

# Learning Through Participation in Joint Management Committees for Reservoir-Level Irrigation Governance in Thailand

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The UN indicates that water for irrigation and food production constitutes one of the greatest pressures on freshwater resources, especially within the Asian region. Recent developments in water management relate to participatory governance, where civil society is included in the political, social, economic, and administrative systems that develop and manage water resources. In Thailand, the Royal Irrigation Department has adopted Participatory Irrigation Management (PIM), which involves multiple sectors of water users in decision-making at all levels of irrigation system management. This research identified learning outcomes associated with participation in Joint Management Committees for Irrigation (JMC), the top PIM governance tier, particularly related to governance and sustainable water management. Our research was qualitative following a case study approach, utilising 51 semi-structured interviews at two sites, participant observation, and document reviews. Results showed that participating in PIM activities facilitated both instrumental (e.g. technical knowledge, skills and information, and task-based learning) and communicative (e.g. insights into the interests of others, communication strategies, and comparative reflection) learning among JMC participants. Findings also showed that action outcomes based on learning were mainly related to adopting new governance systems and conserving water for future irrigation use.

**Keywords:** Participatory irrigation management, learning, governance, sustainability, Thailand

## 1. Introduction

According to UN-Water (2013, p. 1), “water for irrigation and food production constitutes one of the greatest pressures on freshwater resources”. The UN underscores further that sustainable water management can only be achieved through effective water governance (United Nations Development Programme [UNDP], 2012). Participatory Irrigation Management (PIM) is an increasingly common governance approach that promotes the

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involvement of local water users at all levels of decision making to address the shortcomings of technical, government-controlled governance that often results in inefficient water delivery and poorly maintained irrigation systems (Ballet, Sirven, & Requier-Desjardin, 2007; Bassi, Rishi, & Choudhury, 2010; Hamada & Samad, 2011; Pant, 2008; UNDP, 2012; Uysal & Atı̇s, 2010). The inspiration underpinning PIM is that by engaging many stakeholders, participatory water governance could help people to articulate their priorities, exercise their legal rights, meet their needs, and mediate their differences. PIM is also advanced as a promising tool in the development of flexible and adaptable strategies to cope with the complexities and uncertainties associated with contemporary water management, including increasing demand, climate change, and declining water quality (Pahl-Wostl, 2002; Pahl-Wostl et al., 2008).

Moreover, new forms of governance, such as PIM, that include more meaningful public participation encourage individual and social learning which carries the potential to shift perspectives and behaviors that, in turn, can encourage positive social action and institutional change (Marschke & Sinclair, 2009; Pahl-Wostl, 2002; Pahl-Wostl et al., 2008; Sinclair, Kummerdpet, & Moyer, 2013; Webler, Kastenholz, & Renn, 1995). Transformative learning theory, in particular has great potential for understanding the linkages amongst public engagement, dialogue, learning that leads to individual perspective transformation, and individual and collective action that supports decision-making for sustainability (Diduck, Sinclair, Hostetler, & Fitzpatrick, 2012; Fitzpatrick & Sinclair, 2003; Sinclair et al., 2013; Walker, Sinclair, & Spaling, 2014).

It has been established that certain deficiencies associated with PIM including lack of awareness, a balance of power that favors top-down management, inequitable opportunity for participation (e.g. head-end vs. tail-end users, small-scale vs. large-scale farmers, gender imbalance), lack of transparency and accountability, and lack of technical capacity, frequently hinder the realization of such positive outcomes of PIM in practice and these would no doubt also impact the learning potential of PIM (Clark & Semmahasak, 2013; Hamada & Samad, 2011; Teamsuwan, Satoh, Onimaru, & Boonkird, 2010).

In Thailand, the Royal Irrigation Department (RID) has adopted PIM governance for irrigation and characterises it as the involvement of both Water User Organisations (WUOs), representing individual farmers, and Local Administrative Organizations (LAOs) in decision-making about irrigation management and operation of an irrigation system. Although WUOs have existed since the 1960s in Thailand, they were relatively ineffective nationally until change was initiated in 1999 when the Modernization of Water Management System project introduced by the Thai government included strengthening WUOs as one of its primary goals (Shioda & Onimaru, 2007). PIM was further developed in 2001 to 2003 with the launch of a series of pilot projects financed by the Asian Development Bank and was formally recognised in the 2004 RID strategic plan (Royal Irrigation Department [RID], 2004). WUOs currently cover approximately 63% of the irrigated land area in Thailand and are comprised of over one million members. While deficiencies remain, PIM schemes in Thailand have resulted in greater ownership and control for local water users over certain elements of irrigation system

management, such as water allocation, operation, and maintenance activities (Kumnerdpet & Sinclair, 2011).

Previous research on PIM in Thailand has primarily focussed on farmers involved in Water User Groups (WUG) and Integrated Water User Groups (IWUG) at the ditch and canal levels, respectively (e.g. Shioda & Onimaru, 2007; Sinclair et al., 2013; Teamsuwan et al., 2010). Clark and Semmahasak (2013) underscore that important decision making often happens above the WUG/IWUG levels, therefore possibly excluding communities from true participatory governance. They observe that Joint Management Committees for Irrigation (JMCs), the top PIM governance tier, are innovative and developing institutions with the potential to promote dialogue and conflict resolution amongst agricultural and non-agricultural stakeholders and improve transparency in decision making. Moreover, “JMC might develop as a multi-scale mechanism for translating sustainable water policy into management practice, bringing new configurations of actors into engagement and creating new opportunity structures for social learning (Clark & Semmahasak, 2013, p. 893).”

