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# THE ROLE OF ISSUE LINKAGE IN MANAGING NON-COOPERATING BASINS: THE CASE OF THE MEKONG

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# The role of issue linkage in managing non-cooperating Basins: the Case of the Mekong

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## Abstract

The Mekong River is the major water source in Southeast Asia, shared by six countries. There is a rush, by riparian states, to acquire sources of alternative energy and other benefits to meet growing demands for water and energy. China and Myanmar have refused to cooperate fully in the Mekong River Commission, leading to increase risks within the region. Development of the water resources of the Mekong River Basin is the subject of intense debate both within the Mekong region and internationally. This paper investigates the concept of issue linkage to resolve unidirectional externalities in the Mekong River. Using linked games, the paper shows that the downstream nations can consider the use of linkage as a form of side payment in achieving a basin-wide agreement. While this approach supports the integrated water resource management (IWRM)-based Basin Development Strategy adopted by the Mekong River Commission in April 2011 for managing the region's sustainability development, facts on the ground suggest that traditional issues to be linked may not be sufficient. The paper addresses this observation and suggests a cadre of issues, including non-traditional ones, to be analysed in a future work.

**Keywords**: *Transboundary river basin, Mekong River, externality games, issue linkage, cooperative solution, water resources, energy*.

**JEL codes**: C71, C72, D62

## INTRODUCTION

The Mekong River (MR) is the major water source in Southeast Asia, shared by six countries. Originating at over 4500 meters elevation in the Tibet Qinghai plateau, the Mekong- the tenth-longest river in the world flows for over 4800 km through China, Myanmar, Laos, Thailand, Cambodia and Vietnam (MRC, 2005). Prior to entering the South China Sea, it drains over 795,000 square kilometres (MRC, 2005). The Mekong river provides not only a source of energy through hydropower production but also many environmental, economic, and other benefits for the region, including fisheries, wetlands, ecosystem services valuation, transportation, trade, water supply, and tourism.

Like many transboundary river basins in the world, joint management water resources has become the subject of increasing competition between many sectors in the Mekong River Basin and is a source of tensions (Campbell, 2009). The four downstream nations (Thailand, Laos, Cambodia, and Vietnam) signed the 1995 Mekong Agreement and formed the Mekong River Commission (MRC) to promote development and management of the river and its resources in a sustainable manner (MRC, 2005). The MRC serves as the primary regional organization in the Mekong basin and has the mandate to cooperate on development, including mainstream and tributary damming. To date it is largely dependent on overseas donor funding (Suhardiman *et al,* 2012) and has only managed to involve its member states on apolitical issues (Matthews, 2012). Currently the MRC has faced difficulties in sustaining the basin resources. About 21% of the Mekong River Basin (MRB) area is eroding; only 31% of its original forests have been left intact and only 5% are under regulated protection (UNEP, 2006). In addition, about 75 million people that depend upon its resources for food production (Osborne, 2004, Cronin and Hamlin, 2012) are likely to face some monumental challenges in the years to come. One of the most urgent developmental challenges is the management of water resources to meet growing demands for food production and energy. In developing the MRB, home to the world's poorest and fastest-growing populations, this challenge is exacerbated by rapid and often chaotic social and economic change, environmental degradation and limited understanding of the complex web of interactions between water-related uses in different sectors. As it seems, the MRB is already facing many threats to sustainability, which have been the results of many years of non-cooperative management of the basin even by the Lower Mekong Basin (LMB) countries, which are signatories to the 1995 Mekong Agreement.

The MRB has attracted considerable international attention due to a long and somewhat seemingly successful history of institutionalized river basin cooperation (further details; see Jacobs, 1995; 2002).[1] On the other hand, it has also been experiencing recent challenges in terms of the potential alteration of complex ecological and social systems (Dore and Xiaogang, 2004; Campbell, 2009), especially given the very high economic growth rates in China and the political intransigence of the Myanmar Government. Southeast Asia's need for energy is big and its development is rapid. The rush to acquire resources of alternative energy

[1] There are many that dispute the success of the 1995 Mekong Agreement in stirring cooperation in the LMB due to the lack of legal and procedural elements for joint management (Phillips et al. 2006; Bearden 2010; Osborn 2010).

and other benefits have created a regional resource politics (Hirsch and Sciortino, 2011) leading to the so called "water grabbing", where powerful state and private actors are able to mobilize power to control the benefits of hydropower while livelihoods and ecosystems that depend on the water resources that hydropower production disrupts are negatively impacted (Matthews, 2012). Though the MRC appears to be caught between short term economic focused water resources management agendas of the Mekong states, there is a large disconnect between the MRC's program objectives and those of regional governments (Suhardiman *et al* 2012). China[2] is host to the Mekong´s origin and has played a leading part in the Upper MR. China is also able to exert its power both in traditional terms (military, economic, diplomatic actions) as well as more non-traditional ways (i.e. unidirectional upstream externalities).

Recent studies suggest an urgent need to support the MR countries in their responses to likely impacts of and adaptation to climate change in the MRB, including cooperation as expressed in the 1995 Agreement (Phillips *et al*, 2006; Fox and Sneddon, 2007; Osborne, 2010; Rayanakorn, 2011). In particular, major concerns have been expressed with regards to impact of climate change on the lowest portion of the Mekong—the Mekong Delta with its rich ecosystem (Truong et al. 2011). The downstream co-riparians remain at risk under circumstances where China and Myanmar have refused to cooperate fully in the Mekong River Commission (Phillips et al, 2006; Osborne, 2010). Without China´s full participation in the MRC, the commission is "vulnerable to biophysical and socioeconomic stress as it cannot estimate the amount and quantity of water in the MR due to the development of Chinese hydroelectric and water infrastructure projects in Yunnan" (Hensengeth, 2009: 340). As the Lower Mekong Basin (LMB) states largely failed to bring China to the negotiating table and apparently lack the will or ability to challenge China on its dam-building, China can expand its dam capacity without the need for cooperation with the LMB nations[3]. The MRB sustainable development provision remains largely ambiguous due to the lack of a legal framework and procedures for management (Browder, 2000; Phillips *et al.*, 2006; Bearden, 2010; Osborne, 2010). The partition of the water is just one issue to be taken into account, in addition to be insufficient on its own to establish a viable regime (for sustainable development), which reflects all water-related management problems in the Mekong.[4]

The literature on transboundary river management shows that economic efficiency alone is not a sufficient condition for cooperation, especially when it is related to the transfer of a scarce resource, such as water, among hostile potential cooperators (Dinar and Wolf, 1994). Therefore, when negotiations address an issue with strong asymmetry, grouping relevant issues with opposite asymmetry interests can be advantageous because countries are more likely to exchange in-kind side payments than monetary side payments and facilitate credible threats against defections (Just and Netanyahu, 2000). The Transboundary Freshwater Dispute Database also shows that 43% of river treaties include linkages with non- water

[2] China was one of three countries voting against the adoption of the 1997 UN Convention on the Laws of the non-navigational uses of International Watercourses.

[3] Since Myanmar share in the catchment is only 3 percent and it contributes to the flow only 2 percent, it will not be considered in our analysis.

