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Data-sharing bottlenecks in transboundary integrated water resources management: a case study of the Mekong River Commission's procedures for data sharing in the Thai context

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Integrated water resources management (IWRM) relies on co-ordination, co-operation and sharing of collected data amongst relevant organizations. This article presents the results of systematic research into non-technical barriers that influence IWRM-related data sharing in transboundary contexts, with a focus on the Mekong River Commission's procedures for data sharing in Thailand. The current extent of data sharing is quite limited. The main bottlenecks hindering relevant Thai organizations' sharing data across national boundaries appear to be a perception of limited gains, and concerns for national security. The article concludes that data sharing for IWRM implementation cannot be radically improved without significant changes in the mind-sets of the relevant organizations, and suggests how to achieve this.

Keywords: integrated water resources management; Mekong River Commission; data; exchange; data sharing; theory of planned behaviour

Introduction

During recent decades, integrated water resources management (IWRM) has played a significant role in water management in many countries, both internally as well as in transboundary contexts. According to Savenije and Van der Zaag (2008), IWRM is a process that “seeks to manage the water resources in a comprehensive and holistic way” (p. 290). It recognizes the changing dynamics of water resources themselves and those induced by water users. Its decision-making processes need to take into account all of the social, economic and environmental aspects of water management. Moreover, proper institutional, legal and financial arrangements are necessary to achieve successful IWRM (Savenije & van der Zaag, 2008). In practice, especially in a transboundary context, IWRM is complicated, and its implementation has been hampered by national interests among riparian countries (Biswas 2004, 2008; Hansson, Hellberg, & Ojendal, 2012; Mehtonen, Keskinen, & Varis, 2008). Experience thus far seems to suggest that IWRM can be adopted easily as a principle but is difficult to implement in practice.

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IWRM implementation in transboundary contexts calls for data and information exchange and sharing to support the decision-making and planning processes of the riparian countries. The 1997 Convention on the Law of the Non-navigational Uses of International Watercourses calls for data and information related to water resources, such as hydrological and hydrogeological data, to be exchanged regularly as well as upon request (United Nations [UN], 1997). This principle of data sharing in transboundary contexts is embedded in many transboundary agreements, as the analysis of international treaties signed over the last 50 years by Gerlak, Lautze and Giordano (2011) shows. Anecdotal evidence suggests that the implementation of data-sharing procedures is lagging behind the institutional and legal obligations, not due to a lack of data or technical issues but due to non-technical obstacles (Gerlak et al., 2011).

This article investigates the non-technical barriers to data sharing for IWRM implementation in a specific transboundary context, the Lower Mekong Basin. The Mekong River is one of the world's largest and of high importance for the riparian countries in the Lower Mekong Basin (Cambodia, Lao People's Democratic Republic, Thailand and Vietnam) that are joined by the Mekong Agreement. The framework of the Mekong Agreement aims to achieve sustainable development and integrated water resources management in the basin, requiring accurate, real-time sharing and exchange of data and information for several purposes, such as decision making, basin-wide planning and monitoring. To realize this, several tools and procedures have been developed, including a Decision Support Framework and the Procedures for Data and Information Exchange and Sharing (PDIES). Despite this and despite a long history of data collection in the basin (Giordano & Wolf, 2003), data and information sharing is limited (see e.g. Affeltranger & Lasserre, 2009; Gerlak et al., 2011). This article aims to go beyond anecdotal evidence in carrying out a systematic investigation of the obstacles to the implementation of the data-sharing framework of the Mekong River Commission (MRC). Specifically, it investigates the non-technical factors that influence the willingness of key organizations in the Thai context, namely the Thai National Mekong Committee (TNMC) and the national line agencies (typically national government departments or agencies), to share data.

The remainder of the article is organized as follows. The second section depicts the institutional structures and challenges for cooperation in the Lower Mekong Basin, with a focus on Thailand and on data-sharing limitations in this transboundary context. The third section presents relevant theoretical advances on data sharing, from which an organizing framework is selected for the research. The fourth section portrays the methodology used to study data sharing in the Thai context of the MRC's data-sharing procedures (PDIES). In the fifth section, the results are presented and discussed, followed by concrete steps forward for fostering the implementation of the PDIES. The final section provides conclusions on the implications of this research beyond the Thai context.

Background

The Mekong River Commission and Thailand: institutional structures and challenges

The Lower Mekong Basin is a transboundary basin shared by four riparian countries: Cambodia, Lao PDR, Thailand and Vietnam. These countries are bound by the 1995 Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin (known as the Mekong Agreement). The Mekong Agreement aims to achieve sustainable development for the benefits of the riparian states (Mekong River Commission [MRC], 1995). In addition, water resources management on the Mekong

River primarily aims to improve social and economic growth, together with poverty reduction in the member countries (MRC, 2011a). Based on this agreement, the MRC was established as an intergovernmental organization to facilitate the co-ordination and co-operation of its four member countries. It also provides technical support to its member countries in addressing challenges in the basin, such as rapid population growth, economic growth and climate change. In other words, the MRC is a regional river-basin organization that manages the various sectors in the Lower Mekong basin, using the framework of IWRM (Mehtonen et al., 2008).

In the Thai context, the institutional structure related to the MRC is composed of the TNMC and its line agencies. The TNMC is composed of key ministers from the national ministries related to transboundary water management and representatives from relevant organizations. Currently, there are 23 subcommittees chaired by the Minister of Natural Resources and the Environment. The Department of Water Resources acts as the Secretariat of the TNMC. The structure of the TNMC has been criticized for being marginalized from “real decision-making and water resource development planning and investment within the country” (Dore & Lebel, 2010, p. 68). It is also considered weak in connecting with and influencing other powerful line agencies, such as the Royal Irrigation Department and the Electricity Generating Authority of Thailand (Dore & Lebel, 2010). It can be argued that this situation is affecting the implementation of the Mekong Agreement and the PDIES within Thailand.

