conference & 10th international seminar on participatory irrigation management, Tehran, Iran http://www.irncid.org/pim2007/Articles.aspx?ID=4&C ateld=7.
22. Teamsuwan, V. & Satoh, M. (2009) Comparative analysis of management of three water users' organizations: successful case in Chao Phraya Delta, Thailand. *Paddy and Water Environ*., **7**, 227−237.
23. Teamsuwan, V. et al. (2010) Analysis of water management structures of an integrated water user group in the Chao Phraya Delta, Thailand. *Paddy and Water Envriron*., **8**, 51−61.
24. Vermillion, D. (1992) Irrigation management turnover: Structural adjustment or strategic evolution. *IIMI Rev*. **6**(2), 3−12.
25. Vermillion, D. (1997) Impacts of irrigation management transfer: a review of the evidence. *IWMI Res. Rep*., **11**, 1−35.
26. Vermillion, D. L. et al. (2000) An assessment of the small-scale irrigation management turnover program in Indonesia. *IWMI Res. Rep*., **38**, 1−36.
27. Watson, E. E. et al.(1998) Indigenous irrigation, agriculture and development, Marakwet, Kenya. *The Geogr. J.*, **164**, 67−84.
28. Yakubo, M. & Hassan M., U. (2007) Mainstreaming rural poor in water resources management: Preliminary lessons of a bottom-up WUA development approach in Central Asia. *Irrig. and Drain*., **56**, 261−276.
29. Yoder R. (1994) *Locally managed irrigation systems-Essential tasks and implications for assistance, management transfer and turnover programs*, International Irrigation Management Institute, Sri Lanka, pp.81−85.