

Integrated water resources management on the Tonle Sap Lake, Cambodia

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Abstract Integrated Water Resources Management has been identified as one of the basic water resources related policy approaches in several recent important commitments and recommendations including the Johannesburg Summit and World Water Forums. Recognizing that IWRM is largely still a theoretical concept with not much sound scientific research, our objective is to investigate how the IWRM process in the Mekong Basin is institutionalised, and implemented in practice. We focus on the Cambodia's Great Lake, the Tonle Sap. Of particular interest are the bottlenecks of IWRM, both those that are within the water sector and those that relate to various, more general development tendencies.

Keywords Cambodia; environmental impacts; IWRM; Mekong; planning; social impacts

Introduction

Should a poor country such as Cambodia develop its water resources with the priority of environmental conservation, in economic growth, or in poverty reduction? There is enough justification for all of them. Yet, there are many failure stories from cases in which the scopes have been too one-sided in any direction, and genuine multidisciplinary is needed.

It is difficult to frame another country in which the people are still be as rural-based and as profoundly dependent on aquatic resources as Cambodia. The lifeline of the country is the Mekong River, and the heart of that river is the Tonle Sap Lake, the largest permanent freshwater lake in Southeast Asia. With its unique seasonal flood dynamics it is a world-class natural treasure. Equally it is the source of livelihood for millions of poverty-driven rural people, who make their living out of the rich ecosystem of the lake and its floodplain.

We document the experience of the Tonle Sap Modelling Project (MRCS/WUP-FIN, 2003) and various related academic activities in which the Tonle Sap has been analysed and modelled from natural, environmental, socio-economic and institutional viewpoints. This is done from the perspective of Integrated Water Resources Management (IWRM).

The Mekong River Commission (MRC) is currently working on a comprehensive Basin Development Plan for the Lower Mekong River Basin, supported by a large-scale research undertaking, the Water Utilization Programme (WUP). The MRCS/WUP-FIN project is complementary to both of these activities. The project is missioned to develop analytical tools (models) for increasing the understanding of the Tonle Sap, its floods and ecology, and help the MRC to promote sustainable management of the lake's water and other natural resources. Essential to the project has been to collect primary data on

hydrology, meteorology, hydrodynamics, water quality and socio-economy, and to study how the water regime changes may impact people and their livelihoods in and around the lake.

The Mekong River and the Tonle Sap Lake

Carrying around 475 km³ of water each year, the Mekong is the world's 8th largest river (MRC, 2003). It is one of the world's most pristine large rivers with around 55 million people in the Lower Mekong Basin (MRC, 2003). In Vietnam, Lao PDR and Cambodia, around 40% of the population live below the poverty line. Over 50% of the GNP originates from fishing and agriculture which are totally dependent on water resources.

The Tonle Sap Lake (Figure 1) is a unique lacustrine-wetland ecosystem. It is Mekong's major natural reservoir with annual water level fluctuations of around 8 metres. The area exceeds 15,000 km² during the monsoon floods, and shrinks to 2500 km² in the dry season. Being one of the world's most productive large wetland ecosystems, its biodiversity is extreme. Fish and rice are the backbones of the traditional livelihood.

The Mekong Basin has witnessed a period of wars and disquiets in the past 60 years. The countries are now in the process of recovery on many fronts and rapid growth of economic prosperity. The infrastructure needs urgent development and is undergoing speedy progress, and so are the educational and health care systems. Government institutions, above all ministries, are still weak and corrupted but may be on the way to improvement.

Economic growth and globalisation have changed the traditional rural–urban balance and thus the urbanization levels are soaring. Currently 23% of Cambodians are urban.

The economy of a big part of the Mekong Basin relies on very basic subsistence farming and fishery. Poverty is widespread. Illegal activities, largely based on destructive exploitation of natural resources, mushroom. Nature is heavily pressed by the present informal economy and poverty-driven destructive practices.



Figure 1 Tonle Sap Lake and its floodplains

There are major ambitions to develop the basin in various ways; by dam construction particularly in China and Laos; agricultural development and exploitation of forests throughout the catchment; road and settlement construction and other activities, which modify the mass flows and hydrology in a considerable way.

The Framework: Cambodia, Mekong and the Mekong Agreement

Cambodia shares a hostile and volatile past with most of the Lower Mekong countries. It has become gradually pacific during the 1990s, but is still in the process of recovery. The government institutions are slowly getting on track, remaining still overly weak compared to the development challenges of the country. Cambodia has also gradually rejoined the international community. Some important landmarks are the membership in the newly established MRC in 1995, as well as joining the ASEAN in 1999 and the WTO in 2004.