Given this context, the purpose of the research was to focus on the JMC governance tier by identifying the learning outcomes associated with participation on JMCs for the associated multi-sector representatives. Transformative Learning Theory was used as a guiding framework in the analysis, which focuses in particular on learning outcomes related to sustainable water management and evolving governance.

## **2. Transformative learning and sustainability**

There has been wide acknowledgement that meaningful public participation in environmental decision making can result in positive individual and social learning outcomes that facilitates the transition to sustainability and promotes good governance (e.g.,; Fitzpatrick & Sinclair, 2003; Jha-Thakur et al., 2009; Moyer, Sinclair, & Diduck, 2014; Sims, 2012; Sinclair, Sims, & Spaling, 2009; Webler et al., 1995). Shifting away from unsustainable patterns of resource use requires a fundamental transformation in values and behavior (Diduck et al., 2012; Sims & Sinclair, 2008), and for this reason transformative learning, a theory of how adults learn, is a promising framework for understanding the linkages amongst public participation, individual learning, social action, and transitions towards sustainability in natural resource management, including water governance. Adult learning has an important role in creating this change, making transformative learning particularly relevant as it develops autonomous thinking in adults which is necessary for full participation in democracy, and for making morally sound decisions in situations of rapid change (Mezirow, 1997). Sinclair et al. (2009) have argued that personal empowerment, through participatory learning in the civil commons, promotes far-reaching learning that could enable the transition to sustainability, including more equitable governance systems. This is particularly true when participation in resource governance processes approximate Mezirow’s (1994) ideal conditions of learning in that they include accurate and complete information, freedom from coercion, openness to alternative perspectives and equal opportunity to participate (see also Diduck et al., 2012; Sinclair & Diduck, 2001).

Learning outcomes in this research were analysed based on two principal domains established in the transformative learning literature - instrumental and communicative. Instrumental learning involves learning how to successfully achieve desired ends (Mezirow, 1997). Examples of instrumental learning among agricultural water users could relate to methods of conserving water, reducing water system loss, and understanding the connection between a reservoir and end users. Communicative learning relates to understanding others, being understood, and engages the learner in negotiating meanings, intentions and values. Thus, a learner should develop an understanding of the issues at hand and the related opinions of others, and effectively articulate his or her own values, feelings, purposes, and meanings (Habermas, 1984; Hart, 1990; Mezirow, 2000). Examples of communicative learning among agricultural water users could include understanding the impacts of all users on water availability, ways to resolve conflict, or recognizing the needs of other users. Critical evaluation of learning outcomes in these realms can lead to perspective transformation, which may in turn lead to change in action and behavior (Cranton, 2006; Mezirow, 2000). In this paper we identify instrumental and communicative learning outcomes associated with participation in JMCs and consider the potential of these outcomes to result in a transformation towards enhanced governance and sustainability at the top tier of irrigation management in Thailand.

### **3. Methods**

Our research was qualitative, taking a case study approach (Yin, 2009). The two chosen case studies were regarded as successful PIM schemes in part due to their recently received prestigious United Nations Public Service Awards. In addition, both cases represent the typical Thai gravity flow irrigation system and have a complete PIM framework at all three levels of management, including at the reservoir level, which was the primary focus of this research. We did not establish if all PIM schemes in Thailand are as participatory as these cases, especially at the highest tiers of management (JMCs), so they are not necessarily representative of JMC function on a broad scale, but were rather ones that had high potential for participant learning due to the sectors represented on their JMCs and the way these people were engaged.

Semi-structured interviews, participant observation, and document reviews were utilised to collect the relevant data. A total of 51 interviews with JMC members were conducted, including 24 and 27 from the Mae Yom and Krasieo study sites, respectively (See Table 1). Interviewees were asked about their roles in the JMC, the governance processes of the committee, and learning outcomes that have arisen through participation. Participants from all five categories of JMC membership were identified from the lists of JMC participants. Interviews lasted an average of approximately 80 minutes and were conducted with the assistance of local translators. The researchers attended one general JMC meeting and one follow-up JMC meeting at Krasieo as well as two follow-up JMC meetings at Mae Yom, which provided excellent opportunities to observe discussion, decision-making, and learning in action. All relevant and accessible written materials, such as irrigation system

Table 1  
JMC member representative and interview participants for each category

Member Category	Mae Yom		Krasieo	
	Total members	Interviewed	Total members	Interviewed
Local RID Officers	6	2	5	5
Local Administration Reps	21	7	11	4
Other Public Agency Reps (Agriculture Officers, Water Works)	5	2	5	2
IWUG Reps	31	13	30	14
Private Agency Reps	0	0	2	2
<b>Total</b>	<b>63</b>	<b>24</b>	<b>53</b>	<b>27</b>

and management overviews and JMC meeting minutes, were reviewed in order to gain a more thorough understanding of the cases.

All interviews were audio recorded, transcribed, and coded into pre-identified and emerging grounded themes using the qualitative data analysis software package NVivo 8 (QSR, 2008). The data collected are represented by participant quotations in the results section below, which represent majority opinions unless otherwise noted.

#### 4. Joint Management Committee for Irrigation

JMCs govern at the reservoir level and members are generally derived from five sectors including local RID offices, local administration organizations (LAOs) (i.e. elected sub-district and municipality leaders), integrated water user groups (IWUGS), and other related public (i.e. agriculture officers, water works) and private (e.g. ethanol, sugar factories) agencies. Figure 1 illustrates the hierarchy of PIM governance in Thailand. According to the RID (2012), the primary duties of JMCs include developing water allocation and delivery agreements, generating irrigation system maintenance plans, and disseminating those plans to other relevant management bodies in order to promote effective water use. Recent statistics indicate that 381 JMCs have been established in the country (Sinclair et al., 2013).

