What Role Can Traditional Irrigation Play in Rural Development? A Study from Northern Thailand

In northern Thailand, locals are primarily employed in rice farming, orchard cultivation, or cash crop growing. Water is therefore a vital resource throughout the year. To get the water they need, many farmers participate in the "muang fai", a small-scale, communal irrigation system that has been practiced for centuries. This traditional system is currently being challenged by the introduction of various alternative irrigation technologies, such as the privately-owned underground pump irrigation system.

There has been little economics research to assess the benefits of the "muang fai" system, especially its role in northern Thailand rural development. To help fill this gap, a new EEPSEA study has explored the various factors that influence farmers' participation in the system. It also compared this traditional approach with the underground pump irrigation system that is threatening to replace it.

The study findings show that the "muang fai" system is not only better than underground pump irrigation in terms of water use efficiency, but that it is also better at improving the farmers' livelihood. The study therefore concludes that the "muang fai" should be supported and improved, and recommends that the Thai government should fully or partially subsidize investment in new canals to make water from the "muang fai" system more accessible.

A summary of EEPSEA Research Report No. 2013-RR17: "Muang Fai" Irrigation System in Northern Thailand: Farming Productivity and Water Use Efficiency’ by Ms. Arriya Mungsunti, Charles Stuart University, New South Wales, Australia. Email: arriya.mungsunti@gmail.com
The irrigation challenge in Thailand

Large and medium-scale irrigation systems in Thailand have not yet managed to provide adequate water to a large number of farmers who still rely on dry land agriculture. This has stagnated improvements in the welfare of rural farmers. In addition, dam construction cannot be the universal solution to inadequate agricultural water supply due to various geographic, geologic and other technical reasons. This means that interest is currently high in the role that traditional irrigation systems – such as the muang fai – can play in rural development.

The muang fai irrigation system (Figure 1) relies on surface water from rivers and streams and is managed through community-based participation that has undergone little change for generations. This system is over 700 years old and applies local knowledge in managing water for agricultural purposes.

The objective of the EESEA study was therefore twofold. First, to explore the various factors that influence farmer participation in the muang fai irrigation system. Second, to compare the muang fai system and the underground pump irrigation system by identifying which is better at generating economic benefits (measured by farm productivity) and environmental benefits (measured by water use efficiency).

The study area

The chosen study area was the San Pa Tong District of Chiang Mai Province. A communal irrigation system – the muang fai Sop Rong – has been practiced in the region for many generations. This system still preserves many of the original physical features and traditional management practices. It is located on the right bank of the Ping River, one of the headstreams of Chao Phraya River, the principal river of Thailand. The irrigation system distributes water using a 7.8 km-long main canal, which traverses 12 villages in the Manka District and 3 sub-districts in San Pa Tong. Water either flows from the canal or is pumped to the farmland where it is used.

The muang fai Sop Rong management group sets up rules and agreements for general water management and maintenance. The agreements outline how each village that joins the muang fai Sop Rong should contribute to the group, usually by maintaining their own water management systems. Fair water distribution is the key element of the approach. The muang fai farmers’ fees help maintain the irrigation system.

Farmers in the Sop Rong area use muang fai water for either paddy farming, longan orchards, or growing crops for domestic consumption. Many farmers believe that water from the muang fai is vital for their crops and they report that they hardly ever face any extreme water shortage problems. However, as mentioned, some farmers in the area do not participate in the muang fai and have instead engaged in underground pumping irrigation.

Collecting information from farmers

To get the information required for the study, a survey was carried out targeting 481 longan farmers who are located within the 12 villages that are part of the muang fai Sop Rong. Longan is one of the main crops of the region. The survey respondents were divided into two a) muang fai members and b) non-members who engage in underground pumping irrigation.

Through the survey, information on farm structure, land use, farm typology, and the socio-economic characteristics of farmer-households were collected. Farmers were also asked about their reasons in choosing the irrigation system to use. The rate of water flow that farmers enjoyed (from either the muang fai system or from their underground pumps) was measured at 45 households (top-right photo).

Factors that affect participation in muang fai

Using a logistic model, the collected survey data was analyzed to determine the factors that affect the likelihood of farmer participation in the muang fai. The study found that the factor that most strongly affects farmer participation is the distance of their fields or orchards to the closest muang fai canal; the shorter the distance to the canal, the more likely it is that a farmer will use water from it.

