

Publication VII

Marko Keskinen. 2008. Water resources development and impact assessment in the Mekong Basin: Which way to go? *Ambio*, volume 37, number 3, pages 193-198.

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Water Resources Development and Impact Assessment in the Mekong Basin: Which Way to Go?

The Mekong River Basin is facing rapid changes, including intensive plans for water development. While the different development projects are considered to be important for economic development, the negative impacts that they are likely to cause for ecosystems and livelihoods are estimated to be remarkable. Yet, existing impact assessment processes seem in many cases to be inadequate to capture even the actual magnitude of the impacts at different levels. This article looks at the different impact assessment processes and their challenges in the basin. It is argued that impact assessment in this kind of dynamic and complex setting requires better coordination between assessments at different levels. Basinwide impact assessment would benefit from a more adaptive, multilevel approach that makes better use of assessments from local levels up to the regional level and builds on more participatory and interdisciplinary methods. Successful impact assessment also requires the recognition of the highly political nature of water development and related planning processes.

INTRODUCTION

The Mekong River is among the greatest rivers of the world: it is the 10th largest in the world, with an estimated length of 4909 km and mean annual flow of 475 km³ (1, 2). Altogether six countries—China, Burma/Myanmar, Thailand, Laos, Cambodia, and Vietnam—fall partly within the Mekong Basin. The basin is currently facing rapid changes: population is growing and urbanizing and the economies of riparian countries are developing rapidly. At the same time disparities are growing, particularly between urban and rural areas, and water and related resources are under increasing pressure.

While the ongoing and planned water-development projects—most notably the construction of large hydropower dams—are considered to be important for economic development, the negative impacts that they are likely to cause for river-dependent ecosystems and for livelihoods of millions of people are estimated to be remarkable (3, 4, 5). The benefits and losses related to water development are also often felt in different countries, making water development a sensitive transboundary issue as well.

Still, discussion about the development plans and their potential impacts in the basin remains relatively weak, and the public engagement in planning processes is low. At the same time, assessments in different parts of the basin provide differing estimates on potential environmental, social, and economic impacts, and, particularly, basinwide assessments have several challenges related to their comprehensiveness and overall reliability (see, e.g., 3, 4, 6–8). Despite these challenges, the results from different assessments are used to guide development in the basin (see, e.g., 9).

MEKONG IS BEING DEVELOPED: WHAT ABOUT THE IMPACTS?

The Mekong River system is home to a large variety of fish and other aquatic species, and the freshwater fishery in the basin is believed to be one of the largest in the world (10). The Mekong and its tributaries also support a variety of floodplains and provide water for agriculture that forms the main source of livelihood in the rural areas (11). These water-related resources support the majority of the basin population, many of whom are poor.

The ongoing and planned water-development projects are likely to cause remarkable changes for the availability of these water-related resources and, consequently, for the livelihoods of millions of people (3, 4). Different assessments and analyses have therefore been undertaken at different levels and by different actors to guide planning and decision-making. However, as will be discussed herein, the information available for development plans and their impacts seems in many cases to be insufficient for balanced planning to actually take place. Current assessments are also predominantly responsive, looking at the impacts of planned (or even already ongoing) developments in the basin, while the more strategic assessments about the possible development paths and options, e.g., in form of Comprehensive Options Assessment (12), are basically nonexistent.

It is, however, exactly these more strategic assessments that would be needed to consider the most sustainable options for development in the basin. Although the basin resources are already utilized in a variety of ways, particularly through subsistence farming and fishing and diverse use of wetland resources (4, 11), the common justification for large-scale water development in the basin is the “underdevelopment” and “underutilization” of the basin and its resources (9). Consequently, most development plans focus on modern sectors, such as irrigated agriculture and hydropower, while a majority of the population in the basin actually depends on more traditional livelihood sources. Worryingly, in many cases, these kinds of large-scale development interventions seem—despite their ultimate objectives of poverty reduction—to actually undermine the foundations of the livelihoods of the poorest groups by negatively impacting the availability of and access to common pool resources, most importantly fish (4, 13).

