Mekong River Basin - A Study of Water Management and Development

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Abstract

The ability of the Mekong River Commission (MRC) to promote policies that prevent member Parties from mismanaging water resources in the lower Mekong river basin is constrained by the local politics. The Mekong runs through China, Myanmar, Laos, Thailand, Cambodia, and Vietnam. In 1995 the lower basin countries signed a regional agreement which created the Mekong River Commission for sustainable management of the basin. The grounding rules provided by the MRC (G) are not always implemented by riparian actors utilizing the basin resources for fishing, transportation, navigation, irrigation, hydropower generation, and recreation. Hydropower development (C), as one of the most pressing challenges that the MRC faces, is an indicator of the need to strengthen the regime (G) in light of a "new politics of sustainability" among MRC members. Dam construction on the river basin is affecting biodiversity and causing major disruptions in the natural dynamics of the ecosystems functions and services (E). We found that by strengthening the existing regime results in better management of the most pressing challenges and positive effects will spread to the economy (C) and the environment (E) with more sustainable outcomes. Two major projects are compared: the Pak Mun Dam, which was built before the 1995 agreement was signed, and the Nam Theun 2 Dam, which is nearing completion and is clearly a post-MRC project. This comparison provides evidence on the progressive movement towards improved water management, development, and the new politics of sustainability.

Questions Addressed and Wisdom Gained

The key questions addressed in this case study are: i) What are the major issues faced by the actors managing international river basins? ii) How are these issues reconciled? What are the tools societies have in hand to overcome unsustainable practices in international river basin management? Here we find that an effective regime for sustainable management relies on institutional capacity. Strong institutional capacity determines policies and rules that deviate actors from unsustainable practices in resource management; especially if the resources are perceived as common pool or public. The challenges posed by environmental degradation or economic pressures from hydropower projects on the Mekong River set substantial constraints for an effective water resource management plan. Yet, the greatest challenge for the Mekong River Commission in the sustainable management and development of the basin is fostering institutional capacity and dealing with domestic politics among all stakeholders.

1. Issues, Stakeholders and Relevant NSS Variables

<table>
<thead>
<tr>
<th>Lack of or unclear policies and rules for the effective management and development of the basin. Domestic politics</th>
<th>Mekong River Commission membership (Cambodia, Laos, Thailand, and Vietnam)</th>
<th>Governance (G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing demand for hydropower</td>
<td>Hydroelectric projects: Pak Mun Dam by the Electricity Generating Authority of Thailand and Nam Theun 2 (NT2) Dam by Nam Theun 2 Power Company, the French-Thai-Lao special purpose company, and the Government of Laos</td>
<td>Economy (C) Ecosystem (E)</td>
</tr>
<tr>
<td>Disruptions in ecosystems</td>
<td>River basin users and the environment</td>
<td>Economy (C) Ecosystem (E)</td>
</tr>
</tbody>
</table>

2. Description of the Setting

<table>
<thead>
<tr>
<th>Location</th>
<th>Cambodia, 20%; China (Yunnan province), 21%; Lao PDR, 25%; Myanmar 3%; Thailand, 23%; Vietnam, 8%. The Lower Mekong River Basin (LMB) is composed of Cambodia, Lao PDR, Thailand and Viet Nam.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watershed area</td>
<td>809,500 km²</td>
</tr>
<tr>
<td>Average discharge</td>
<td>15,000 cubic meters per second</td>
</tr>
<tr>
<td>Population</td>
<td>60 million people. Over 100 different ethnic groups</td>
</tr>
<tr>
<td>Annual mean rainfall</td>
<td>2000mm. Korat Plateau: 1,000-1,600 mm; Northern Highlands: 2,000-2,800 mm.</td>
</tr>
</tbody>
</table>
The Mekong River originates in the snow capped Tanggula Shan Mountains of Tibet and ends near Ho Chi Minh City in Vietnam where it discharges into the South China Sea. Along its nearly 4900 km long journey the Mekong comes into contact with six countries: China, Myanmar, Laos, Thailand, Cambodia, and Vietnam. The Mekong River Basin (MRB), which includes the Mekong River and its vast network of tributaries, is typically divided into two parts: the Upper Mekong River Basin (UMRB), which consists of the territories of China and Myanmar, and the Lower Mekong River Basin (LMRB), which includes Laos, Thailand, Cambodia, and Vietnam.
The Mekong River Basin