JMC members are either elected or appointed depending on the sector they represent. Each elected IWUG leader serves on the JMC. In some instances, such as in the Krasieo case study, additional representatives are elected by each IWUG group and serve for either two or four year terms, depending on the preferences of the group. LAO representatives, usually elected sub-district leaders, are appointed to the JMC and serve on the committee for the duration of their term in office. A few members of the local RID staff, including the director who acts as the JMC secretary, are chosen as members of the JMC primarily to provide information and facilitate meetings. The governance structure is designed locally, with RID Headquarters providing only a guideline for JMC structure and code of conduct. The mutual agreement on governance structure among all parties is at the heart of each JMC operation.

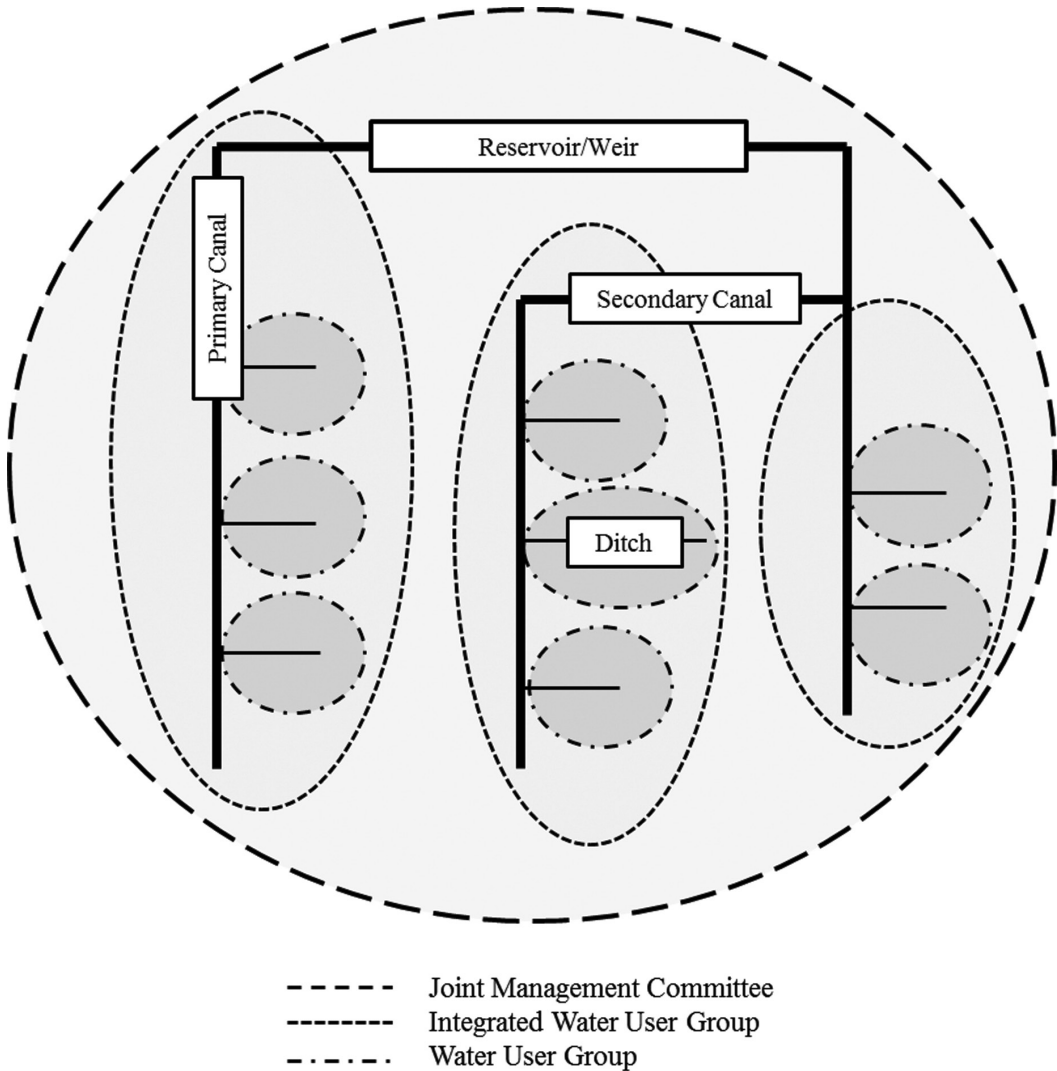


Figure 1. Governance areas of the Joint Management Committee (JMC), Integrated Water User Groups (IWUGs), and Water User Groups (WUGs).

JMC activities include at least two general meetings per year and study tours arranged by the irrigation offices. At meetings, problems from the previous cropping season are discussed and allocation plans for the upcoming season are made. Water delivery agreements are made through the facilitation of open discussion followed by a member vote. Study tours, exchange opportunities that allow JMC members to observe irrigation systems and management in other regions, exchange ideas and experiences, engage in skills training, and learn from members of other JMCs, are organised for members about once per year.