[4] Linkage of political issues has also been common since the 1950s.

issues (cited by Biba, 2012). In their works, Bennett *et al*. (1998), Kliot *et al.* (2001) and Kemfert (2004) suggested that the complexity of international negotiations can be better modelled by linking independent games. Regional economic development, which can involve treaty commitments to develop the basin through construction of infrastructure (such as land transport projects in the Greater Mekong Subregion, dams, barrages, or irrigation networks, or even linking trade agreements) is among the most promising direction perceived by states to generate positive gains (UNEP, 2012; Stone and Strust, 2010).

Several studies analyzed the upstream-downstream conflict in the Mekong. Pham Do *et al.* (2012) developed a stylized set of games to demonstrate the potential of linkage in solving a simple upstream-downstream conflict in the Mekong. Zhu *et al*. (2013) use a bargaining framework that is connected to an international transfer of funding to provide incentive for regional cooperation. As such they analyse the implications of different bargaining powers in the basin under two governance structures in among the LMB states. Houba *et al*. (2013) investigate the welfare effects in the year 2030 arising from strengthening the MRC's governance versus joint management of the entire MRB (with China). Without joint management, strengthening the MRC's governance has a significant potential to increase welfare gains, but it requires that the interests of all stakeholders be equally balanced. Houba *et al*. (2013) show that the LMB has no incentive to negotiate with China and is better off strengthening the MRC's governance instead. If such strengthening could be realized, further welfare gains of joint management by a wider and stronger MRC, including China, would be negligible. Biba (2012) provides a very detailed description of the likely impact of the basin dam development by China on the LMB states, possible and impossible actions to be taken by the LMB states, and possible issue linkages. While the paper is descriptive in nature, it allows understanding of the forces acting in the region and the possible scenarios to take place. While all those works are very useful, in their own way (see Johnston and Kummu, 2012 for further details), in explaining existing and potential developments among upstream and downstream interests in the basin, none of them applies an issue linkage game to empirically addresses all relevant issues, and to provide a comprehensive assessment of the likelihood for a cooperative arrangement in the Mekong Basin.

In this paper we analyse systematically various opportunities for the joint management of a wider MRB. We consider the interaction between upper and lower Mekong in a general form of externality games (specifically addressing dam construction upstream) and view the negotiation for achieving a wider-basin agreement as the outcome of the aggregated isolated linked games. The paper aims to address the following questions: (1) to which degree (condition) should different policy issues be linked in MRB agreements? (2) do existing MRB institutions limiting the ability of nations to enhance welfare because it does not link more policy issues in the same agreement? and (3) to what extent can the linked game explain the actual cooperation arrangement in the wider MRB, and how can it be enhanced. Using the notions of games with externalities and issue linkage, we show that the LMB riparian nations can consider the use of issue linkage as a powerful tool in negotiating with China. We also demonstrate that the LMB has potential opportunities to show that a basin-wide agreement might indeed contribute to the region’s sustainable development. In the next section, we provide a background (on conflict and cooperation) for the region and outline the

possibilities of issue linkages. A generalized framework of linkage games for analyzing the role of regional cooperation among states in managing the Mekong is presented in section 3. Policy implications and concluding remarks follow in the last section, including a discussion of difficulties to realize the outcome in reality and what can be suggested.

## CONFLICT AND COOPERATION CHALLENGES FACING THE MRB

The transboundary nature of the MR adds an extra dimension of complexity to the debate about equitable sharing of the river's resources. This section provides a brief review of the Mekong River Basin's situation, including existing conflicts and cooperation issues.

### The Mekong River Basin

The MRB encompasses a vast range of geographic and climatic zones and is divided into the Upper Mekong Basin (UMB) constituting China and Myanmar (24% of the total drainage area) and Lower Mekong Basin (LMB) constituting Cambodia, Laos, Thailand and Viet Nam (76 % of the total drainage area). Table 1 presents a summary of the distribution of water and land resources of the MRB.

**Table 1: The water resource profile of the MRB**

| | China | Myanmar | Laos | Thailand | Cambodia | Vietnam |
|---|---|---|---|---|---|---|
| Area ($\times 10^3$ km$^2$) | 165 | 24 | 202 | 184 | 155 | 65 |
| Catchment area as % of MRB | 21 | 3 | 25 | 23 | 20 | 8 |
| Flows as % of MRB | 16 | 2 | 35 | 18 | 18 | 11 |
| Average flow (m$^3$/sec) | 2410 | 300 | 5270 | 2560 | 2860 | 1660 |

Source: MRC (2005).

Although only 16% of the total discharge originates from the upper MR, China is the important part of the basin.[5] During the critical dry season, China' discharge amounts to most of the Mekong River mainstream flow in Laos and Thailand and contributes to almost 45% of the average flow in Cambodia (Goh, 2004). Moreover, about 35% of the spring flow and over 55 % of the sediment flux originates from its upper territory (Kummu *et al*, 2008). The MRB is home to nearly seventy five million people[6]. It possesses the region´s largest potential water resources and related resources that support on-going economic development and basin community livelihoods.

Table 2 presents some selected aggregated indicators of the Mekong region. Populations range from 6.7 million people in Laos to over 90 million in the combined Yunnan/Guanxi

[5] As mentioned in footnote 3, Myanmar is not included in our analysis.
[6] This is one of the poorest regions in the world as a third of whom survive on a few dollars a day (ADB, 2004; Mehtonen *et al.* 2008).

region of China[7]. As a whole, its average growth of real gross domestic product (GDP) has continuously increased in recent years (ADB, 2012). Despite this, the proportion of the population living below the poverty line exceeds 30 per cent, including over 100 different ethnic groups, in parts of Laos, Cambodia and Vietnam (UNEP, 2008). Poverty is still a critical issue across the basin, despite its significant economic growth.

**Table 2: Selected aggregate indicators for MRB and China in the Great Mekong Sub-region in 2013.**

| | **Population** (million) | **Population growth** (%) | **GDP** (US$) (billion) | **GDP real growth rate** (% for 2012) | **GDP per Capita (rounded)**[a] (US$) | **PPP per capita (rounded)** (US$) |
|---|---|---|---|---|---|---|
| Cambodia | 15.20 | 1.67 | 14.25 | 6.5 (35)[b] | 930 | 2400 |
| Laos | 6.69 | 1.63 | 9.27 | 8.3 (13) | 1385 | 3000 |
| Myanmar (for 2012) | 54.58 | 1.07 | 53.94 | 6.3 (39) | 990 | 1400 |
| Thailand | 67.45 | 0.52 | 377.00 | 5.5 (53) | 5590 | 10000 |
| Vietnam | 92.48 | 1.03 | 138.10 | 5.0 (63) | 1490 | 3600 |
| China | 1349.84 | 0.46 | 8227.00 | 7.8 (20) | 6130 | 9300 |

Source: CIA World Factbook (access June 26, 2013).

[a]Authors' calculation. Obtained by dividing values in GDP column by values in Population column

[b]In parenthesis is the ranking of GDP real growth rate of the country among other world countries.

As can be seen in Table 2, there is quite a large difference between the basin states in several parameters that indicate the regional disparity. For example, GDP , which is a measure of the economic power of the state, ranges a great deal across the states between US$9 billion (Laos) and US$8227 billion (China), and GDP per capita (not in the table), which measures the welfare power, ranging between US$930 and US$6130. These disparities suggest a possible different set of issues of interest and abilities to equally negotiate over these issues by the basin states. We will get to this point at a later stage of the analysis.

