



UNIVERSIDAD PONTIFICIA COMILLAS  
Facultad de Ciencias Humanas y Sociales

Grado en Relaciones Internacionales

Trabajo Fin de Grado

**WATER SECURITY AND  
MANAGEMENT IN THE  
MEKONG BASIN  
A CASE OF FAILED COOPERATION**

Estudiante: **Alfredo Felipe Díaz-Grande Rojo**

Director: Miguel Ángel Benedicto Solsona

Madrid, abril 2018



## **ABSTRACT**

The Mekong Basin, one of the world's largest river systems, is at risk. Shared by six countries, the need for transnational management of its waters seems evident; however, effective cooperation has not yet been achieved, nor is it foreseeable in the short term. Recent efforts by upstream riparians to foster a rapid GDP growth through dam building, supported by the interest in attaining energy security, have led to structural mismanagement of the Mekong waters, thus posing a very real issue for the security of nearly 60 million people downstream, whose lives depend on their activities along its banks. Agriculture, fisheries and even biodiversity are in danger.

The great asymmetry of power in the region, together with the different interests at play has led to great instability in the basin. Starting with China spearheading a damming effort along its portion of the river – known as the Lancang in China – and its tributaries, with virtually no real opposition, the issue has developed into a potentially destructive downward spiral, in which the different actors are clearly antagonistic with regards to the management of the shared waters. For some, development in economic terms seems to override the possible negative effects; for others, their means of survival are being stretched thinner by the day. This paper aims to analyse the interests at play in this struggle, as well as the fruits brought by cooperation so far and the potential for the future.

**Key terms:** water, water security, dam, hydropower, Mekong, environment, cooperation

## RESUMEN

La cuenca del Mekong, uno de los sistemas fluviales más grandes del mundo, se encuentra en peligro. Compartido por seis países, la necesidad de una gestión transnacional de sus aguas parece evidente; no obstante, todavía no se ha logrado una cooperación eficaz, ni se prevé en el corto plazo. Los recientes esfuerzos por parte de los Estados ribereños de la cuenca alta dirigidos a fomentar un rápido crecimiento del PIB a través de la construcción de presas, sustentados por el interés en alcanzar seguridad energética, han llevado a una mala administración estructural de las aguas del Mekong, planteando una problemática muy real para la seguridad de casi 60 millones de personas en la parte baja del río, cuyas vidas dependen de las actividades realizadas a lo largo de sus orillas. La agricultura, pesca y mismo la biodiversidad se encuentran amenazados.

La gran asimetría de poder en la región, junto con los diferentes intereses en juego, han llevado a una gran inestabilidad en la cuenca. Comenzando con China encabezando una serie de proyectos hidráulicos en su sección del río – conocido como el Lancang en China – y sus afluentes, con prácticamente nula oposición, la cuestión se ha desarrollado en una espiral potencialmente destructiva, en la que los distintos actores son claramente antagónicos con respecto a la gestión de las aguas compartidas. Para unos, el desarrollo en términos económicos parece superar los posibles efectos negativos; para otros, sus medios de subsistencia son cada día más escasos. Este trabajo trata de analizar los intereses en juego en este conflicto, así como los frutos generados por la cooperación hasta la fecha y el potencial para el futuro.

**Términos clave:** agua, seguridad del agua, presa, energía hidráulica, Mekong, medioambiente, cooperación.

## TABLE OF CONTENTS

LIST OF ACRONYMS .....	VI
I. Justification and Aims of the Research.....	1
II. Objectives .....	3
III. Methodology .....	4
IV. Literature Review & Theoretical Framework .....	6
a. Politics of Water and Security: Conceptualisation .....	6
b. Cooperation and Water Management.....	8
c. International Relations Theory.....	10
V. State of the Question .....	13
a. Human Actions on the Environment: Dam Building .....	13
b. The Mekong River .....	14
i. Environment, Fisheries and Agriculture .....	15
ii. Hydroelectric Power .....	17
VI. Analysis .....	18
a. Damming of the Mekong.....	18
i. Chinese Developments .....	18
ii. Downstream Dams.....	20
iii. Consequences of Dam Building.....	20
b. Cooperation Efforts .....	24
i. Institutionalisation prior to the Mekong River Commission .....	24
ii. Cooperation after 1995.....	25
c. Cooperation: the Reality .....	27
i. The Failures of the MRC.....	27
ii. Why has Cooperation Failed?.....	28
d. The Future of Cooperation in the Mekong.....	32
VII. Conclusion.....	35
BIBLIOGRAPHY .....	38
ANNEXES.....	42

## LIST OF ACRONYMS

ADB	Asian Development Bank
GMS	Greater Mekong Subregion Program
GDP	Gross Domestic Product
LMB	Lower Mekong Basin
LMI	Lower Mekong Initiative
MLC	Mekong-Lancang Cooperation
MRC	Mekong River Commission
PDR	People's Democratic Republic (of Lao)
PDP	Power Development Plan (of Vietnam)
PRC	People's Republic of China
UN	United Nations

## **I. Justification and Aims of the Research**

*When the last tree has been cut down, the last fish caught, the last river poisoned, only then will we realize that one cannot eat money.*

– Native American saying

It seems ridiculous to argue for the importance of water; it is evident that the human species needs it in order to survive. Nevertheless, this understanding of the value of water solely for its physical attributes and direct survival needs is reductionist and naïve at best.

As author Sandra Postel (2001) so eloquently argues, we must heed the lesson coming from ancient Sumeria thousands of years ago. She, as well as other historians understands it to be one of the earliest civilisations to fall from its glory due to irrigation and bad water management. As such, water cannot be taken into consideration purely as a matter of physical resource demand vs. availability; it's management affects national security, human relations, livelihoods and development in a much deeper manner.

At a time when droughts seem to happen more regularly and severely than ever before in recorded history<sup>1</sup> and energy procurement and independence drives much of the world's States' political agendas, water resources must be thoroughly analysed and debated in terms of achieving the best possible management to guarantee the future availability of the resource. Policy-makers thus need to understand the consequences of shortsighted water policies that, looking only at short-term economic and political benefit, can and will, in fact, lead to scarcity and conflict in the future.

Some of the world's water bodies are of particular relevance due to their magnitude in terms of water carried, biodiversity and fisheries, agricultural exploitation of their basins as well as other indirect benefits such as tourism. One of these such rivers is the Mekong, in Southeast Asia. Flowing through six countries, more than 60 million lives depend on it, and the economies of its riparian states owe their

---

<sup>1</sup> At the time of writing, the residents of Cape Town, South Africa, are experiencing their worst drought yet, and awaiting what is now known as "Day Zero", recently pushed back to 2019, when their water reserves will be emptied.

development largely to it. Recent projects along its banks have sparked debate on the possible effects of dam-construction on the future of this fresh-water system, with some arguing that dams will bring about the end of the Mekong as we know it today. Hence, it seems critical to fully understand the implications in order to devise policies that assuage the strain placed on the river and allow for inclusive and sustainable development of the region. This paper will therefore try to shed light on the principal issues that plague economic development in the Mekong Basin through dam-building efforts and their potentially disastrous end-result.

To this end, this report will be structured in the following manner: firstly, it will examine the existing literature regarding water security and management, as well as the possibilities of cooperation with regards to common pool resources as applied to shared water bodies. Following the setting of this theoretical framework, the study shall then analyse the difficulties of water management as with a focus on certain critical examples, to be followed by the thorough analysis of the Mekong River. The paper will put forward different data to better understand the causes that have led to the issue at hand pertaining to the dam-building efforts along its riverbanks, and where it seems to be heading, coming up with insights as to what the riparian countries may do to better collaborate with one another to revert the situation or whether this is even a possibility.



## II. Objectives

The following project aims fundamentally to give an answer to the following question: What conflicting interests are at play with regards to the Mekong river and how has cooperation failed in the region in terms of the management of its waters?

For this, a number of other objectives will configure the full extent of this report's research:

1. Examine and understand the existing literature concerning the management of freshwater sources and water security, as well as transnational cooperation, establishing the theoretical framework to be applied in the subsequent analysis.
2. Establish the importance of the Mekong waterway for the Southeast Asian population through the analysis of its implications for the economy and well-being of the local populations.
3. Conduct an empirical analysis of the situation in the Mekong Basin today with regards to dam building and understand the reasons for this recent development.
4. Explain the potential effects generated by the aforementioned dams, particularly regarding the damage done to downstream countries.
5. Study the historical evolution of cooperation among the Mekong's riparian countries and analyse its potential, studying the interests at play
6. Lastly, conclude with a summary of the main findings through which to give an insight as to how the current situation could develop in the near future and actions that can or should be undertaken.

### **III. Methodology**

This research paper can be divided in a number of elements, for which different sources will be used, including both primary and secondary. In order to develop the theoretical framework, a literature review will be conducted. Firstly, the very notion of water will be defined according to institutional sources, namely the UN and its current understanding of this resource. As well as this, this report will go through the different aspects and value of said resource to comprehend its security implications, by analysing the work of researchers such as Peter Mollinga or Mark Zeitoun, who provides new and insightful ideas to tackle water policy.

Having established the relevance of water as a security issue and the different levels of human lives affected by it, this paper will put forward some economic and sociological theories, from Garrett Hardin to Elinor Ostrom, so as to shed light on the issues of collective action and the debate surrounding the path to solving said issues.

Lastly, this theoretical framework will be concluded through summarising the main notions of the international relations theory, specifically of realism and liberalism, which will then be used to take non-cooperative game theories and collective action insights to the international sphere.

The next element tackled in this paper is how the issue of dam-building has been analysed by scientists and researchers, thus pointing out some of the main conclusions of previous studies, with institutions such as the World Dam Commission, as well as environmentalist Patrick McCully, as the main sources.

The previous section will then be followed by the analysis of the particular case of the Mekong, especially since 1995 with the first dam construction. The case will be further subdivided into analysing the Mekong itself, the developments experienced in the past decades and then, the cooperative actions undertaken in the basin. For this, an empirical analysis will be carried out, in which a quantitative economic analysis – both from primary (governmental and institutional, mainly the MRC) and secondary sources – will shed light on key data regarding the Mekong River. Once its economic implications are understood, this paper will provide a summary of the relevant developments in terms of dam construction in the area, obtained from newspapers and

reports as well as previous studies by authors such as Marvin Piessse or Richard Cronin and Timothy Hamlin.

The consequences of the aforementioned analysis will also be further explained through governmental data as well as economic studies, being the one conducted by Portland State University, in collaboration with Mae Fah Luang University, the most insightful for this purpose.

Lastly and more importantly, this report will undertake the task of explaining how cooperation for water management has evolved in the previous decades, analysing historical documents from different institutions as well as the thoughts of other researchers, with the end goal of gathering information to come up with a pattern so as to explain the reasons for cooperative failure as well as some final insights as to what can be done in the future for institutionalised cooperation to become a reality in the Mekong Basin.

## **IV. Literature Review & Theoretical Framework**

### **a. Politics of Water and Security: Conceptualisation**

The concept of water has progressively evolved historically from its purely physical aspect, as a resource critical for the survival of humankind to a multidimensional concept, with value as a cultural resource of religious significance, as well as a social or economic resource (2005); from the historical “right of thirst” which gave primacy to those in need for water access, this resource has transgressed its initial function and physical boundaries to become a many-pronged element of human contentiousness.