## 5. Case Study Profiles

### 5.1. Mae Yom

The Mae Yom irrigation system is located in Phrae province, northern Thailand. A 350m weir across the Yom River, built in 1947, provides irrigation water to 35km<sup>2</sup> and 28km<sup>2</sup> in the rainy and dry seasons, respectively (RID, 2012). From the weir, two primary canals extend 77km and 64km from Song District in the north and converge in the southernmost district of Den Chai. A series of 68 secondary canals and additional tertiary canals radiate from the main canals to deliver water to farmers at the ditch level. Rice is the dominant crop in the area and is usually planted twice per year.

The PIM scheme at Mae Yom encompasses 794 WUGs, 72 IWUGs, and one JMC. The JMC was established in 2010 with a total of 63 members (See Table 1). The JMC generally meets twice per year prior to each rice crop planting (July and November), although additional follow-up meetings with JMC members and other local actors may occur, especially prior to the dry season planting. This research took place during the dry season and we observed three follow-up meetings held to finalise water allocation plans. Through small and full group discussion, the JMC made adjustments to the water delivery schedule based on what worked and what did not in the previous year. Open votes finalised the agreements. Other topics of discussion included canal maintenance, using pumps and temporary weirs for dry season delivery, issues from the previous season, and conflict resolution mechanisms.

### 5.2. Krasieo

The Krasieo reservoir, a large-scale dam project, is located in the Dan Chang district of Suphanburi Province in the central region of Thailand. A 4.25 km dam allows for a storage capacity of approximately 240 Mm<sup>3</sup> (Sinclair et al., 2013). The 200 Mm<sup>3</sup> available for use provides irrigation water to 177km<sup>2</sup> of agricultural land and also supplies water for industrial (three Mm<sup>3</sup>/annum) and domestic use (one Mm<sup>3</sup>/annum) (Kra Seaw Operation and Maintenance Office, 2012). The dominant crops in the region are rice (60%) and sugar cane (39%).

The Krasieo PIM scheme currently has 278 WUGs, ten IWUGs, and one JMC operating under the scheme. The tenth IWUG was recently added and represents the water users from the areas outside of the official irrigation area. The JMC agreed to supply this group from the Krasieo reservoir only during the first crop season when water is more abundant.

The JMC, first established in 2003, is comprised of 53 members (Table 1). Like Mae Yom, one JMC meeting is generally held prior to both cropping seasons, with additional follow-up meetings on an as-needed basis. The researchers attended the general JMC meeting prior to the dry season where through open dialogue and vote, the JMC decided to forgo water delivery (except for a brief ten day period) in order to ensure adequate water supplies for the first cropping season in the following year. One follow-up meeting was conducted to plan a schedule for the ten day period of delivery. Other topics of discussion

at the meetings included information provision by RID and agricultural officers, canal maintenance, issues from the previous season, and future study tours. In addition, being one of the most mature JMCs, Krasieo hosts numerous study tours for JMC members from other areas and other visitors. They hosted about 40 visits per year until they received the Thailand Quality Public Service Awards in 2010 and the United Nations Awards in 2011, and since visits average about 100 per year.

## 6. Learning

This section identifies major themes of instrumental and communicative learning outcomes and explores the similarities and differences in those outcomes based on the sectors that individual members of the JMCs represent (Table 2). JMC meetings and study tours were the two primary platforms for learning identified by those who participated in this research.

### 6.1. Instrumental Learning

Instrumental learning outcomes identified through the case studies fall into the three primary themes of acquired technical knowledge, management and governance related skills and information, and task-based learning (See Table 2).

Table 2  
Instrumental and communicative learning outcomes identified by participants

Learning outcomes		IWUG leaders	Local RID staff	Private & other public agencies	LAOs
		Instrumental			
Technical Knowledge	Water information	x		x	x
	Irrigation system information	x			x
	Developing rotational water delivery plans	x			x
	Water use by sector	x			
	Crop selection based on water availability	x			
	Crop price information	x			
	Water is a finite resource	x			
	Role of RID in PIM	x			
	Calculating water demand				x



Learning outcomes		IWUG leaders	Local RIIJ staff	Private & other public agencies	LAOS
Governance Information and Skills	PIM structure	x			x
	Integrating local knowledge	x	x		
	Democratic leadership	x			x
	Power of group decision making	x			
	Following JMC agreements	x		x	
	Facilitating discussion & group decision making	x		x	x
	Fostering a sustainable JMC		x		
	Joint management can reduce outside influence		x		
	Joint management increases willingness to accept final decisions			x	
	Importance of good leadership			x	x
	Critical thinking skills				x
	Arranging study tours				x
Task-based learning	Building temporary weirs	x			
	Pump use in the dry season	x			
	Using scenarios for problem solving	x			
Communicative					
Insight into the interests of others	Understanding needs/concerns of water users in other sectors	x	x	x	x
	Understanding needs inside & outside irrigation area	x			
	Understanding others results in caring more for them			x	x
	More accepting of others' opinions	x			
Communication Strategies	Working together makes problem solving easier	x	x	x	x
	New ways to communication information	x			x
	Importance of trust building	x			
	Importance of study tours for improving management		x		
Comparative Reflection	Change since JMC establishment	x	x	x	x
	Affirmation in management structure	x	x		
	Differences/similarities amongst JMCs	x			

*Technical Knowledge* Of the 51 interviewed participants, 29 (100% of LAO & private agency, 56% of IWUG, and 0% of RID representatives) remembered learning new information about the irrigation system or about the water itself through JMC involvement. Although IWUG leaders already had an intimate knowledge of rainfall patterns and water use in their own cropping areas, many mentioned that JMC involvement has enhanced their knowledge about the broader system, such as the amount of water available for delivery from the reservoir or weir and the overall water demand within the whole irrigation area.