The challenges related to impact assessment and, overall, to water development can be linked to the broader challenges with water governance in the Mekong Basin. In terms of governance, the planning and decision-making processes in practically all riparian countries remain relatively nonparticipatory and non-transparent, hindering open discussion about the different development plans and their potential impacts. Due to the crosscutting nature of water, water management also falls under several different ministries and institutes; both vertical and horizontal discontinuities and even institutional rivalries follow, making water governance particularly challenging to coordinate (14, 15, 16).



Same-same but different: while rice cultivation forms the main livelihood source in the entire basin, its characteristics vary between different areas. Rain-fed rice cultivation in the Tonle Sap floodplain where cultivation is largely dependent on annual flood cycle. (Photo: M. Keskinen)



Rice cultivation in the floodplains of the Mekong Delta where water-control structures and agricultural intensification have enabled cultivation of even three rice crops per year. (Photo: M. Keskinen)

Regional Cooperation

In terms of water management, the most relevant regional coordination body in the basin is the Mekong River Commission (MRC) (17). The MRC was established in its current form in 1995 by four downstream countries, Laos, Thailand, Cambodia, and Vietnam, and it aims to guide balanced water resources in the basin. The Commission's task is, however, challenged by the absence of China, the most upstream country, which has massive plans for hydropower development on the Mekong mainstream. The MRC has also its own, internal challenges; many consider the commission to be insensitive to local realities, too technically oriented, and not transparent enough to really facilitate discussion about the development plans, their impacts, and consequent trade-offs (see, e.g., 13, 14, 18, 19).

Perhaps the biggest challenge for the MRC is that, despite the often-highlighted objective of riparian countries' governments for coordinated development, labelled as "the Mekong Spirit," the MRC seems to be increasingly sidelined from the actual planning processes of water development in its member countries (8, 14, 15). The political elites of the riparian countries share relatively similar aspirations for economic development, and the potentially negative local-level impacts of different development plans are thus not always taken properly into consideration, even in national- and regional-level discussions—be it at the MRC or elsewhere (15).

Despite these challenges, the MRC is arguably the most suitable organization for basinwide impact assessments. The commission does not, however, have a common impact assessment approach that would be applied systematically by the commission and its national committees. Instead, the different MRC programs have developed and applied several different assessment methods over the years, often with relatively poor coordination among the programs (20).

One commonality to most of these approaches is that they are planned in a relatively top-down manner and that they predominantly make use of aggregated, macroscale data. Many of the assessments also focus narrowly on selected issues only, instead of more comprehensive and cross-sectoral approaches. Despite these challenges, the assessment results provided by the different MRC programs are used to guide planning and decision-making on water development in the basin. For

example, the World Bank used the results generated by the MRC's Decision Support Framework to formulate its Mekong Regional Water Resources Assistance Strategy and therefore to study the possibilities for basin development, concluding that "there is scope for significant levels of coordinated development" in the basin (9). This statement has been challenged by other actors and assessments (see, e.g., 13, 24).

Different Approaches for Impact Assessment

There are several initiatives to assess the development impacts at different levels in the Mekong Basin. Numerous impact assessment methodologies have been applied and even more proposed by different actors, including national line agencies, universities, nongovernmental organizations (NGOs), as well as regional actors, such as the MRC and the Asian Development Bank. Most of these assessments focus on basic hydrological analyses and common Environmental Impact Assessments, but also broader, strategic assessments have been proposed, drawing on, e.g., Strategic Environmental Assessment (21).

Impact assessment in the basin is challenged by the large variety of development plans in different parts of the basin, and by the lack of comprehensive information on these plans. The complexity of interconnections among hydrology, ecosystems, and livelihoods provides an additional challenge for environmental and social assessments, especially because there still exist severe information and knowledge gaps, even on the most critical environmental and social issues, such as fisheries (25). It comes therefore as no surprise that different impact assessments provide often remarkably different estimates on potential hydrological, environmental, and social impacts of basin development.

