

Management of Transboundary Water Resources Case Study: Mekong River

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Abstract- - Integrated management approaches in an area of increasing water stress is mandatory for conflict prevention and a good optimization of the common use. A combination of equitable political cooperation with balanced management practices can surely maintain a sustainable economic growth. Among the main international water bodies, the Mekong River is the largest in Asia. Its management approaches face different challenges. This paper aims to define the objectives and principles implemented by the different countries surrounding the Mekong River and to highlight the achievements through effective management projects.

Index Terms- Transboundary, Integrated Water Resource management, Cooperation, Mekong River.

I. INTRODUCTION

Water is an important, indeed essential natural resource for all countries. Every state's drinking water supply, food production, energy supply, and consequently, economical development is related to water availability. Human health and essential living conditions are crucially related to water, thus the resource is the main element for a sound ecosystem. Sustainable Management of these waters and especially Transboundary water bodies has to be effective and efficient for a better social, political and economical balance and stability. This paper focuses on the implementation of integrated management on water resources but also the necessity of its use for shared water bodies where nearly half of the population is located.

II. TRANSBOUNDARY WATER RESOURCES

a. Definition

The Transboundary basin connects different populations from different countries or regions and supplies the social and economic life of millions of households around the world. The surrounding societies of Transboundary water bodies share hydrological resource interdependency between each other. Thus, that water contributes heavily to the economic development and if well managed, helps reduce poverty and attainment of sustainable goals.

Around 40% of the world population was recorder living depending on rivers and lakes that connects two or more countries. 276 existing Transboundary basins cover about half of the globe's land surface and its freshwater volume is estimated at about 60% of the earth's freshwater flow. The states including territories in such water bodies are about 150 in total. 21 of them are completely within them. Moreover, a number of 300 Transboundary aquifers represent the main source of about 2 billion people worldwide.[1]

b. Issues that cause tension

As it has been mentioned before, water is a vital element for human life, and human activities are closely connected to availability, access and quality of water sources. In Transboundary water bodies, conflicts arise for several reasons:

- Quantity: Navigation, flow, consumptive use, flooding
- Timing
- Quality: Salts, nutrients, turbidity, toxics

- Infrastructure: Dams, electricity generation, treatment plants

Over 145 treaties were analyzed and the main source of conflict remains the hydroelectric power and water consumption[2].

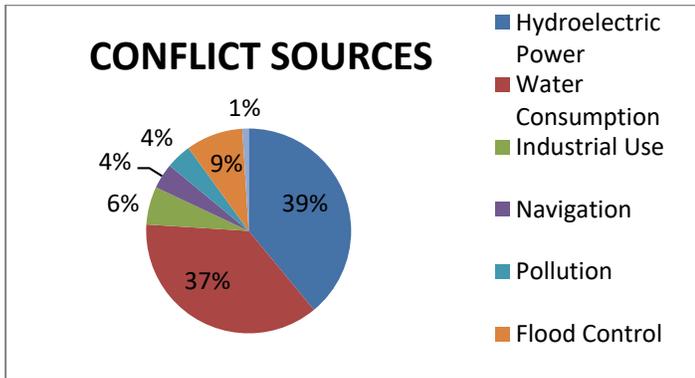


Figure 1: Distribution of conflict sources in Transboundary water bodies [3]

While creating room for concern, disagreement, and conflict, they embed opportunities for cooperation and economic development as well as security and peace awareness. However, the great potential of Transboundary waters could be well controlled by better management practices, and thereby reduces impacts to reduce or solve conflicting.