Characteristics:
Area: 809,500 Km² (21)
Length of mainstream: 4,400 Km (12)
Average discharge: 15,000 m²/s (8)
The total catchment area of the Mekong River Basin is approximately 795,000 km² with the lower Mekong basin covering roughly 606,500 km² or about 75% of the entire Mekong Basin. While the Mekong Basin only accounts for 1.7% of China’s total land mass and 3.5% of Myanmar’s total land mass, the basin covers a much larger share of the land mass in the four lower countries. The basin accounts for 85.3% of the area in Laos, 35.9% for Thailand, 85.6% for Cambodia, and 20% for Vietnam.2

The mean annual discharge of the Mekong is approximately 475 km³ in the rainy season and 79 km³ in the dry season. In comparison with other large rivers, the flow of the Mekong is notably predictable: typically there are relatively small differences in volume between high and low flood years. To outline the water-level cycle, the level of the Mekong River begins to rise in May with the onset of the southwest monsoon and continues until reaching its peak in August or September in the upper MRB, and in September or October in the lower reaches. At that point the water level declines rapidly until December and then continues to decline, although at a slower rate, until April. One of the unique characteristics of the lower Mekong Basin is the flux of the Tonle Sap Lake in Cambodia, the largest freshwater lake in Southeast Asia. During the dry season, water flows out of the lake, through the Tonle Sap River, into the Mekong but during the rainy season the flow reverses direction and the lake more than triples in area as the water fills back in. This system provides natural fertilization to the floodplains of Cambodia each year and also regulates flow downstream as the stored water flows out to the Mekong during the dry season, increasing low flows and therefore assisting irrigation and reducing saltwater intrusion in the delta.3

As mentioned, the rainfall in the lower Mekong Basin is largely determined by the southwest monsoon which lasts for about five months, beginning in May and concluding in October. Average annual precipitation for the lower Mekong region is approximately 1,600mm but due to the diversity in geography there is significant variation in the distribution of rainfall. More than half of the water that flows through the entire basin originates on the left bank side of the Mekong. Nonetheless, much of the Tibetan region is under snow during the winter and as altitude increases, rainfall decreases and snow becomes a major source of runoff. During the dry season the melting of these mountain snows becomes a major source of water in the upper basin. This melting also helps to maintain the dry season flows downstream.

Of the approximately 170 million people4 that live in the lower Mekong countries of Laos, Thailand, Cambodia, and Vietnam, it is estimated that at least 55 million live in the Lower Mekong River Basin. By the year 2010, the MRB population is expected to grow to 70-90 million.5 Though the distribution varies significantly from country to country, the average population density of the basin is relatively low and about 80 percent of the Mekong River Basin's population live in rural areas. The population density for the Lower Mekong River Basin is only 88 person/km² but ranges from a high of 260 person/km² in the Vietnamese region to a low of 24 person/km² in the Laos portion of the basin.6 Nevertheless, the population of the basin is growing rapidly and is expected to continue to increase in the next 25 years.

The Mekong River is very rich in its fish biological diversity with more than 1200 species described and there may be as many 1700 species. Some of the most abundant species are grouped in the families: Homalopteridae (loaches); Cyprinidae; Gomphidae (carps); Channidae, Ophicephalidae (murrels); Sisoridae, Siluridae, Pangasidae (catfish). One of the icon species of the river is the Giant Catfish (Pangasianodon gigas)7. This critically endangered fish that can reach up to 3 m. in length and weight around 300 kg. Another species from a completely different group is the freshwater dolphins (Orcaella brevirostris).

It is estimated that nearly 120 species may have economic importance but only less than 20 species are commercially used. Fish are very important in the local diet for the people in the Mekong basin. Based on several studies compiled by the MRC, in 2007 nearly 2.6 million tons of fish and other aquatic animals were consumed; although per capita consumption varies from country to country, its range is between 25 kg to 35 kg per year.8 This activity in Thailand alone generates nearly US$ 700 million per year.