A good example of the variation between estimates of different impact assessments is provided by Kummu and Sarkkula (6), who analyzed the estimates provided by three different cumulative impact assessment studies on predicted flow changes to Tonle Sap Lake of Cambodia. Different assessments provide relatively differing estimates; for example, the estimated changes in Tonle Sap's dry-season water level range from an increase of 15 cm up to 60 cm. While the difference of few dozens of centimeters may seem rather insignificant, this variation does actually mean a remarkable difference, in particular, for the gallery forests in the Tonle Sap

floodplain. The estimated gallery forest areas that would be permanently inundated—in essence destroyed—vary remarkably between different assessments, and the three assessments focusing on something as straightforward as water-level changes thus provide relatively different estimates about the potential impacts in the area (6).

In addition, the assessments focusing on hydrological changes present only the very first step toward comprehensive impact assessment. A river is much more than a hydrograph, and estimations about hydrological changes cannot thus be used to draw direct conclusions about the actual ecological, social, and economic consequences (24). Instead, proper environmental and social impact assessments require consideration of much broader themes and their linkages across different scales—an approach that is still largely lacking in the Mekong Basin.

CHALLENGES FOR BASINWIDE IMPACT ASSESSMENTS

The previous discussion has demonstrated that the lack of coherent information about the development impacts in the Mekong Basin is not due to the lack of impact assessments *per se*—actually vice versa. Why then are the existing assessment approaches not that successful in providing coherent and meaningful information about the impacts likely to occur in different parts of the basin? Based on experience from impact assessments in different parts of the Mekong Basin (26), there appear to be four major challenges that make it more difficult for the basinwide impact assessments to reliably and comprehensively estimate the impacts at different levels.

Data Reliability and Representativeness

Most of the basinwide analyses and assessments applied in the Mekong Basin build on quantitative macroscale data, and data are usually presented at national and/or provincial levels (see, e.g., 27). There are, however, several cases where the comparison of this macro-level data with information available from lower levels has indicated that severe biases and even errors emerge from the macroscale data when compared with the actual situation on the ground (see, e.g., 21, 28, 29). The reasons for these biases seem to stem from the misinterpretations and simplifications of the aggregated data, as well as from the biases of the actual enumeration methods (28).

Many of the current basinwide impact assessments seem thus to fail to capture the diversity of social, cultural, economic, political, and environmental issues and their interconnections in different parts and levels within the basin. Most regional impact assessment approaches offer little flexibility in their indicators or research methods, but instead they force—in the name of comparability and clarity—the assessments at different levels into the same format by using standardized and predecided indicators and methods. While this ensures better comparability, a great deal of the diversity occurring in the lower assessment levels can be lost. As a result, regional assessments may miss important local-level aspects and can thus present overly simplified pictures of different areas.

Spatial and Temporal Scales

The challenge with scales can be seen to have two main dimensions, that of time and that of space (30). The challenge with spatial scales is that while the impacts of water developments in the basin are in effect felt at the local level, coordinated planning and decision-making require essentially a regional approach. The scope of truly comprehensive basinwide impact assessments should therefore extend from very local

level to regional level and, in some aspects, even to the global level (31). The situation thus reflects the challenge related to environmental assessments in general, namely, that the traditional, centralized assessment efforts at regional and global levels are often too insensitive and inflexible to really be able to assess the multilevel nature of environmental and social problems (32, 33, 34).

The need to assess the impacts at different spatial scales is closely linked to the need for increased interaction between the assessments at the different levels. The challenge with spatial scales becomes thus also a challenge with scales of management, institutions, and, ultimately, of information and knowledge. As highlighted by Cash et al. (32), the failure to properly address these different issues and their cross-scale dynamics has, in many cases, had adverse consequences for management of human-environment systems. In the Mekong context, basinwide impact assessments can be seen to be particularly vulnerable for failure to properly take into account the complexities across different scales. Basinwide assessments are usually focused on a limited number of key issues, since this makes their implementation less resource- and time-consuming (see, e.g., 7, 21, 23, 27). In order to ensure that these regional key issues do capture the diversities at the different levels, however, at least the following things should be in place: close interaction between the actors at different levels, sufficient knowledge about the actual local-level diversities, and transparent and adaptive assessment processes (32). In terms of existing basinwide impact assessments in the Mekong Basin, there is still plenty to improve on in practically all of these aspects (21).