The MRC and its member countries have faced several challenges in managing the transboundary basin through an IWRM framework, such as the non-inclusion of upstream countries (China and Myanmar) in the Mekong Agreement (Mehtonen et al., 2008). Campbell (2007) argues that too few efforts have been made by the MRC to collect and analyze data and then publish the results, due to both the high rate of turnover of MRC staff and a shortage of technically competent staff. As a result, reliance on external consultants with possible misconceptions of current problems further exacerbates uninformed Mekong River basin management with lengthy priority setting and addressing of non-critical issues. Furthermore, the MRC has been criticized for its lack of a mandate to work as a central platform for decision making on water issues (Affeltranger, 2009) and the lack of co-operation from its member countries (Affeltranger, 2009; Dore & Lebel, 2010). The member countries still hold sovereignty in water-related decisions and are reluctant to co-operate with the MRC (Affeltranger, 2009; Dore & Lebel, 2010). Moreover, a ‘Mekong spirit’ seems not to have materialized, given that plans and projects are still conceived and implemented without consulting the MRC (Keskinen, 2008). Meanwhile, Dore and Lebel (2010) suggest that the MRC has recently become a “knowledge broker” whose role is still quite limited regarding the dissemination and use of data, models and research. The MRC Secretariat has argued that its work is not independent and that it has to respect the member countries’ sensibility regarding data and information (Dore & Lebel, 2010). In conclusion, both the MRC and the related Thai institutional structures have been put in place, but their effectiveness has been called into question.

Data sharing in the Lower Mekong Basin

Although there is a long history of collecting hydrological data in the Lower Mekong Basin, data sharing has been limited. Some data related to water have been exchanged since 1957; this started during the Vietnam War (Giordano & Wolf, 2003). Currently, the data-sharing approach in the Lower Mekong Basin seems to consist of member countries

doing “sampling and analysis”, while the MRC Secretariat compiles those data (Bach et al., 2012). Several tools and procedures have been developed, including a Decision Support Framework and the PDIES (adopted in 2001). The PDIES have three key objectives:

- (i) operationalize the data and information exchange among the four MRC member countries;
- (ii) make available, upon request, basic data and information for public access as determined by the NMCs [National Mekong Committees] concerned; and
- (iii) promote understanding and cooperation among the MRC member countries in a constructive and mutually beneficial manner to ensure the sustainable development of the Mekong River Basin. (MRC, 2001, p. 2)

The PDIES provide the legal basis for the MRC to operationalize data and information sharing and to promote co-operation among member countries for the mutual benefit of sustainable development of the basin by establishing a data and information system that is reliable and accessible (MRC, 2001).¹ The National Mekong Committees and the MRC Secretariat have a duty to co-operate, support and promote the application of the PDIES.

However, Gerlak et al. (2011) claim that the Mekong River basin is one of the weakest regions globally with respect to water-related data exchange. Similarly, Aliagha (2004) argues that the major cause of environmental problems in the Mekong River basin is ineffective data and information sharing that (still) requires more co-ordination among relevant stakeholders, and claims that this lack of co-operation on a data-sharing system could even incite regional conflict. Focusing on meteorological data sharing in the Lower Mekong Basin, Affeltranger and Lasserre (2009) also note the limited extent of hydrological data and identify constraints in terms of “technical, organizational, financial and political features” as obstacles to hydrological data and information exchange. Moreover, Affeltranger (2009, p. 595) points out that in the Mekong, for the MRC’s hydrological data exchange, “control over hydrological data remains a political tool”. He also claims that the Mekong countries are in competition for water use, and seem to fear that data sharing would reveal their water-use plans to other countries. A variety of recent sources such as the MRC’s Strategic Plan 2011–2015 (MRC, 2011a), the Hua Hin Declaration² (MRC, 2010), the summary document of the Mekong2Rio Conference (Bach et al., 2012), and the Information and Knowledge Management Programme 2011–2015 documentation (MRC, 2011b) mention the need to improve the implementation of the PDIES in practice.

The national line agencies are crucial for supporting data and information exchange and sharing under the PDIES. According to the MRC’s *Guidelines on Custodianship and Management of the MRC Information System* (2002, p. 2), “NMCs/Line Agencies of each riparian country, are the ones that initially collect, process, and store the data and information to be exchanged and shared under the Exchange and Sharing Procedures, shall be ‘Primary Custodians’.” Specifically, each National Mekong Committee has the duty to select primary custodians in its country for the 12 types of data and information that are required to implement the Mekong Agreement.³ At the time of undertaking this research, only an unofficial draft list of primary custodians in Thailand had been developed for selected data-sets. For example, the Department of Water Resources is the primary custodian for hydrological data, with support from associated agencies, namely the Royal Irrigation Department and the Electricity Generating Authority of Thailand. For land-use and land-cover data, the Land Development Department is the primary custodian, working with associated agencies including the Department of

Mineral Resources and the Department of National Parks, Wildlife and Plant Conservation. No official list for all data-sets that fall under the PDIES was available at the time; it can be argued that this represents a further indication of the limited implementation of the PDIES up to then.

Relevant theoretical advances in data sharing

This article focuses on data exchanges and sharing in a specific context (the MRC's PDIES in the Thai context). The types of data considered under the PDIES include data related to water resources, topography, natural resources, agriculture, navigation and transport, flood management and mitigation, infrastructure, urbanization/industrialization, environment/ecology, administrative boundaries, socio-economic aspects, and tourism (MRC, 2001). Most or all of these types of data can be considered as including spatial or geographic data, which Comber et al. (2003, p. 299) define as "a sub-set of information that represents some features, attributes and objects of the world; typically it includes both physical (e.g. land cover, soil type) and socio-economic (e.g. land use, soil capability) facets". Such data have special characteristics that are different from other data: they are costly to collect and complicated to process using a variety of technologies; and they need to be maintained and updated in accordance with the current situation (Wehn de Montalvo, 2003b). We therefore turn to the literature on spatial data sharing, which has aimed to provide a theoretical basis for improving the effectiveness and efficiency of sharing such data. This field of research has evolved over the last two decades, focusing initially on rough categories of variables (facilitators and constraints, costs and benefits, antecedents and consequences of data sharing) Wehn de Montalvo (2003b). Initial models (e.g. Calkins & Weatherbe, 1995; Kevany, 1995) were based on personal experience (rather than being constructed theoretically) and not verified empirically (e.g. Kevany, 1995). Moreover, often the 'non-sharers' were excluded from the research (e.g. in the framework of Nedovic-Budic and Pinto, 1999), leaving out the possibility of capturing insights into why individuals or organizations may *not* wish to engage in sharing at all.