MRC's backbone is the Mekong Agreement (MRC, 1995). It defines the MRC's mandate as working towards *"...a balance between the economic, social, and environmental decisions and development. With the majority of the basin's inhabitants being rural-based and poor, socio-economic considerations inevitably assume vital importance in development planning and implementation."* MRC's Vision statement brings us right back to the question stated in the first paragraph: *"An economically prosperous, socially just and environmentally sound Mekong River Basin."*

These accord with the sustainable development concept, as stipulated at the Johannesburg Summit on Sustainable Development in 2002. Consistently, the concept of IWRM was strongly promoted, as the Johannesburg Plan of Implementation includes the commitment to prepare IWRM and water efficiency plans by 2005 for all major watersheds of the world.

IWRM can be condensed in the following way (GWP, 2000): waters should be used to provide economic well-being to the people, without compromising social equity and environmental sustainability. This should happen in a basin-wide context, with stakeholder participation and under good governance (Figure 2). Thereby, IWRM aims at developing democratic governance and promotes balanced development in poverty reduction, social equity, economic growth and environmental sustainability.

It is important to realize that the Mekong Agreement of 1995 is in full accord with the IWRM principle. The MRC has the mandate to implement IWRM in the Lower Mekong

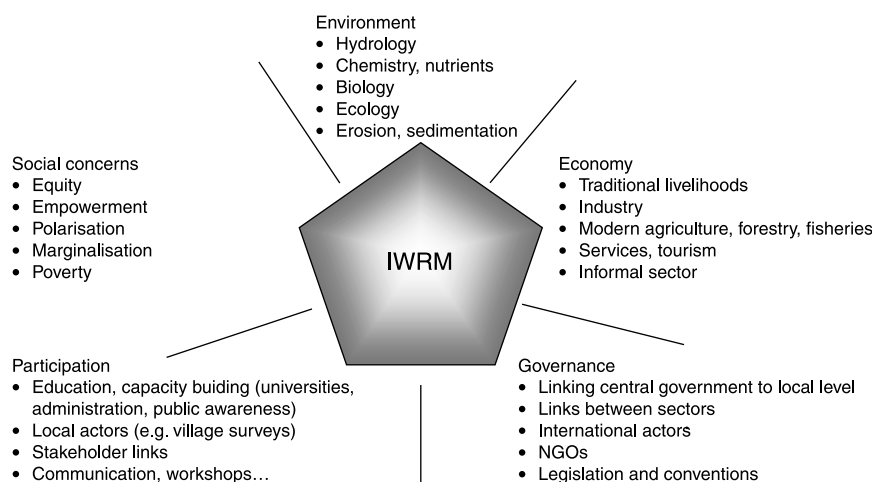


Figure 2 The facets of IWRM

River Basin, but MRC is not alone. There is a spectrum of other actors in the play, ranging from international to national, to the grassroots level.

We will summarise the pentagon of [Figure 1](#) after the site description that follows.

Environment

The Tonle Sap Lake is one of the world's most productive large lacustrine-wetland ecosystems, with an extreme biodiversity. Fish and rice are the backbones of the traditional livelihood in the area. For many of the Mekong fish species, the floodplain of the lake, and particularly the riparian flooded forest and shrublands, offers ideal conditions for feeding, breeding and rearing their young ([Poulsen *et al.*, 2002](#)). The lake also operates as a natural flood water reservoir for the lower Mekong Basin in the wet season and makes an important contribution to the dry season flow to the Mekong Delta.

The knowledge about the Tonle Sap ecosystem has remained largely a white spot. The decent scientific work on Tonle Sap sedimentology in the 1960s was followed by political turbulence and civil war in Cambodia for more than two decades. Only in the late 1990s was research restarted, still in restless social conditions. Thereby, the data and knowledge shortcomings on the ecology and environment are strikingly large.

What is understood by now is that the Tonle Sap system's high productivity depends on the flood pulse from the Mekong, which transfers terrestrial primary products into the aquatic phase during flooding (e.g. [Lamberts, 2001](#)). The lake's flood pulse is very dependent on the conditions in the Mekong mainstream and thus, the upstream development impacts on Mekong's flows are crucially important to understand for future planning and IWRM in the lake.

The functioning of the flood pulsing system in the Tonle Sap needs to be better understood before the changes and threats to it can be assessed and effectively demonstrated. This work can benefit a lot from the studies made and experience gained in the Central Amazon floodplain by [Junk \(1997\)](#) and his colleagues since the 1960s. This can speed up and direct the investigations on the role of the terrestrial and aquatic shifting mechanisms, as well as on the critical components that are driving and controlling the biological productivity of the Tonle Sap system. On top of the flooding process itself and the material transports (sediments, nutrients, larvae), the role of the plant ecosystems in channelling the food web items must be clarified. Concerted and coordinated research efforts must be amplified and accelerated, involving riparian institutions and researchers as well as international teams.