Fish diversity is threatened by over-exploitation and the use of destructive gears. Nonetheless, the main concern comes from habitat degradation and the reduction in water quantity and quality.9 Some of the rivers have been alter to the point they cannot longer sustain fish population to a healthy level. Given the economic and social values of fisheries in the basin, fish conservation should not be overlooked.

### 3. Problem Definition

This case study explores cooperation agreements and the effects of domestic politics for the management of international river basins. We depart from the assumption that any resource on a river basin may be viewed and employed as a common pool or public resource; we believe that this form of management leads to different degrees of undesirable outcomes caused by mismanagement of water resources.

In the particular case of the Mekong River Basin, we see that the “1995 Agreement on the Cooperation for the Sustainable Development of the Mekong River”, which created the Mekong River Commission, provides grounding rules and an institutional regime (G) that leads riparian actors onto a progressive movement towards improved water management, development, and a new politics of sustainability. We suggest that stakeholders can progressively reach positive outcomes under this cooperation agreement for the sustainable management of the river basin. As sustainable management of the river basin is a dynamic process in a continuously adaptive system, it is fundamental for the rules and programs of the MRC to respond and adapt to feedbacks from the elements integrated in the system.

In our view, the structure of the regime affects all other variables across both the natural and societal systems. Moreover, the most important resource of the Mekong, its water, is a major driver of interactions among various elements of the systems we described; that is, an element of the Natural System is the avenue for interactions between other variables in the Natural System and variables in the Societal System.

The construction of dams for hydropower generation on several tributaries of the Mekong is causing a major disruption in the relationships of the variables affecting many stakeholders on the basin. Dams play a central role in the regional economies (C), the construction of many projects is justified by the rapid increase in demand for electricity and population growth. Also, some countries are explicitly taking measures to shift energy dependency from oil to renewable energy. Thus, the construction of a dam affects economic improvement of the countries in the basin and reduces their dependency on oil.10 In our view the economic importance for the countries in the basin (C) is the most important variable which (G) can affect and for this the MRC must work under a new politics of sustainability.
Likewise, dam construction on the river basin is causing major disruptions in the natural dynamics of the ecosystems (E). On the one hand, the impact of dams is most notably reflected in the reduction of fish populations as a consequence of reduction in water quantity and quality. Some of the rivers have been altered to the point where they can no longer sustain fish populations at a healthy, sustainable level. On the other hand, the reduction in water quality may be considered a secondary effect as its primary cause is deforestation. Still, it is important to consider its impact on the ecosystems because dams exacerbate this problem. Given the economic and social values of fisheries in the basin, fish conservation should not be overlooked. Figure 2 presents the dominant variable as well as the secondary variables and the potential outcomes from their dynamic interactions.

4. Variable Identification

Table 1: Key Variables in increasing order of importance

<table>
<thead>
<tr>
<th>Variable</th>
<th>Economic (C)</th>
<th>Governance (G)</th>
<th>Ecosystem (E)</th>
</tr>
</thead>
</table>

Economy (C)

The Mekong River Basin is a relatively poor region but the basin states have recently been experiencing high levels of economic growth. Laos, Cambodia, and Vietnam are all classified as low-income countries by the World Bank therefore they are amount the least developed nations in Southeast Asia. Nevertheless, in 2007 GDP growth was 10.2% in Cambodia, 7.5% in Laos, and 8.5% in Vietnam. Even Thailand, which has the largest economy in the Lower MRB, grew by 4.8% in 2007.

Agriculture is the key economic factor in the Mekong River Basin. Approximately 75% of the MRB population is directly dependent on agriculture and fisheries. Moreover, in 2006 agriculture contributed 42.6% of Laos’ GDP, 20.3% of Vietnam’s GDP, and 31.9% of Cambodia’s GDP. Farmers in the MRB have used the river and its tributaries for irrigation for years and the basin’s massive rice production is important for the region's social values as well as for its economy.