Wehn de Montalvo (2000, 2001, 2003a, 2003b) introduced a theory from social psychology, the Theory of Planned Behaviour (Ajzen, 1991),⁴ to systematically investigate the willingness of key individuals within organizations to share spatial data across organizational boundaries. She argued that using the Theory of Planning Behaviour as an organizing framework to analyze spatial data sharing (1) can embrace technical and non-technical aspects (such as attitudes, as well as neglected factors such as social pressures to engage in spatial data sharing) by allowing empirical investigation of the determinants (rather than relying on a priori assumptions); and (2) can be applied to the whole set of potential shares (i.e. 'sharers' and 'non-sharers'), thus allowing a more systematic investigation (Wehn de Montalvo, 2003a). This model was validated empirically in the broad range of organizations comprising the GIS (geographic information systems) community in South Africa. This finding was drawn upon subsequently by Omran and Van Etten (2007), and her mixed-methods approach to data-sharing research was employed by McDougall, Rajabifard, and Williamson (2007). For this article, the conceptual framework for investigating the willingness to share data is based on this model, adjusted to the context of the MRC, to systematically understand the aspects that may influence the willingness of relevant organizations to share data (much of which consists of spatial data) under the PDIES. The main constructs of the conceptual framework are presented in Figure 1.

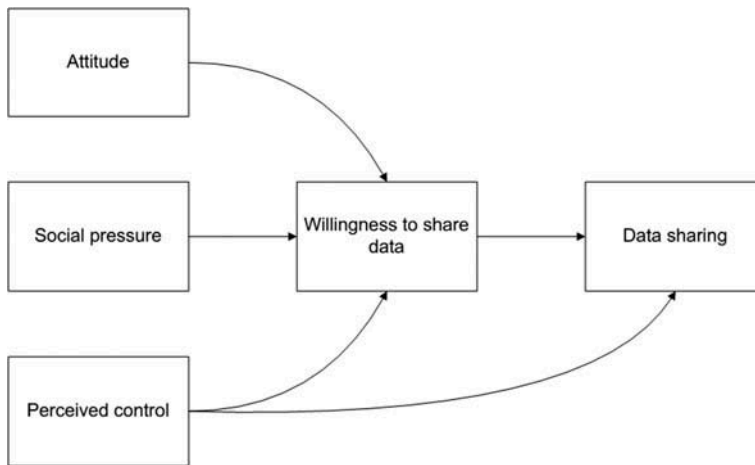


Figure 1. Basic conceptual model of data sharing.
 Source: Based on Wehn de Montalvo (2000, 2001, 2003a, 2003b).

The fundamental constructs are (1) attitude, (2) social pressure, and (3) perceived control. These are hypothesized to have effects on the willingness of key individuals within organizations to engage in data sharing across national boundaries. Each of these constructs is formed by a number of underlying beliefs that such key individuals hold. **Box 1** presents further details on each of these constructs and their adjustment to the PDIES/MRC context.

In conclusion, the main questions addressed by this research are: (1) How do the PDIES actually function compared to the objectives set out by the procedures? (2) What factors seem to influence the willingness of key individuals within the TNMC and its line agencies to exchange and share data across national boundaries in the framework of the PDIES?

Methodology

This research presents a case study of PDIES implementation in the Thai context, with key individuals within the TNMC and its line agencies as the unit of analysis, to understand the diversity and selection of beliefs or perceptions that influence their organizations' engagement in data exchange and sharing under the PDIES. As mentioned above, each of the theoretical constructs (attitude, social pressure and perceived control) is formed by a number of underlying beliefs that individuals hold. The beliefs underlying these constructs were therefore traced through empirical research, complemented by a literature review. The empirical investigation used a mixed-methods approach, combining qualitative with quantitative research. An interview protocol was set up with guiding questions operationalized from the conceptual framework.

The data-collection methods consisted of a combination of semi-structured interviews (using the interview protocol and a selection of ranked questions⁵), document review and field observations. Twenty-six interviews were conducted by a Thai national and native speaker during the period of 19–26 November 2012 in Bangkok, Thailand, and Phnom Penh, Cambodia. Interviewees were targeted based

Box 1. Details of constructs.**Attitude towards data sharing**

Attitude is made up from an assessment of perceived outcomes of actual behaviour (Ajzen, 1991). According to Wehn de Montalvo (2003b), attitude towards data sharing consists of beliefs about resource outcomes, about organizational activities, about the organization's strategic position, and about social outcomes. Especially in a transboundary basin such as the Lower Mekong Basin, several concerns can affect the perceptions of individuals and organizations with regard to data exchange and sharing, such as the implications for national security. Moreover, in the case of the strategic position of an organization, sharing can be considered to imply a loss of control over data, information and ideas.

Social pressure to share data

Social pressure is determined by the pressures that individuals perceive from key referents (i.e., individuals, organizations or institutions that implicitly or explicitly exert such pressures) related to data exchange and sharing. These domains are structured by normative beliefs that are evaluated by considering the approval or disapproval of data sharing by these referents (Wehn de Montalvo, 2003b). In the context of the PDIES/MRC, beliefs are grouped into three domains: institutional pressure, organizational pressure, and moral norms. In the MRC context, inter-regional cooperation and national interests cannot always be harmonized effortlessly. This might result in institutional pressure from the MRC and other member countries, as well as organizational pressure from managerial levels, for individuals to exchange and share data. Moreover, the PDIES themselves are an institution that the MRC member countries have a duty to co-operate and comply with. This can also be perceived as pressure to share and exchange data.