Assessment of development impacts is further challenged by the issue of time; the impacts of water developments usually differ depending on the timescale used, where shorter- and longer-term impacts may be potentially very different. This is partly due to the different timescales of responses to different changes, where some impacts are felt immediately and others more slowly over time (35). In addition, cumulative impacts occurring over longer periods can be very different compared to the estimated short-term impacts, with longer-term impacts being generally more difficult to assess. The situation may, however, also be vice versa. Many cumulative impact assessments combine in their estimations, for example, hydropower and agricultural development, which typically leads the potential flow changes from these two developments to partially cancel each other out. This is, however, not necessarily true in the short-term; hydropower and irrigation projects in different countries are rarely planned in a coordinated manner, and the projects may thus be completed on very different timescales. The short-term impacts of certain water developments may thus actually be radically different—and potentially more dramatic—than the estimated longer-term impacts (36).

Crosscutting Issues

The third major challenge related to current basinwide impact assessment practices is related to the problem of assessing the impacts of basin developments that result from particularly complex, crosscutting issues such as fisheries or flood pulse. The actual impact of these kinds of crosscutting issues consists typically of an array changes that have both direct and indirect impacts on the issue in question (4, 40). Meaningful impact assessment of these kinds of crosscutting issues would thus require a holistic approach that integrates expertise from several different disciplines. However, most of the impact assessments in the Mekong Basin have a relatively narrow, sectoral focus, and they thus tend to “compartmentalize” the environment and social systems into selected indicators and sectors (37, 40).

A prime example of this kind of crosscutting issue is the flood pulse system of Tonle Sap Lake and its floodplains (38).

The flood pulse of the lake is believed to be the main driver for ecosystem productivity in the lake and floodplains, which provide the source of food and livelihoods for millions of people (28, 37). Consequently, assessments of the possible changes in the flood-pulse dynamics would be critically important from environmental, social, as well as economic points of view. As pointed out by Lamberts (40), however, the current environmental impact assessment practices fail to assess the actual impacts of complex, crosscutting processes such as flood pulse and, thus, fail to identify the full consequences of flow alterations for the Tonle Sap ecosystem (41).

Another major crosscutting issue in the basin is, of course, fish, which is not only environmental but also very much a social and economic issue due to its critical importance for food and income for different social groups, including the poorest (4, 10). Already, this multidimensionality makes the Mekong fisheries a particularly complex, crosscutting issue. In addition, due to extensive fish migration along the Mekong mainstream as well as between mainstream and tributaries, fish production is particularly vulnerable to flow changes. For the same reason, the actual social and economic impacts caused by decreased fish production may be felt in very different areas than where the decrease is actually caused, requiring, therefore, a holistic, cross-scale assessment approach.

Public Engagement

The most important reason to carry out impact assessments is to inform planning and decision-making. Indeed, environmental decision-making is relying increasingly on technical expertise and assessments—so much so that Rayner (42) characterized the present era as the “age of assessment.” Ideally, impact assessments would be based on neutral information and sound science, and they would thus provide objective advice for a rational decision-making process. This is, however, rarely—if ever—the case, and neither assessments nor planning processes can be separated from values and interests of different groups and, consequently, from broader political processes linked to them (43, 44). Different forms of public engagement have been proposed as a way to take the interests of different groups into better account, to make alternative forms of knowledge and information more available, to increase the transparency of assessment processes, and, overall, to increase shared responsibility for planning and management (see, e.g., 42–45).