The Mekong riparian states have quite different long term major use patterns of the river. However, the river's waters are used mainly for hydropower production and irrigation (MRC, 2010). Table 3 presents the annual economic values of China and the LMB, based on the four main water-using sectors in 2010. The economic value of the LMB is calculated as the aggregate of the individual MRC members. Irrigation generates the highest aggregate economic value for both China and the LMB, contributing 40% and 62.5% of each region's aggregate economic value, respectively. The share of water used for irrigation is expected to increase in the LMB (FAO, 2012). Hydropower generation contributes the second-highest economic value (32%) for China, while fishery is the second highest (22%) for the LMB.

[7]Not presented in the Table. Yunnan's population is about 46 million.

**Table 3: Annual economic value (in billion US$) from different types of water uses in 2010.**

| | China | The LMB | The entire MRB |
|---|---|---|---|
| Households and industrial | 0.408 (17) | 1.956 (14) | 2.364 (15) |
| Hydropower on mainstream | 0.758 (32) | 0 | 0.758 (5) |
| Hydropower on tributaries | 0 | 0.206 (2) | 0.206 (1) |
| Irrigation | 0.961 (41) | 8.619 (62) | 9.580 (59) |
| Fisheries | 0.237 (10) | 3.000 (22) | 3.237 (20) |
| **Total** | 2.364 (100) | 13.781 (100) | 16.145 (100) |

Source: (Houba et al, 2013).

Note: In parentheses are rounded percentages of the types of water use values.

At present the LMB's hydropower generation takes place in the tributaries and produces only 2% of the total economic value of the LMB. This low value reflects the undeveloped hydropower potential in the LMB. Based on data compiled in Dinar *et al.* (2013) existing and under construction hydropower production facilities consist of only 20% of the total potential hydropower production capacity in the LMB (estimated at 29,760 MW. The MRC has proposed many plans for developing this potential through dam projects; there are 11 mainstream dam proposals and 30 planned tributary dams to be developed between 2015 and 2030 (Kubiszewski *et al*, 2012). However, these dam projects are not going to be realized due to lack of legal and procedural elements in the 1995 LMB treaty.

***Overview of development and cooperation obstacles in the Mekong***

Development of resources in the Mekong has not been considered without controversy. China views the upper Mekong primarily as a source of hydropower and as a trade route. Laos also considers the Mekong primarily as a source of hydropower. More than 90 per cent of electricity in Laos is produced from hydroelectric plants (Campbell, 2009). Thailand considers the Mekong as a water resource for irrigation. The main value of the Mekong for Cambodia is for fishery production, while Vietnam relies on the water to support the Mekong delta's agricultural production. There are clear potential conflicts between these demands for water, which will require trade-offs among water-using sectors. Can such diversity of interests allow reaching cooperation?

Over the years, the six riparian states of the Mekong have grouped into different water institutions and programs for managing the Mekong. An increasing number of river-based cooperation institutions have emerged in mainland Southeast Asia since early 1990s. Among these are the Mekong River Commission (MRC), the Greater Mekong Subregion (GMS) and the Mekong Basin Development (MBD) that take place under the overarching framework of the Association of Southeast Asian Nations (ASEAN). As the MRC is troubled by the diversity of expectations among the member countries, the ASEAN has played an important role in economic development of the Mekong region and has attracted international attention (for details see Weatherbee, 1997; Hensengeth, 2009). These institutions will play a role in analyzing opportunities of issue linkage in reaching a basin-wide agreement. For more details on these institutions see Annex.

Recent hydropower project developments in the MRB are largely unbridled because of the lack of legal hurdles and international coordination on such projects (Phillips *et al*., 2006; Bearden, 2009; Osborne, 2010). The MRC's mission is to promote and coordinate sustainable management and development of water and related resources for the countries' mutual benefit and the people's well-being by implementing strategic programmes and activities and providing scientific information and policy advice (MRC, 2005). The absence of China, however, is one of the MRC's main weaknesses. Governments in the LMB face critical decisions about the future of the mainstream MR, as will be discussed in the next section.

***Impacts of hydropower projects on the MRB***

With quite impressive economic growth (Table 2), electricity demand in the Mekong region has grown rapidly at annual rates ranging from 4.9% to 20.9% since 2000 (ECA, 2010). In particular, China's economy has been doubling since its reform period began in 1978, leading to surging energy demand. The fast export-led growth in Thailand, Laos, Cambodia and Vietnam has also increased demand for electricity in the middle and lower Mekong region. China has more than doubled its consumption between 1997 and 2007. Its electricity production capacity in 2012 is estimated at 4.94 trillion kWh of which nearly 22 per cent are from hydropower (CIA, 2013) while its hydro-electricity production presently). China's energy demand has been an important driving force for the development of hydropower projects along the MR mainstream.

Table 4 presents the electricity consumption forecast for 2020 and the expected annual growth rates in the period 1993-2020 for all six Mekong Basin states. Currently there are about eighty dams in various stages of planning and construction on the Mekong mainstream and its tributaries (Li, 2012). Most of the recent interest in developing hydropower on the mainstream focused on locations in Laos, Laos-Thai border and the Cambodia reaches of the Mekong mainstream. The MRB consumption forecasts suggest that there will be a need for increased capital investment from US$5 billion in 2004 to US$14 billion in 2020 (Yu, 2003). Hydropower projects in the Mekong region have generally been profitable for both host governments and private-sector sponsors.

**Table 4: Electricity demand for 2020 and annual growth rates in 1993-2020 (Yu, 2003).**

| **Forecast for 2020** | **Low** | **Base** | **High** |
|---|---|---|---|
| Demand (GWh) | 415,242 | 597,298 | 830,799 |
| **Average annual growth** (%) | | | |
| Cambodia | 6.4 | 8.0 | 9.2 |
| Laos | 5.9 | 7.3 | 9.3 |
| Myanmar | 3.8 | 6.6 | 6.9 |
| Thailand | 6.4 | 7.6 | 9.0 |
| Vietnam | 6.7 | 8.0 | 8.7 |
| Yunnan (China) | 4.7 | 6.6 | 8.1 |
| **Regional average** | 6.2 | 7.6 | 8.7 |

According to Li (2012), the total monetary value of benefits from hydropower operations in the next twenty years in the region is estimated to be US$15-20 billion. However, dam-building may have both positive and negative impacts that should also be taken into account. As a transboundary river, the hydropower resources of the Mekong are limited because too many dams may lead to the tragedy of the common (i.e. multiple parties acting independently in non-cooperative behaviour will ultimately deplete a shared limited resource). Studies have already shown that upstream dams can lower water levels downstream. Lowering the water levels and flow, upstream dams will also lower downstream hydropower potential and its expected economic return (Ziv *et al*, 2012; Kubiszewski *et al*, 2012; and Biba, 2012).

Although dams can help with flood control in the wet season and with increased water supply for irrigation and navigation during the dry season for downstream riparian states, the potential negative consequences for the LMB are multi-faceted and likely to materialize in ecological, economic and negative political outcomes (Biba, 2012). Planned dams will block critical fish migration routes between the river's downstream floodplains and upstream tributaries. For example, the Chinese upstream main Mekong dams' environmental impacts have received much attention. A UN Environmental program-Asian Institute of Technology report from 2009 suggests that the Chinese dams may pose considerable threats to the MRB, while Chinese scholars suggest otherwise (Li, 2012). Recent studies on the impacts of dams' constructions on the Mekong suggest that dams have a significant negative impact on fisheries, in some cases driving them to collapse (Ziv *et al*, 2012; Pukinskis and Gehab, 2012). Ziv *et al* (2012) find that the completion of 78 dams on tributaries would have catastrophic impacts on fish productivity and biodiversity. Moreover, the value of lost capture fisheries, future aquaculture production in the LBM and the values of lost ecosystem services is estimated to be in the range of US$33 billion to US$274 billion (Kubiszewski et al, 2012). Therefore the transboundary nature of the MR adds an extra dimension of complexity to the debate about equitable sharing of the river's resources.