Perceived control over sharing data

According to Ajzen (1991), 'perceived control' beliefs need to be considered in researching behaviour that may not be entirely under an individual's volitional control, as is the case in data sharing (Wehn de Montalvo, 2003a, 2003b). The perceived-control construct is used to evaluate perceptions regarding the absence or presence of necessary resources and opportunities for data sharing and exchange.

on the relevance of their organization, their hierarchical level and their involvement with PDIES implementation (e.g. in primary custodians such as the Land Development Department, the Department of Water Resources and the Department of Fisheries). [Table 1](#) presents the interviewed organizations, covering the TNMC, the MRC Secretariat and relevant Thai line agencies (10 line agencies were included). In addition to the semi-structured interviews, a limited number of ranked questions were presented to the interviewees from the line agencies and the TNMC to assess the extent of the actual implementation of the PDIES and to evaluate their organization's current willingness to exchange and share data under the PDIES.⁶ Twelve interviewees completed the ranked questions.

All data from the interviews were transcribed, including recordings if available. A summary of each interview was then produced for further analysis. Data analysis began by anonymizing the interviewees, since many had asked not to be named in

Table 1. Overview of interviews.

Organization	Division	Number of interviews (number of respondents to ranked questions)
Thai National Mekong Committee (TNMC)	TNMC Secretariat	5 (2)
	TNMC Member	1
Line agencies (10 organizations)	Department of Water Resources	4 (2)
	Land Development Department	2 (2)
	Electricity Generating Authority of Thailand	2 (2)
	Department of Groundwater	1
	Royal Irrigation Department	1 (1)
	Fisheries Department	1
	Marine Department	1 (1)
	Department of Disaster Prevention and Mitigation	1 (1)
	Department of Treaties and Legal Affairs	1
	Office of Natural Resources and Environmental Policy and Planning	1 (1)
Mekong River Commission	Technical Support	3
	Senior staff	2
Total		26 (12)

view of the sensitive nature of the issues discussed. Next, data responses relating to specific questions during the interviews were compiled. These responses were grouped into the key beliefs underlying the domains of the conceptual framework. Finally, the qualitative and quantitative results were compared for each of the domains of the conceptual framework and triangulated further with data from documents and observation.⁷ While most of the data types referred to under the PDIES fall into the category of spatial data, the PDIES do not refer to spatial data explicitly, and therefore respondents were not familiar with this terminology. The interviews and analysis therefore focused on data sharing more generally.

Results and discussion

Actual functioning of the MRC's data exchange and sharing procedures

The PDIES were adopted in 2001; guidelines and technical documents were developed between 2002 and 2005. Almost all interviewees from the TNMC and line agencies knew about the PDIES in general terms. The majority of the interviewees from the line agencies were middle and senior management who had been involved with the MRC through activities such as training, meetings, projects and data delivery to the MRC Secretariat under the PDIES, but without realizing that they were implementing the PDIES. Most of them considered the PDIES to be tools of the MRC for data and information exchange and sharing. In this view, they create a platform for discussion and consultation on data and information among the MRC countries. Some interviewees mentioned that they had come to know more about the PDIES only since attending a recent orientation meeting about them. The interviewees from the line agencies seemed to lack a clear understanding of the PDIES, including such aspects as the institutional arrangements, definitions, guidelines and technical documents.

In terms of its first and second objectives,⁸ the PDIES aim to operationalize data and information and make these available to the public. Under the PDIES, the MRC Information System (MRC-IS) is to establish the central data and information storage for the MRC. It collects data from the MRC Secretariat, member countries and other regional stakeholders and makes it available to member countries and the public through the MRC Data Portal (<http://portal.mrcmekong.org>). It provides information services, time-series data, interactive maps, multimedia, toolboxes, and a master catalogue.⁹ Considering the large amount of data and information stored in the MRC Data Portal, it seems that the MRC has achieved this objective of the PDIES in technical terms. However, according to the statistical record of the users of this system, the MRC Data Portal was accessed only 847 times between 19 July 2010 and 3 January 2013, by 265 internal users and 4 administrators from the MRC member countries (MRC, 2013). This suggests that the web portal is not well known either among the MRC member countries or by the public. Yet the benefits arising from such a central system could constitute a main incentive for member countries to engage with the PDIES. It appears from our empirical research that most individual staff from Thai line agencies know the MRC-IS and its web portal, but they report that they rarely use it. In their view, they have sufficient data and information (both in terms of quality and quantity) to carry out their work. Such perceptions may significantly affect their willingness to exchange and share data and information under the PDIES.

According to their third objective, the PDIES aim to promote understanding and coordination among the MRC member countries in a constructive and mutually beneficial manner to ensure the sustainable development of the Mekong River basin. Individuals from the line agencies knew about the PDIES in general, but they lacked a detailed understanding of the PDIES as well as the whole MRC organization. Moreover, though the principles of IWRM and 'sustainable development' are frequently mentioned in various MRC documents, during the interviews, these principles were hardly commented upon and did not seem to be linked to the interviewees' data exchange and sharing activities.

More specifically, with respect to the actual extent of data exchange and sharing, this was assessed with ranked questions about the types of shared data, schedule, frequency, arrangements, charges and average quantity. Most of the data exchange and sharing activities take place based on a project basis rather than regular interactions (e.g. daily, weekly, or monthly), but free of charge. These responses are in line with PDIES guidelines, according to which line agencies are 'internal data and information users' with full access to all data and information in the MRC-IS with respect to copyright, intellectual property and confidentiality. Overall, while a few respondents indicated that data were exchanged and shared on a daily basis, most specified that they never exchanged and shared data or that this did not apply to their organizations. We therefore conclude that, among this group of interviewees from relevant Thai organizations, the extent of the data exchange and sharing activities under the PDIES seems to be very limited, confirming, at least for Thailand, earlier claims regarding the limited implementation of the PDIES in the region (e.g. Affeltranger, 2009; Aliagha, 2004; Gerlak et al., 2011).