*Table 2: Regional Energy Demand Forecast (MW)*

<table>
<thead>
<tr>
<th>Year</th>
<th>1995</th>
<th>2000</th>
<th>2005</th>
<th>2010</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cambodia</td>
<td>84</td>
<td>176</td>
<td>384</td>
<td>580</td>
<td>1,649</td>
</tr>
<tr>
<td>Laos</td>
<td>78</td>
<td>157</td>
<td>277</td>
<td>444</td>
<td>871</td>
</tr>
<tr>
<td>Thailand</td>
<td>13,420</td>
<td>15,254</td>
<td>20,818</td>
<td>28,913</td>
<td>43,627</td>
</tr>
<tr>
<td>Vietnam</td>
<td>2,910</td>
<td>5,505</td>
<td>9,226</td>
<td>14,474</td>
<td>28,180</td>
</tr>
<tr>
<td>Total demand</td>
<td>14,000</td>
<td>19,000</td>
<td>28,000</td>
<td>42,000</td>
<td>71,000</td>
</tr>
</tbody>
</table>

Ecosystem (E)

Among other issues that affect the local environmental of the Mekong basin, deforestation is one of particular interest to this study because it is largely caused by population growth and economic development. The forest cover in the Mekong Basin in 1970 was estimated to be 50% of the total land but by 1985 only 30% of the basin territory was classified as forest. Furthermore, the percentage of forest cover continues to decrease. As the region’s population grows there is greater demand for land for residential, commercial, and agricultural purposes. As a result, many physical variables are affected, natural habitats are lost, and with their destruction unique biological relations and life supporting systems are disrupted.

In addition, one of the local agricultural cultivation techniques is slash-and-burn—this intensifies the erosion effect caused by bared land. Also, land sedimentation produces a drastic reduction in water quality which negatively impacts fish populations. Moreover, erosion reduces hydropower generation potential because of the more rapid accumulation of sediment in dams. Consequently, although deforestation does not directly affect dam building in the Mekong Basin, its effects cannot be ignored.
Governance (G): The Mekong River Commission

The political, social, and economic developments of the Mekong River have evolved noticeably since 1950s when predecessor of the MRC was in existence, what was once called the Mekong Committee for the coordination of investigations on the lower river basin. Cooperation relations to develop the lower basin became more important in 1954 with the independence of Cambodia, Laos, and Vietnam from France under the Geneva Accord. The formal establishment of the Committee was openly promoted by the United Nations under the UNDP, and it smoothed the way for the constructions of infrastructure to provide electricity and irrigation systems on the basin. Similarly the U.S. government had political interests in the region and thus explicitly supported the organization for some time until the relations the member countries deeply deteriorated; other countries in European and Japan had to some extend engaged with the Mekong Committee. During this initial stage the Committee was heavily dependent funds coming from abroad.  

In 1995 Cambodia, Laos, Thailand, and Vietnam, after intensive negotiations to reconcile differences that took place during the era of the Committee, signed the Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin. This regime was instituted foster cooperate in the sustainable development, utilization, management and conservation of the resources of the Mekong basin. The areas of cooperation are targeted at optimizing mutual benefits of all riparian countries, the well being of their people as well as minimizing the harmful effects caused by natural processes or induced by human activities.

To achieve this mission the agreement created an international organization named the Mekong River Commission. In general the agreement creates several provisions which clearly intend to manage the resources of the basin in a sustainable way. However, one of its most fundamental weaknesses is that civil engagement in the decision making process is tacit. Consequently, this is one of several opportunities for improvement. Despite this elementary flaw, the MRC works its ambitious agenda around a joint comprehensive planning process for the entire lower river basin. This Basin Development Plan involves the regulation of fisheries, navigation, agriculture, irrigation and forestry, watershed management, environment monitoring, flood management, recreation, and hydropower development. In this sense every new development or intervention in the basis, especially hydropower projects, has to be part of the Basin Development Plan.
Evidence

As we have described, the issue of hydropower development in the Mekong Basin is a complicated one. In order to gain a deeper understanding of the complex interactions between the system variables, we focus on two dams in the lower Mekong Basin: the Pak Mun Dam in Thailand and the Nam Theun 2 (NT2) Dam in Laos. We have chosen these two projects as examples because they highlight the importance of governance and integrated water resource management in the basin. The Pak Mun Dam was completed in 1994, the year before the formation of the MRC, and thus provides the opportunity to examine water resource development in the absence of an integrated basin management organization. Alternatively, the Nam Theun 2 Dam, scheduled to enter operation in early 2009, offers a post-MRC perspective and leads us to assess the impact of the MRC and consider the potential impacts of both the NT2 and other proposed hydropower projects.

