Socio-economic evaluation of sustainability of participatory irrigation management in Ban Sawang, Khon Kaen Province, Thailand

Hiromasa Hamada[1)], Nongluck Suphanchaimat[2)]

[1)] Soukphasith Survey-Design and Construction Sole Co., Ltd, Ban Nong Nieng, Vientiane Capital, Lao PDR
Tel: 856-20-22095810, E-mail:hamadah1015@gmail.com
[2)] Faculty of agriculture, Khon Kaen University

Abstract

Irrigation is essential to enhance agricultural production especially groundwater irrigation for intensive crop cultivation. However, reports on irrigation management mentioned that it was less successful than expected. One reason is that factors for sustainable irrigation management are not clear. In this research, we proposed items of questions for evaluation of sustainability of participatory irrigation management (PIM) that applied to a rural development project in Ban Sawang, Khon Kaen Province. A case study method together with an interview with about 30 percent of users was implemented in August to October, 2011. The results revealed that groundwater irrigation was collectively managed and factors for sustainable PIM were suitable water users' group (WUG) management, water supply and economic status of farmers and WUG. Ban Sawang where hygienic vegetable is produced by groundwater irrigation is regarded as a successful case of PIM.

Keywords: Participatory irrigation management, Sustainability, Groundwater irrigation, Intensive crop production

1) Introduction

Irrigation is essential for enhancing and stabilizing agricultural production, indicating one of important activities for rural development. After World War II, irrigation land has been increased, especially in the mid-1970s when the annual increasing rate was about 2.5% [1]. Many of the irrigation facilities were planned, constructed and managed by the government, often with financial support from international donor agencies. Farmers as users were not consulted in the design or in the management of the irrigation facilities. By the early 1980s there was widespread dissatisfaction with the performance of irrigation projects, physically, economically and financially. The government bureaucracies lack incentives and responsiveness to optimize the management performance [2].

During the 1980s, international organizations made efforts to promote a participatory approach to irrigation management, involving water users' association in operation and maintenance. Participatory irrigation management (PIM) and irrigation management transfer (IMT) which is a program to transfer irrigation management from government to local users group have been extended in developing countries. After three decades, however, there are many reports that PIM and IMT have been less successful than expected and a case that PIM discontinued has been reported [3] [4]. The main reason is that factors for sustainable irrigation management were not clear. Hamada and Samad (2011) mentioned basic principles for sustainable PIM by reviewing previous studies [5]. In this research, we propose items of questions for evaluation of sustainability of PIM based on their principles and apply to a rural development project in Khon Kaen Province which appears to be a successful case.

2) Purpose

The purposes of this research are:

1. To propose items of questions for evaluation of sustainability of PIM
2. To apply them to a project of rural development and evaluate sustainability of PIM socio-economically.

3) Theory

Hamada and Samad (2011) proposed the following principles for sustainable irrigation management: (1) The rules of water users' group (WUG) and governance are clear and adequate; (2) Through participation in WUG, 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 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; (5) Information on the financial status is disclosed to all members of WUG in a transparent manner. These principles can be applied to all irrigation systems such as surface water and groundwater. It is necessary to aim at achieving these principles for sustainable PIM [5].

4) Methodology

4.1) Study site

Ban Sawang is located about 20 km northeast of Khon Kaen city. Department of Groundwater (DGR) promoted groundwater use for agriculture in order to improve rural livelihoods. Ban Sawang is one of pilot sites of these projects. This area became famous for chemical–free supplier recently and appears to be a successful case. Usually, reports on PIM mentioned unsuccessful cases. We expected that Ban Sawang would be a successful case of PIM and selected it as a study site. There are 289 households or 1,182 people in 2011. Total agriculture land is about 400 ha. Topography is undulating hill where 50% is rice field and 30% is upland crops. All farmers grow rice. Over 60% of farmers planted sugar cane and few farmers planted cassava and recently rubber. There are three wells. One (1st well, 60 m deep) is used for domestic consumption and the others are used for hygienic vegetable production. Public land near the 2nd well (78 m deep) in the village was allocated to farmers in 2008. Each farmer received small land (0.03ha) for hygienic vegetable production using village groundwater system. It is referred to as the old plots. As market for vegetable expands, the 3rd well (78m deep) was drilled in 2009. The district office provided funding to clear 6.4 ha public land in upland. About 100 farmers were provided with 400 m^2 of land for vegetable planting. It is referred to as the new plots (Fig.1) [6].