While several water-related planning processes in the Mekong region already do engage public—or, as they are usually referred to, “stakeholders” (46)—in a variety of ways, very few of them seem to provide a really meaningful and truly engaging way to influence the actual planning and decision-making processes (see, e.g., 3, 7, 8, 15). The problems with public engagement in water planning in the Mekong region can also be linked to the existing governance challenges. In practice, none of the riparian countries is truly a democratic one, and all of them have their own problems with public engagement in decision-making processes. The challenges with participation in impact assessments are linked, among other things, to the transparency of assessment processes and related water development, to the ways in which the public is engaged (and not engaged) in them, as well as to the quality of communication of assessment methods, assumptions, and findings to different stakeholders (47).

WAY FORWARD: MULTILEVEL IMPACT ASSESSMENT WITH PARTICIPATORY AND INTERDISCIPLINARY TWIST

The previous paragraphs argued that many of the current basinwide assessments fail to comprehensively take into account

the issues and impacts at different levels. The question thus arises: how can the situation be improved, and in which ways should the current impact assessment practices be developed? Although impact assessments should always be context-specific, with different situations requiring different approaches and methods, some general principles that can help to overcome at least some of the challenges can still be recognized. These are discussed in more detail next (48).

Multilevel Impact Assessment

Many of the challenges described here are related to the issue of scales and to problems with linking information from different levels together in a meaningful way. Currently, most of the existing assessments in the Mekong Basin seem to either focus on the impacts in a relatively small area—for example, in a tributary or even within a village—or they look at the impacts at much higher levels, focusing on costs and benefits, for example, only on national level (51). These two approaches seem to be rarely combined or even systematically analyzed together (5).

As a result, few current impact assessment approaches seem to actually be able to assess the impacts in a manner that would be consistent at the basinwide level and yet would not oversimplify, or even misrepresent, the issues at lower levels. It would thus seem beneficial to move toward more flexible, multilevel assessment approaches that make use of analyses and assessments at multiple levels. Preferably, this kind of multilevel assessment approach would *first* carry out local-level analyses, and only after that—based on the results from the local analyses—would assess the impacts at higher, national and regional levels (52). While the more local-level assessments help to better capture the lower-level diversities, the information provided by more macroscale analysis can help to create the bigger picture and thus to identify the most relevant issues regionally. In addition, to overcome the weaknesses of different research methods, the multilevel assessment approach should also encourage utilization of different techniques, including both quantitative and more qualitative methods (4, 28).

Ideally, the assessments at different levels should build on common impact assessment framework that recognizes the main objectives and general research methods for the assessments (53). In reality, however, there are rarely enough time, resources, and/or capacity for a systematic assessment that would include planning, implementation, and analysis of different assessments in a common framework from the local level to the regional level (34). Instead, the impact assessments in the Mekong Basin—like in many other transboundary basins—continue to be carried out by different actors at different levels with different methods and objectives.

It is therefore crucially important to make better use of already existing analyses and assessments, and increase interaction between different assessment processes at different levels—with specific emphasis on including lower-level assessments better into national and regional processes. Since different assessments are providing relatively different estimates on possible impacts, it is also very important to make use of the results of several different assessments—rather than relying only on one assessment—when formulating the strategies for water development in the region.

Towards Interdisciplinarity

Another major challenge for basinwide impact assessments is the assessment of cumulative impacts of different development plans because these plans are located in different parts of the basin and have often different impacts that may both reinforce and cancel out each other. In addition, impact assessment is

particularly challenging in the case of complex, crosscutting issues such as fisheries. Indeed, many of the current assessment processes in the Mekong Basin seem to fail to properly address the cumulative impacts due to their sectoral approach and focus on selected plans and projects only (4, 37, 40).

In order to better assess these kinds of cumulative impacts, it is suggested that impact assessments should move toward multidisciplinary and, increasingly, interdisciplinary approaches (53). Although multidisciplinary assessments seem to be getting more common in the region, the problem is that they are not really going to challenge the dominance of sectoral approaches in most impact assessments. The impact assessment processes would thus benefit from greater interdisciplinarity and, consequently, from new kinds of assessment and analysis methods that build on actual challenges in hand rather than on disciplinary research traditions.