***Opportunties and Challenges in the MRB***

The rich human and natural resources, as well as the current peaceful political situation in the Mekong region, have attracted many foreign investments and made it one of the world's fast growing regions (UNEP, 2008). In this section we report some opportunities and challenges of the MRB. As trade is an important issue driving economic growth and infrastructure is a necessity condition for trade, infrastructure development has a key role in economic development in both the MRC and GMS programs. We will focus especially on the water management and trade issues in the context of the MRC and the GMS programs.

The MRC's scope of work has expanded from its original tasks during the 1957-1992 Mekong Committees period, of primarily water resources related development, to include environmental, capacity building and socio-economic considerations in its various programmes. Table 5 provides 2010's electric power trade and energy resources in the Mekong region. China, Myanmar and Laos are three exporting countries. China and Laos endow the most mainstream hydropower potential, and are positioned to reap most of the benefits from damming the river. The heavy socioeconomic costs will be disproportionately

borne by downstream countries, especially Cambodia, Vietnam and riverine parts of Thailand (Cronin, 2012). For example, the MRC's Basin Development Plan estimates a cumulative net economic benefit of US$33.4 billion over 20 years and total economic benefits for 11 proposed dams ranged from a small positive sum of US$6.6 million to a larger negative (cost) sum of US$274.4 billion. Though the LMB countries overall seemed having positive total benefits, under the Basin Development Plan assumption, only Laos has a net benefit whereas the impacts for the three other members of the MRC ranged from negative US$50 billion to negative US$128.9 billion (Cronin, 2012; Kubiszewski *et al.*, 2012).

**Table 5 GMS electric power trade and net import in 2010 (GWh).**

| Country | Import | Export | Total | Net import | Energy Resources (2009) |
|---|---|---|---|---|---|
| China | 1720 | 5659 | 7379 | -3939 | 104370 |
| Myanmar | | 1720 | 1720 | -1720 | 39669 |
| Laos | 1265 | 6944 | 8209 | -5679 | 17979 |
| Thailand | 6938 | 1427 | 8365 | 5511 | 4566 |
| Cambodia | 1546 | | 1546 | 1546 | 9703 |
| Vietnam | 5599 | 1318 | 6917 | 4281 | 35103 |

Source: Tables 1 and A1.1 in ADB (2012).

Water use in the Mekong region can be categorized as consumptive or non-consumptive. Consumptive use commonly refers to water that is unavailable for reuse in the basin from which it was extracted due to evaporation, incorporation into production biomass, transfer to another basin, seepage to saline sink, or contamination. Non-consumptive use refers to water that is available for reuse within the basin from which it was extracted, such as return flows. Total water use is now understood to be a poor indicator of the value or productivity of water, and a poor indicator of true efficiency (Gleick *et al*, 2011). According to Gleick *et al* (2011), the soft path for water recognizes that the real purpose of water use is not evaluated or measured in terms of total water volumes or new water produced, but by measures of the goods and services provided by that water use. Hence, society´s goal should be improved social and individual well-being per unit of water used (Wolf and Gleick 2002). In this regard, one can think of linking water and non-water issues in managing a water resource. As trade is an important issue driving economic growth, and infrastructure is necessity for trade, infrastructure development has a key role in economic development in the MRB and in improving water use efficiency.

**Table 6: Intra-GMS exports (Adjusted from Stone and Strutt, 2010).**

| Export from/to (US$million) | Cambodia | Laos | Myanmar | Thailand | Vietnam | China |
|---|---|---|---|---|---|---|
| Cambodia | | 0.57 | 0.36 | 49.78 | 43.86 | 55.38 |
| Laos | 0.31 | | 0.02 | 101.24 | 0.38 | 16.26 |
| Myanmar | 0.24 | 0.01 | | 1089.4 | 0.44 | 206.04 |
| Thailand | 555.8 | 454.2 | 613.4 | | 1978.0 | 12786.0 |
| Vietnam | 51.1 | 0.2 | 0.3 | 451.7 | | 2516.1 |
| China | 624.3 | 86.1 | 969.8 | 7148.2 | 4863.4 | |

The GMS countries have grown rapidly since 1992. Openness, as measured by the ratio of the sum of exports and imports of goods and services to gross domestic product (GDP), increased in all the GMS countries except Myanmar during the last 2 decades (Srivastava and Kumar, 2012). However, while there is some variation across the GMS, overall it remains a relatively poor region (Stone and Strutt, 2010). Srivastava and Kumar (2012) find that, in the five lower Mekong countries (GMS5), the growth of trade has been rapid even without China. Table 6 shows the Intra-GMS exports. In terms of intra-regional trade dependence and the degree to which China plays a role in that dependence, China has grown faster than the overall GMS5. In addition, on January 1, 2010 the China-ASEAN Free Trade Agreement (CAFTA) came into force. This established the third-largest free trade area (FTA) in the world, just behind the European Union and the North American Free Trade Area (NAFTA). However, China is now facing a great challenge in getting the agreement formally implemented because the trade structure between China and ASEAN countries (AFTA) is competitive rather than complementary (Wang, 2011).

Various studies (for example, Barrett, 1994; Dinar *et al*, 2013 and references therein) show that allocation procedures and mechanisms are more problematic in transboundary water resources. The two main characteristics of the problem are: countries' welfare are interdependent, through water quantity/quality externalities; and all solutions to the allocation problem must be consistent with the principle of national sovereignty, that is, a country's compliance with the agreement must be strictly voluntary and self-enforcing. A feature peculiar only to international rivers is the un-directionality of river flow, which makes the allocation process even more difficult. Within this context, static game theory may generate outcomes in which the dominant strategy for the upstream country is not to cooperate, whereas the downstream country's dominant strategy is to cooperate. The resulting equilibrium, therefore, is not efficient. To achieve an efficient outcome, side payments have been suggested (Porter, 1988; Barrett, 1994) as means to internalize the externality by the upstream country. With all that background it is obvious that an evaluation of a possible issue linkage would require the use of a normative model. In the next section we present a model of issue linkage as a form of side payment.

## A MODEL FRAMEWORK

To address the peculiar situation in the Mekong, a model is developed with focus on the MRB structure. However, the features of the model allow easy adaptation of the model to structure and number of riparian states in any other river basin. In the following we introduce the notions of issue linkage and linked games that will be used for analyzing the possible joint management options in the Mekong.

We consider a negotiation between upstream (China) and downstream (four LMB countries) for achieving a basin-wide agreement as a two-stage game. In the first stage, countries (China and LMB)[8] can play non-cooperative over independent policy issues[9] (strategies) such as

[8] Myanmar is excluded both due its political separation policy and thus, lack of data, and its minute contribution

energy (hydropower generation), trade and the ecosystem (fishery and agricultural productions) to determine (evaluate) their policy (variables). Then in the second stage the final outcomes are calculated in a linked game structure for the negotiating countries. The features of the model allow its easy adaptation to the structure and number of riparian states in any other river basin.