Mollinga (2008) argues that water is inherently political due to the contested nature of the resource and the management of power relations over said resource, and distinguishes four types of water politics, the first being the everyday politics of water resource management, referring to the day-to-day water use. He also describes water policy in the context of sovereign states (within) as well as inter-state hydrogeopolitics, referring to negotiations or conflicts between sovereign states, particularly in relation to trans-boundary water systems. Finally, he talks about global water politics, referring to the international level of water discourse and policy making. All of these levels imply different interests and potential conflicts pertaining to the usage of our water resources, and thus understanding them and developing eloquent policies accordingly is crucial for their management.

Connected to this notion of water as inherently political and relating to the invigorated international discourse on the issue, debate around the notion of water security only started in recent years, after the international community realised that traditional water management was leading in many cases to not just political confrontations, but was directly threatening the lives of many in different regions of the world; it was in the second half of the 20th century that the world came to the conclusion that a sustainable approach to water was needed.

After different conferences accentuated the need for the world to come to agreement in the defence of the environment and water management – such as the 1972 Stockholm Conference on the Environment –, the Global Water Partnership was

founded, becoming a full-fledged international organisation devoted to achieving a worldwide sustainable approach to water in 2002. From this turning point on, the international community began to fully realise the importance of developing a concept in order to fully define and delimit the issue and thus undertake action; in 2013, at a time where the international community debated the soon to be agreed upon Sustainable Development Goals, the UN came to formulate its very own definition of water security, and the importance of water and sustainable development was then captured in 2015 in the UN agenda titled “Transforming our world: the 2030 Agenda for Sustainable Development” (United Nations, 2015).

The UN has thus defined water security as “the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability” (United Nations, 2013).

From this definition, it becomes clear how water security refers not only to water as a resource and its physical availability, but also to all the ramifications that come from its management. This highlights water’s centrality for achieving a larger sense of security, sustainability, development and human wellbeing. Unfortunately, most times, policy makers have taken a very narrow and determinist approach when tackling water security issues, leading to short-sighted policies, limited in scope and long-term benefits.

In order to tackle this, researcher Mark Zeitoun established the notion of a ‘web’ of water security as a conceptual tool to guide research and policy. This web of water security comprises different aspects, such as energy security, national security or food security, all of these interconnected and classified into what Zeitoun called physical and social vulnerability; in this sense, it would become clear that good governance in water management aims to both relieve the physical aspect of water scarcity to guarantee security in terms of energy or food needs, as well the social aspect, which relates more directly to the notions of human or even national security. In Zeitoun’s view, policy-makers have a tendency to isolate water resources, understanding them as separate from

their implications in terms of the other security elements outlined above, and thus fail to develop impactful policies for water management.

Zeitoun thus refers to ‘Sustainable’ water security; because this “web” is replete with trade-offs and asymmetries, equitability and balance are suggested as principles to counter the potential development of selective and short-term water security measures (Zeitoun, *The Global Web of National Water Security*, 2011).

## **b. Cooperation and Water Management**

Another relevant notion to consider when dealing with water security is the classification of the different types of resources according to their excludability and rivalry. Different policy researchers and economists have at various times discriminated goods based on these two previous concepts into either private, public, common pool or club goods.

The basic idea behind rivalry is that consumption of a certain good by one does not allow for this same resource to be consumed by any other, such as food. The opposite group, non-rivalrous goods, are those which, for any level of consumption, there’s no added cost nor limit to how many more consumers can use or consume it; an example of this could be solar energy, in the sense that the building of one solar plant does not limit the production capacity of another, as there is no limit to the use of this particular resource.

On the other hand, excludability refers to goods to which access cannot be denied, and thus in terms of economics, goods are excludable if consumers who have not paid for them can be prevented from access to them, as is the case, for example, with . Therefore, the opposing non-excludable goods are those to which free access cannot be prevented, such as the air we breathe or even a state’s national defence; those who, for diverse reasons do not contribute to the public financial system nevertheless benefit from the security provided by the State.

Most research conducted has been focused on public (non-excludable and non-rivalrous) and private goods (excludable and rivalrous); nevertheless, it has been

common pool resources that have posed more problems for policy-makers in terms of defining the actions to be undertaken to guarantee their provision and sustainability.

Water is a common pool resource, and this means that while it's rivalrous, it is also non-excludable. In short, nobody can be excluded from its use, but at the same time it's finite, leading to issues regarding its responsible management. Hardin's Tragedy of the Commons (1968) or even the Prisoner's Dilemma are both economic theories that help in understanding the difficulty of cooperation even if it is the best option for all parties involved, much more so if a particular actor benefits more than others off specific actions. Closely related to Hardin's view is Mancur Olson's who, in his book, *The Logic of Collective Action* (1965), argues: "unless the number of individuals is quite small, or unless there is coercion or some other special device to make individuals act in their common interest, rational self-interested individuals will not act as to achieve their common or group interests".

Applied to transnational river systems, these theories can be used to explain how when the cost of a policy regarding water management is borne by all, but the benefit is concentrated in one actor, this actor will then undertake this action in order to maximise its own profit, leading to negative consequences for all involved. Cooperation in the case of transnational common pool resources is therefore very hard to achieve, as there is no higher body with coercive power for enforcing cooperation.

To overcome the "tragedy"<sup>2</sup> described by Hardin (1968), researchers Elinor Ostrom (1990) and Robert Wade (1986) have countered the previous authors' understanding of the inevitability of conflict for shared resources, as well as their prescription for a central "Leviathan" or coercive force in order to limit the self-interest maximising strategies of actors regarding common pool goods.

Wade argues that the notions of the prisoner's dilemma or the tragedy of the commons are based on a number of assumptions he rejects, primarily the lack of information of participants. As well as this, he expresses a need for differentiating between vital and non-vital resources, believing that in the case of the former, when

---

<sup>2</sup> This "tragedy" as explained by Hardin, rests not on the catastrophic results themselves, but rather on the knowledge of the inevitability of it.

survival is at stake, the rational individual will effectively exercise restraint and follow a cooperative course of action.

In this sense, Ostrom agrees with Wade, rejecting both centralisation and privatisation of common pool resource management as argued by previous authors. Analysing the different possible scenarios for non-cooperative games, she comes to conclude that the centralisation of by state authorities of the management of resources incurs in extreme costs and information deficits, while the determining property rights for their privatisation does not seem to be a viable alternative, less so in the case of water resources. Thus, she suggests collective action through a binding contract made by the players, enforced by an external authority, be this public or private.

### **c. International Relations Theory**

The previous theories aid us in understanding water as a wider concept than it has historically been entertained by most policy-makers, giving us the main framework for comprehending the ramifications of its management and the difficulties that arise in the cooperative actions needed for its management; however, because these are mainly descriptive of situations among equal actors within a game system, it is the international relations theory that can be used to extrapolate these to the international sphere, refocusing the issue towards what Mollinga (2008) described as inter-state and global hydropolitics.

Traditionally, two theories have led the international relations discourse, these being realism and liberalism. While there have been other authors who have posited new perspectives, such as the constructivist or the many critical approaches, it is liberalism and realism that have been at the core of the IR debate since its inception.

To put it simply, realism, on the one hand, offers a pessimistic view of the world. From the Greek historian and general, Thucydides, to Thomas Hobbes, realists have drawn on various thinkers and philosophers and developed the view that the international system is led by constant competition between the actors at play, fuelled by fear and self-interest. Although the interpretations and ideas behind realist thinking have evolved over-time, with examples such as Waltz's neorealism or Mearsheimer's offensive realism, some core principles serve as the main pillar, these being:



- The international system is anarchic, as there is now higher governing body,
- States are the main actors in international relations,
- States are rational actors and thus will act in their best interest to maximise their chance of achieving their goals,
- The main goal of states is to guarantee their survival.

In order to guarantee this objective, states will develop militarily, which then leads to a key concept within the realist theories, the security dilemma. Since states have no knowledge of their neighbours actions, and due to the inherent distrust within the international anarchic system, they will build up their strength through different strategies which may in fact lead to higher insecurity for all, ending in conflict when this may not have been the initial intention of any of the sides.

On the other hand, we have the optimistic view of the world upheld by liberalism, which accentuates the possibility of cooperation among states, bringing benefits to all actors involved. For liberals, the principles of realism are to be questioned, in that interdependence among states can generate increased trust and reducing the need for unilateral action so as to maximise individual benefit. Therefore, the notion of permanent and inescapable competition is questioned, rejecting power as the sole goal of states.

The liberal theory of IR is itself diverse, with the most relevant discourses following the democratic peace theory, the institutional peace theory and the commercial peace theory. The first analyses the effect of distinct political regimes on the inter-state relationships within the international system, arguing the impossibility of war among democracies. The second argues for the development of institutions so as to foster cooperation among states, overcoming the permanent animosity between actors who can thus cooperate to realise longer-term goals other than immediate survival and power acquisition. Finally, the commercial peace theory defends the notion that increased free trade and economic interdependence among states lessens the tensions among them and allows for increased peace in the global sphere.

While these theories have questioned the principles that sustain each other and have also been questioned themselves by many alternative authors, the IR debate still

revolves around the main issue of how states can act within the anarchic international system. It puts the State forward as the main actor, trying to understand the reasons behind its actions and the possibilities of conflict and cooperation. Due to this, the aforementioned IR theory will be of interest in the following analysis, as a means to understand the motives and possibilities of the Mekong Basin states, combined with the previously explained water management and cooperative theories to grasp a fuller understanding of the reality among these Southeast Asian nations. As a prelude, I will try to shed light on other international issues pertaining to water security and dam building, in order to establish parallels and distinctions along the analysis, for a clearer understanding of the complete picture within the Mekong.

## **V. State of the Question**

### **a. Human Actions on the Environment: Dam Building**

Water is a scarce resource in today's world. The more than 7.5 billion people worldwide need fresh water to live and as mentioned, this common pool resource is renewable although not infinite, and has no substitute for most of its uses. This brings about the need for transnational management regarding water resources; nevertheless, this interdependency between states does not always imply cooperation because of the aforementioned forces that lead state actors to pursue policies that result in end damage for the collective.

In the case of the Mekong River, recent policies and infrastructure developments pursued by the basin states are leading to a situation that some fear may be damaging for the river system and already irreversible.

The anthropogenic impacts on the environment have been documented by researchers and institutions for some years now; particularly, the Millenium Ecosystem Assessment (2005) already concluded that in the 50 years prior to the analysis, humankind had altered ecosystems more rapidly and profoundly than ever before. They argued that while there had been net gains in terms of economic development and overall human well-being<sup>3</sup>, there costs in terms of degradation of the environmental medium could pose a very large risk for future populations, and thus set the reversal of this degradation as a necessary goal for future global developments.

Dams, as we will come to analyse more closely with respect to the case of the Mekong, are one of the most notable constructions in terms of the human action on the environment mentioned above. With the main objective of storing water and raising its level in the upper regions of the river, be it for the resource itself or the provision of energy, they exert a large environmental pressure in their location. Patrick Mcully, an American environmentalist, analysed said pressures in his book *Rivers No More: The Environmental Effects of Large Dams*, in which he asserted that the main impacts of dam construction and operation are the fragmentation of the riverine ecosystem,

---

<sup>3</sup> For this study, the concept of human well-being was assumed as composed of 5 different elements: basic material for good life (livelihood, nutritious food, shelter, etc.), security, health, good social relations and freedom of choice and action

blocking migrations and isolating species and, most of all, the destruction of natural flooding, turning floodplains into reservoirs (McCully, 2001).

Acknowledging the problems associated with large dams, the now dissolved World Dam Commission produced a series of guidelines for dam development in the year 2005. Through their assessment of large dams they came to a similar conclusion than the previously mentioned reports: understanding the socio-economic and environmental costs generated by dams, the institution developed a series of recommendations to be followed by developers so as to limit the damages. Some key principles contained within their report were the need for thorough environmental and social study of dam proposals, as well as transparency in decision making processes; most relevant to the issue at hand was the suggestion that any objection by a co-riparian to any dam proposed by a country should imply the halting of the project, were the objection upheld by an independent study.