Before, others and I were curious about the [ethanol and sugar] factories – how much water they use and whether it affects the water that comes to the fields - but I got involved in the JMC and learned about how the factory uses and manages water (Interview 40, IWUG leader).

Interviewed LAO and factory representatives noted that learning about the irrigation system has supported them in their ability to effectively manage water within their area of governance.

Before the JMC, the factory didn't know when the water would be delivered, so it was hard to manage. Now we know information about the situation of the water and dam so we can plan to pump the water or find other water to use (Interview 36, sugar factory representative).

I gained a broader view of the management in the whole area and a better understanding of the entire system. So now I can bring this knowledge to adapt to the area outside the irrigation area to improve the management there (Interview 21, LAO representative).

Through presentations and discussion during a study tour opportunity to the Krasieo management area, a number of Mae Yom interviewees learned about planning and using a rotational system of water delivery to ensure equitable distribution amongst water users within the irrigation area.

In Krasieo, they have the WUGs as well, and they know how to divide their water to all of the farmers. That was something we learned that could be applied here (Interview 15, LAO representative).

Due to contact with irrigation office staff through JMC involvement, one LAO representative learned skills relevant to water management, such as how to calculate projected water use and record long term statistics. A Krasieo RID staff member also commented that JMC meetings have been excellent fora for the exchange of technical information amongst the various committee actors, not only in regards to water use, but also other news and ideas relevant to the local agricultural sector.

The members of JMC come from different places – the factories, agriculture government units, etc. They share knowledge with each other. For example, the sugar cane factory shares knowledge about how to grow sugar cane to increase production. The agriculture office shares ideas about the best methods to grow crops and how all of this impacts water (Interview 34, RID staff).

Others mentioned that JMC meetings are also opportunities for the discussion and exchange of information and new ideas such as current crop pricing and policy, organic methods for raising crops and livestock, and crops that are most suitable for current climate conditions.

*Governance related information and skills* Two key themes emerged under this category – learning about participatory management and gaining management skills. JMC members from all sectors cited gaining new insights related to governance approaches via PIM, while the management skills theme was dominated by LAO representatives and local RID staff members.

Members learned about the best structure for PIM through involvement in JMC meetings. For example, those representing group ten from outside the irrigation area at Krasieo area noted that they took what they learned and developed WUGs and IWUGs in hopes of ensuring more efficient water management within their area. In addition to learning about the structure of PIM and the roles of the various stakeholders through participation in the JMCs, interviewees also referenced learning through experience about the potential benefits of PIM governance, especially the JMC component. Such benefits include the integration of local knowledge for better water management, power in group decision making, and protection from political influence.

Before the JMC, we [farmers] didn't like the [water delivery] schedule that the government gave us to use. So now we talk together about how to use the water. The JMC has been good for us and improves the way the water is used (Interview 12, IWUG leader).

One participant came to the realization that there is power in group decision making and that ideas and projects can be better developed by the committee than by individuals.

The rubber weir on the spillway came from a JMC decision. Now we think that if we have other projects and push them, we can receive them (Interview 24, IWUG leader).

Members of the Krasieo JMC mentioned that in the past, government representatives have used water issues for political gain. The formation of JMC and the communication of JMC agreements throughout the irrigation area have curbed this potentially negative influence.

Sometimes government comes here to tell farmers that 'if you elect me, I will bring water to you'. Because of the JMC the local people here already know the situation of the water. So politicians can't use this to sway peoples' political opinions (Interview 33, local RID staff).

Through participation in the JMC, LAO representatives learned new management skills such as how to facilitate good discussion and organise study tours to ensure benefit from information exchange. In fact, one LAO representative working on the district school board has implemented exchange experiences, modelled after JMC study tours, involving students from different schools in hopes of fostering improved relationships and mutual learning. Both LAO and private company representatives also learned about the significance of good leadership in the facilitation of collaborative decision making.

I've learned about cooperation and harmony and the role of leaders. Now I know from the leaders of the water user groups the benefits of how they discuss and work together collaboratively (Interview 35, ethanol factory representative).

Finally, upon reflection on his role in the JMC, a local RID staff member came to realise that rather than being a primary decision maker, providing information and playing

the part of a facilitator would best encourage the JMC to evolve into a strong, sustainable governing body.

The JMC consists of four sectors. It's like a car. If it has no fuel, they can't run. The JMC was founded on our ideas, but to make it run it needed a bit of a push. That has come to my mind – that the irrigation office should push a little bit – like arrange meetings – so it can push it towards being sustainable (Interview 32, local RID staff).

*Task-based learning* This category of instrumental learning arose primarily through participation in study tours arranged for JMC members. On a recent two-day tour, Krasieo and Mae Yom JMC members learned new hands-on techniques for water use in the dry season.

We learned about how to use sandbags to slow down the flow of water. This way we could conserve the water to use on this land. And we learned about the techniques to use the pumps (Interview 3, IWUG leader).

Scenario and role playing activities on study tours also evidently fostered critical reflection and learning for participatory water management, especially in regards to the development of rotational plans to ensure equitable water distribution.

We built a model of the village with canals and made scenarios where some places needed more water and some places needed less. Then we discussed together how to deliver the water (Interview 23, IWUG leader).

## 6.2. *Communicative learning*

Gaining insights into the interests of others, developing communication strategies, and comparative reflection were the three most frequently cited themes among the data collected within the communicative learning domain (See Table 2).