We view the MRB as a trans-boundary water resource, shared by two players (regions): China (upstream) and the LMB countries (downstream) represented by the MRC. At present, the cooperation between these regions is lacking. As the LMB does not talk in one voice, the MRC has weak policy instruments and seems politically biased in favour of hydropower generation (Grumbine *et al*, 2012). Hence, on the water issue, the LMB riparian nations seem to face two strategies (regimes): weak (i.e. the four countries act individually) or strong governance (the four countries can act collectively, via MRC), whereas China has two strategies either cooperate or not with the LMB on water uses.

In addition to the water issues, each player also has two strategies regarding regional trade, as is described below. In January 2007, the ten South East Asian countries agreed to implement the ASEAN Economic Community (AEC) by 2015, committing to provide a comprehensive framework for economic integration (Petri *et al*, 2012). Based on the progress in the implementation of the blueprints for building the ASEAN community by 2015, there is an enhanced role for the ASEAN in dealing with regional and global challenges. As the four LMB nations are members of ASEAN, the LMB has advances on the trade issue (such as introducing the elements of the AEC as well as the AFTA, as is indicated in the Annex, and new international agreements with external partners) for negotiating with China. In the following we provide the technical underpinning of the model.

Let $N = \{1, 2..., n\}$ be a set of policy issues. Assuming that the two players, $J = U, L$ (i.e. China, *U*, and LMB, *L*), make simultaneously a policy choice or action $a_J = (a_{J_1}, ...a_{J_n}) \in A_J$. An *action (policy) profile* $a = (a_U, a_D) \in A = A_U \times A_L$ specifies, for each player, a policy choice with respect to each $i \in N$. For example, we may think of dam construction plan, trade, energy plan, ecosystem protection, environmental policy and so on. Furthermore, for each issue $i \in N$, each player $J$ has a measurable *payoff function* $w_{Ji}^a$ on action profile *a* with the *players' objective function beings linearly separable in the policy issues,* i.e. $w_J = \sum_{i=1}^{n} w_{Ji}^a$. We assume that all players face the same utility from payoff levels in the game, namely utility from marginal payoff is similar for China and LMB.

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of water to the Mekong runoff.

[9] We assume for simplicity that the LMB states act in one voice. While this is a simplifying assumption given the present on-going disagreements between the LMB states, still we believe that they have a common threat and interest in the conflict with China. In future work we will also add another stage to the game, where equilibrium is reached in the internal LMB. We address the ability of the LMB states to speak in one voice on Mekong water issues via the MRC ability to demonstrate weak or strong governance.

Since a basin-wide agreement can be achieved only if all players participate (i.e. cooperating and forming a grand coalition), we consider the (static) simplest games with two strategies: agree (cooperate) or defect and focus on bilateral (i.e. two regions) rather than multilateral games. In other words, to achieve an agreement through linked issues, each player has *two possible actions:* either takes *c* for cooperation (i.e. $a_{Ji} = \arg\max_{a_{Ji}} (w_{Ui}(a) + w_{Li}(a))$) or *d* for defection (selfish policy action $a_{Ji} = \arg\max_{a_{Ji}} w^a_{Ji} \neq a_{Ji}$). The corresponding stage game with strategy space $a_J = A_{J1} \times A_{J2} \ldots \times A_{Jn} = \{c, d\}^n$ is denoted by $\Gamma$. Let $\Gamma_i(a)$ be the 2-person (externality) game with respect to issue *i*.

**Definition** *The policy issues i and k are called substitutes for player J, if* $(w^a_{Ji} - w^{cc}_{Ji}) + (w^a_{Jk} - w^{cc}_{Jk}) < 0$ *, and complements if* $(w^a_{Ji} - w^{cc}_{Ji}) + (w^a_{Jk} - w^{cc}_{Jk}) > 0$ *for any action plan a (≠ (c,c)).*

One can easily see that if two issues are substitutes, a cooperative outcome would be a better choice for both players (i.e. a wider-basin agreement can be achieved) as the final outcome of cooperation generates a higher outcome. Therefore, if two issues (or more) are substitutes, linkage can maintain the positive allocation effects or increase the amount of available enforcement power, i.e. support cooperation[10]. However, if two issues are complements, the surplus opportunistic potential of one policy could outweigh the surplus enforcement power of the other policy, making defection a dominant strategy in both regimes (policy issues), and turning linkage into a destructive policy (destroy cooperation).

The following model, based on Pham Do *et al* (2012), explores the idea of using linkage as a mechanism for facilitating broader cooperation. The intuition behind this idea is that linking two (or more) policies (regimes) could allow countries to use surplus enforcement power that may be available in one policy domain to discipline cooperation in other domains. For example, for policy profile $a = (a_U, a_D)$ and two issues *i* and *k* (such as water and trade issues), the 2-person games $\Gamma_i(a)$ and $\Gamma_k(a)$ are described as follows.

**Game $\Gamma_i(a)$**

| | | **Lower** | |
|---|---|---|---|
| | $\Gamma_i(a)$ | c | d |
| **Upper** | c | $(w^{cc}_{Ui}, w^{cc}_{Li})$ | $(w^{cd}_{Ui}, w^{cd}_{Li})$ |
| | d | $(w^{dc}_{Ui}, w^{dc}_{Li})$ | $(w^{dd}_{Ui}, w^{dd}_{Li})$ |

**Game $\Gamma_k(a)$**

| | | **Lower** | |
|---|---|---|---|
| | $\Gamma_k(a)$ | c | d |
| **Upper** | c | $(w^{cc}_{Uk}, w^{cc}_{Lk})$ | $(w^{cd}_{Uk}, w^{cd}_{Lk})$ |
| | d | $(w^{dc}_{Uk}, w^{dc}_{Lk})$ | $(w^{dd}_{Uk}, w^{dd}_{Lk})$ |

From any two independent games, we construct a 2-issue-linked game in which the payoff values are determined as the sum of the two values in the two independent games. Hence, in a linked game, the player *J*'s payoff is $w_J = w^a_{Ji} + w^a_{Jk}$. The objective of each player is to maximise its final outcome $w_J$ $(= \max_a \{w^a_{Ji} + \quad + w^a_{Jk}\})$.

[10] That is, a better strategy can be to delegate policy issues to different independent players (Spagnolo, 2001).

***The Water issue game*** $\Gamma_i(a)$

In many transboundary water problems around the world, "free riding" behavior of parties have led to a "tragedy of the commons" outcome despite the existence of cooperative optimal solution. The essence of this problem can be represented as a prisoner dilemma (PD) with a payoff structure[11] given by

$$w_{Ji}^{dc} > w_{Ji}^{cc} > w_{Ji}^{dd} > w_{Ji}^{cd}, \text{ for all J and} \qquad (3.1)$$

$$w_{Ui}^{cc} + w_{Li}^{cc} > w_{Ui}^{a} + w_{Li}^{a}, \text{ for all a} \neq \text{(d, d)} \qquad (3.2)$$

Conditions (3.1) and (3.2) imply that this foregoing (water) game $\Gamma_i(a)$ has a unique solution (Nash equilibrium) in which cooperation cannot be achieved, though both countries could receive higher payoffs if they could agree to cooperate[12].