All of the aforementioned papers and research stress the need to contain the downside of dam development through cooperation and basin-wide socio-economic studies, and recommend the decommissioning of large dams should they be proven pernicious to the river system, subject to an analysis of the impact of such measure<sup>4</sup>. However, in the case of the Mekong Basin, dam construction has been carried out with little to no regard to the negative ramifications derived from it. The following section will thus analyse the importance of the Mekong River and how dam developments have evolved over the years, since China first inaugurated its Manwan Dam in 1995.

## **b. The Mekong River**

The Mekong River is said to be the lifeblood of Southeast Asia (Brown, 2016), it is the longest river in the region, and encompasses a catchment area of approximately 795,000 km<sup>2</sup>; From its source in the Tibetan Plateau, the Mekong river then flows through a total of six countries: China, Myanmar, Thailand, Lao PDR, Cambodia and Vietnam, emptying in the South China Sea.

---

<sup>4</sup> Dam decommissioning should also be dependent on thorough analysis of the possible consequences that the release of waters and dam dismantling could generate.

A number of tributaries and distributaries complete this river system. Whilst the Chinese tributaries in the Yunnan province of China are small, those of the more downstream countries are much larger in size, widening the river as it flows to the Delta, where it splits forming what is known as the “Nine Dragons”. One of the most relevant elements of the Mekong’s flow takes place through the Tonlé Sap River, a tributary connecting the Mekong to the lake of the same name in Cambodia; during the dry season, the Lake empties into the Mekong, whilst in the wet season, from June to November, the flow is reversed and thus water flows from the Mekong into the Tonlé Sap Lake (Mekong River Commission); this very particular cycle will be of great importance in understanding the effects of the changes in the river’s flow.

In terms of its catchment area, the upstream section in China and Myanmar accounts only for a small percentage of these countries’ landmass. In contrast, downstream countries are highly dependent on the river and its tributaries, as the Lower Mekong basin, covering almost 75% of the entire river’s catchment area (Water Environment Partnership in Asia), occupying a very large percentage of their territories (refer to Annex 1). For nearly 60 million people living in Laos, Thailand, Cambodia and Vietnam, this river system is crucial for their survival (Mekong River Commission). China’s location as the most upstream riparian, with over 44% of the length of the river and 16% of its flow (Mekong River Commission) going through the country before entering the following Southeast Asian nations, shows how the PRC is in a position of power; its actions are determining regarding the management of the Mekong’s waters (Osborne, 2004).

Understanding the economic and security impacts of the potential actions undertaken regarding the Mekong river system is of crucial in order to analyse the different interests at play in the current developments, and the consequences that certain state behaviour could imply. The issue at hand poses a conflict between the economic gains of hydropower development and the dependence of the Lower Mekong Subregion on its agricultural and fishing industries.

#### **i. Environment, Fisheries and Agriculture**

The Mekong River is responsible for one of the world’s largest inland fisheries, accounting for nearly 25% of the world’s freshwater catch (Murdoch, 2015) and close

to 3% of the region's GDP, or US\$17 billion - this figure not taking into account the associated industries which some estimates show could have an output of up to US\$7.4 billion -. For the particular cases of Cambodia and Laos, fisheries actually have a much greater relevance, accounting for 18% and 12.8% respectively (Piesse, 2016).

From its source in the Himalayas to its mouth by the Delta in Vietnam, the Mekong basin includes areas with very different climates and geographies; because of this, it possesses a very wide ecological diversity, being second only to the Amazon in terms of the number of different animal and plant species (Mekong River Commission). A large amount of the region's ecosystems rely on the seasonal fluctuations of the river, and many of the river's fish depend on these cycles to survive. Indeed, most of the Mekong's fish are migratory, laying their eggs in the flood plains during the wet season, whilst swimming hundreds of kilometres to their refuges for spending the dry months (John Valbo-Jørgensen).

For a better understanding of the dimension of this phenomenon, biologist Zeb Hogan from the University of Reno, Nevada, has stated that "The migration [in the Mekong] rivals the great terrestrial migrations of the Serengeti in Africa, or caribou in Alaska or the millions of songbirds traveling thousands of miles from Europe to reach wintering grounds in Africa."

One of the most important of such migratory movements takes place in the Tonlé Sap Lake; whilst migratory fish lay their eggs in its surrounding floodplains during the wet season when the river flows in its direction from the Mekong, these fish then proceed to migrate to other regions of the river, contributing to its ecologically rich habitat. This cycle is repeated around the many different tributaries of the Mekong, whereby fish migration is constituted as the major driving force explaining the sheer amount of freshwater catch available in the river's waters (Patrick J. Dugan, 2010).

Added to the Mekong's importance in terms of fisheries and animal and plant biodiversity, this waterway is also a source of irrigation for the LMS riparian communities in these countries, who are largely agricultural (refer to Annexes 2 & 3), with Vietnam's agro sector accounting for an extremely high 48% of the country's labour force (Central Intelligence Agency, 2012). In this particular case, it is also worth

noting that the Mekong Delta region in the South of Vietnam produces nearly a quarter of Vietnam's annual GDP.

The river's wetlands provide the perfect environment for the development of flood agriculture, intrinsically linked to the historical development of the LMS, particularly through rice agriculture (Mekong River Commission).

## **ii. Hydroelectric Power**

While the ecological, agricultural and fishing importance of the river is clear, its potential as a source of energy is what is driving the current developments. It is estimated that the Mekong could generate up to 250 GWs of energy (Piesse, 2016) through hydropower, providing a much-needed economic push in a region where poverty is widespread<sup>5</sup>.

Nevertheless, these benefits carry a potential downside by risking the survival of the ecosystem that provides livelihoods for millions living in the region. Dam construction on the Mekong cannot be done without significantly impacting fisheries, sediments, water quality and availability; in the Mekong's case, the food security – energy trade-off is very substantial (Cronin & Hamlin, 2012). We can thus see how water management clearly affects different security dimensions, as represented in Zeitoun's (2011)'s conceptual web of water security, from energy to basic survival, and how in extreme cases, the very own national security of a nation could be put under duress.

---

<sup>5</sup> 4 out of the 6 riparian states (Cambodia, Laos, Vietnam and Lao PDR) are at the bottom of the list in terms of GDP per capita in Southeast Asia, according to the World Bank, 2016.

## **VI. Analysis**

### **a. Damming of the Mekong**

As of today, Asia accounts for 60% of the world's population, but only 36% of the world's renewable freshwater resource (UNEDSA, 2014). Therefore, and coming back to our previous literature analysis, unilateral decisions regarding usage and exploitation of transnational water resources by a country in this region can have an enormous impact on the environment and the local population. The Mekong can be used as a clear example of a non-cooperative game, in which a specific actor obtains the benefits from the carrying out of a specific action, whilst the costs are borne by all within the basin. This is one such case with the damming efforts that started with the Chinese dam cascade in the 90's.

#### **i. Chinese Developments**

As a result of China's modernisation and development over the last decades, the country has focused its efforts in energy and resource security directed at development as its main policy focus; with extremely high levels of pollution, hydropower is seen as a cleaner way towards development and a means to assure water and energy needed for city growth. Thus, in order to reduce the pressure on the developed eastern cities and promote inclusive growth for the country, the government over the years has constructed around 86.000 dams<sup>6</sup>. These dams, capable of providing up to 282 GW of electricity (Piesse, 2016), were initially built in internal rivers and their tributaries. However, the building up of pressure and increased need for water and energy, due to heightened urbanisation and rapid development, took China to start a much bigger-scale project, explained in the following paragraphs.

Damming has therefore become a crucial element for achieving China's goal of promoting economic growth and investment in the western Chinese regions, known as the Great Western Development Strategy or China's "Develop the West" policy. Through this plan, China also acknowledges the increased importance of these regions

---

<sup>6</sup> This number does not refer solely to dams included in the Western Development Project, but rather to dam development within China as a whole.



for the global economy, as they house many valuable resources, including and most importantly for this issue, over 80% of China's water resources (Yeung & Shen, 2004).

As mentioned above, in terms of water abundance, China is a very heterogeneous country; whilst many areas, particularly in the South, enjoy an over-abundance of water, other regions suffer from an ever-threatening drought (Magee, 2011). Because of these large disparities in water distribution, Chinese officials took on the task of transferring waters mainly from the abundant Yangtze<sup>7</sup> to the drier Yellow River, in order to provide for the more urban areas, particularly the growing capital, Beijing. This project, already conceptualised in the 50s by Mao, was given the final go-ahead in 2001, is known as the South-North Water Transfer (SNWT), and has been implemented through the development<sup>8</sup> of a series of dams, channels and other infrastructure to divert the aforementioned waters (Wong, 2007).

Linked to this water transfer was the development of another policy, the West-East Electricity Transmission project, approved in the 10th 5-year plan (2000-2005), which would see the development of large electricity corridors from the Western Provinces to the Eastern megacities; one of such corridors, would flow go from the Southern Yunnan province to the Eastern regions, providing electricity, among other sources, from the development of large hydroelectric power plants (Gibson, 2013).

Hence, the need for further hydroelectric power dams has led to construction on its section of the Mekong – known in China as the Lancang –, located in the Western province of Yunnan, as a part of the plan to bring investment to the underdeveloped West, while providing for the needs of its booming East. The first Mekong dam (the Manwan dam) was finished in 1995. Since then, China has built another five dams on this river, in a project known as the Lancang Dam Cascade (refer to Annex 4) consisting of a series of eight originally planned hydropower dams (Yeophantong, 2015), a number that has now been reduced to seven, with the Mensong dam having been cancelled.

---

<sup>7</sup> The Mekong river was also included in plans for water transfer from its course to the Yangtze to then follow on to the North

<sup>8</sup> The entire Project is forecast to take 50 years to complete

Out of all of the Chinese development projects, the Mekong dam cascade has become one of the most controversial, due to its international dimension and potential consequences. It has managed to attract apprehension from all sectors ranging from communities within China to other countries, such as Vietnam (Piesse, 2016).

## **ii. Downstream Dams**

On the other hand, following China's initiative in dam-building along the Mekong, and thus regulating the Mekong flow, countries downstream have been encouraged to start their own damming projects. Chinese dams store water in their reservoirs; because of this, large amounts of water are retained in the wet season, whilst the release of said waters increases the flow of the Mekong in the drier months.

Laos, an economically underdeveloped and landlocked country, aims to become the "Battery of Southeast Asia" (refer to Annex 5). The construction of 9 dams along its section of the Mekong and others on its tributaries are expected to generate 12,000MW of hydropower energy by 2020, and boost this capacity to 24,000 by 2030 (GE Reports, 2016); thus providing enough hydropower energy to export to neighbouring countries like Thailand and optimally accounting for 70% of the country's total exports, around \$2.1 billion. Were these predictions to be fulfilled, hydropower would become Laos' main source of revenue (International Centre for Environmental Management, 2010). Cambodia also plans to build two dams within its border, expecting to also reap benefits from the increased electrical production.

Although many of the construction projects have been on the table for years now, without the augmentation of the river's flow in the dry season, most of these would not be viable: in the drier months, the lack of water would render dams useless, with no electricity generating capacity (Cronin & Hamlin, 2012). We must conclude, therefore, that the Chinese projects are the main cause for the developments now taking place in the LMS; the PRC's unilateral actions have allowed for generalised mismanagement of the waters.