Willingness to exchange and share data under the MRC's procedures

Willingness and intention are usually the motivations behind actual behaviour and are typically closely related to actual behaviour (Ajzen, 1991). Generally, our results

indicate that the interviewees and their organisations were willing to share data and information under the PDIES.¹⁰ However, their organizations also had their own practice. While in principle specific data and information can be shared as necessary on a case-by case-basis, general data such as irrigation areas and statistical data can be shared across borders with no demands attached. Sharing of sensitive data such as digital elevation models and satellite images was considered more carefully because of the level of detail conveyed by such data with potentially significant impacts for economic competition among MRC countries. The survey responses show that respondents normally share data about the Lower Mekong Basin only within the Thai boundaries. For example, the only hydrological data shared about the Chi and Mun Rivers (tributaries of the Mekong) were those concerning the areas at the outlets of the rivers to the Mekong. In some cases, limitations apply and sharing is stipulated for agreed content and scope for use with respect to a specific project. Some individuals mentioned that data and information of their organizations had been shared through publicly accessible websites. However, others argued that accessing data and information through a website was not the intention behind the PDIES and the MRC's co-operation. Several individuals frequently mentioned the Official Information Act of 1997 as a principle of information sharing amongst public organizations in Thailand. But this act deals with public information sharing within Thai borders; its mandate does not extend to sharing across national borders.

Attitude towards data exchange and sharing under the MRC's procedures

The attitudes surrounding this issue stem from the evaluation of the (positive and negative) outcomes of the exchange and sharing of data under the PDIES in terms of resource outcomes, organizational activities, strategic position and social outcomes. Since data exchange and sharing under the PDIES were evidently limited, the interviewed individuals could not always provide answers in very specific terms.

Regarding attitudes towards data exchange and sharing under the PDIES, interviewees perceived both positive and negative outcomes, as summarized in [Table 2](#). They perceived that they could gain advantages in terms of enhancing the quality and quantity of data, reduced redundancy, and access to the MRC-IS. Such sharing was perceived as contributing to effective basin-wide planning, decision making and impact assessment at the regional level. However, negative outcomes were also mentioned in terms of staff time and loss of competitive advantages. For example, some interviewees perceived that the Thai side of the Mekong Basin has better data in terms of quantity and quality compared to other MRC member countries. As a result, they felt that the Thai side received fewer data than they delivered to the MRC-IS, with little to gain from sharing.

They also perceived that the exchange and sharing of data could cause a loss of control over their commercial competitiveness; this is in line with the perceived low benefits of data sharing due to the advanced economic development of Thailand in the region. Engagement with the PDIES could cause work overload and time-consuming situations due to an insufficiency of skilled staff within their organizations. Moreover, nowadays the interviewees rarely use the MRC-IS and they seem not to perceive beneficial outcomes of this system. These factors could be a disincentive for people to engage with the PDIES. Nevertheless, the pending establishment of a National Information System could gradually motivate individual staff to engage with the PDIES.

Table 2. Summary of perceived outcomes under the Procedures for Data and Information Exchange and Sharing.

Perceived outcomes	Positive	Negative
Resource outcomes	<ul style="list-style-type: none"> ● Enhance quality and quantity of data and information (3 LA, 2 TS) ● Avoid redundancy of work (4 LA) ● Data and information expansion by the MRC-IS and NIS^a (15 LA, 1 C, 5 TS) ● Provide storage of data in the MRC-IS^b (8 LA, 6 TS) 	<ul style="list-style-type: none"> ● Time-consuming and work overload (2 LA, 1 TS) ● Lack of trained staff (2 LA) ● More sharing implies more checking (2 LA)
Strategic position	<ul style="list-style-type: none"> ● Better decision making (15 LA, 1 C, 5 TS) ● Well-arranged ownership/copyright of data and information under the PDIES (3 LA, 2 TS) ● Promote own work to the public (1 LA) 	<ul style="list-style-type: none"> ● Loss of agricultural competitiveness amongst member countries (4 LA) ● Shared data used for politics, e.g. negotiation (3 LA, 2 C, 2 TS) ● Gap of 'knowledge' definition in PDIES means knowledge-sharing aspect is being neglected (1 LA) ● Low benefits from sharing at regional level – different levels of development among member countries (Thailand more advanced) (7 LA)
Social outcomes	<ul style="list-style-type: none"> ● Basin-wide planning possible (15 LA, 1 C, 5 TS) ● Improved impact assessment (3 LA, 1 C, 4 TS) ● Capacity building (7 LA) 	

Note. C = committee. LA = national line agency. MS = Mekong River Commission Secretariat. TS = Thai National Mekong Committee Secretariat.

^aThe National Information System (NIS) is being set up in the member countries and will be synchronized with the MRC-IS.

^bThe MRC Information System (MRC-IS) was established under the PDIES as a central system for timely and accurate data and information.

Social pressure to exchange and share data under the MRC’s procedures

Social pressures to share data can be categorized into institutional pressure, organizational pressure and moral norms. Under each domain, the key referents that can exert pressure on individuals and organizations to share data were identified. These included, among others, stakeholders such as the MRC and other member countries and the Mekong Agreement and the PDIES as key referents of institutional pressure. Table 3 presents a summary of the investigated aspects under social pressures.

Given the context of the MRC, other member countries were considered key referents exerting pressure on Thailand with respect to data sharing. A diverse range of interviewees (respondents from line agencies, the TNMC, the TNMC Secretariat and the MRC Secretariat) were under the impression that the other member countries enthusiastically want the Thai side to share data and information with the MRC Secretariat. One source in particular mentioned that downstream countries such as Vietnam and Cambodia naturally require more data and information than upstream countries. Another respondent criticized donors for putting emphasis on the implementation of data sharing. Politicians could not

Table 3. Summary of perceived pressures within the Thai context. For abbreviations, see the notes after Table 2.