In the water game $\Gamma_i(a)$, the dominant strategy is either not to share water (player *U*) or not to pay for the water (player *L*), because either sharing or making side payment always costs it some welfare reduction.[13] In the context of the MRB, the strategy where player *U* shares water with player *L* is interpreted as stopping or reducing dam building by China and allowing more water slow in the main stream. The strategy where player L provides side payments to player U is interpreted as having LMB compensating China for the forgone energy it produces from the Dams that it will not construct and impound.

Let $G_{Ji} = w_{Ji}^{dc} - w_{Ji}^{cc}$ denote the gain from defecting (or free riding) of player $J$ and $L_{Ji} = w_{Ji}^{cc} - w_{Ji}^{dd}$ be the loss from foregone future gains from cooperation for issue *i*. A grim-trigger strategy supports a cooperative solution in the water game $\Gamma_i(a)$ if the following conditions hold.

$$0 \leq w_{Ji}^{dc} - w_{Ji}^{cc} = G_{Ji} < L_{Ji} = w_{Ji}^{cc} - w_{Ji}^{dd} \text{ for all J} \qquad (3.3)$$

We therefore can consider $G_{Ji}$ and $L_{Ji}$ as cost and benefit for evaluating cooperation: the larger the benefit the larger the potential for cooperation.

***The Trade issue game*** $\Gamma_k(a)$

The standard trade theory uses a cooperative trade game with the assumption

$$w_{Jk}^{cc} > w_{Jk}^{dc} > w_{Jk}^{dd} > w_{Jk}^{cd}, \text{ for all J,} \qquad (3.4)$$

which is one dominant strategy to restrict trade barriers[14].

For the trade game (second issue) $\Gamma_k(a)$, condition (3.4) implies $w_{Jk}^{cc} - w_{Jk}^{dd} > w_{Jk}^{cc} - w_{Jk}^{dc} > 0$ for

[11]As each player has only two strategies, we can use similar notations. That is, the first upper letter indicates the player's choice, given the other's strategy. For example, if *J=U* then condition (3.1) can be written as $w_{Ui}^{dc} > w_{Ui}^{cc} > w_{Ui}^{dd} > w_{Ui}^{cd}$ where the first upper letter is player U's strategy.

[12]i.e. the Nash equilibrium $(w_{Ui}^{dd}, w_{Di}^{dd})$ is not a socially optimal outcome because $w_{Ui}^{cc} + w_{Li}^{cc} = \max_a \{w_{Ui}^{a} + w_{Li}^{a}\}$.

[13]It is evident that China's GDP of roughly US$8 trillion in 2008 was almost eight times the combined GDP of all four countries of LMB. Hence, LMB has not been able to financially compensate China to halt further dam-building (Biba, 2012).

[14]It implies that there is no need for negotiations, and nations should liberalize unilaterally (Krugman, 1997).

all players $J$ and $w_{Uk}^{cc} + w_{Lk}^{cc} > w_{Uk}^{a} + w_{Lk}^{a}$, for all $a \neq (c,c)$. Following (3.3) and (3.4), it appears that

$$w_{Ui}^{cc} + w_{Uk}^{cc} + w_{Lk}^{cc} + w_{Li}^{cc} > w_{Ui}^{a} + w_{Uk}^{a} + w_{Lk}^{a} + w_{Li}^{a}$$

or (3.5)

$$w_{Ui}^{cc} + w_{Uk}^{cc} + w_{Lk}^{cc} + w_{Li}^{cc} = \max_{a}\{w_{Ui}^{a} + w_{Uk}^{a} + w_{Lk}^{a} + w_{Li}^{a}\}.$$

We now turn from analytical possibilities to actual proceedings in order to see whether players would have been able to make use of any of the transformation strategies delineated above.

For each player, the total payoffs from defecting and cooperating on $i$ and $k$ issues are $w_{Ji}^{dc} - w_{Ji}^{cc} + w_{Jk}^{dc} - w_{Jk}^{cc}$ and $w_{Ji}^{cc} - w_{Ji}^{dd} + w_{Jk}^{cc} - w_{Jk}^{dd}$, respectively. One can easily see (based on the definition provided earlier) that if $w_{Ji}^{dc} - w_{Ji}^{cc} < w_{Jk}^{cc} - w_{Jk}^{dc}$, then issues $i$ and $k$ are substitutes. Hence, the (larger) gains from the second issue can be used for compensating (negotiating) the free rider in the first issue. The following proposition therefore is obtained.

**Proposition** *For any externality game, if two policy issues are substitutes, then linking issues always facilitates policy cooperation in a linked game.*

The above proposition implies that if players do not cooperate on one issue they value relatively cooperation on substitute issues. Thus the players' ability to maximize their social outcomes can be obtained if there is existence of substituted linkage issues in linked games. The next section will show how the analytical results above are translated into the empirical situation on the Mekong and whether or not linkage in the MRB can provide a basin-wide agreement.

## THE ROLE OF ISSUE LINKAGE IN MANAGING THE MRB

In this section we construct an empirical-linked MRB game based on the previous two games (water and trade) and then illuminate how issue linkage can be used as a form of side payment in managing the Mekong. Due to a lack of information from Myanmar, our analysis comprises only 5 Mekong riparian nations.

To construct a water game, we adopt the model introduced by Houba *et al.* (2013) where the LMB, represented by MRC, has two options it faces in bargaining with China: strengthening or not strengthening its governance and China's strategies are to join or not to join the MRC. We also adopt the simulations of Petri *et al.* (2012) in deriving a trade game. Currently, governments in the LMB face critical decisions that involve trade-off between (i) the economic benefits from hydropower generation and (ii) potentially irreversible negative impacts on the ecosystems that provide livelihoods and food security to the rural people. As a means of analyzing the potential of cooperation even though China has refused to be a member of the MRC, we assume that both the LMB and China (UMB) are faced with two

strategies (i.e. cooperation and non-cooperation) in each game[15].

***The water issue game***

In the physical hydrological basin model, with a unidirectional water flow from China to the LMB, introduced in Houba *et al.* (2013), the LMB has two strategies: either strengthen its governance or remain as a weak player; China's two strategies are to join or not join the MRC. Due to the current situation of the LMB states, "weak' governance represents a structure in which each LMB state considers to maximise its own profits from water utilization without taking into account the externalities they cause on other LMB states. Strong governance represents a structure where the LMB regional welfare will be optimized. In this model, flow in the mainstream Mekong is measured in the confluence of upper Mekong to Lower Mekong, at Chiang Sean. The economic values of water uses are determined by aggregating four main activities in each region, *U* and *D*, and each season (wet and dry), namely industry and households, hydropower generators, agricultural irrigators, and fishery. During the wet season China's water resources can be used for industrial and household activities, storage for use in the dry season, hydropower generation that is reusable further downstream, and simply passing through a dam. China's outflow in the wet season fosters local fish reproduction before it runs to the mainstream of the LMB downstream. During the dry season, water inflow plus the (fraction of) stored water can be used for similar purposes as in the wet season and outflow from the dams can also be used for irrigation.

For the tributaries of the LMB, water inflow can be used for similar economic activities as observed in China and the water flows are similar to those in Upper Mekong, except for the impact of dams on tributaries' flow. The water inflow for the mainstream LMB solely consists of the outflow received from China. As suggested from the analysis in Houba *et al*. (2013), future mainstream dams will only be used for hydropower generation. One can see that currently China and LMB have similar dam capacities, 75.441 and 75.454 $km^3$, respectively.