It has become clear that the understanding of the ecosystem functions and tools for predicting the development impacts are essential for IWRM, and for sustainable basin-wide planning and national and regional policy making ([Kummu *et al.*, 2006](#); [Lamberts, 2006](#)).

Economic and social concerns

Cambodia was the Mekong region's most advanced country economywise in the 1950s and early 1960s. The countries have followed very different paths ever since. In 2002, Cambodia's GNI per capita was US\$300, only 15% of Thailand's GNI ([World Bank, 2004b](#)). In the Tonle Sap Basin, the figure was only US\$150, which is 41% of the international poverty line of US\$1 per day per person. Measured with this economic indicator, Cambodia is one of the poorest countries of the world, and the Tonle Sap region is its poorest part. Any social indicator tells the same story ([Varis and Keskinen, 2003](#)).

The livelihoods in villages around the lake are linked deeply and in various ways to water resources, environmental changes and migration. These connections are very poorly known, despite of their profound importance to a big share of the Khmer population.

The extensive poverty and a large dependency on natural resources are alarming since the services provided by natural resources are in a clear decline. The deterioration of natural resources and the rapid population growth is an unsustainable combination that has resulted in worsening of living throughout the area. The communities would need diversification in their income sources in order to respond to the growing polarization that takes place in regions increasingly exposed to a market-driven economy (Keskinen, 2006).

The process of urbanization is accelerating rapidly, and the roots to the sprawl of urban shantytowns are in the impoverished living conditions in rural areas, often greatly influenced by water-related factors (Heinonen, 2006a, b).

Governance

Given the harsh starting point offered by the violent past of many decades, the development must find a controlled path. Strengthening the capacity and building formal institutions, supporting the civil society, mobilization of the informal institutions for common benefit instead of illegal, destructive activities, promoting rural development, particularly egalitarian and participatory empowerment of the poor, and providing education and health care are the entry points in developing this region into a prosperous one which would still enjoy a rich nature. The opposite scenario—a deprived society with destroyed nature—is quite possible, too. Things evolve and may change very much in only a decade or two. History has shown it many times in Southeast Asia and there is no doubt that it will show it again.

Due to the history, geopolitics and the Mekong's transboundary character, the Tonle Sap's governance has an international dimension. Besides the MRC, various other organizations such as Asian Development Bank, the Greater Mekong Subregion Programme, the ASEAN, UNESCAP and many other international organizations, with various, important donor countries have a considerable influence on policies, institutional development, capacity building and other governance related matters in the Tonle Sap area. Their roles are very complex and rivalries are common (Makkonen *et al.*, 2006; Sokhem and Kunada, 2006).

At the national level, the formal governance system suffers from horizontal and vertical discontinuities. Water related issues are handled under several ministries with their specific mandates, strategies, agendas, ambitions and policies. The share of the informal sector is substantial and in growth (World Bank, 2004a; Heinonen, 2006b). Moreover, various Non-Governmental Organizations, both local and international, contribute to the governance. Coordination of such system is challenging.

The possibilities to find combinations of sector policies for achieving often conflicting goals were analysed using a probabilistic, Bayesian network model. Four policy scenarios were constructed, one promoting each of the three development goals (economic growth, poverty reduction, environmental protection) specifically, and one integrated, compromise scenario. A compromise policy appeared possible, being far more balanced and acceptable than any of the policies targeting on one of the three goals solely (Varis and Keskinen, 2006).

Very challenging is the functioning of the vertical links, from the central government to provincial and local authorities and all the way to villages. The way from centralized, international river basin agencies such as the MRC to local villages and communities of those basins seems to be very long. Geographically this is unavoidable if a basin is large—yet this is not the key issue. In terms of institutions and communication the remoteness is often excessive—and a far more serious problem than the geographical distance. The same applies to the opposite direction: from villages to agencies. Perhaps

the detachment in this direction is still larger in all ways due to many practical and capacity-related issues. These ways should—and definitely could—be shortened and paved in one way or another.

The very basic institutional and communication gaps are indicators of disintegration rather than integration and thereby great bottlenecks to the implementation of IWRM (Varis and Keskinen, 2003, 2006; Resurreccion, 2006).

Participation

Several analyses (e.g. Ovesen *et al.*, 1996; UNDP, 1999) show that the Khmer villages do not have traditionally a high social cohesion and solidarity. In this respect, there is an important difference to, for instance, China, Vietnam or India, where community solidarity is stronger than in Cambodia. A Khmer peasant seems to have an individualistic culture, and there are surprisingly few formal structures beyond the level of the individual household (Ovesen *et al.*, 1996). It can be argued that the violence in the last decades, and particularly the Khmer Rouge rule, have further destroyed traditional social networks. At present, perhaps the most important institution of social solidarity is the Buddhist religious orders represented in the different kinds of pagoda associations.