III. TRANSBOUNDARY WATER MANAGEMENT

a. Facts

Over the past decades, nations seek to adopt Transboundary water management in order to resolve water conflicts of interest. For instance, dam projects with downstream impacts, extreme climate conditions, irregular rainfall seasons or flood instigates communities to share issues and solutions. Thus different nations communicate to adopt a good management practice for meeting expectations and achieving goals. A good communication containing integrated water management encourages healthy watershed areas. The key factor of how water resources can be shared by different nations is agreements resulting from negotiations. However reaching common goals is a challenging matter due to differences between policies or regulations from a

state to another as well as the multiple expectations and urgent needs. According to United Nations standards, cooperation between nations is the typical Transboundary management requirement, a suitable fair and legal institutional work structure, as well as common approaches for planning and sharing both the costs and benefits of water management.

b. Objectives

The primary objectives of Transboundary water management agreements are:

- Maximum Utilization of the watersheds
- Conflict Prevention
- Maintaining ecological sustainability

IV. MANAGEMENT PRINCIPLES

The Transboundary water resource management counts numerous principles. We discuss in this part the principles that are recognized by international management treaties and conventions. These principles form the basis of the “1966 Helsinki Rules on the Uses of the Waters of International Rivers hereinafter Helsinki Rules and the 1997 UN Convention on Non-Navigational Uses of International Watercourses hereinafter UN Watercourses Convention”. [4][3][5]

The Theory of Limited Territorial Sovereignty: basically a theory of assertion of freedom. Each community has a part in the shared water resource streaming through its territory. The utilization of this shared river has to respect the rights and concerns of other states. This theory is well known as the ‘theory of sovereign equality and territorial integrity’. This principle enhances fairness and recognizes the rights of every country surrounding the stream. Location equity especially between upstream and downstream regions is one of the main interests of this theory. [3]

In recent years, a majority of treaties for fair sharing of territorial resources have adopted the principles of equitable and reasonable use of these resources. These principles also put across an obligation that users are not to cause significant harm to the shared resources. An example of such treaty is the Mekong River basin (Article 4-7) 1995 Agreement. [3]

Principle of Equitable and Reasonable Utilization:

This principle entitles all the affected states to a reasonable and equitable share of the water resource. This is because it advocates for the bigger issue of limited territorial sovereignty.

Even though fair and rational use of the resources is determined by a principle of shared sovereignty and impartiality of rights, it doesn't mean that everyone will necessarily get an equal share of the water resource. Therefore, other relevant factors ought to be considered if there is going to be a fair and reasonable sharing of the water. These factors may include things like the size of the population, physical location, social and economic demands, etc. [6]

The theory of Obligation Not to Cause Significant Harm

Respect of others is by definition de base of this principle. It is encouraged and accepted by international water and environment law. This theory is also integrated in all international water treaties and considered as an important part of agreements. International shared watercourses users might be aware of the impacts caused to others. It is not allowed to use the water by any harmful way to the other neighboring states, the health of its people, the safety or the sustainability of their environment or even the watershed living organisms however the main challenge in here is the exact definition of significant harm and to what extent it is recognized significant. [3]

Principles of Notification, Consultation and Negotiation:

The international legal documents mostly agree with principles that allow fair sharing of territorial water resources by all the riparian states in a shared watercourse. An example is Article 3 of the ILA's Complementary rules which are applicable to international resources. Such legal documents articulate however riparian state is entitled to the rights to be given prior notice, consulted and negotiated with by other riparian states who proposes a water use that may put at stake their rights and interests to the water use. It is not a surprise though

those most upstream countries would have a tendency to oppose this principle. For example, Ethiopia (Nile Basin), Rwanda (Nile Basin) and Turkey (Tigris-Euphrates Basin) are upstream riparian countries that were the only countries to oppose the negotiation process of the 1997 UN Watercourses Convention (Articles 11-18). [7]

Peaceful Settlement of conflicts:

In case agreements cannot be reached after negotiation between the different states, modern international conventions and treaties of shared watercourses adopted a principle that seeks peaceful settlement between every country surrounding the water resource. [3]

Principles of Cooperation and Information Exchange

This principle starts with a first important step that is promoting trust building through several activities where different parts are sharing information. This exchange is the beginning of a reliable institution for an efficient management of Transboundary waters. However every cooperation needs to set activities for every actor in order to meet certain goals. The principle of trust sharing and cooperation has been practiced for decades as a process oriented tool in the TWM.