## **iii. Consequences of Dam Building**

These projects, controversial due to their international dimension and consequences downstream, also reflect, as Mark Zeitoun (2011) warned, how the

prioritisation of dealing with a particular security issue (in this case, energy security), has directly impacted the security of other resources at an international level; water, food, environmental and human security. China is located in the upstream region of the Mekong Basin and so its management of the river is crucial for the seasonal flow in the countries that follow (Osborne, 2004). The flow of water is being forced to decrease in the wet season and increase in the dry (see Annex 6), reaching up to a 50% rise in areas as low as Kratie in Cambodia (International Rivers, 2014).

Added to the changes in the river's hydrology is the alteration of sediment flow, which is being trapped in the upper dams and is bringing about irreversible effects on lower regions that depend heavily on fisheries and agriculture. Nevertheless, for some of the Mekong's riparians, namely Laos and Cambodia, the lower levels of sediment offer a double edged sword: reduced sediment allows for increased life expectancy for downstream dams and more reservoir capacity, while at the same time, it affects agriculture and fisheries in a negative way

Estimates show that the mean sediment trapped by just the Manwan dam in its first 10 years of operation was up to 35% of the total sediment transported to the Lower Mekong (International Rivers, 2014). This, added to the change of the nature in the migration routes for fish across the river decreases the fishing capacity for downstream countries that rely heavily on this economic input. Less flow and sediment deposition decreases the quality of the water for irrigation purposes, diminishing the productivity of the fertile flood plain areas, meaning that crops, especially rice, are fewer and agricultural profit is lower. In Vietnam, 90% of rice exports and 60% of seafood are threatened by the disruption of sediment to the Mekong Delta Region (Murdoch, 2015).

Besides, seawater intrusion in the Delta of Vietnam is now a reality. Aside from the effects of climate change, the alteration of the river flow is also an important factor leading to this crisis situation; by lowering the amount of water that flows towards the Delta in the wet season, the sea is able to enter the Vietnamese mainland at a faster rate than was previously taking place. The increasingly salinized water is making production drop annually by 30%, and forcing locals to give up on traditional crops like rice for salt resistant products like pineapple (Baadsgaard Lange & Mørck Jensen , 2013).

In addition to the impact of the damming on food and water security, biodiversity is also being threatened; the Mekong catfish is in risk of extinction, and the Irrawaddy dolphins, found in the waters between Cambodia and Laos and have reduced significantly in number since the start of the damming process. Studies show that only 80 individuals remain alive (Cambodia, 2016).

As mentioned in the previous analysis of the Mekong, this river is responsible for one of the world's largest inland fisheries, accounting for nearly 25% of the world's freshwater catch. For Vietnam, its own Prime Minister has stated that due to river developments, the country could experience a drop of 27% of its country's GDP (Murdoch, 2015). The effects of damming on fish populations are already being felt in the region. One local Vietnamese fisherman expressed his worries to Mekong Commons (Oc, 2017): "(...) I could catch around 50 kilograms of fish per day (...). However, since 2010, I noticed that there is less fish in the river. I am barely able to catch even 20 kilograms per day. Sometimes, there are only a few kilograms per day. The water level is low as well."

In the Mekong's development, the most downstream riparian countries, will indeed perceive the worst impact: whereas their potential benefits from hydropower developments are rather limited in comparison to their upper-stream counterparts, their downside is large, owing to their dependency on agricultural activities and fisheries.

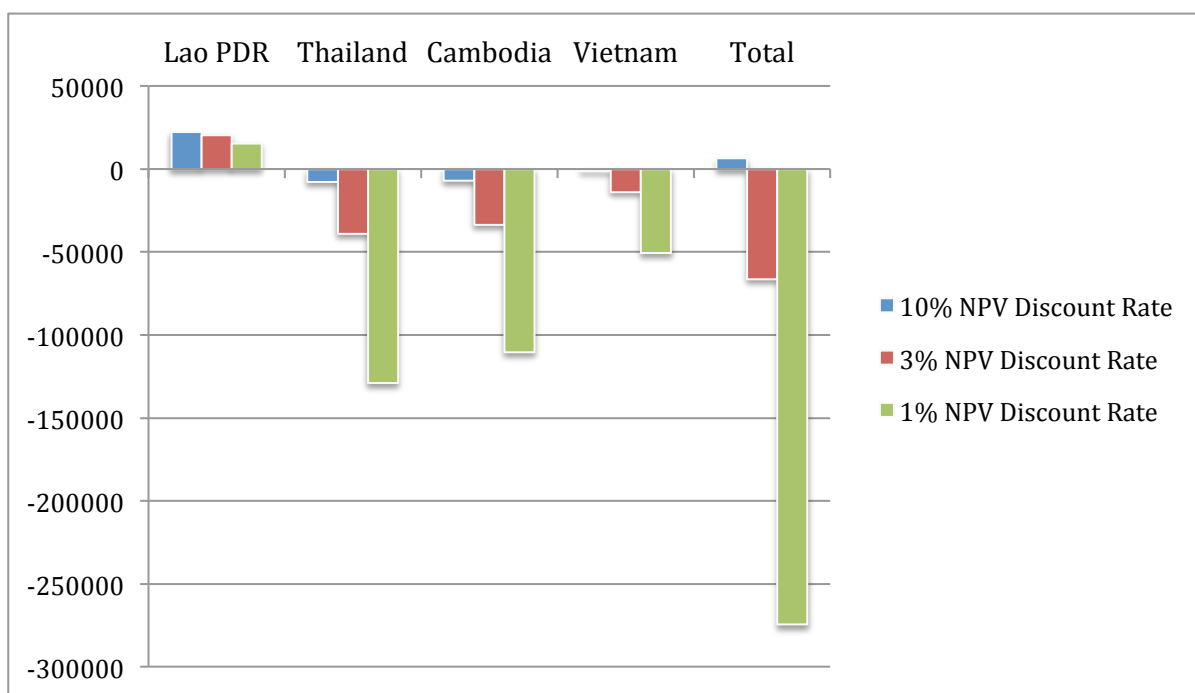
In the particular case of Lao PDR, despite its intentions to become a hydropower giant for the region, foreign contractors will carry out most of the projects undertaken. Not only will Thailand import most of Laos' electrical output through its national electricity company, but it will also have a role in the building and operating of hydroelectric stations, such as the Xayaburi Dam, the first and most controversial of the Laotian projects and developed by Xayaburi Power Co. Ltd., a subsidiary of Thai CH. Karnchang PLC.

Thus, despite dams being considered as a path to eradicate poverty and allow for growth in both Laos and Cambodia, it is not yet clear whether the trade-offs between the increased energy output and the losses reaped from the damage done to the river ecosystem account for a positive net balance. The lack of governance in these countries is currently forcing local communities to be displaced from project areas with no

compensation and no training for the search of a new life (Cronin & Hamlin, 2012), which shows that it could be the case that the income from electricity sales doesn't, in the end, materialise in an improvement for the wellbeing of the general population.

The benefits of these projects are therefore unclear. What's more, a study conducted by Portland State University, with the collaboration of Thailand's Mae Fah Luang University (2011) concluded that the region as a whole would earn a benefit of \$6.6billion dollars at best, and a giant loss of \$274.4billion under the worst assumptions. As asserted by Apisom Intralawan, a scholar at the Institute for the Study of Natural Resources and Environmental Management in Chiang Rai, Thailand: "The downstream people are losers... We get electricity, but we lose fisheries, and if you examine the consequences, the fishery loss is greater than the electricity gain" (Bernstein, 2017).

**Graph 1. Expected 20 yr. gains/losses by country and discount rate for the 11-dam scenario (\$ million)<sup>9</sup>**



Source: Adapted from *Planning Approaches for Water Resources Development in the Lower Mekong Region* by Costanza, R., Kubiszewski, I., Paquet, P., King, J., Halimi, S., Sanguanngoi, H., et al. (2011). Portland State University; Mae Fah Luang University.

<sup>9</sup> This paper has reflected the data for the 11-dam scenario, considering that as of today, neither Cambodia nor Laos have stated any intention to cancel any of the proposed dams in the Lower Mekong. For further data, refer to Annex 7.

In all scenarios considered, Laos would be the only one with a net benefit (this study excludes China). Considering what has been said above, this net benefit shouldn't be taken at face value either. Global income for the country has the potential to increase and strengthen GDP growth; however, due to the lack of governance and inclusion in decision-making of those communities affected, it may accentuate disparities between those reaping the economic benefits from the dams in the city and those suffering the consequences in the country's rural areas.

## **b. Cooperation Efforts**

Due to the described importance of the river for the wellbeing of its riparian countries, several efforts to increase cooperation and responsible management have taken place in the recent years. In the following section, this report will analyse the evolution of cooperative actions in the Mekong Basin, particularly of the Mekong River Commission so as to gain an understanding of how it has or hasn't been successful and the reasons behind this.

### **i. Institutionalisation prior to the Mekong River Commission**

The first attempt at cooperation came in the form of the Committee for the Coordination of Investigations of the Lower Mekong Basin, created in 1957 with support from the US. Integrated by Vietnam (South), Cambodia, Laos and Thailand, its function was mainly to assess the possibility of building dams, which would then lead to the development of the region. At this time, the "Hard Path" water development strategies were on the rise – promoted by the "Big Push" perspective on economic development –, which focused on the building of large-scale water infrastructure to meet human demands (Gleick, 2003). However, none of the plans were realised, as the Vietnam War erupted, shifting the attention of the US to the conflict (Osborne, 2004). Nevertheless, this first contact with the US and Hard Path notions are at the root of dam developments today, as many of the dams now planned or under construction were conceptualised at the time.

In the years after the War, interest on the region resurfaced. The Asian Development Bank then proposed the creation of the Greater Mekong Subregion Program (GMS) in 1992, which did in fact involve all 6 riparian countries (Asian

Development Bank). While this Program still operates today as a regional forum concerned with issues ranging from tourism to energy production, it has no regulatory power. It has been a platform for the Asian Development Bank for the strengthening of the region's economic foundations, and as such, has focused mainly on economic integration through infrastructure building and related projects, some of which have been the financing of some of the Mekong dams (Both Ends, 2011). In a sense, the multilateralism devised by the ADB for the creation of the GMS has actually accentuated the river's degradation, by promoting infrastructure development as a means for growth, providing no real platform for discussion.

## **ii. Cooperation after 1995**

Some years later, in 1995, we arrive to what is believed to be the breakthrough institution in the struggle for a common management of the Mekong. Out of the ashes of the Mekong Committee, the Mekong River Commission (MRC) was created with the signatures from four of the riparian states: Thailand, Lao PDR, Cambodia and Vietnam. This institution is "the only inter-governmental organisation that works directly with the governments of Cambodia, Lao PDR, Thailand and Viet Nam to jointly manage the shared water resources and the sustainable development of the Mekong River". (Mekong River Commission).

Throughout the years, the MRC has managed to develop a series of guidelines for the Mekong's riparians, in a bid to ensure inclusive, sustainable policies, with the aim being that "*member states share the benefits of common water resources despite different national interests*" (Mekong River Commission). Its work has produced a series of guidelines for the joint management of the river, most notably for the case at hand, its "Procedures for Data and Information Exchange and Sharing" and the principle of "Prior Consultation and Agreement". Under the aforementioned procedures, which develop the 1995 founding Agreement, member countries agree to maintain fruitful contact among each other, providing relevant data regarding water resources, navigation, flood management, environmental and other river-related information critical for riparians to manage the Mekong in a holistic, regional manner (Mekong River Commission, 2001). Concerning the "Prior Consultation and Agreement", the MRC developed a series of procedures to be followed by any of the institution's members when undertaking any project involving the use of the Mekong's waters in

any way that could lead to changes in the mainstream's flows, particularly in the dry season. According to these, a notification by the state in question should be issued through a specific Mechanism established by the MRC, including information on the project to be carried out, which would then be analysed by the MRC's Joint Committee and agreed upon by the affected parties (Mekong River Commission, 2003)

All in all, the MRC's activity has focused on the development of a framework for joint action on the river's mainstream, attempting to guarantee a cooperative relation among its member states regarding the usage of its waters and limiting any project that could potentially harm the region.