According to Charernnaw et al.(2011), groundwater safe yield was calculated to be about 2000 m^3/day which was 10 times as the current groundwater use, indicating groundwater use at sustainable level [7].

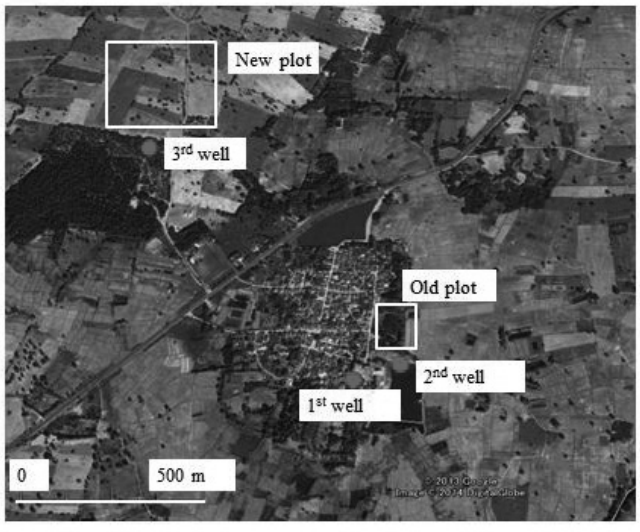

Fig.1 Study site (Ban Sawang)

4.2) Field survey

An interview with 30 farmers out of about 100 farmers was implemented in August to October, 2011 in order to access basic rules and regulations in the WUG that

supported sustainable PIM. We used random sampling from the name list of vegetable growers in the village taking the minimum size of 30 farmers which is more than 20 % of the total growers. Most of the interviewed farmers were female and average age is 56 years (40-72 age range). All were members of the vegetable production cooperative that was recently established for marketing purpose. The average farm size is 18 rai (1rai =1600 m^2) with the range of 4 – 33 rai. Over 70% of the member has off-farm work and most workers have been supported the family at average of 28,050 baht per year.

Details for irrigation management were formulated based on the basic principles by Hamada and Samad (2011). Table 1 shows the basic principles and items of questions related to them. Main issues of the questions are management of WUG, water supply and economic status of participating farmers and the WUG. For farmers' opinions regarding to the groundwater use, we used Likert scale (1-5). The maximum satisfaction level is 5 and the lowest is 1. We also investigated the history of water resource development by interview with district officers and farmers. It is important to note that the definition of PIM by the World Bank is the involvement of irrigation users in all aspects and at all levels of irrigation management. In addition, we asked current problems regarding to the groundwater use in order to clarify factors to hinder PIM in future.

Table 1 Basic principles and items for questions

Basic principles	**Items of questions**
(1) The rules of water users' group (WUG) and governance are clear and adequate.	(1) Adequacy of roles of WUG (2) Awareness of members to roles of WUG
(4) All members are treated equally with respect to water allocation, cost sharing and decision-making.	
(5) Information on the financial status is disclosed to all members of WUG in a transparent manner.	
(2) Through participation in WUG, farmers are guaranteed that their demand for water is supplied in a timely manner.	(5) Fee collection rate (6) Rate of attending meetings (7) Rate of participating in activities of WUG such as maintenance (8) Farmers' satisfaction with water supply
(3) Farmers receive financial benefits through the use of water, which allows them to cover the costs of water and associated services.	(9) Farmers satisfaction with income by irrigation (10) Account condition of WUG

5) Results

5.1) History of water resource development

The history of development is as follows:

In 2008, villagers were solicited to grow hygienic vegetables by district officers. A public land at the center of the village that used to be a village school was taken back by the village after the school moved out. Each farmer was provided with small plots of public land (0.03 ha) which was installed with pipeline from the 2nd well. Since then, villagers have been engaged in cultivation of hygienic vegetables and have been renowned for chemical free vegetable suppliers.

In 2009, 3rd well was drilled by DGR.

In 2010, the village has contracted by one supermarket to supply hygienic vegetable regularly. To increase production, the buyer and the district office provided funding to clear new area at another village public area and installed with pipeline from the third bore well. Each farmer received 400 m^2. Villagers started planting vegetables at the new plots.

The cultivation of hygienic vegetable started from the initiative of district officers and water users participated from the initial stage. After drilling a new well, they tapped a new market immediately. As an effect, farmers increase employment and income.