Ovesen *et al.* (1996), however, emphasises that this does not mean that Khmer society is lacking structures that influence and govern people's lives. Rather, the social structures are on a different level than the usual social groupings and are usually more cultural and ideological than organisational. Consequently, the main structural principle that governs most social relations is hierarchy.

The above-mentioned facts indicate that a true participation particularly in the grassroots level can be a real challenge in any management process in Cambodia. In the MRCS/WUP-FIN Project, grassroots level participation was addressed by participatory village surveys (Keskinen, 2006). Due to the scope and nature of the project, the surveys were used mainly to collect information on water-related livelihoods and their trends, and not that much on increasing local people's participation. On the other hand the participation on higher management levels was addressed by putting considerable effort into training and capacity building to increase the potential for the maintenance and future use of the developed models at the MRC Secretariat, Cambodian ministries, line agencies and universities. Moreover, to increase the potential for the maintenance and future use of the developed models, capacity building has been extended to the Cambodian ministries and line agencies and universities. The model package is presently extended to cover the entire Cambodian floodplains and the Mekong delta in Vietnam, with corresponding enlargement of the training activities.

Lessons learned

On the basis of the experience gained within the MRCS/WUP-FIN project and various closely linked academic projects, it has become obvious that IWRM is a far more strategic, even philosophical issue than often recognised. One example is the MRC's ongoing Basin Development Plan process, which is the third of its kind in history. The first two, one in the 1960s and the other the in 1980s, were never implemented. This was due to various reasons, not only because of the wars, but because they both shared the typical problem of such plans: they were not really rooted to societies and cultures of the riparian countries. River basins are the cradles of mankind, and each basin has its own ages-old and recent history a pot pourri of cultural, ethnic, political and other factors with specific institutional arrangements, governance characteristics, locally, nationally and internationally. These all influence the implementation of IWRM. The water sector should build its

own efforts on these realities, and not act as though alone (see also Makkonen *et al.*, 2006; Varis *et al.*, 2006).

Without the common recognition and ownership of the IWRM concepts in the villages, at the local governance, at the government level and in the international setting, IWRM remains a theoretical concept with not much sound scientific background from real-life development projects and not much sustainable impact on the environment, society and economy. Seeing the water issues in the broad, cross-cutting framework of other development issues—and integrating the visions and policies of the sector—would be the way to go towards a better future through successful freshwater management.

The water sector is usually seen as too disconnected from other sectors. The water sector itself is a many-dimensional mosaic of activities, with no clear disciplinary boundaries (Mohile, 2005). Energy, agriculture, environment, health, etc., sectors are part of the water sector in the Mekong Basin, but they are also sectors in their own right, and parts of other sectors. We should try to bring these all together, but recognize too that many other sectors are suffering with similar integration challenges—in some of them water is an important component.

The inclusion of IWRM as one of the standard components of Poverty Reduction Strategy Papers (the documents that are used as the baseline for targeting donor funds) has been emphasised lately (e.g. WWF4, 2006). That would still enhance the political role of IWRM.

It is important to recognize that in the bulk of the developing regions of the world, IWRM requires massive international efforts because of the transboundary character of the problems, accorded typically with complicated and difficult political settings. The Johannesburg Plan of Implementation meant that all major river basins of the world should have an IWRM and water efficiency plan by the end of 2005. The Mekong experience shows clearly that approaching the myriad of problems and challenges of the world's major river basins, many of them being transboundary, with such a one-shot plan—although being an attractive idea at the first glance—is challenging in many ways.

In the Mekong Basin, the institutional set-up is a complicated mix of various international, national, governmental and non-governmental, commercial or subsistence-related, and many other agencies and other stakeholders. The stakes and ambitions within a river basin do not originate alone from the basin itself. Nowhere does a single agency have the privilege to ignore other agencies and stakeholders. So is the case with the MRC, ASEAN, ADB, GMS, UNESCAP and other organizations, not to mention national level actors. None of the institutions has the undisputable leading role within the water sector (Makkonen *et al.*, 2006).

To follow the Johannesburg recommendations, the MRC is in the process of finalising its IWRM Long Term Strategy (MRC, 2005), and besides a number of other studies and projects, the Tonle Sap experience documented here has fed this strategy.

Acknowledgements

This work has been jointly funded by the Academy of Finland (project 211010), the WUP-FIN project and Helsinki University of Technology. The authors are deeply indebted to the WUP-FIN team and our host institutes, particularly to P. Vakkilainen, M. Virtanen, S. Hellsten, H. Lauri, J. Nikula, M. Käkönen, M.M. Rahaman, T. Kajander and the Cambodian co-workers and trainees. The fluent co-operation with the MRC is appreciated. The following individuals deserve special thanks: P. Sokhem, B. Resurreccion, D. Lamberts, F. Goes, S. Sethy, K. Geheb and C. Aagaard.

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