One of the main challenges in the introduction of truly interdisciplinary approaches seems to be the lack of understanding about what it actually means and requires. Although increasing numbers of impact assessments in the region claim to be interdisciplinary (see, e.g., 4, 23, 50), in reality, most of them remain largely multidisciplinary, relying on disciplinary/sectoral methods and indicators. Developing a truly interdisciplinary approach for impact assessment is a slow process that requires enough time and resources as well as flexibility for further development of the assessment methods. The experts involved in a truly interdisciplinary process must also be ready to give up some of their “disciplinary sovereignty” and modify and develop the methods they are used to applying within their own disciplines and sectors (49).

Increasing Participation

Since large-scale water-development projects are likely to bring differing benefits and losses to different groups, water-planning processes are not only technical but unavoidably also social and political processes. The impact assessment is thus not only about neutral numbers, but also about the values given—consciously and subconsciously—to different issues (43). Increasing participation of different stakeholders provides one possibility to address these more social and political aspects of impact assessment.

While participation does have its own challenges and can in some cases even strengthen existing power imbalances (see, e.g., 15, 42, 55), it also has the potential to enhance the legitimacy of the assessment process, to increase acceptance of assessment findings among different stakeholders, and, most importantly, to make the entire assessment process more transparent and comprehensive. Truly engaging participation also has the potential to increase understanding of local-level diversities and to get feedback from different stakeholders on assessment methods and results. This kind of mutual learning is particularly important for the impact assessments of complex and dynamic issues because their assessment should build on iterative, adaptive processes rather than on on-off analyses.

The impact assessments in the Mekong Basin should therefore increase their emphasis on public participation to ensure that different stakeholders have meaningful ways to participate in the assessment processes, and to develop and discuss the objectives, methods, and assumptions of the assessments. The assessments should also make better use of the experiences from existing participatory assessment processes, such as Thai Baan research (56). There is also a need to emphasize publication and communication—particularly in native languages—of the principles and results of different impact assessments, combined with an increased capacity to facilitate discussion and information exchange on these topics.

CONCLUSIONS

The Mekong River Basin is truly at the crossroads. The drive for increased utilization of the river and its resources is intensive as riparian countries search means for development, yet the actual impacts of these developments remain in many aspects unclear, and discussion about the most sustainable development options is weak. This article discussed the current state of development of water resources in the Mekong Basin, with a specific emphasis on basinwide impact assessment practices and their major challenges. It is suggested that the impact assessments would benefit from a more multilevel approach that combines assessments from lower levels up to the regional level and make better use of interdisciplinarity and participation. Assessments of complex environmental and social issues should also have long-term perspective, and the entire assessment framework should thus build on adaptive, learning-oriented processes.

The good news is that there already exist several impact assessment processes at different levels in the Mekong Basin. These processes provide a remarkable knowledge base about the estimated impacts as well as about the strengths and weaknesses of different assessment methods. Better coordination between the different assessment processes and, in particular, increased interaction between the assessments at different levels would thus be potentially very beneficial for impact assessments in the basin. Particularly important is to make better use of the diverse experiences from the local-level assessments, and take these as the basis for broader, regional assessments.

These kinds of practical recommendations provide, however, only the starting point on the way toward more comprehensive and engaging impact assessment. A truly meaningful impact assessment also requires the recognition of the highly political nature of water development and, consequently, of planning and impact assessment processes. The underlying reasons—and solutions—for the challenges with impact assessment are therefore likely to lie beyond merely methodological issues and can instead be found from broader political processes related to water development. For this reason, water-related planning and impact assessment should build on transparent processes and encourage dialogues with different stakeholders about the requirements, methods, and assumptions used as well as the results achieved in the assessments. This kind of more open impact assessment approach can help to facilitate discussion and information exchange about the different development options, their impacts, and consequent trade-offs, and, ultimately, it can lead the way toward more balanced and integrated water resources management in the Mekong Basin.