As well as the Mekong Commission, it is worth noting that several other mechanisms have been established in more recent years, starting with the Lower Mekong Initiative in 2009 and following with the Lancang-Mekong Cooperation, in 2015.

The former, launched by the US, is in essence the focal point of the United States' shift towards Asia, specifically of its engagement with the Southeast. Welcomed eagerly by the MRC's members, it aims to promote "sustainable and inclusive growth in the Lower Mekong Region" and "meet regional development challenges with active involvement and close cooperation of LMI governments" (Lower Mekong Initiative). In a sense, whilst cementing the ground for aid flows to the region by the US and its allies<sup>10</sup>, it also shows an intention to counter China's growing influence. Its actual role, anyhow, has been defined as "short of substance" (Cronin & Hamlin, 2012).

On the other hand, the Lancang-Mekong Cooperation Mechanism was launched by one of the riparians: China. As the most powerful actor in the region and characterised by historical unilateralism with regards to the Mekong, this mechanism intended to foster cooperation is most likely to become an institution that primarily serves Chinese interests, as the country attempts to block any possible resistance to its projects following a "build first, talk later" policy (Pongdsudhirak, 2016). As reported by Asia Times (Hutt, 2018) after the second MLC Summit in January, little came up at the gathering terms of the problems faced in the region due to dam developments;

---

<sup>10</sup> The LMI has formed the "Friends of the Mekong", a group comprised of the US and other like-minded donors such as the ADB, the World Bank and other allies.



rather, its aim appeared to be the gathering of Southeast Asian support for Chinese projects in exchange for investments in the region. Hence, both of the aforementioned institutions seem to be another way for the great powers (US & China) to exercise their influence and gain a level of control over regional governments and their political alignments in exchange for investment and political support.

### **c. Cooperation: the Reality**

For a clearer understanding of the cooperative dynamics in the Mekong basin, and in order to determine whether such cooperation has effectively aided in alleviating the dangers of dam-building in the region, the following paragraphs will try to shed light on the reality of the issue. Looking at the region from the theoretical framework defined and through a critical lens, this paper will attest to the effectiveness of the Mekong's institutions – particularly of the MRC – or the lack thereof, in terms of the promotion of dialogue in the region and its allowing for collective action to take place.

#### **i. The Failures of the MRC**

The effectiveness of riverine institutions, most notably the MRC, has been surrounded by controversy over the years, starting since their foundation. One must note, before going further into the analysis, that China, as the most powerful actor in the region, had in a way already sentenced the institution to limited relevance, as its rejection to join this organisation ended any expectations of a strong institution from the start.

Today, China, together with Myanmar, as Dialogue Partners to the Commission, are not obliged to share information and the former continues to dismiss complaints of the damming's potential environmental damage (Ray, 2017) Despite the efforts by civil society groups to ensure MRC's information transparency on the impacts of the dams, limited response has been granted. The Commission has also been criticised for a lack of public participation and its little success in protecting regional food security and positioning itself as a “facilitator” among the region's hydro developers (International Rivers, 2009). Since the same year of its creation, in 1995, five dams have been constructed in China, and two are under construction in Laos and Cambodia (refer to Annex X).

Therefore, although it was hailed, as we mentioned, as the breakthrough institution for the Mekong, it is clear that its efforts are having little effect. One of the MRC's most renowned failures came in 2011. At the time, the first and most controversial of the Laotian dam projects, the Xayaburi Dam, was halted after calls from Cambodia and Vietnam to first conduct studies on the environmental impacts of the dam. Pöyry, a Finnish consulting firm, was hired to carry out such assessments, and gave the green light for Laos to go ahead with construction, expecting the dam to become fully operational by 2019 (Piesse, 2016). Organisations such as International Rivers (Herberston, 2012), denounced the firm's strong conflict of interest due to its business relationship with said dam's Thai promoter. Governments (Vietnam and Cambodia) and civil society groups called for a delay to conduct an Environmental Impact Study (International Rivers, 2011). Nevertheless Lao understood the consultation required by the MRC's standards to have taken place and thus continued with Xayaburi's construction.

Through its actions, Laos has confirmed the limited power of the 1995 MRC. By giving the advice of an international consultancy firm prevalence over any of its neighbour's concerns, Lao PDR has shown no intention of fulfilling its 1995 promises under the Mekong River Commission Agreement, following Chinese's lack of interest in multilateralism for negotiating river developments.

## **ii. Why has Cooperation Failed?**

As we can appreciate in the Mekong, non-cooperative game theory seems to apply in an unfortunately precise way; although the end result will be detrimental to the region and even to some of the dam-developing countries in the long term, they undertake the actions that will unequivocally lead them to this end. Once China, perceiving the benefits of dam-building to be superior to the possible costs, decided to go ahead with its project, nothing was holding back the rest of the Mekong region's countries. The case of Cambodia is particularly relevant: while being one of the most gravely affected by these dam developments, the dynamics of common pool resource management (or mismanagement) have put it in a position where the benefits to begin its own dam-building are perceived as higher than remaining still while others make use of the waters. This will only accelerate the rate at which the river deteriorates and impacts the whole region, particularly downstream.

Even when considering dam-building through a purely national perspective, the same theory seems to apply: the political elites and businesspeople in the city benefit from undertaking dam development in the Mekong, whilst rural inhabitants and the disavowed minorities, with no real power for decision making, suffer the direct consequences. We can find an example of such a case in Thailand: whereas the previously analysed study concluded that Thailand would suffer greatly from dam developments in the region, and many within the country have voiced their rejection of the aforementioned projects, Thai banks and electricity companies continue to fund damming in the Lower Mekong, with apparent acquiescence by the government.

Most recently, the Laotian and Thai Governments signed a new power purchasing agreement in 2016, increasing the annual energy purchases to Lao PDR to 9,000 MW. As well as this, Vietnam, the most openly critical of the Mekong's dam developments, also signed a MoU in 2008 with Lao PDR, pledging to purchase up to 5,000 MW of electricity to the country (although estimated at less in the PDP VII). Seeing as Lao's electrical output comes fundamentally from hydropower, these show an apparent contradiction between the LMB governments' actions and their rhetoric against dam building.

In the end, the destruction of the riverine ecosystem will be pernicious to all, but those with the capacity for action will seemingly continue this course of action. These see the concentration of benefit on themselves, while the damage is experienced by a large number of actors (and thus dispersed). Authors such as Hardin, Ostrom or Wade suggested different ways for allowing cooperation to take place, from an external Leviathan to privatisation or collective action among members. In the case of the Mekong, being a transboundary resource, there is no authority above states to establish the rules of the game regarding its management; hence, no coercive force can act on all members to guarantee their compliance to any standard.

Privatisation, on the other hand, was already understood to be of limited viability in the case of water resources, due to the impossibility of determining property rights over the resource. Thus, it would seem that direct cooperation through collective management of the Mekong is the alternative for the Mekong: should countries establish a set of rules and penalties among themselves, together with an external actor to guarantee a fair following of said guidelines, should allow for multilateralism in the Mekong waterway. This was the intention of the MRC at the time of creation: Mekong

Basin states would devise guidelines to be followed when undertaking any action that could affect the river in any negative manner for any of the other members. However, the MRC hasn't been all that successful, and the following lines will try to answer as to why.

Analysing the issue through the international relations theory can bring us closer to understanding the Mekong's reality: realism would argue that this is again a situation of power politics in which individual state interest will prevail. The case of the portrayed uselessness of the MRC and the refusal of China to participate in it can be understood as an example of how institutions are only relevant as long as powerful countries feel they can reap benefits from them.

China is not only the most powerful actor in the region in terms of size or economy, but its position as the uppermost riparian gives it an added leverage with regards to the Mekong. The ability to control the initial flow of the river is thus exercised unilaterally, since China's position and strength allows it to do so without having to reach any agreement with its neighbours, with the delays and complications this could imply. From China's perspective, any signing of an agreement that could potentially limit its freedom of action was not in accordance with the view of the government. Due to this, many of the actions carried out by China with regards to the Mekong have been debated and opposed by the MRC, albeit with little to no effect. Driven by national interest and its focus in GDP growth and thus a need for energy, China believes in its right to carry out unilateral actions.

Due to the high power disparity and the Mekong countries' interests in being on good terms with China, it has done so without much real backlash. As geostrategist Brahma Chellaney (2016) puts it: "smaller downstream countries in Southeast and Central Asia now use only coded language to express their concerns over Chinese dam building (...) Smaller states are wary of mentioning [China] by name."

Liberalism, on the other hand would argue that increased economic interdependence and the strengthening of institutions are the key to solve the mismanagement of the Mekong River. However, as is the case with the MRC, not all countries are keen on conditioning their national interest to regional discussion. In a way, the limited democratic practices of the countries in the region, together with the

political alignment of most of these countries with China have meant that little formal opposition has been expressed. Even countries that have been more vocal, such as Vietnam, they themselves participate in the degradation of the Mekong: the lowest riparian has indeed signed agreements to purchase energy from Lao and Cambodia in the future, coming mostly from these contentious dams.

It must be stressed how the river's developments are based on particularly strong interests concerning the survival of the Mekong Basin states, from demographic pressures in China's Eastern Coast and thus the need for the West's development, to a growing demand for water and energy in the region's booming cities. Interestingly, these affect even those who will mostly suffer the detrimental consequences: while Vietnam, Thailand and Cambodia will likely lose out on agriculture and fisheries, the growth of cities such as Bangkok or Ho Chi Minh has placed a strain on the provision of energy, thus leading to contradicting actions which go counter to their purported official stance regarding the dams. Therefore, those pushing for dam construction see no large downside, and the opposing affected states have not acted coherently; contradictory actions among the LMB have impeded the placing of real pressure for Lao and China to reconsider their course of action, and even Cambodia now plans to make the most out of its dire situation by building two dams, further deepening the problem.

As a summary, there are some key elements that have led to this disastrous situation in the Mekong Basin, namely:

- The region's power asymmetry has allowed for China to undertake unilateral action.
- Political ties among basin states and the aforementioned disparity have limited formal complaints.
- China's lack of participation in the MRC has incapacitated said institution as a platform for real discussion.
- Following initial developments, dam building downstream has become viable and more appealing.
- Lao's quest to become the "Battery of Southeast Asia" has led to yet another rejection of multilateralism.

- Domestic disparities within the basin countries have led to diverging interests among the decision-making elites and those dependent on the river's ecosystem.

#### **d. The Future of Cooperation in the Mekong**

Although the previous section has tried to shed light on the failures of the Mekong River Commission as an institution for cooperation in the basin, and the reasons for this failure, there is still some hope that joint action can be achieved in the future.

The main criticism of the MRC relies on its weak mandate as per the 1995 Agreement. MRC members have no capacity for vetoing potentially disastrous river developments; as an institution with very limited capacity and lack of legally binding authority, countries are, effectively, free to act as they see fit. This is unlikely to change, as Asian nations tend to respect the principle of non-interference with regards to other states' sovereignty. However, there may be other ways in which the MRC could prove useful to its founding cause.