Pak Mun Dam

The Pak Mun Dam is located on the Mun River, a tributary of the Mekong in northeast Thailand, and was built by the Electricity Generating Authority of Thailand (EGAT), which generates and transmits power throughout the country. It is a roller-compactcd concrete type dam with a height of 17 meters, a total length of 300 meters, and an installed capacity of 136MW. The reservoir has a surface area of 60 square km and a capacity of 225 million cubic meters. Power is transmitted to the national power grid through an 115kV transmission line.

The Pak Mun project was built largely in response to the rapid economic growth and soaring energy demand in Thailand during the late 1980s and early 1990s. However, the dam was a highly controversial project in Thailand and generated numerous conflicts between stakeholders. The relationship between villagers and EGAT was particularly problematic.

While the Pak Mun hydropower project began with good intentions, various factors led to a significant difference between the projected and actual costs, benefits, and impacts. The final cost of construction provided by EGAT in 1999 was 6.5 billion Baht ($US 260 million), a 90% increase in nominal costs over the original 1988 EGAT estimates. Combined with the large increase in cost, the energy benefits of the Pak Mun project have been less than anticipated due to inaccurate assumptions in the planning process. The dependable capacity of the project is much lower than the initial estimated dependable capacity because of the unpredictability of the runoff from the Mun River and the Pak Mun's power production peaks in the wet season when power is least needed in the national system. So in general, the project was not cost-effective and it did little to address the growing energy demand in Thailand.

The Pak Mun project led to several other unexpected impacts as well. The fish catch directly upstream of the dam decreased between 60-80% after the dam's completion and numerous fish species have since disappeared. Over 50 species of fish dependent on river rapids have disappeared and 51 have been caught less significantly since the dam's completion. In addition to the obvious negative impact on the ecosystem, there was a significant adverse impact on local communities. The percentage of upstream households dependent on fisheries declined from 95% to 66.7% and many villagers who were reliant on fisheries for income were displaced without any other means of livelihood.

The Pak Mun project is an example of poor water resource management in the Mekong Basin. Without an international commission to provide guidance and minimize oversight, the project directors overlooked the impact on fisheries, failed to gather the necessary information, and refused to involve all stakeholders. For this reason the project was almost constantly slowed down by conflicts between local communities, the government, and the project developers.

Nam Theun 2 (NT2) Dam

The NT2 Dam is a hydropower project located in central Laos on the Nam Theun River that is scheduled to enter operation in early 2009. The dam is being built by the Nam Theun 2 Power Company (NTPC), a French-Thai-Lao special purpose company, along with the Government of Laos. The project is also supported by financing from the World Bank, the Asian Development Bank, and several other donor agencies. The project is expected to cost approximately US$ 1.45 billion and it has an installed capacity of 1,070 MW which means that it will more than double the hydropower generation capacity in Laos.

While the NT2 project is most certainly not immune from criticism, it improves upon the Pak Mun venture in several respects. The NT2 Dam aims to address both the growing energy demand in Thailand and the poverty in Laos. Additionally, the project includes measures to improve the probability that the project is both socially and environmentally sustainable.

To deal with the economic issues in both Thailand and Laos, the NT2 project will sell 95% of the electricity it generates to Thailand. This helps to satisfy Thailand's surging energy demand and it also helps to reduce poverty in Laos because the Lao government will receive approximately $2 billion in revenues over 25 years from the project. Also, the government of Laos intends to use the revenues from the project to invest in poverty reduction programs.

Furthermore, the project's social and environmental programs have been designed to minimize the negative effects on the community and the ecosystem. In terms of the impact on local communities, the project has allowed the roughly 6,000 resettled people to design their own houses and towns. The project aims to not only increase the living standards of those individuals displaced but to double their incomes within five years. Environmental impacts are also considered and as a result the project seeks to protect the region's valuable biodiversity through the creation of a 4,000 km² protected area for wildlife, the largest in mainland Southeast Asia.