**Table 7: Aggregated economic net values (adjusted from Houba et al., 2013) for two governance regimes in 2030 (in billion US$).**

| | Strong governance | | Weak governance | |
|---|---|---|---|---|
| | China | LMB | China | LMB |
| Cooperation | 2.75 | 22.06 | 3.76 | 21.05 |
| Non-cooperation | 2.73 | 22.03 | 2.73 | 20.03 |

Based on Houba *et al*. (2013) the calculated net economic benefits from the water game under two governance regimes is presented in Table 7. Under the weak governance LMB states act individually and thus will produce a net aggregate economic welfare, which is lower than the one produced under strong governance, where all LMB states act in coordination. While China's dams are built in the mainstream, the LMB's dams have been built mainly in tributaries. In the future (prediction for 2030), China's capacity expands by

[15] For simplicity, given the present situation of the four lower Mekong states, "cooperation" means to achieve a basin-wide agreement in the LMB strong governance's scenario.

48.2% (Houba et al., 2013: Table 4) which is in line with existing construction. Under weak governance (i.e. the LMB states act individually), 302.615 $km^3$ (80.4%) of this planned capacity is installed, which even exceeds dam capacity upstream. These results indicate that the stakes are high for damming the mainstream of the LMB. Also, Chinese construction and electricity companies, which are already active in the LMB, are eager to build and operate such dams. Together with the MRC's preferences for hydropower generation, this explains the persistence of plans for mainstream dams. This pattern will continue and is evident in the recent Xayaburi dam project in Laos (Cronin and Hamlin, 2012; Herbertson, 2013). From the annual economic net values in the year 2030 under cooperation and non-cooperation given by Table 7, a water game is constructed as follows (Table 8).

**Table 8: The Mekong Water Game**

| | | **LMB** | |
|---|---|---|---|
| | $\Gamma_1(a)$ | **Strong governance** | Weak governance |
| **China** | **Cooperation** | $(\mathbf{2.75}, \mathbf{22.06})^*$ | $(\mathbf{3.76}, \mathbf{21.0}5)$ |
| | Non-cooperation | $(2.73, 22.03)$ | $(2.73, 20.03)$ |

*=Nash equilibrium

In this water game, we can see that the total basin-level annual incremental welfare gains are 2.05 billion US$ for moving from non-cooperation to cooperation under weak governance[16], and 0.05 billion under strong governance. In addition, almost all of the maximal joint welfare gains can be realized by strengthening the LMB's governance (regardless China's situations) because LMB obtains almost the same payoff under both cooperation and non-cooperation with strong governance. From the perspective of China, the incentives are quite different because China can gain more when it cooperates while LMB is weak in governance. This could help explain why China is interested in signing bilateral agreements rather than multilateral ones, namely enhance the weak governance status of the LMB states (Naohiro (2012); Yongqi and Anfei, 2013).

***The trade issue game***

The literature on water, conflict and cooperation in international river basins suggests that cooperative relationships (effective intergovernmental cooperation on environmental issues) in the Mekong basin declined from 94 % in the period before 2000 to 73% in the period 2000-2008 (De Stefano et al, 2010). However, recently China has become more engaged in a wide-ranging economic cooperation with all Mekong countries within the Association of the South-East Asian Nations (ASEAN). For example, China is considering expanding the construction of land transport lines from Yunnan and Guangxi to Thailand via Laos; it is also considering transport directly to Vietnam to link its south western inland provinces to the sea (Biba, 2012). When China's open-door policy and especially after Yunnan has emerged as an international gateway to the dynamic economies of Southeast Asia in 1991, the annual rates of export (31%) and import (35.3%) growth of Yunnan's province during 1993-1997 rose

[16] The total welfare in non-cooperation is 2.73+20.03=22.76 while the LMB is in weak governance and 24.81 in strong governance.

above the Chinese average (Poncet, 2006). Trade between Yunnan and Myanmar, Laos and Vietnam is significantly greater than trade between those countries and other Chinese provinces. However, the exports and imports to GDP ratio of Yunnan remain quite low and close to the national average because this province is deeply landlocked (Poncet, 2006). It is apparent that trade is an important economic activity with high interest to both China and LMB. Given the various existing trade arrangements in the Greater Mekong sub-region, we construct the following trade game for analyzing the second issue linkage for the LMB.

Since trade is an important driver of economic growth, 10 members of ASEAN agreed to implement the ASEAN Economic Community (AEC) by 2015, which commits to free movement of goods, services, foreign direct investment and free flows of capital (ASEAN, 2010). Then all ASEAN economies are open to trade and investment. Over the last two decades, the trade/GDP ratio is 131% for the region as a whole (Petri *et al*, 2012). ASEAN markets are especially important for Laos and Vietnam. Laos appears as a "free rider" in ASEAN and Vietnam is a loser. For trading issue, Vietnam is a potential player on agricultural productions.

The trade game is based only on trade results related to the four LMB states and China. Taking AEC as a benchmark, the strategies of LMB as members of ASEAN are either to retain barriers with non-ASEAN partner economies (such as China); or to remove the barriers, i.e. open trade with more partners of the world. UN COMTRADE (cited in Petri *et al*, 2012, pp 97) reports that the region's share pattern is essentially symmetric: the shares of ASEAN, the USA and the EU, China and Japan, and the rest of the world each account for about one-quarter of the overall ASEAN trade. We consider China as a partner of ASEAN but it can be involved with AEC only under two arrangements/conditions, namely, either increased bilateral free trade area with the four LMB states (under CAFTA) where LMB are members of AFTA, or enjoy bilateral free trade area with AEC (under AFTA).

**Table 9: The Mekong Trade Game**

| | | **LMB** | |
|---|---|---|---|
| | $\Gamma_2(a)$ | Open | Restrict |
| **China** | CAFTA | (-7.8, 15.4)* | (0.4, 2.8) |
| | AFTA | (**-12.2, 52.9**) | (-4.6, 12.0) |

*=Nash equilibrium

Note: (CAFTA; Open), (CAFTA; Restrict), (AFTA; Open), and (AFTA; Restrict) values are taken from Column AEC, AFTA, AEC++, and AFTA+, respectively in Petri et al. (2012: Table 6).

Due to lack of data from Yunnan, we adapt the results from Table 6 in Petri *et al.* (2012) to address the welfare gains from regional cooperation and from external partnerships in deriving a trade game (Table 8). Note that the welfare gain of the LMB is defined as the aggregated gains obtained from all four LMB nations in ASEAN plans. One can realize that the LMB has 'open' trade as the dominant strategy; while China's dominant strategy is CAFTA. In this game, the Nash equilibrium (CAFTA, Open) is not efficient as the total outcome is less than in (AFTA, Open).

Scrutiny of the Mekong water game and the Mekong trade game (Tables 8 and 9) suggests very clearly that playing each game separately will lead to nowhere. Therefore, we turn to constructing a linked game as the sum of the two independent games in expectation that it would lead the regional players to cooperation, as suggested in the theoretical section of the paper. Since the water game and the trade game are expressed in 2010 monetary values, we can sum across the games.

***The Linked game***

As Cooperation is the dominant strategy in the water game above, while Open is the dominant strategy in the trade game, we will take two outcomes of the water issue and two outcomes of the trade issue to construct a linked game below (Table 10) [17].