Another key factor in determining muang fai participation was farm size. The relationship between farm size and participation was found to be non-linear. For farms with an area of less than 5.95 rai (0.95 ha), an increase in land area made it more likely that a farmer would participate in the muang fai system. However, for farms larger than 5.95 rai, the probability of participation decreased as farm size increased (Figure 2).

This effect of farm size on muang fai participation is thought to be because the larger a farm, the more it needs its water supply to be from a source that can be used more flexibly. With the muang fai system, there is a constraint on when a farmer can take water because of the need to consider other members in line. With a private underground pump system, a farmer has more flexibility, and such flexibility may be needed with larger farms. However, for small-scale farms where the length of irrigation time is not so important, an increase in farm size (and therefore water demand) may instead positively affect participation.

Unexpectedly, results also show that the more experience a farmer has, the less likely they are to participate in muang fai. Part of the reason for this could be that experienced farmers are concerned about the uncertainty of water availability in times of drought. They therefore feel that it is risky to rely on muang fai water. These farmers may feel more secure if they have an underground water supply over which they have full control.

It was also found that richer farmers tend to use underground pumps (instead of participating in the muang fai) as they are more able to afford the technology. The study also shows that farmers who live in a village that has more muang fai members tend to have a higher probability of participating in the system. This shows the importance of networking and information on participation.

Effectiveness of the muang fai system

The Propensity Score Matching (PSM) method was used to estimate the impact of muang fai participation on farm productivity and water use efficiency. This method assigns each farmer in the sample a propensity score, which measures their probability of participating in the muang fai system, regardless of actual membership. The propensity score was estimated through logistic regression using various farm, demographic and socio-economic characteristics collected from the survey. Productivity comparison between muang fai members and non-members was then done.
based on similarity of propensity score. By comparing the productivity of a subset of farmers in both member and non-member groups that share the same propensity score, other factors that may explain their differences in productivity, other than muang fai participation, was then eliminated.

The PSM analysis shows that participating in the muang fai irrigation system results in a significant increase in farm productivity, because it significantly increases the sales value of crops. This increase is between THB 4,721 and THB 6,399, which is equivalent to an increase of 30% to 44% in sales value.

This may be partly explained by the fact that the muang fai water quality is better than that from underground pumping, as reported by farmers during the focus group discussions conducted by the study. Water quality tests conducted also confirm this; muang fai water is of a substantially better quality than underground water in terms of salinity and trace elements like iron content. Better water quality resulted in higher longan fruit quality, and better market prices. Farmers also reported that muang fai users spent less time pumping water onto their farmland (as compared to those using underground pumps) and that this led to lower petrol costs.

The study also found that the muang fai irrigation system is much more efficient at using water. With the underground irrigation system, average water use is about 10,800 m^3/ha per year. If farmers using the underground pumps used muang fai irrigation instead, they would conserve almost half of their water consumption (45%).

The muang fai system also provides other community benefits. The fieldwork study showed that strong community relations are essential to the successful operation of a muang fai irrigation system. This is because the process of constructing and maintaining the irrigation canals brings about cooperation and reduces conflict among water users. Presently, with water conflicts taking place in many regions, it’s no surprise to find that many villagers believe that water management under the muang fai system is worth investigating.

**Key policy implications**

One of the key findings of the study is that some farmers within the irrigation area are willing to become muang fai members, but they can’t do so because they can’t access the system’s canals.

To overcome this problem, the study suggests that the government initiate a project to expand the muang fai water canals to reach other surrounding areas. The government could fully or partially subsidize investment in these new canals. Partial subsidy would mean that the beneficiaries of any new canals would need to be charged part of the investment cost. As such, an additional important project element would be to demonstrate to farmers that the benefits they would gain from the new canals (i.e., higher sales price for their crops) would be significantly more than the amount they would be asked to pay.

Overall, it is clear that the muang fai system has a lot to offer in terms of improving farmers’ livelihoods and conserving scarce water resources. Because of this, it is hoped that the study will be useful in demonstrating to the government the benefits of an improvement in the system.

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