5.2) WUG management

Groundwater supply system has been transferred to local government or Tambun Administration Office (TAO) after its inception. Water management was designed and carried out by villagers. The cost of water is 4 baht/m^3 based on amount of used water, which encourages farmers to save water. At Ban Sawang, a water committee is the subset of village committee which consists of 7 members. The village head chairs the water committee within the 7 members. 3 members are responsible for recording water meter and collect money. They receive allowance at 1,000 baht per month. They report financial status at the village meeting every month and have to inform the TAO. If the well is broken, the village water fund should be used together with TAO budget to fix it. Water meter and pipes to each field are handled by each user with the help of the water committee. The water fund is reported at the village meeting, and informed the chairman. So far, farmers do not participate in day to day operation as long as they agree upon the fee and know that the main system will be maintained by the committee and the TAO. Water management for agriculture at Ban Sawang is similar to village water supply system for domestic use. It is charged by water utilization rate and farmers can use water at any time so the water matter can be integrated into the village management system.

Our results show: (1) The roles of water users' group and governance are clear; (2) All members are equal in water allocation, cost sharing and decision-making; and (3) Information such as financial accounts of the WUG is disclosed to all members. However, farmers tend to leave works for irrigation management to the water committee. It is necessary to enhance their consciousness to irrigation management.

5.3) Farmers' opinions regarding village pipe water system

It is important for sustainable PIM that members get guaranteed amount of water in a timely manner after participation in the group. Table 2 shows farmers' opinion regarding village pipe water system (Very poor:1, Excellent:5). The average score were more than 4 indicating that satisfaction level is high. It means that farmers receive enough water when they need.

Table 2 Farmers' satisfaction level

Items	Average score	SD
Satisfy with village water committee	4.00 (Very poor:1, Excellent: 5)	0.79
Satisfy with village water costing system	4.10	0.71
Confident in the village pipe water system	4.20	0.71
Satisfy with pipe water system	4.43	0.68

5.4) Farmers' economic status

On average, farmers can earn about 89,203 baht per year of which 82% can be obtained from agricultural sources. Major source (47%) of agricultural income is from field crops such as sugarcane and cassava whereas 17% of the income can be derived from vegetable selling which is slightly higher than income from rice. Table 3 shows economic status in one crop cycle of vegetable production. Although vegetable plots are small, the intensive farming and cooperative supports in marketing enable them to get net positive benefits and to pay fee for water use. The satisfaction level of farmers was 4.32 (SD: 0.77) indicating that farmers are satisfied with the income from vegetables.

Table 3 Cost and return in one crop cycle of vegetable production

Item	Old plot (105m^2)		New plot (400 m^2)	
	Baht	%	Baht	%
Imputed labor cost	499.6	32.7	1,716.7	52.1
Material cost	452.0	29.6	511.0	15.5
Water cost	65.8	4.3	200.0	6.1
Other	510.0	33.4	866.7	26.3
Average revenue (Baht per crop)	3,395.8		5,666.7	
Net return (Baht per crop cycle)	1868.4		2,372.4	
% net return to income	55%		42%	

5.5) Current problems

Now, farmers cultivate hygienic vegetables at the old and new plots through a year. In rainy season (May to September), soil moisture exceeds appropriate range to produce required-quality vegetables resulting in a problem of under supply (21 answers out of 30farmers). Meanwhile, 16 farmers answered over supply in dry season (October to April). Technical advices on suitable cultivation and control of production are required to meet the demand of vegetables.

6) Summary

We proposed items of questions for evaluate sustainability of PIM socio-economically and applied to a groundwater irrigation project in Ban Sawang. As a result, it was revealed that management of WUG is necessary to ensure sustainability. Farmers get benefits by intensive agricultural production like hygienic vegetable and they are satisfied with irrigation management. We judged that Ban Sawang is a successful case of PIM. However, vegetable supply to meet its demand is a problem indicating that it is necessary to advise suitable cultivation and supply control technically.

7) Recommendation

7.1) Recommendation gained from the research

It is required to aim at achieving basic principles such as management of WUG, water supply system and financial status of WUG for sustainable irrigation management. Sustainable irrigation development needs multi-discipline approach such as irrigation, socio-economic research and crop production.

7.2) Recommendations for future studies

In this research, a groundwater irrigation project was analyzed. We have to conduct more case studies such as a large-scale surface water irrigation and long-time monitoring of some irrigation sites in order to produce a guideline for development of sustainable irrigation

management.

8) Acknowledgment

This research was conducted by IWMI under the project, "Survey on analytical estimation of participatory irrigation management."

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