*Insight into the interests of others* Through participation in the JMCs, members gained insight into the interests of others both within and across sectors. Within-sector learning applied mostly to IWUG leaders who became more aware of the needs of other agriculturists within and outside of their respective irrigation areas.

Before I joined the JMC, I was just thinking of myself first.... When the water came I tried to be one of the first to get it. But when I joined the JMC, I learned to listen to the problems of everyone and started to help the people also (Interview 49, IWUG leader).

In addition, JMC involvement led IWUG leaders within the Krasieo irrigation area to empathise with those outside of the system who did not have, but needed, access to the reservoir.

Even though group ten isn't in the irrigation area, they need the water too. We saw that problem and decided to involve that group in the JMC... So when they asked for the water we talk about it and give the water that we can give because the water belongs to everyone... (Interview 22, IWUG leader).

Through interaction within the JMCs, members have also gained an increased appreciation of the interests and concerns of those representing other water users.

The thing I learned is that through discussion at the meetings, we can start to understand and care about the needs of other people so people don't fight, but solve problems through discussion (Interview 36, sugar factory representative).

The rice farmers have a reason to grow rice, and the sugar cane farmers have a reason to grow sugar cane. When we are involved in the JMC, we come to know the ideas of the other members and why they think like that. That's an important thing I have learned – about the different ideas and about what those who do different activities think (Interview 34, local RID staff).

Participants also provided examples about how through PIM and a better understanding of others they learned to resolve conflict. An example noted by a number of participants related to the supply conflicts that had to be resolved through PIM.

Three years ago, there was no system to decide how to deliver the water. There were many problems and conflicts. The members of the JMC improved the way things work through discussion. Now the people at the tail-end of the canal can use the water. Before, people would block the canals and the people at the end would come and destroy them. But now they have made a system with dates when people can take the water (Interview 12, IWUG leader).

*Communication Strategies* Under the communication strategies category, discovering new ways to communicate information and learning about the importance of sharing information and working together were two main themes identified through participant interviews. A number of IWUG leaders and LAO representatives learned how to communicate JMC agreements and water information to their WUGs and communities that they govern. Of the 51 interviewees 24 (47%), representing all sectors of water users, also cited learning about the importance of working together through enhanced communication with individuals from other sectors – in other words learning to communicate with each other. The data indicate that they have come to realise that collaborative discussion allows for the incorporation of diverse views and enhanced problem solving, wider acceptance of final agreements, and trust building amongst members and sectors.

I've learned about the importance of consulting together and sharing experiences. If I have a problem that can't be solved, I can look at you and we can discuss and help each other to solve the problem. Sharing experiences together helps solve problems (Interview 1, agricultural officer).

*Comparative Reflection* Two broad categories of comparative reflection were distinguished based on interview responses. Firstly, study tours facilitated reflection on similarities and differences between JMC irrigation and management systems. Particularly, members of the fairly newly established Mae Yom JMC often cited learning new techniques that could be applied to improve their own management.

I have learned how to better help the people in this area – especially from going to visit other places and seeing how they do things there and thinking of the ways that these can be applied here (Interview 15, LAO representative).

In contrast, through interaction during study tours members of the Krasieo JMC, the first in Thailand, usually were either reaffirmed in the strength of their own management or felt responsibility to take on a teaching role and advise others in building a strong JMC.

When we go to meet other JMCs... One thing we often see is that the members and chairmen are government officers. Here they are farmers and water users and everyone trusts them. So we show it can work better than in other places where the chairman comes from the government (Interview 33, local RID staff).

Secondly, many members reflected on positive changes that had arisen since JMC establishment, including conflict reduction, greater efficiency in water distribution, increased unity amongst members, and to some extent, positive shifts in water conservation activity.

Significantly, 42 (82%) research participants have noticed decreased conflict within their respective irrigation areas, primarily attributed to more equitable water distribution achieved through the development of JMC member agreements.

After the JMC was born, the quality of water management is better. There are fewer problems. There are not conflicts amongst the farmers like there were before. It's very good (Interview 7, LAO representative).

Almost 60% of interviewees indicated that they have noticed greater unity amongst JMC members over time, both during meeting discussions and more broadly amongst the various sectors involved.

At the beginning there wasn't a lot of discussion until the members realised they could speak and everyone started to show their mind. It's been a long process. It started with conflict in the meetings, but now the members are learning to work together and share ideas constructively (Interview 33, local RID staff).

Before the JMC, the head of the irrigation office was the big boss and everyone saluted him. But then the JMC was founded. The chairman came from the farmers and the irrigation office is just the secretary. So the irrigation staff have changed a lot. They really listen to other people and it is a good thing that we can work together now (Interview 31, IWUG leader).

Thirteen of 27 (48%) Krasieo participants noticed a positive shift in water conservation activity since the JMC was formed. This is attributed by participants to knowledge gained about the overall amount of available water, increased ownership, and local input into management of the resource.

The farmers changed their habits of using water. Before, they just used the water and let it out. When the JMC was established, we learned about the situation of the water in Krasieo reservoir. It's like 1 glass of water. If you use it until it's empty, it's empty. This thing has changed – everyone now uses the water in a saving way (Interview 24, IWUG leader).

At the time of this research, both case study locations were experiencing lower than normal precipitation amounts leading to concerns about the advisability of dry season rice planting. Significantly, the Krasieo JMC decided to forgo water delivery for the second crop season to ensure sufficient quantities of water would be available for the first rice

planting in the following year. Some participants noted that this marked an evident shift in the quality of decision making over time.