Social pressure	Key referents	Perceived pressure	
		to share	Not to share
Institutional pressure	<ul style="list-style-type: none"> ● The MRC ● Other member countries ● Donors ● Politicians 	<ul style="list-style-type: none"> ● Other member countries want Thailand to share its data (4 LA, 1 C, 2 TS, 2 MS) ● Donors can play a role in data sharing in certain projects. (1 LA) ● Politicians can apply pressure to share data at the policy level (1 LA, 1 TS) 	
	<ul style="list-style-type: none"> ● The Mekong Agreement ● The PDIES ● National Data Policy 	<ul style="list-style-type: none"> ● Low: the Mekong regime is based on voluntary co-operation, resulting in only low pressure to share (9 LA, 6 TS, 2 C) 	<ul style="list-style-type: none"> ● Absence/uncertainty regarding national data policy in relation to PDIES (8 LA)
Organizational pressure	<ul style="list-style-type: none"> ● Management level within organization ● Internal policy on data and information sharing regarding national security 		<ul style="list-style-type: none"> ● High uncertainty about national security arising from unclear policy and classification of data and information (9 LA, 1 C)
Moral norms	<ul style="list-style-type: none"> ● Regional benefits ● IWRM 	<ul style="list-style-type: none"> ● Low: IWRM rarely mentioned (13 LA, 3 TS) 	

be confirmed as directly pressuring individual staff or organizations, but they were mentioned as being able to do so, in principle, at the policy level. Yet in practice, interviewees suggested that government priorities seem to lie with regional economic development rather than environmental or technical frameworks such as the MRC, as a result of which the implementation of the PDIES seems to be neglected at that level. Since the MRC system is based on the principle of good-faith co-operation and the PDIES are procedures for implementing the Mekong Agreement, the MRC Secretariat cannot put pressure on the NMCs to implement the PDIES. This is also confirmed by the results, indicating that the interviewees seem not to receive pressure from these institutions to share data.

Under the PDIES, the types of data and information for exchange and sharing are classified rather broadly. Apparently, the classification of data and information in terms of confidentiality according to domestic Thai laws and regulations had not yet been officially articulated in relation to the PDIES. Yet, the MRC Secretariat was reported to be sending a detailed list of data requests to member countries year after year. Given the lack of classification, individual staff were very concerned about their authority to exchange and share data and information, especially in an international context. Moreover, within the Thai context, domestic law and regulations regarding official data and information

access were argued to be on the increase, with government staff having to comply with these to protect the national interest. Nevertheless, there was no official analysis of to what extent domestic laws and regulations need to be applied before engaging with the PDIES. The uncertainty regarding the classification of data to be shared across national boundaries contributes to institutional pressures, in fact inhibiting data sharing because of national security concerns.

Similarly, organizational pressure arises from the ambiguity in and uncertainty regarding organizational data policies, seemingly creating considerable pressure *not* to share data. Many interviewees indicated unclear internal policies and classification within their organizations regarding which data and information can be shared across national boundaries. Of course, at either level (institutional or organizational), this ambiguity may simply also be used as a excuse for not sharing data.

With respect to moral norms as a form of social pressure for data sharing, IWRM is a relevant aspect which, in theory, the MRC has adopted as a strategic direction. The MRC implements IWRM principles in its programmes, such as the Information and Knowledge Management Programme, and tools, such as the PDIES. According to our research, the relevant line agencies had not yet recognized the importance of IWRM in basin management. This could be an indication that the MRC's adoption of IWRM as a top-down policy has not yet been embraced by the relevant organizations (the line agencies) on the ground.

Perceived control over data exchange and sharing under the MRC's procedures

The perceptions of individuals regarding control over data sharing refers to the perceived ease or difficulty of sharing data under the PDIES in terms of a number of internal and external factors, as summarized in [Table 4](#). Internal factors relate to the organization's technological capabilities (including interpersonal skills) and data (in)dependence. External factors consist of opportunities outside the organization that are considered important for sharing data.

Most interviewed individuals within the Thai context perceived that they were technically closer to being ready to share data under the PDIES, in terms of the required skills and technologies, compared to other member countries. They also considered the quality and quantity of their data superior to that of other member countries, contributing to their strong data independence and rendering their organizations independent of other member countries. Furthermore, the PDIES themselves were deemed to create opportunities for sharing through the MRC-IS and the National Information System, which will be synchronized over the coming years. The PDIES were also considered to create a platform, both at the national and the regional level, for relevant organizations to consult on PDIES implementation.

On the other hand, there were still some perceived difficulties for Thailand. Overall, in absolute terms, skilled staff were considered to be missing, while existing staff require better IT skills, spatial data-related skills, and English-language skills (English is the official language of the MRC). Other perceived difficulties were related to networking, negotiation and negative past experiences with data sharing, which may also influence the willingness to share. Finally, the different degrees of development and economic growth among member countries were perceived as obstructing the implementation of the PDIES. Although data are not necessarily substitutable, Thailand's higher levels of development were perceived as going hand in hand with higher quality and quantity of data, and this in turn was deemed to considerably lessen the importance of data-sharing opportunities.

Table 4. Summary of perceived control over data and information exchange and sharing in the Thai context. For abbreviations, see the notes after Table 2.

Domain	Perceived control	
	Easy/present	Difficult/absent
<i>Internal factor</i>		
Technological capabilities	<ul style="list-style-type: none"> ● Capacity (technical skills) to engage with the PDIES compared to other member countries (11 LA, 5 TS) 	<ul style="list-style-type: none"> ● Lack of skilled staff (6 LA, 2 TS, 1 C) ● Spatial data formats, standard, metadata, and IT related to the MRC-IS (4 LA, 3 TS) ● Different technical skills in member countries (1 LA, 1 TS) ● English language (2 LA) ● Networking and teamwork (6 LA, 8 TS) ● Negotiation skills (4 TS) ● Extra time and work (4 LA) ● Negative past experience with shared data being used for politics (1 LA, 1 C, 5 TS)
Data (in)dependence	<ul style="list-style-type: none"> ● Independence in terms of data (4 LA) 	
<i>External factor</i>		
Opportunities	<ul style="list-style-type: none"> ● The MRC-IS and NIS create opportunities for data sharing (2 LA, 3 TS) ● Awareness and fora created by the PDIES (2 LA, 2 TS) ● Capacity-building activities raised awareness of the PDIES (3 LA, 4 TS) 	

The way forward for implementation of the MRC's data exchange and sharing procedures

The findings presented above are summarized in Figure 2, which maps the identified clusters of beliefs underlying the willingness to share data under the PDIES in Thailand. From the concrete suggestions made by the interviewees, a variety of options arise to strengthen the implementation of the PDIES.