Over the years, the institution has seen its usefulness limited to data collecting and information sharing among states; this is no negligible feat. The first step towards addressing transnational water confrontations should be transparency and discussion. In this sense, the MRC has been responsible for conducting studies and analysing potential effects of changes in the river's hydrology, which could then be used to influence policies regarding the river. As well as this, its renewed efforts to engage in public participation (Neusner, 2016) could have the desired result of pushing government officials to listen to their constituents.

The misalignment of national interest and the wants and needs of local affected populations could be driven to convergence should civil society be further included in the MRC's processes, expressing their views and obtaining information, thus generating national dialogue.

In terms of transnational alignment, the MRC has served as a forum for discussion. Although results have not been optimal in the past years, the conversation

has nevertheless been there, which can be considered a step forward. Concerning China's activities, it seems very unlikely that it will change course in terms of hydropower development or the MRC membership. However, initiatives in the region such as the LMI, created by the US, could aid in establishing new power dynamics in the basin. Backed by the US and their "Friends of the Mekong", with the investment and funds implied, China could find itself in a situation where it is in its interest to collaborate with the provision of more information to downstream countries regarding dam discharge and the implementation of environmental safeguards in dams.

Already, the Lancang-Mekong Cooperation Mechanism seems a step towards further collaboration. Whereas it is most likely to become an institution for serving Chinese interests and cementing its projects in the area, it also shows a predisposition to strengthen ties with downstream countries and increase multilateral discussion.

Besides the previous attempts of common management of the Mekong, it is important to consider the possible future potential role of the UN Convention on the Non-Navigational Uses of International Watercourses; approved by the UN General Assembly in 1997 and put into force in 2014 after the ratification of the 35<sup>th</sup> country; Vietnam; although this country "reserves the right to choose the appropriate means of dispute settlement notwithstanding the decision of the other party to the concerned dispute." (United Nations, 1997).

As of today, this treaty is the only universal framework applicable to the governing management of common fresh water resources. The convention is made up of 37 articles which contain a set of principles and rules set out as an attempt to fill the lagoons in existing river basin agreements (i.e. MRC). Indeed, Article 5 stipulates that a state sharing international water resource must manage the flow throughout its national borders in an equitable and reasonable way (United Nations, 1997).

Regardless of having been signed by only one of the Mekong's riparian countries so far, it enhances and strengthens regional agreements and offers future possibilities for avoiding and if not mitigating adverse impacts from initiatives like the Mekong dam cascade. Vietnam has reached a point where it is trying to diversify its discussion arenas; tired of negotiations carried out through the different Mekong institutions, now seeks to provide a new momentum to this UN Convention, to shed

light on the uncertain future of the Mekong River Basin and put international pressure on the upstream countries to stop their unilateral actions and degradation of the river.

For now, however, the situation remains at an impasse. Should the MRC and its members improve their data collection techniques and incorporate the public into the discussion, the LMB countries may reach an agreement in terms of a shared stance regarding water usage. These could then, with the added leverage provided by other mechanisms such as the LMI or the UN Convention on the Non-Navigational Uses of International Watercourses, place pressure on China to engage in the discussion. Perhaps it's too late to revert the dam developments, but with increased transparency and joint action, its effects could be alleviated, from measures to allow for increased fish migration, to data on dam discharge and river flow variations. More impactful would be if certain planned dams were decommissioned, but this seems today like a far-fetched scenario.



## VII. Conclusion

As we have seen through this essay, power asymmetry in transnational water management is accentuating the dynamics of non-cooperation characteristic of common pool resources. From environmental degradation and biodiversity reduction to agricultural and fishing loss, mismanagement of river systems poses great threats to dependent populations. As farmers and fishers lose access to their livelihoods, aside from the economic losses, they may pose a threat in terms of not only protest or internal turmoil, but also may well migrate across borders to look for a better life, resulting in the problems that this usually entails, such as overcrowded cities, and strained resources. Zeitoun's web of water security has proven useful for analysing the ways in which a determinist focus on one aspect of water policy may have dire consequences in other aspects, such as food, national and human security.

In this particular case study, due to China's increased interest in the development of the West, and from this the building of the Lancang dam cascade, countries downstream have begun plans of their own to develop hydropower stations – a total of 11 dams – in an effort to increase their revenues. This paper has initially summarised the main conclusions of studies conducted by researchers and institutions such as the World Dam Commission, which clearly reflect the risks associated with anthropogenic actions on the environment, and most particularly, dam building.

Comprehending the cruciality of the Mekong for the survival of the ecosystem and thus, the human population living on its banks, this paper has aimed, subsequently, at understanding the possible effects of the aforementioned dams. The main study analysed for this paper, carried out by Portland State University in collaboration with Thailand's Mae Fah Luang University, has shown the – at best – uncertain future of these projects, with expected economic losses mainly in fisheries and wetlands of up to \$274.4 billion under a worst-case scenario. Nevertheless, the fast rising global energy demand and prices, short-sighted development policies and a pursuit of rapid GDP growth, together with Chinese ambitions in the area, have led to a structural mismanagement of the Mekong River. Only after the regulation of the Mekong's flow by China have countries downstream been able to reap benefits from their own dam building efforts, thus consolidating a downward spiral dynamic.

Studies have indicated that for a correct transnational water management, efforts should be undertaken from a regional and basin-wide approach, and for this, the Mekong River Commission was created back in 1995. Therefore, the next and most central matter of this paper has been the questioning of institutional and cooperative effectiveness in the region, mainly through the MRC but also regarding more recent frameworks and institutions.

As a common pool resource, cooperation between states for the management of this transboundary resource was never guaranteed, and this paper has shown how the MRC and other institutions have proven to not be enough, with no formal power to monitor state activities. China's refusal to become a member of the MRC condemned the institution to limited relevance from its birth; as the most powerful action in the region saw the benefits of unilateralism and acted accordingly, countries downstream have consequently undertaken their own projects and formal complaints have been limited due to the power disparity in the region leading to an interest in being on good terms with China. With a crippled institution from its foundation (the MRC) and other initiatives that appear mostly to serve US and Chinese interests in the region (LMI and MLC), the current outlook does not appear too auspicious.

Chinese and Laotian dam building efforts are led by a strong array of forces and interests that seem unlikely to change, and thus any expectations of a stop to these developments appears extremely hopeful. As a consequence, other countries such as Cambodia, Thailand or Vietnam have had no other real option but to try and make the most out of the situation, be it through their own dam building – as it the case for Cambodia – or the purchasing of energy – in the case the other two –. These apparently contradicting actions, counter to their stance against unbridled river developments, have shown an inability to present a clear position against river developments, thus limiting the pressure for reconsidering dam building.

In the future, however, the MRC and the more recent mechanisms can still prove useful if they serve for a deepening of regional ties and the increase of multilateral talks. Downstream members members should aim to present a more unified stance to demand greater transparency and create participatory mechanisms that will take downstream interests into consideration in the operation of these dams. As well as this, institutional capacity of these existing organisations must be strengthened so as to better monitor

compliance to the “best practices” in collective water management. In this way, and together with US backed investments in the area through the LMI, the Lower Mekong countries will be in a much better position to engage with China on this issue and mitigate the adverse effects of the projects, aiming for the best-case scenario for the future. Parallel to this institutional debate, the UN Convention on the Non-Navigational Uses of International Watercourses, put into force in 2014 after Vietnam’s approval, has sparked hope, in the expectation that it will provide an opportunity for real change, bringing international pressure to the issue of water management and the Mekong’s degradation.

The issue of dam building in the Mekong is thus, as this paper has shown, a result of non-cooperation dynamics in an unequal power relationship. From its transnational aspect, regarding China and Lao’s unilateralism, to the local disparities between the affected rural populations and the energy-hungry elites preventing a clear opposition from taking place, the Mekong riparians have failed until now to foster collective action regarding the management of its transboundary waters. More than 60 million people downstream are at risk; it is time make a real use of all existing multilateral instruments, so that genuine discussion and basin wide participation can take place for achieving a regional approach to sustainability.

## BIBLIOGRAPHY

Asian Development Bank. (n.d.). *Regional Cooperation and Integration*. Obtained from Asian Development Bank Website:

<https://www.adb.org/countries/gms/main>

Baadsgaard Lange , R., & Mørck Jensen , K. (2013). *CLIMATE POLITICS IN THE LOWER MEKONG BASIN: NATIONAL INTERESTS AND TRANSBOUNDARY COOPERATION ON CLIMATE CHANGE*. Danish Institute for International Studies, Copenhagen.

Bernstein, R. (27 September 2017). China's Mekong Plans Threaten Disaster for Countries Downstream. *Foreign Policy* .

Both Ends. (2011). *The ADB-GMS Support for Hydropower Dams and Power Grid*. Both Ends: Environment and Development Service.

Brown, D. (6 October 2016). *Mongabay*. Obtained on 22 October 2016, from Vietnam sweats bullets as China and Laos dam the Mekong:

<https://news.mongabay.com/2016/10/vietnam-sweats-bullets-as-china-laos-dam-the-mekong/>

Cambodia, W. (2016). *The Irrawaddy Dolphin and Mekong River Conservation*.

Obtained from WWF :

[http://cambodia.panda.org/projects\\_and\\_reports/mekong\\_dolphins/](http://cambodia.panda.org/projects_and_reports/mekong_dolphins/)

Central Intelligence Agency. (2012). *CIA World Factbook*. Obtained from

<https://www.cia.gov/library/publications/resources/the-world-factbook/>

Chellaney, B. (16 March 2016). China's dam boom stokes concerns in Asia. *Nikkei Asian Review* .

Costanza, R., Kubiszewski, I., Paquet, P., King, J., Halimi, S., Sanguanngoi, H., et al. (2011). *Planning Approaches for Water Resources Development in the Lower Mekong Region*. Portland State University; Mae Fah Luang University.

Cronin, R., & Hamlin, T. (2012). *Mekong Turning Point: Shared River for a Shared Future*. The Henry L. Stimson Center.

GE Reports. (2016). *Powering Up "the Battery of Southeast Asia"*. General Electric.

Gibson, D. T. (19 February 2013). *Wilson Center: China Environment Forum*.

Obtained from Electricity on the Move China's Network of Transmission Lines Moving Coal Power and Hydropower Eastward:

<https://www.wilsoncenter.org/article/map-chinas-west-east-electricity-transfer-project>

Gleick, P. H. (2003). Global freshwater resources: Soft-path solutions for the 21st century . *Science* , 302 (5650), 1524-1528.

- Hardin, G. (1968). The Tragedy of the Commons. *Science* , 162 (3859), 1243-1248.
- Herberston, K. (2012). *Pöyry Responds on its Role in the Xayaburi Dam*. International Rivers.
- Hutt, D. (2018 January 2018). China flexes its control on the Mekong. *Asia Times* .
- International Centre for Environmental Management. (2010). *Strategic Environmental Assessment of Hydropower on the Mekong Mainstream*. Mekong River Commission.
- International Rivers. (2014). *Environmental and Social Impacts of Lancang Dams*. Internaitonal Rivers: People, Water, Life.
- International Rivers. (23 June 2011). Government Unilaterally Claims Regional Consultation Process Complete. *International Rivers* .
- John Valbo-Jørgensen, C. S. *Lateral Fish Migrations between the Tonle Sap River and its Floodplain*. Mekong River Commission , Component of Assessment of Mekong Fisheries.
- Lower Mekong Initiative. (n.d.). *The Lower Mekong Initiative*. Obtained on 15 March 2018, from LMI Overview: <https://www.lowermekong.org/about/lower-mekong-initiative-lmi>
- Ma, D., & Summers, T. (2009). *Is China's Growth Moving Inland? A Decade of 'Develop the West'*. Chatham House, Asia Programme.
- Magdy, S. (18 November 2017). Egypt warns Ethiopia Nile dam dispute is "life or death". *The Times of Israel* .
- Magee, D. (2011). Moving the River? China's South–North Water Transfer Project. En S. D. Brunn, *Engineering Earth: The Impacts of Megaengineering Projects* (págs. 1499-1500). Springer Science+Business Media .
- McCully, P. (2001). Rivers No More: The environmental effects of large dams. In P. McCully, *Silenced Rivers: The Ecology and Politics of Large Dams*. London: Zed Books.
- Mekong River Comission. (n.d.). *Mekong River Commission For Sustainable Development*. Obtained on 16 February 2018, from <http://www.mrcmekong.org/mekong-basin/physiography/>
- Mekong River Commission. (2001). *Procedures for Data and Information Exchange and Sharing*.
- Mekong River Commission. (2003). *Procedures for Notification, Prior Consultation and Agreement*.