According to The Regional Water Governance Project of the University of Arizona Transboundary water cooperation is divided into three categories[8].

1. **Shallow cooperation:** known by 'loose institutional cooperation', where structures like technical teams, task forces, joint committees are shifting instead of having an official bureaucratic mechanism or even an official headquarter. Partnerships are highly encouraged in this category. [8]
2. **Deep cooperation:** opposite of the principle mentioned before, this cooperation is based on a high level of financial independence also based on bureaucratic organizations instead of partnerships. Thus to secure a stability of management and reach high decision makers in order to achieve deep cooperation goals,

through a more formal institutional arrangement. [8]

3. **Intermediate cooperation:** As an in between of the two cooperation above this one is characterized by a permanent headquarter and regular meetings between all parties where each participant has its independent staff. However at this level of bureaucratic organization there is no financial independency and thus depend on other punctual funding like donors as an example. [8]



Figure 2: levels of cooperation [8]

V. MANAGEMENT PRINCIPLES

The challenges to effective Transboundary water management appear different in diverse parts of the world. In regions that are ‘securitized’ (where there is a strong focus on security issues such as military conflicts, for example the Middle East region), cooperation and advancement of cooperation beyond the water sector is arguably less likely than in regions where there are less pressing security issues. In other parts of the world, financing for appropriate institutional development for joint management is lacking, and in yet other contexts, under financing of

much-needed infrastructural development to meet increased climate variability and change prevails. There follows an outline of the importance of adequate management of Transboundary waters and suggestions for ways in which it can be improved and developed, as well as the identification of a number of new challenges for the effective management of Transboundary waters.

I. IWRM (Integrated Water Resource Management)

Through time integrated approaches have been proved to be best ways of managing Transboundary water resources

IWRM is an empirical concept that has been built on the experience of experts in the field. Although many parts of the concept have existed since time – it started from the first World Water Conference in Mar del Plata in 1977 – then after Agenda 21 and the World Summit on Sustainable Development of Rio in 1992 the concept took the shape of long discussions about what it means in the ground experience. So far, the integrated water resources management of the Global Water Partnership had positive returns. It states: “Integrated water resources management is a process that promotes the coordinated development and management of water, land and related resources to maximize equitable economic and social well-being without compromising sustainability” [8].

In order to achieve sustainable water resource management through efficient and acceptable practices, IWRM has been the most known approach around the world. However a better knowledge of advantages and disadvantages, challenges and a clear perspective of the accomplishments are important along with the awareness of water resources shortage and nature of Transboundary water bodies. TIWRM (Transboundary integrated water resource management) can then aim to meet sustainable goals.

IWRM involves two critical phases: The first one takes into consideration the Transboundary water resource management practices and the second dimension considers the ecosystem management contexts.

A study on the effectiveness of Integrated Water Resource Management in Transboundary conducted in 2001 by (name of the author) revealed that there are five fundamental imperative characteristics for good integrated river basin management:

1. Clear and strong institutional arrangements, supported by clear regulations, decrees, or agreements and with well-defined implementing procedures[9]
2. Good water-related data, information, systems, and models readily available to the river basin partners and those agencies and bureaus operating within the basin[9]
3. A complete and clear suite or package of basin-wide policies, procedures, and strategies to guide water and natural resource planning, management, and administration[9]
4. An appropriate form of communication and participation for all basin stakeholders and partners[9].
5. Basin sustainability performance indicators and an agreed approach to monitor and report on how the basin is being managed and the resources consumed and protected[9]

However, these attributes require trained staff, making capacity building programs necessary for the implementation of Integrated Water Resource Management.