Perhaps first and foremost, as indicated also by the findings regarding social pressures, concrete action is required by the TNMC in terms of developing a clear policy regarding the classification of data and information exchange and sharing under the PDIES to alleviate national security concerns. Once this is in place, organizations will not be able to 'hide' behind a claimed lack of clarity. The promotion of the PDIES in Thailand has also emerged as an urgent need in order to enhance understanding of, and to raise awareness of, the PDIES among relevant individuals within line agencies and the public.

Based on the results related to attitudes to (or expected outcomes of) data sharing, the added value for line agencies of the PDIES – the MRC- IS and the National Information System – needs to be elaborated to strengthen the incentives for sharing data and information. Specifically, since Thailand seems to perceive little gain from data sharing

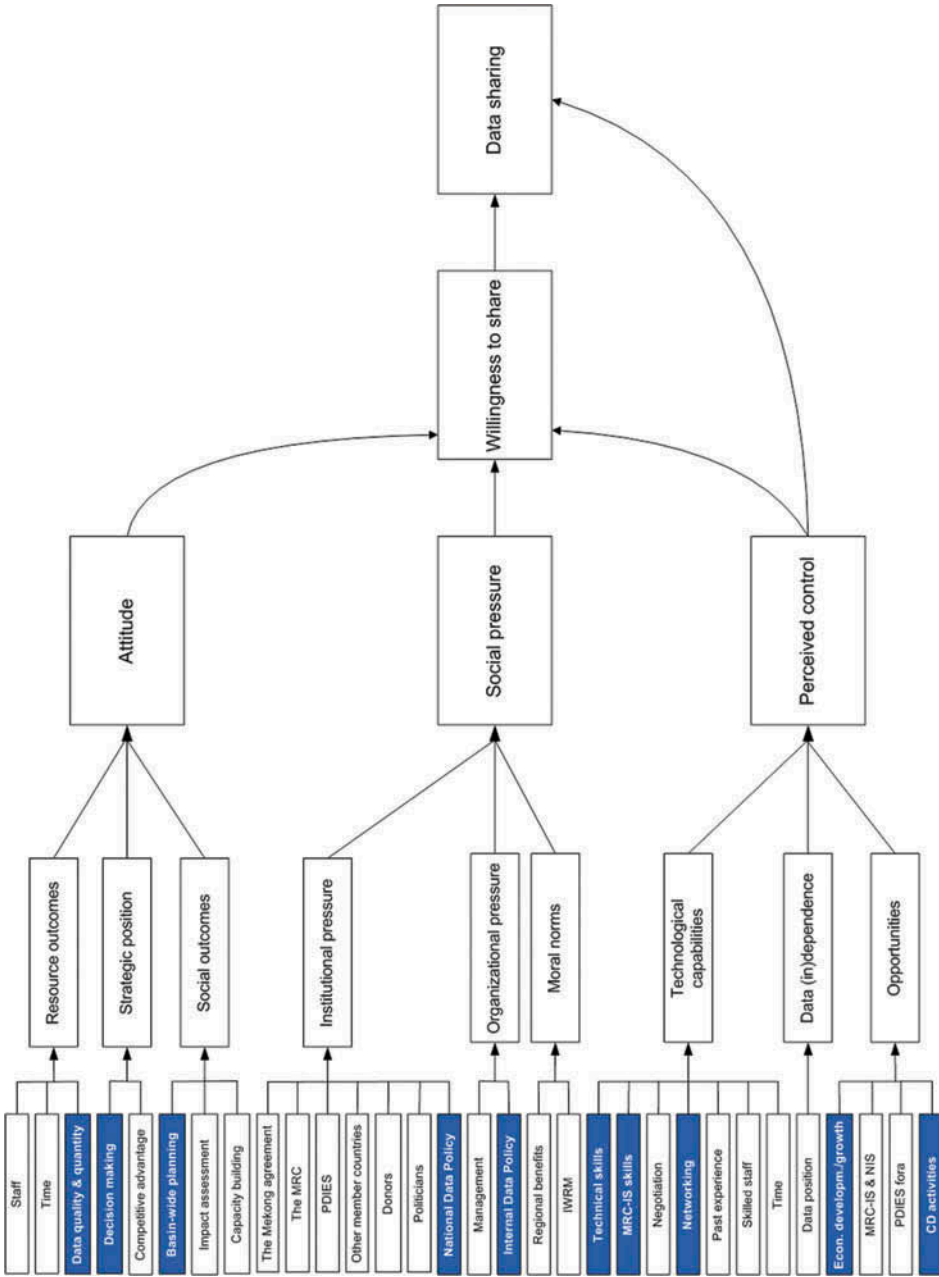


Figure 2. Model of data sharing in the Thai context – key determinants of the willingness of organizations to share data.

across national boundaries in terms of resources (quality and quantity of data), coupled with perceived weak pressures to share, the implications of sharing in terms of improved IWRM and fostering the sustainable development of the region need to be articulated more convincingly, so that these can present stronger incentives for sharing relevant data and information with the member countries.

In line with the results related to the control over data sharing, the continuity of competent staff in line agencies and at the MRC needs to be taken into account at the policy level and within each line agency to facilitate the MRC's work as well as for PDIES implementation. It will also be important to transfer relevant knowledge and experience from the MRC Secretariat to the National Mekong Committees and line agencies.