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25. For example, the fisheries data for the Tonle Sap system—that is one of the most important fish production areas in the basin and both socially and economically critical for all of Cambodia—were for years grossly underestimated and remain even today problematic, being far from comprehensive (37).
26. This experience has been gained through academic research and consultancy work in four Lower Mekong Basin countries between 2002 and 2007. Most influential work in this regard has been that related to the WUP-FIN Project under the MRC. For more information on the project, see <http://www.cia.fi/wup-fin>.
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30. Also, other scales can naturally be relevant for impact assessment. According to Cash et al. (32), for example, different scales related to human-environment interaction include spatial, temporal, jurisdictional, institutional, management, networks, and knowledge scales.
31. For example, the newly emerged drive for hydropower development in the Mekong region can be partly linked to the increasing emphasis globally on renewable energy production as one important way to mitigate climate change.
32. Cash, D.W., Adger, N., Berkes, F., Garden, P., Lebel, L., Olsson, P., Pritchard, L. and Young, O. 2006. Scale and cross-scale dynamics: Governance and information in a multilevel world. *Ecol. Society* 11, article 8, 12 pp.
33. Cash, D.W. and Moser, S.C. 2000. Linking global and local scales: Designing dynamic assessment and management processes. *Glob. Envir. Change* 10, 109–120.
34. Cash, D.W. 2000. Distributed assessment systems: An emerging paradigm of research, assessment and decision-making for environmental change: Viewpoint. *Glob. Envir. Change* 10, 241–244.
35. An example of the impacts being felt immediately could be the submersion of agricultural or other land areas due to hydropower dam construction, while the impacts to fisheries due to gradual habitat changes present an example of longer-term impacts.
36. The first cumulative impact assessment presented in Kummum and Sarkkula (6), for example, includes hydropower dams and increased agricultural water use in its scenario. This combined scenario is estimated to result in a 15 cm increase in dry-season water level of Tonle Sap Lake. It is, however, likely that the implementation of these two forms of water development will happen at different timescales, with hydropower development occurring first. This would lead to a situation where the dry-season water level would actually be considerably higher during the years before irrigation projects included in the scenario were actually accomplished.
37. Lamberts, D. 2006. The Tonle Sap Lake as a productive ecosystem. *Int. J. Water Resour. Dev.* 22, 481–495.
38. Flood pulse is a term for an ecological paradigm that integrates the processes of productivity in river-floodplain ecosystems, with a particular focus on the lateral exchange of water, nutrients, and organisms between a water body and the connected floodplain. For more information, see, e.g., (39).
39. Junk, W.J., Bayley, P.B. and Sparks, R.E. 1989. The flood pulse concept in river-floodplain systems. Proceedings of the International Large River Symposium (LARS). *Can. Spec. Publ. Fish. Aquat. Sci.* 106, 110–127.
40. Lamberts, D. 2008. Little impact, much damage; the consequences of Mekong River flow alterations for the Tonle Sap ecosystem. In: *Modern Myths of the Mekong*. Jummum, M., Keskinen, M. and Varis, O. (eds). Water & Development Publications, Helsinki University of Technology, Espoo, pp. 3–18.
41. Worryingly, Lamberts (40) also pointed out that it is currently possible to meet the environmental safeguarding requirements of the World Bank and the Asian Development Bank—both of whom are among the main players in water development in the Mekong Region—without really assessing the actual impacts to integrative processes such as flood pulse.
42. Rayner, S. 2003. Democracy in the age of assessment: Reflections on the roles of expertise and democracy in public-sector decision making. *Sci. Public Pol.* 30, 163–170.
43. Karl, H.A., Susskind, L.E. and Wallace, K.H. 2007. A dialogue not a diatribe: Effective integration of science and policy through joint fact finding. *Environment* 49, 20–34.