- Millenium Ecosystem Assesment. (2005). *Ecosystems and Human Well-Being: Synthesis*. Washington D.C.: Island Press.
- Mollinga, P. P. (2008). Water, Politics and Development: Framing a Political Sociology of Water Resources Management. *Water Alternatives Journal* , 1 (1), 7-23.
- Murdoch, L. (27 June 2015). Could damming the Mekong destroy south-east Asia's greatest river and food bowl? *Sydney Morning Herald* .
- Neusner, G. (6 December 2016). Why the Mekong River Commission Matters. *The Diplomat* .
- Oc, V. V. (20 June 2017). *Mekong Commons*. Obtained from More dams, less fish and fishers: A Mekong Delta fisher voices concern: <http://www.mekongcommons.org/dams-less-fish-fishers-mekong-delta-fisher-voices-concern/>
- Olson, M. (1965). *The Logic of Collective Action: Public Goods and the Theory of Groups*. Harvard University Press.
- Osborne, M. (2004). *River at Risk: The Mekong and The Water Politics of China and Southeast Asia*. Lowy Institute for International Policy.
- Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. (D. C. James E. Alt, Ed.) Cambridge: Cambridge University Press.
- Patrick J. Dugan, . C.-C. (2010). Fish Migration, Dams and Loss of Ecosystem Services in the Mekong Basin. *Ambio, a Journal of the Human Environment* , 39 (4), 344-348.
- Piesse, M. (26 May 2016). *Future Directions International*. Obtained from Livelihoods and Food Security on the Mekong River: <http://www.futuredirections.org.au/publication/livelihoods-food-security-mekong-river/>
- Pongsudhirak. (2016). *Nikkei Asian Review*. Obtained from Thitinan Pongsudhirak: China's alarming 'water diplomacy' on the Mekong: <http://asia.nikkei.com/Viewpoints-archive/Viewpoints/Thitinan-Pongsudhirak-China-s-alarming-water-diplomacy-on-the-Mekong>
- Postel, S. (2001). Growing More Food with Less Water. *Scientific American* , 284 (2), 46-49.
- Ray, T. (24 March 2017). Damming the Mekong: Environmental Degradation and the “Build First, Talk Later” Approach. *Georgetown Security Studies Review* .
- Salzman, J. (2005). *Thirst: A Short History of Drinking Water*. Research Paper, Duke Law School, Legal Studies.

- UNEDSA. (2014). *United Nations Department for Economic and Social Affairs (UNEDSA)*. Obtained from Water for Life Decade: Asia and the Pacific: <http://www.un.org/waterforlifedecade/asia.shtml>
- United Nations. (2015). *Sustainable Development Knowledge Platform*. Obtained on 13 February 2017, from Transforming our world: the 2030 Agenda for Sustainable Development: <https://sustainabledevelopment.un.org/post2015/transformingourworld>
- United Nations. (2013). *United Nations Inter-Agency Mechanism on all Freshwater Related Issues, including Sanitation*. Obtained on 23 March 2017, from Water Security: <http://www.unwater.org/topics/water-security/en/>
- United Nations. (1997). *United nations Treaty Collection*. Obtained from Convention on the Law of the Non-Navigational Uses of International Watercourses: [https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg\\_no=XXVII-12&chapter=27&clang=\\_en](https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXVII-12&chapter=27&clang=_en)
- Wade, R. (1986). *The Management of Common Property Resources: Collective Action as an Alternative to Privatisation or State Regulation*. World Bank, Agriculture and Rural Development Department.
- Water Environment Partnership in Asia. (n.d.). *WEPA State of Water*. Obtained on 22 October 2016, from [http://www.wepa-db.net/policies/state/cambodia/river2\\_1\\_1.htm](http://www.wepa-db.net/policies/state/cambodia/river2_1_1.htm)
- Wong, S. (2007). China Bets on Massive Water Transfers to Solve Crisis. *World Rivers Review*, 22 (4).
- Yeophantong, P. (2015). *China and the Politics of Hydropower Development: governing water and contesting responsibilities in the Mekong River Basin*. Working Paper, University College Oxford, Department of Politics and International Relations.
- Yeung, Y.-m., & Shen, J. (2004). *Developing China's West: A Critical Path to Balanced National Development*. Hong Kong: The Chinese University Press.
- Zeitoun, M. (2013). Global environmental justice and international transboundary waters: an initial exploration. *The Geographical Journal*, 179 (2), 141-149.
- Zeitoun, M. (2011). *The Global Web of National Water Security*. University of East Anglia. London School of Economics and Political Science and John Wiley & Sons Ltd.

# ANNEXES

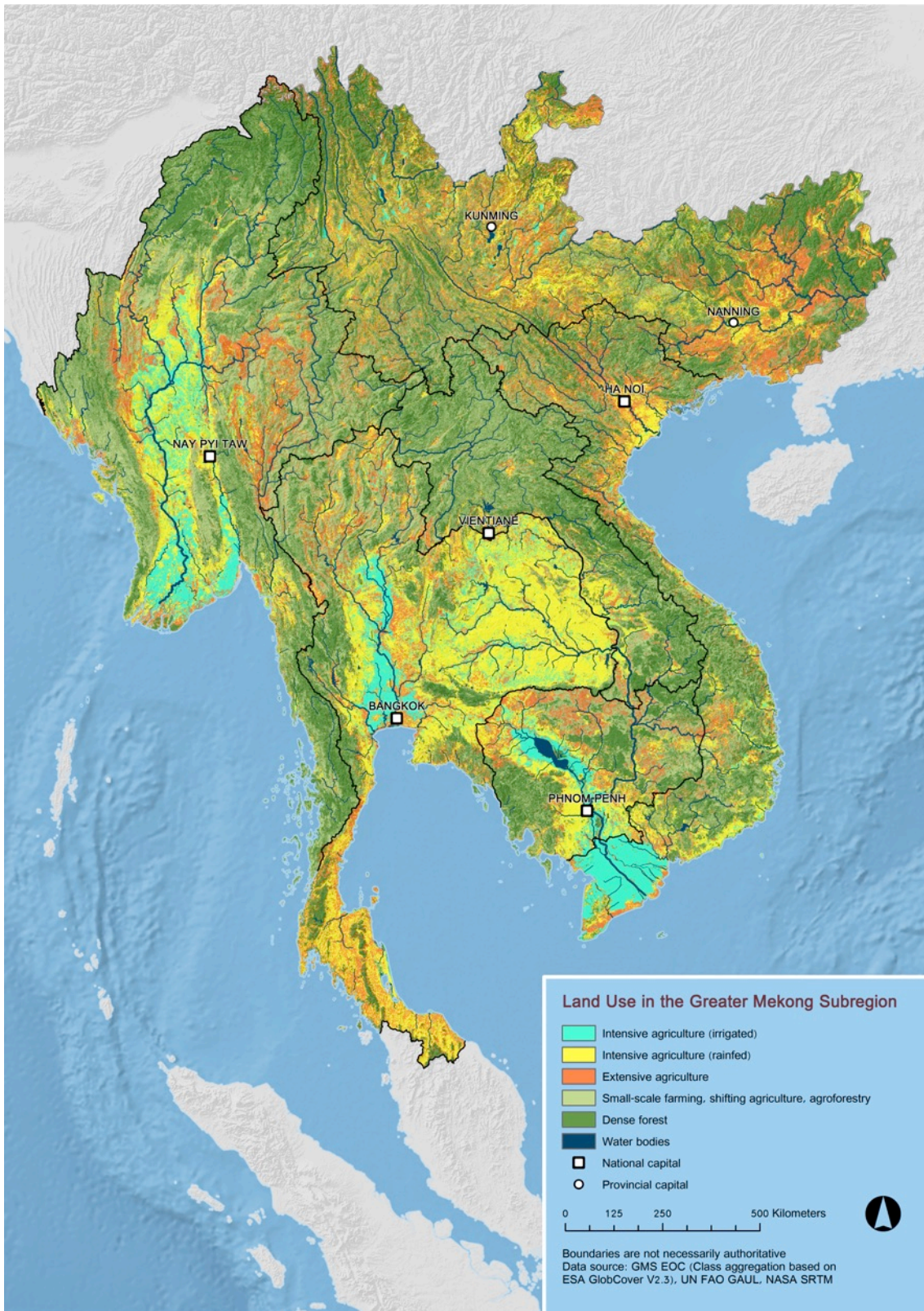
## ANNEX 1. MEKONG RIVER BASIN



Source: Maps, Greater Mekong Subregion Information Portal, 2012.



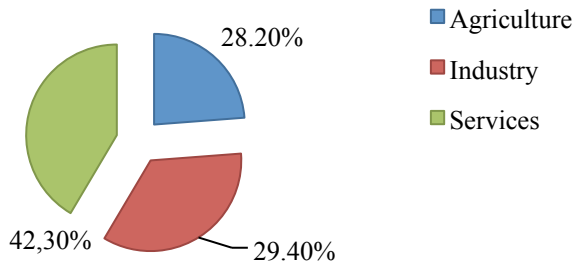
## ANNEX 2. LAND USE IN THE GREATER MEKONG SUBREGION



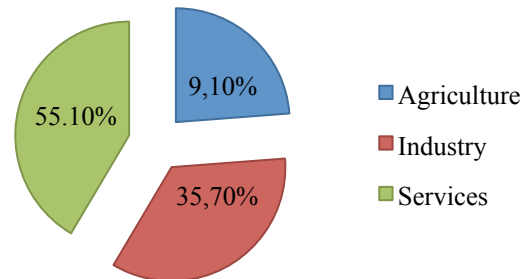
Source: Maps, Greater Mekong Subregion Information Portal, 2012.