VI. INTERGRATED WATER RESOURCE MANAGEMENT ON THE MEKONG RIVER

The Mekong River Basin, in Southeast Asia, is the region's largest river basin shared by six countries. The basin is divided into two parts: The Upper Basin in Tibet and China, where the river is referred to as the Lancang Jiang and the Lower Mekong Basin (LMB) shared by Cambodia, Lao P.D.R., Thailand and Vietnam. The riparian countries of LMB have maintained a mechanism for collaboration since 1957, which is now widely praised as the "Mekong Spirit". Even though the region passed through difficult times in 1970s with political changes in basin countries and a number of conflicts among member states, the spirit of cooperation persisted. The initial objective of the cooperative mechanism was to plan and implement

basin wide development of water resources through collaborative projects of infrastructure development for storage control and regulation of water use. However, very few of these planned projects were implemented[10].



Figure 3: Countries surrounding the Mekong River (WWF)

Mekong River Water Use

The Mekong River, the longest international river of Asia, is the ninth largest river in the world, spanning 4,909 km and draining an area of 795,000 km², discharging 475 km³ of water annually. The river basin is heavily populated with over 72 million inhabitants[10].

The Mekong River originates from Himalayas in Tibet, passes through the deep and thinly populated gorges of Yunnan province in China and enters the Lower Mekong Basin near the Burmese-Laotian border. It continues through Laos to stretch along the Thai-Lao border and at the Khone waterfalls the river enters Cambodia before it slows down and discharges into the South China Sea through the Mekong Delta in the southern part of Vietnam (fig 3). Although the Mekong riparian enjoys abundant water resources, availability varies widely by country, by region within

countries and by season. Water availability in Laos and Cambodia depends virtually entirely on the Mekong. In Thailand and Vietnam, large regions are fully dependent on the Mekong River Basin resources. The Mekong is a major water source in Yunnan Province, China. Only Myanmar is not that dependent on Mekong waters. On a per capita basis, Laos has the largest internally renewable water resources in the region at 55,305 m³ /yr, whereas Thailand has the lowest per capita resources availability among the riparian countries in the lower basin, at 3,559 m³ /yr, as indicated below[11].

Country	Availability		Withdrawals		Withdrawal share of availability (%)
	(km ³ /yr)	(m ³ /cap/yr)	(km ³ /yr)	(m ³ /cap/yr)	
Cambodia	88	8,585	1	98	1
China	2,812	2,292	500	407	18
Laos	270	55,305	1	205	<1
Myanmar	606	13,024	4	86	<12
Thailand	210	3,559	33	559	16
Vietnam	318	4,479	65	915	20

Figure 4: Water resources availability and withdrawal in Mekong Basin States 1995

Mekong River Commission

Approaches

The establishment of the Mekong River Commission (MRC) following the signing of “Agreement on Cooperation for the Sustainable Development of the Mekong River Basin” in 1995 by the Governments of the four riparian countries is a major step in broadening the scope of cooperation in all fields of basin development and resource management, river navigation, flood control, fisheries, agriculture, power production and environmental protection. Furthermore, the MRC has made a major move from a project-by-project approach to a strategic planning approach to guide development of a comprehensive series of programs, namely the Water Utilization Program (WUP), Basin Development Plan (BDP) and Environment Program (EP) that will directly contribute to cooperative, basin wide sustainable development activities[12].

Achievements

The MRC Decision Support Framework (DSF) developed during the period 2001 to 2007 under the

Water Utilization Project (WUP) and through a participatory process of the four-member countries. This framework provides a powerful analytical basis to understand the behavior of the river basin, to assess associated impacts on the natural environment and people’s livelihood and to assess the magnitude of biophysical changes through natural and man-made interventions in the LMB. Consequently the results were presented in a report by MRC at the 3rdWorld Water Forum 2003 in the International Network of Basin Organization (INBO), highlighting the achievements of the programs and providing a brief on excellent points [13].