44. van Kerkhoff, L. and Lebel, L. 2006. Linking knowledge and action for sustainable development. *Ann. Rev. Envir. Resour.* 31, 445–477.
45. Hisschemöller, M., Tol, R.S.J. and Vellinga, P. 2001. The relevance of participatory approaches in integrated environmental assessment. *Integr. Assess.* 2, 57–72.
46. Although the terms “stakeholder” and “stakeholder involvement” are widely used also in the Mekong region, the entire issue of stakeholders, their selection process, and actual representativeness of the diverse number of people that “have a stake” in an issue as complex and broad as basinwide water development would require a much more detailed—and critical—view.
47. These challenges are particularly valid in many water-related sectors, including hydropower, road construction, and large-scale irrigation. All these sectors require considerable amounts of financial capital and are thus the focus of major investments by donors, development banks, and, increasingly, the private sector. The growing involvement of the private sector in water-development plans in the basin has also increased concerns about the transparency of and the possibilities for public participation in these projects (see, e.g., 3).
48. The recommendations provided in this chapter are largely based on the author's experience from the WUP-FIN Project as well as from the IBFM process and the Built Structures Project. For more information on these, please have a look at (4, 21, 23, 49, 50).
49. Sarkkula, J., Keskinen, M., Koponen, J., Kummum, M., Nikula, J., Varis, O. and Virtanen, M. 2007. Mathematical modelling in integrated management of water resources: Magical tool, mathematical toy or something in between? In: *Democratizing Water Governance in the Mekong Region*. Lebel, L., Dore, J., Daniel, R. and Koma, Y.S. (eds). Mekong Press, Chiang Mai, 127–256.
50. Ratner, B.D., Kähkönen, M., Rahut, D.B., Keskinen, M., Navy, H., Sambo, Y., Leakhena, S. and Chuenpagdee, R. 2007. *Influence of Built Structures on Local Livelihoods: Case Studies of Roads, Irrigation, and Fishing Lots*. Study of the Influence of Built Structures on the Fisheries of the Tonle Sap. Cambodian National Mekong Committee and the World Fish Center, Phnom Penh, 50 pp.
51. Commonly, the former kinds of assessments are carried out, for example, by NGOs and/or academic researchers, while the latter, more regional assessments are mainly implemented by the regional organizations such as the MRC.
52. Indeed, the experiences from different case studies carried out within the WUP-FIN Project (21), for example, indicate that local-level analyses can help to reduce the risk for misinterpretations of macrolevel data.
53. The assessment frameworks proposed by the MRCS/WUP-FIN as well as by the IBFM provide examples of these kinds of broader assessment frameworks (21, 23).
54. In this context, multidisciplinary approach means viewing the research topic from a variety of disciplinary perspectives but yet producing a set of disciplinary results from it by using methods available within each discipline. Interdisciplinary approach is seen to be more problem-oriented and holistic as it seeks to integrate both knowledge and methods from different disciplines into new kinds of methods and interpretations to be able to better understand and assess a particularly complex problem.
55. Kähkönen, M. 2007. *Participation at Crossroads? Experiences from Decentralised Natural Resources Management in Tonle Sap*. Proceedings of the Mekong @ Crossroads Workshop, 14–15 May 2007, Chiang Mai, Thailand, pp. 56–57.
56. MWBP and IUCN. 2005. *Thai Baan Research on the Ecology and Local History of the Seasonally-Flooded Forest in the Lower Songkhram River Basin*. Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (MWBP) and The International Union for Conservation of Nature (IUCN).
57. The author is thankful for the lively discussions with large range of colleagues working in the Mekong region. Special thanks are due to Olli Varis, Matti Kummum, Mira Kähkönen, Juha Sarkkula, Jorma Koponen, Yim Sambo, as well as the entire WUP-FIN team and counterparts. Thank you very much also to Louis Lebel, John Dore, Dirk Lamberts, Pertti Vakkilainen, Kanokwan Manorum, and David Hall for your insightful comments. Financial support from Foundation of Technology (TES) and the Academy of Finland (Project 211010) is acknowledged.

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