The extent of the PDIES implementation needs to be monitored by the MRC in all member countries for further development, and co-ordination among the Thai organizations needs to be improved, not only for the implementation of the PDIES but also for the Mekong Agreement and other procedures. Given the lack of influence of the MRC indicated by our results for social pressure, platforms (face-to-face and online) via which line agencies can discuss, listen to each other and give feedback regarding PDIES implementation within the Thai context may present a more effective mechanism for exerting peer pressure and advancing a common understanding, and these should be broadened.

Awareness-raising regarding data and information sharing should also include other relevant stakeholders affected by the Mekong River, to foster a 'data-sharing culture'. For example, with the rapid and wide diffusion of information and communications technologies (ICTs), citizens will increasingly be able to play an important role in environmental observation and data collection (Wehn de Montalvo, 2013), although the practical implementation of citizen-based observations will strongly depend not only on the availability of ICTs but also on both authorities and citizens, in terms of granting and claiming this new role (Wehn & Evers, 2014). This may differ considerably across the different riparian countries of the Lower Mekong.

Conclusions

It has been more than a decade since the PDIES were adopted by the MRC. Technical guidelines and documents were developed systematically and prepared for implementation of the PDIES, yet the implementation of these procedures seems to have advanced slowly on the Thai side. While the PDIES are intended as a tool for achieving the MRC's broader mandate regarding sustainable development of the Lower Mekong Basin, thus far – at least in Thailand – these procedures seem to exist on paper rather than being practised in reality.

This study of the willingness of relevant organizations to exchange and share data under the PDIES traced the perceptions and beliefs underlying the attitude, social pressure and perceived control of key individuals within relevant organizations in order to provide insights into the potential barriers to the successful implementation of the PDIES in Thailand. The interviewed key individuals perceived themselves (and their organizations) as having not only a sufficient level of technology and skills to engage in data sharing but also a higher quantity and quality of available data and information, compared to other MRC member countries. Thailand, an upstream country in the regime of the MRC, may take longer to commit to the PDIES implementation because it may have less to gain from data sharing than other member countries. Arguably, this may be the same situation as in the negotiations on flow maintenance of the Mekong River, in which "Thailand has been accused of 'dragging her feet' and prolonging the establishment of flow regime

regulations” (Backer, 2007, p. 49). Nevertheless, Thailand’s contribution is required for the collective gain of implementing IWRM.

Based on a systematic investigation, this research has revealed that several factors have influenced the willingness to engage with the PDIES, including a lack of understanding of the PDIES, unclear or lacking classification of data and information with respect to national security, concerns about losing control over shared data, and the absence of moral and institutional pressures to share. For PDIES implementation to be improved in Thailand, the relevant organizations should focus on specific perceptions or beliefs (influencing the so-called ‘mindset’) regarding the exchange and sharing of data across boundaries in the light of IWRM. This research has identified specific leverage points for bringing about such change.

From the insights presented in this article, it can be inferred that it is difficult to quickly advance the implementation of IWRM in a transboundary context beyond national security, national interest and a perceived loss of control, not (only) because of technical impediments but because of the perceptions and beliefs that key individuals within relevant organizations hold. A radical change needs to take place in the mindset of individuals regarding data sharing.

Nonetheless, the way forward to improve PDIES implementation depends not only on the Thai context but also on the MRC and a common culture of exchange and sharing among all the MRC riparian countries (Thailand, Cambodia, Lao PDR and Vietnam). Future research may therefore try to elicit how the different countries’ perceptions of data sharing are (re)shaping each other, for example highlighting that Thailand’s attitude derives partly from China’s strategy in transboundary water governance. This may also involve a mapping of the concrete requirements of the Lower Mekong Basin from the upstream countries, specifying the types of data and the purposes for which they would need to be shared. Moreover, the analytical approach presented in this article could be applied to other MRC member countries (and even to the upstream countries, China and Myanmar) to gain insights into their non-technical barriers to data sharing, to improve the implementation of the PDIES, and thus to foster the effective implementation of IWRM in the Lower Mekong countries.

Notes

1. It covers both reciprocal transfer of data among member countries and the provision of full access to data maintained by the MRC Information System for member countries via the MRC Secretariat, to whom member countries in turn have to provide data.
2. “Continuing to improve the Procedures for Data and Information Exchange and Sharing, the Procedures for Water Use Monitoring, the Procedures for Notification, Prior Consultation and Agreement, and the Procedures for Maintenance of Flows on the Mainstream and finalized the Procedures for Water Quality” (MRC, 2010).
3. The 12 types of data and information are: (1) water resources; (2) topography; (3) natural resources; (4) agriculture; (5) navigation and transport; (6) flood management and mitigation; (7) infrastructure; (8) urbanization/industrialization; (9) environment/ecology; (10) administrative boundaries; (11) socio-economy; and (12) tourism.
4. This theory is well established in the field of social psychology and has been applied and validated in several hundred cases and with a wide range of behaviours under study.
5. I.e. closed questions with unipolar or bipolar scales on which to rank responses.
6. These questions are based on the approach developed and validated by Wehn de Montalvo (2003b) to measure the extent of data sharing.
7. In most applications of the Theory of Planned Behaviour, an applied, qualitative approach is employed first to identify relevant beliefs, which are then used to construct a questionnaire for implementation in a second research phase. Given the limited number of organizations

involved in the Thai context of the MRC, a quantitative approach based on a survey was not deemed appropriate given the small size of the population from which to draw a sample which, in turn, would not allow for a thorough statistical analysis of the collected data. Therefore, this investigation used a mixed-methods approach in a single step, combining qualitative with quantitative research in a single phase. Quantitative measures were taken only of the main concepts (attitude, social pressure, perceived control and willingness to share), not of individual beliefs. The analysis of these quantitative measures was limited to descriptive statistics.

8. “(i) Operationalize the data and information exchange among the four MRC member countries; (ii) make available, upon request, basic data and information for public access as determined by the NMCs concerned” (MRC, 2001, p. 2)
9. The master catalogue is a set of “search collections of quality-assured datasets and dataset series held by the MRC, which include spatial data, time-series, non-spatial data, and technical documents” (MRC, 2013).
10. In both the quantitative measure of willingness in the questionnaire instrument and during the semi-structured interviews.

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