- Adoption of an agreement on information and data sharing among the four member countries;
- Establishment and use of a web-based flood forecasting system[14];
- Establishment and use of a web-based dry season river monitoring[14];
- Formulation of a regional flood management program[14];
- Development and adoption of water utilization rules (the latest being the preliminary procedures for notification, prior to consultation and an agreement)[14];
- Historic hydrological data exchange between China [13];
- Creation of a hydropower strategy;
- Research coordination within the Mekong under the CGIAR Challenge Program[15];
- Improved communication strategies that have raised the profile and increased awareness of the organization, i.e. internet communication, technical publication, and media exposure[15];
- Integrated training and junior riparian professional program (MRC MEKONG);
- Development of an integrated approach to agriculture, irrigation, and forestry;
- Implementation of the basin development planning process with the main focus on a sub-basin approach[16];
- Support for development of a navigation program[15];
- Establishment of the inland fisheries research institute in Phnom Penh[17].

Integrated Water Resource Management

The Mekong Integrated Water Resource Management Project is built on 15 years of experience and achievements of MRC, particularly the Water Utilization Project (WUP), which operated from 2000 to 2007. The Project concept was prepared in June 2008 on the basis of the input from MRC member countries and from a series of regional consultations. A more detailed project concept and preparation plan, which was prepared in February 2009, drew on earlier documents and offered an implementation strategy with clearly defined objectives, outcomes, outputs, and activities, implementation arrangements, and risk analysis. The project was structured around three principle elements: firstly the project context and rationale, second the objective and design, and third the implementation and management. These are preceded by a general introduction which establishes the background and provides an overview of the development context and principles which underpin the project[14]

The project contains three interlinked components at basin (regional), Transboundary and national project levels[18]. The regional component provides the overall framework of the principles, procedures and guidelines for Integrated Water Resources Management (IWRM) and water utilization negotiations. The Transboundary and national work will be framed within the regional framework.

Integrated Water Resource Management effectiveness

The IWRM process acknowledges the Transboundary consequences of development decisions from riparian countries of the Mekong river basin. The MRC as an intergovernmental river basin organization relies on the approval of approaches by its Member States. This is done through the basin development plan process aimed to raise awareness on these Transboundary consequences in national decision making by including various national agencies and other stakeholders. The water utilization project has been further promoted through a number of initiatives under the Mekong Transboundary management. It has been known in the lower Mekong basin that China's development of hydropower has significant impacts on the water flow. This has influenced the context of the collaborative planning for the development and

management of the shared water resources. China is not a member of the MRC; this makes the principle of "river basin as the right unit for water resource management" challenging. However subsequent discussions between MRC member states and China are exploring opportunities for better cooperation.

It follows from the above that the main benefit sought for the Mekong River Basin is the sustainability of the Basin for long term and equitable use by all riparian states. With coherent efforts for IWRM at all levels (basin, national, sub-basin and Transboundary), the basin water and related resources can be developed in an integrated manner, balancing interests between sectors, countries and stakeholder groups for "a prosperous, environmentally sound and socially just Mekong River Basin". The main benefits sought for the LMB Countries are related to the strengthening of their water resources management capabilities and to poverty alleviation. In all countries, the capacity of the line agencies responsible for the management of water and related resources and the newly established River Basin Organizations (RBOs) will be strengthened through training, tools, river basin planning, and the implementation of on-the-ground projects that will alleviate poverty and demonstrate practical ways for Transboundary cooperation[16][19].

VII. CONCLUSION

The implementation of Integrated Water Resource Management is multifaceted and difficult in nature. This process is even more complicated when it involves two or more countries using the same river basin.

The last part of this paper centers on the application of IWRM in the Transboundary Mekong River. It attempts to identify the existing bilateral treaties between the riparian countries and pinpoints the constraints and benefits of integrated water management along the basin. This study also highlights the principles related with Transboundary WRM that are essential to ease IWRM implementation in international river basins. Based on the knowledge gained from the Mekong case, cooperation and shared responsibilities are necessary for effective and efficient Transboundary water resource management. Effective cooperation and

coordinated management of shared resources remain the major challenges that countries face in recent times. There is the need for national governments and regional organizations sharing water resources to increase cooperation on Transboundary water to achieve common country goals and healthy ecosystems for the benefits of all parties involved.

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