**Table 10: The linked Mekong Game**

| $\Gamma_{12}(.)$ | Liberalize (c) | Status quo (d) |
|---|---|---|
| Liberalize (c) | (-5.05, 37.46)* | (-4.04, 36.45) |
| Status quo (d) | (-9.25, 74.96) | (-8.24, 73.95) |

*=Nash equilibrium

where

$\Gamma_{12}(c,c) =$ (-5.05, 37.46) = (*2.75* - **7.8**, *22.06* + **15.4**)

$\Gamma_{12}(c,d) =$ (-4.04, 36.45) = (*3.76* -**7.8**, *21.05* + **15.4**)

$\Gamma_{12}(d,c) =$ (-9.25, 74.96) = (*2.75* – **12.0**, *22.06* + **52.9**)

$\Gamma_{12}(d,d) =$ (-8.24, 73.95) = (*3.76*-**12.0**, *21.05* + **52.9**)

The linked game indicates that the total social welfare will increase, when water is linked to trade considerations in the region. As a result, with a higher outcome, the LMB could make a side payment to China. The losses and gains are similar for both China and the LMB in the linked game. For example, for $\Gamma_{12}(d,c) = (-9.25, 74.96)^*$, the total payoff is 65.71 (74.96 - 9.25); for $\Gamma_{12}(d,d) = (-8.24, 73.95)$, the total outcome is 65.71. For the others, $\Gamma_{12}(c,c)$ leads to the outcome of 32.41 and $\Gamma_{12}(c,d)$ also leads to 32.41. Thus, linkage issue will give more opportunities for the countries in the negotiation process

## POLICY IMPLICATIONS AND CONCLUDING REMARKS

The transboundary negative externality nature of the MR flows adds an extra dimension of complexity to the debate about equitable sharing of the Mekong River's resources. Therefore, the MRC, as the representative of the riparian states in the basin, will have to decide on how to strike a balance between hydropower development and the preservation of conditions necessary for sustaining (fish and agricultural production ) ecosystems in the future. Using

[17] As we aim to investigate whether or not China will consider joining the MRC in the context of ASEAN, we assume the LMB states act in one voice in the linked game.

the notion of externality games, this paper demonstrates the advantages of issue linkage for the Mekong region in bringing together five (or 6) countries in order to provide a common framework for coordination and management. The ability of issue linkage to facilitate cooperation by allowing countries to tie issues, in which they have dissimilar interests, is explored. Our results show that the countries in the LMB can benefit most from issue linkages. This allows balancing the interests of all stakeholders in the MRC. Water is just one issue to be taken into account, and is insufficient on its own to establish a viable regime (sustainable development) which reflects all water-related problems in managing the Mekong. Hence, the solutions to these problems also lie with human beings and their institutions. Thus, one must place all in a fair, efficient and sustainable systems of water governance.

There are several conditions under which mutually beneficial solutions maybe reached. In the Mekong, our analysis shows that China does have strong incentives to negotiate joint management and to use the MRC to promote the interests of its international dam construction and electricity corporations. We have also shown that, with the international and regional support, the LMB countries have incentive to negotiate with China in the trade issue. Therefore, China should consider playing a more active role in the MRC, expanding its involvement to the GMS and AEC programs. In addition and properly understood, water management is not management of the water resources alone but also managing people. The proposed approach of building upon the IWRM principles and incorporating these into the appropriate institutional setting at the proper time, based on issue linkages, could serve as a model for confidence-building, as well as conflict prevention and management of the Mekong issues.

***Epilogue: Considering non-traditional issue linkage to address the actual impasse***

Our model and its empirical results suggest that a cooperative management of the Mekong water resources is feasible under a relatively simple issue linkage game that combines water issues with international trade issues in the basin. However, as reported in the popular media, as well as in scholarly publications (Biba, 2012 and references therein cited), water development in the Mekong main stream is far from being resolved and is actually in deadlock in light of dam building on the main stream in China. Recent reports (e.g., the Economist, 2013; Herbertson, 2013), indicate that Laos, with financial support from Thailand, in need for electricity, started the construction in the first (Xayaburi dam) of 9 big dams. This unilateral action in the LMB is against the MRC, which is powerless to block the unilateral push by Laos, and despite strong protests from Cambodia and Vietnam, both commission members and both dependent on the river for fish and for its rich sediment which spreads across farmland during the flood season.

The interpretation of the actual situation in the Mekong suggests that the weak governance of the LMB has first to be addressed, may be by introducing an additional issue linkage internal game for the LMB players. Once and if it is addressed, then either the amount of side payments that could be offered in the linkage game by the LMB countries is not attractive

enough to engage China in a cooperative agreement, or that China believes that it can achieve much more by playing the Rambo game (Biba 2012: 611).

This means that further linkage opportunities could be considered. Here we suggest considering adding to the linkage game several more issues such as transportation and access of products from Yunnan to ports in South Asia, alternative energy sources in the form of oil and natural gas that have been explored recently in the bay of Thailand. While these additional issues are important and could transform the linkage game into a cooperative basin arrangement, they would need more exploration and estimates, and will be left for a future analysis.

**Annex: Review of existing regional institutions in the Mekong Basin**

The MRC is among the first international joint river commissions to have been established. It was formed by the Agreement on Cooperation for Sustainable Development of the MRB (the Mekong Agreement) that was signed by the four lower Mekong nations in 1995, after three years of negotiation, with support from the United Nations Development Program. Having the longest history of cooperation in the Mekong region, the MRC is involved in water resource management. It also supports a joint basin-wide planning process, the so-called the Basin Development Plan, using the principles of integrated water resources management (IWRM). As a successor to the moribund Mekong Committee, which had been created in 1957, the MRC is also involved in fisheries management, promotion of safe navigation, irrigated agriculture, watershed management, environment monitoring, flood management and exploring hydropower options. Though it has the support of various international organizations, the MRC has failed to attract China and Myanmar to join.

The GMS comprises Cambodia, Laos, Myanmar, Vietnam and two regions of China (the Yunnan province and the Guangxi Zhuang Autonomous Region). With assistance from the Asian Development Bank (ADB), the six MRB countries/regions launched the GMS Economic Cooperation Program in 1992 to promote integrative economic links among riparian nations. Unlike the MRC, the GMS has the advantage of having all six riparians as members. This allows it to proceed with the implementation of large scale water infrastructures (such as building commercial relations in terms of cross-border trade and transportation, energy development, investment, and water resource usage). This was also brought about by the peaceful resolution of conflict in Indochina in the early 1990s, the integration of Cambodia, Lao PDR, Myanmar and Vietnam into the ASEAN, the gradual opening of Yunnan province and China itself to its southern neighbours and coupled with financial support (most notably from the ADB). The GMS has become a key for growth and development in mainland Southeast Asia over the past decade.

Established in 1967, ASEAN is made up of Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam. ASEAN had set up an ASEAN Mekong Basin Development Cooperation (AMBDC) institution in June 1996 comprising all member states of ASEAN and China. Moreover, in January 2007, ten ASEAN countries agreed to implement the ASEAN Economic Community (AEC) by 2015. This would permit

free movement of goods, services, foreign direct investment (FDI) and skilled labour and free flows of capital (Petri et al, 2012). All states of the Mekong region are committed to developing market economies, although with varying degrees of structural adjustment. ASEAN's Mekong concept document emphasizes the complementarity of existing development programs linking them to the ADB-GMS and the UNDP-MRC (Weatherbee, 1997). Since all Mekong countries have experienced rapid economic growth in the past few decades, the growing demand for electricity and the abundant hydroelectricity potential make hydropower development in the Mekong region inevitable.

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