**ANNEX 3. LOWER MEKONG REGION ECONOMIES BY SECTOR**

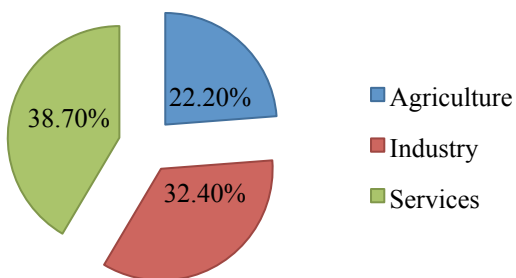
**Cambodia**



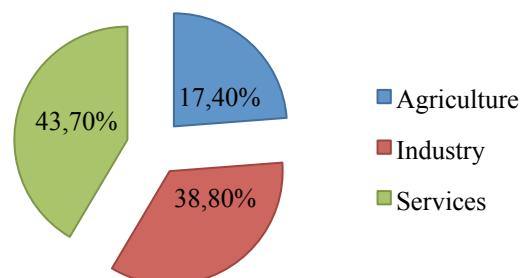
**Thailand**



**Lao PDR**

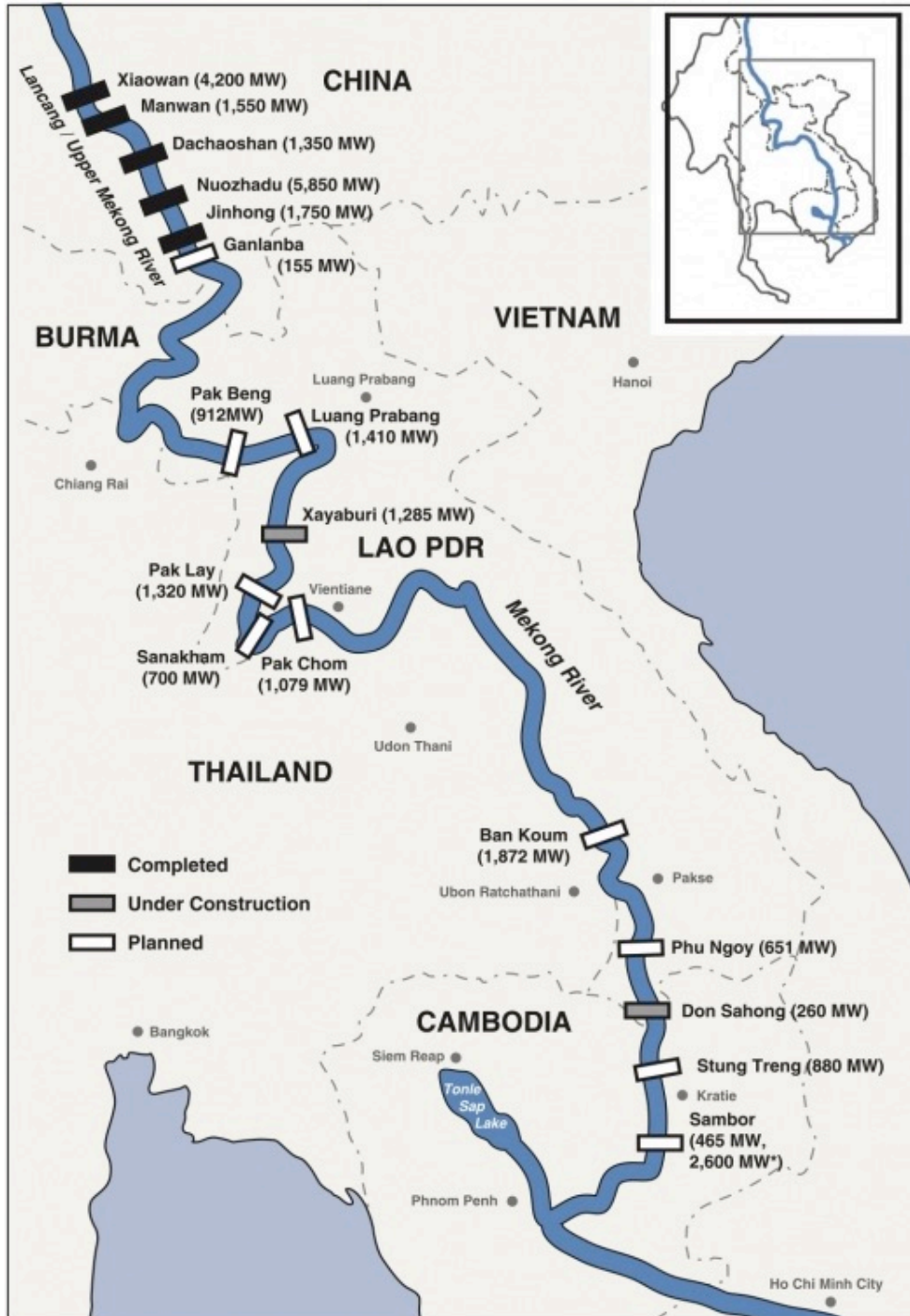


**Vietnam**



Source: prepared with data from the CIA World Factbook (2015).

### ANNEX 4. MAINSTREAM MEKONG DAMS

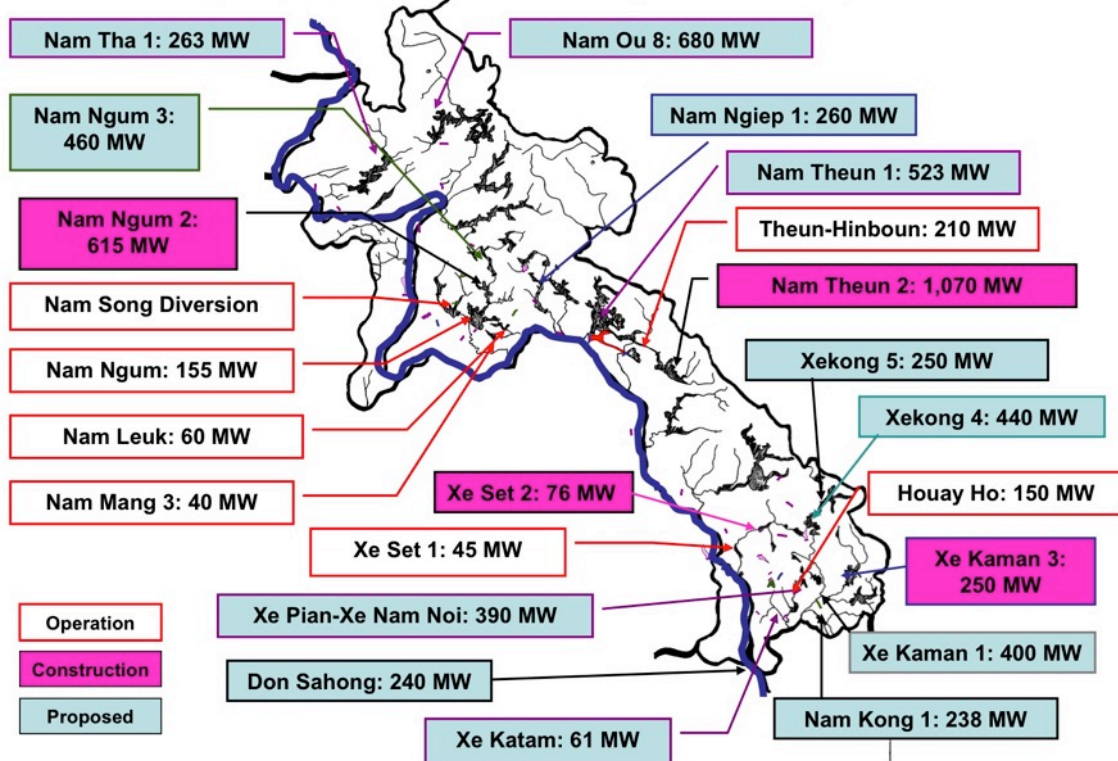


Source: Mekong Mainstream Dams Map. International Rivers (28 June 2017)

## ANNEX 5. LAOS DAMS & CAPACITY

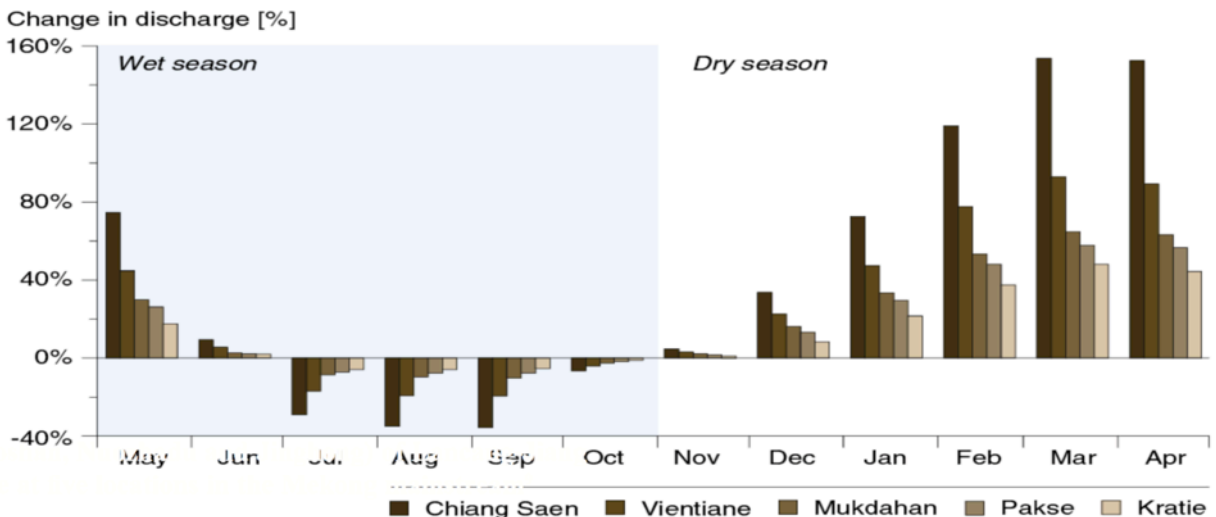
### Key existing and proposed dams in Laos

Map produced by TERRA based on Maunsell-Lahmeyer International Lao Power System Development Plan (2004), and updated by International Rivers with information from August 2007 Lao Power Development Plan



Source: Map of Key Existing and Proposed Dams in Laos. International Rivers (2007)

## ANNEX 6. EFFECTS OF THE LANCANG DAMS ON THE MEKONG FLOW



Source: Environmental and Social Impacts of Lancang Dams. International Rivers (2014).

**ANNEX 7. Economic return of dam  
developments (country/total) by scenario and  
NPV rate**

	NPV 10%		NPV 3%		NPV 1%				
	Definite Future	6 Dams	11 Dams	Definite Future	6 Dams	11 Dams			
<b>Lao PDR</b>	\$5,761	\$17,283	\$22,111	\$3,667	\$16,638	\$20,409	-\$2,315	\$14,796	\$15,546
<b>Thailand</b>	-\$54	\$2,280	-\$7,625	-\$2,791	-\$1,444	-\$39,076	-\$10,610	-\$12,086	-\$128,934
<b>Cambodia</b>	-\$1,200	-\$3,098	-\$6,879	-\$6,395	-\$15,043	-\$33,692	-\$21,240	-\$49,169	-\$110,302
<b>Vietnam</b>	\$2,354	\$2,145	-\$1,052	\$94	-\$1,867	-\$13,925	-\$6,363	-\$13,328	-\$50,706
<b>Total</b>	\$6,862	\$18,609	\$6,555	-\$5,424	-\$1,716	-\$66,284	-\$40,528	-\$59,787	-\$274,396

Source: *Planning Approaches for Water Resources Development in the Lower Mekong Region* by Costanza, R., Kubiszewski, I., Paquet, P., King, J., Halimi, S., Sanguanngoi, H., et al. (2011). Portland State University; Mae Fah Luang University.

Scenarios included in the table are defined as follows in the source material:

**Definite Future Scenario (DF):** 2015 Upper Mekong dams plus 26 additional hydropower dams in LMB and 2008 irrigation and flood measures;

**LMB 20-Year Plan Scenario with 6 mainstream dams in Northern Lao PDR:** 2015 Definite Future plus six LMB mainstream dams in upper LMB and 30 planned tributary dams, irrigation, and water supply. This scenario also includes climate change for an average year between 2010 and 2030 and 17cm sea level rise

**LMB 20-Year Plan Scenario with 11 dams:** Increase to eleven mainstream dams in upper LMB from previous scenario (rest is equal)