The overall goal of the project is to generate revenues for poverty reduction and environmental protection, so in essence, the project attempts to find an equilibrium between the economic variable (C) and the ecological variable (E). With respect to E, the NT2 project works to mutually assist economic development in Laos and to sustain growing energy demand in Thailand. But not only does the NT2 project address a variety of concerns with respect to hydropower development, it also strengthens a relationship between two riparian countries. We believe G, the institutions and governance variable, is the fundamental reason for the NT2's comprehensive development plan. Though the NT2 has its critics and will certainly have its flaws once the project is completed, it illustrates the positive effect that the MRC can have on the Mekong Basin and suggests how the MRC can be more effective still.
Here the MRC has the capacity and obligation to monitor or to facilitate the monitoring of the impacts on the river basin coming NT2. For example, The Asian Development Bank commissioned a cumulative impacts assessment to evaluate the effects of the NT2 project based on development scenarios into a 5 year and 20 year time periods. Here, MRC was consulted as key stakeholders; the study concludes that the impact of NT2 alone on fisheries and water levels downstream of the Xe Bang Fai confluence with the Mekong would be insignificant (World Bank, The Nam Theun 2 Hydroelectric Project NT2).

**Proposed Projects**

Over 100 large dams have been proposed in the Mekong Basin in the last decade. Figure 4 provides a visual demonstration of the huge number of proposed hydropower projects. Most planned dam projects in the lower Mekong Basin are located in Laos because of the high flow contribution of the left bank of the Mekong and because the majority of suitable sites in Thailand have already been developed. This highlights the relevance of the NT2 Dam that we discussed because the NT2 project is part of a 7,000 MW electricity export program between Laos and Thailand. Therefore the example we present is not an isolated case but rather representative of the region as a whole. In addition to Laos, Myanmar and China are also looking to exploit the great hydropower potential of the Mekong Basin in order to meet the growing market demand for electricity across Southeast Asia in countries such as Thailand, Vietnam, Malaysia and Singapore. Thus the NT2 project serves not only as an example of the growing energy trade between Laos and Thailand, it provides an example of the possibilities for the energy market in Southeast Asia as a whole. The construction of future projects are a central theme which needs to be oversee by the MRC for monitoring and when necessary to resolve any potential conflict resolution. Hydroelectric development poses one of the biggest challenges, and a tool to assess the regime and MRC’s intervention effectiveness and of how local politics is reflected in the process. The grounding rules provided by the MRC and Basin Development Plan must be the guiding principles to reaching sustainable management of the basin.

![Image](https://via.placeholder.com/150)

**5. Summary and Key Questions Addressed**

The perception of international river basins resources as common pool or public resources may lead to different degrees of unsustainable outcomes. International cooperation agreements can lead to progressive sustainable management of river basin resources provided clear and effective institutional capacity. We looked at the major issues faced by the actors managing the Mekong River Basin and how are these issues reconciled.

This case study explores these questions by examining a cooperation agreement which created the Mekong River Commission (MRC) for the management of the Lower Mekong River Basin. We provide evidence on the progressive movement towards improved water management and development by comparing two major projects: the Pak Mun Dam, which was built before the 1995 agreement was signed, and the Nam Theun 2 Dam, which is nearing completion and is clearly a post-MRC project.

Our findings suggest that an effective regime relies on the institutional capacity. MRC must have to suggest policies and rules that deviate actors from unsustainable practices in resource management. The challenges posed by environmental degradation or economic pressures from dam constructions on the Mekong River set substantial constrains for an effective water resource management plan. Yet, the greatest challenge for the MRC in the sustainable water management and the development of the basin is building its own institutional capacity and inviting all stakeholders to work under a new politics of sustainability.

1. UNEP, 2006 (See List of References for details)
3. Ibid.
5. UNEP, 2006.
6. Ibid.
10. Regardless of whether this dependency on oil affects only the economy or is also a political strategy related to security, climate change or something else. The important issue here is the fact this policy drives the construction of dams. This question is not discussed here as it is beyond the scope of this paper.
13. The total demand as presented here is not the sum of the individual countries' demand. It is estimated taking into account load factor and losses for the Mekong Basin interconnected system and thereafter rounded.
16. People’s Republic of China and Burma (the Union of Myanmar) are observer parties.
18. The MRC is formed by the Council, the Joint Committee, the Secretariat, and the Chief Executive Officer. Its hierarchical the structure is not discussed in this paper.
20. Ibid.
List of References


Editor: Yongxuan Gao