Some years ago the situation was like this and the water in the reservoir was quite low. I think the people in the meeting were quite stubborn – we wanted to grow. The irrigation office didn't think it was a good idea, but the JMC agreed to plant the second crop. We were lucky that year that rain came to support it. I think back to that time and if I was in that place again, I wouldn't do it (Interview 31, IWUG leader).

In contrast, the Mae Yom JMC opted for water delivery despite lower than average water availability for the dry season planting. Local irrigation and agricultural officers advised farmers to plant crops that use significantly less water than rice, such as corn, soybeans, and other vegetables. However, some noted that this advice was largely disregarded due to the potentially higher income generated by rice.

We warn them to stop planting the second crop of rice, but they don't listen because they can make a lot of money by planting it. A government project supports farmers through a price guarantee. So they take risks on their land (Interview 6, agricultural officer).

We [JMC members] pass the message to the farmers about not planting the rice. Most of them still plant the rice. They are willing to take the risk (Interview 9, IWUG leader).

In addition, interviews and observations at JMC meetings in both case study locations frequently revealed a focus on securing more water, rather than using less. For example, members at a Krasieo JMC meeting debated the feasibility of using artificial rain to replenish reservoir supplies. Others mentioned that previous meeting discussions have centered on a potential megaproject that would divert water from another basin to the Krasieo reservoir. In addition, while local RID staff emphasised that the rubber weir on the spillway was installed for the purpose of flood control, IWUG leaders frequently mentioned their hopes that it would remain inflated after flood seasons to provide more water for agriculture inside and outside the irrigation area.

If the irrigation area isn't extended, it [rubber weir] will guarantee that the area will have more water to use. Or maybe water can be delivered to other places so they can have more (Interview 23, IWUG leader).

## **7. Discussion**

Instrumental and communicative learning through participation in the two JMCs led to expressions of action for collaborative governance and, to some extent, sustainable water use. Learning outcomes in the instrumental domain were dominated by the IWUG leaders involved on the committees, especially in the technical information and task-based learning categories. As Sinclair et al. (2013) note, the agricultural livelihood and some PIM tasks, such as trainings and study tours, naturally foster instrumental learning due to the experiential nature of the activities. At the JMC level, the greater number of instrumental learning outcomes by IWUG leaders may also be attributed to how members view

their roles within the committee. IWUG leaders appeared to be the main actors in interactive and task-based activities, such as role playing on JMC study tours, thus facilitating an abundance of instrumental learning within this group. Since local RID staff members viewed themselves as information providers and meeting facilitators, it is not surprising that their instrumental learning outcomes were limited to governance related information and skills, such as learning the importance of joint management and methods to foster effective and efficient management committee member engagement.

Communicative learning outcomes were evident and relatively evenly dispersed among all sectors of water users on the JMC. In contrast to the Sinclair et al. (2013) study of farmer participation at canal and ditch levels, PIM at the reservoir level showed a significant abundance of communicative learning outcomes, perhaps due to JMC meetings being dominated by verbal interaction, rather than hands-on activity. Many of the communicative learning outcomes noted by participants were indicative of learning for new water governance approaches underscored as critical by many researchers (e.g. Clark & Semmahasak, 2013; de Loë & Kreutzwiser, 2007; Diduck et al., 2012; Pahl-Wostl et al., 2008) such as allowing ample time for open dialogue and encouraging questioning and discussion at JMC general and follow-up meetings, a strong belief in local leadership – not from government, learning from others, and a large JMC membership base.

Three communicative learning outcomes consistent across all sectors with significant governance implications were increased insight into the interests of others, working together to enhance problem solving abilities, and reflection on change enabled by JMC establishment and ongoing performance. Understanding the needs of others resulted in opportunities for mutual learning amongst sectors of water users and in action for collaborative management, including the Krasieo JMC inviting representatives from outside the irrigation area to join the committee, for example. Learning to work together is significant as it facilitates trust building and collective action on environmental issues (Cundill & Rodela, 2012). Moreover, our data supports Clark and Semmahasak's (2013) notion that the JMC is a participatory governance structure with the potential to build bridges amongst various stakeholders, including agriculturalists, local government, and private sector water users, since the data show that integrating multiple forms of knowledge and facilitating trust building and conflict resolution is possible.

Comparative reflection on differences between management systems resulted in Mae Yom JMC members considering how they could adopt or adapt elements of those systems to improve the efficiency and structure of water management in their own irrigation area. JMC members from all sectors also reflected on positive changes since JMC establishment, including reduced conflict through discussion and dialogue, more efficient and equitable delivery, and greater unity amongst stakeholders. This reflection revealed visible confidence and pride in the joint management scheme. Additionally, it indicates that JMCs for reservoir level management can begin to address an identified constraint of lower level water user organizations - that there is no guarantee of equitable water distribution (Shioda & Onimaru, 2007).



In regards to implementing management approaches that encourage sustainable water use, a number of positive outcomes involving greater efficiency and equitability in water distribution were noted in the data. As well, positive efforts in relation to supporting a new governance system (PIM) was clearly evident and supportive of social sustainability and strides made in water conservation at the canal and ditch levels were also important. These may, however, be overshadowed by complexities and external pressures at the reservoir level and beyond that constrain decision making, especially for ecological sustainability. For example, instead of commenting on the need to adopt more sustainable water practices, many participants remarked that both irrigation systems need more water for crop production and suggested several strategies to achieve this desire, such as artificial rain and diverting water from other systems. In accordance with other authors (e.g., Bastakoti, Shivakoti, & Lebel 2010; Purotaganon & Schmidt-Vogt, 2014), we found that market pressures can have profound impacts on irrigation management. For example, Purotaganon and Schmidt-Vogt (2014) found that factors influencing agricultural intensification such as changing land use, farming techniques, and market availability (including recent national fixed-price policies) have caused increased levels of conflict between various sectors of water users as well as head-end and tail-end users in Prachinburi Province. Similar intensification processes were visible in our research area where the national rice price guarantee is causing an estimated 10-20% of Krasieo area farmers to switch from sugar cane to rice (Interview 17, agriculture officer) and Mae Yom water users to plant dry season rice despite local RID advice to plant crops that require less water.

The complexity of these confounding issues was clearly underscored by the decision made by each organization in regard to dry season planting of rice during our study. Despite similarities in conditions at the two locations, Krasieo members decided to forgo water delivery for the dry season, whereas those at Mae Yom decided to continue as usual. The contrast between the decisions may partly be attributed to experience, with the Krasieo and Mae Yom JMCs functioning for 10 and 3 years, respectively. Supporting this notion, Uysal and Atış (2010) found positive trends in utility, productivity, and sustainability performance indicators between the second and tenth years of PIM operation in Turkey. Krasieo RID staff also noticed improvements in JMC decision making over time, citing the example of choosing to deliver water despite lack of availability shortly after the committee was established. This outcome could also be attributed to the experience of the Mae Yom RID staff in helping JMC members to engage in dialogue and debate, rather than just providing them information on which to base decisions as evidenced in the quotes noted above.

Despite the different decisions made by each of the JMCs and in contrast to the findings of Purotaganon and Schmidt-Vogt (2014) our research shows that communicative learning outcomes fostered through JMC participation, such as understanding the needs of water users in other sectors and locations within the irrigation system, have resulted in a visible and noted decrease in conflict amongst water users in spite of comparable intensification processes. Additional research will be necessary to more fully understand if such factors and the resulting improved governance structures may be a platform from which broader sustainability thinking and more nuanced responses to external pressures can begin to occur.

## 8. Conclusion

The need for new governance approaches that encourage the adoption of more sustainable water use and management has been underscored by the UN and its Food and Agriculture Organization, among other international and national organizations. The adoption of PIM has been viewed as one way to achieve this. The data from our (e.g. Kummerdpet & Sinclair, 2011; Sinclair et al., 2013) and other studies (e.g. Bassi et al., 2010; Shioda & Onimaru, 2007; Uysal & Atış, 2010) confirms that PIM adoption is resulting in the establishment of new governance approaches that are far more participatory than existing systems and that the farmers who use the water are now involved in its management, although these benefits are still not universal. Research findings also show that the involvement of more people in the management of irrigation systems has resulted in individual and communicative learning outcomes that have led to social action aimed at improved governance and, at least in part, more sustainable water management. In fact, in the case studies we have done in Thailand we have observed that a significant degree of authority that has shifted from the RID to local PIM organizations and the positive learning, management, and conservation outcomes of such actions for irrigation management, as the data here show in part.

Our results also help to further confirm the importance of considering the role and potential of transformative learning theory for understanding adult learning outside of classroom and in resource governance contexts. Through considering the instrumental and communicative learning outcomes for JMC members, we were able, for example, to highlight the important role and potential of instrumental learning outcomes, particularly the basic usefulness of instrumental learning in farming/living more sustainably. Others have noted the prevalence of instrumental outcomes in resource and environmental governance situations (e.g., Diduck et al., 2012; Sims & Sinclair, 2008; Taylor et al., 2012), but few (e.g., Moyer et al., 2014) have considered the potential of such outcomes (i.e. learning about the system, the amount of water available, rain patterns) for transformative changes (i.e. conserving water, reducing conflict). Our results help to reveal further the importance of instrumental learning for communicative outcomes and the interplay that happens between the two domains. The results also helped to verify the importance of dialogue and discussion within the context of communicative learning especially when results aimed at reducing conflict and promoting sustainability are desired. Dialogue and critical reflection were both key to the Krasieo JMC opting to forgo irrigation in the second cropping season.

We recognise that all is not perfect, as we have tried to show in the discussion above and through our other work, but we are inclined to think that there are good opportunities for learning through PIM activities (i.e. deliberative meetings, study tours, hands-on applications) and that there is potential for more robust changes as PIM in Thailand matures. An identified challenge from a sustainability perspective is getting PIM participants thinking about sustainability beyond the amount of water needed for a first and, if lucky, second crop season. Clearly, the PIM institutions we studied need to develop in this regard, especially since learning at the JMC, as the pinnacle of PIM governance, is at least as

important, if not more essential, to sustainability outcomes than as at the IWUG and WUG levels. There are also governance challenges, especially in relation to ensuring that the lower PIM tiers (IWUG and WUG) are not disenfranchised. This is particularly important in relation to finding new ways to ensure the voice of WUG members is heard (Sinclair et al., 2013). There is also a tremendous responsibility on established JMCs, such as Krasieo, given the number of study tours they are hosting, to impart not only good PIM governance techniques, but also to also explore and share new approaches to sustainable irrigation management. We feel that our data show PIM as a sound on-ramp to more nuanced governance and sustainability outcomes. Strides in this regard could be made in the short term through promoting discussions at PIM tables around topics such as the impacts and management implications of external pressures (e.g. rice price policy, new canals), how to scale up thinking through promoting dialogue around issues of basin level management, and recognising the potential of PIM institutions as learning organisations.

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