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BRINGING BACK THE COMMON SENSE?

Integrated approaches in water management: Lessons learnt from the Mekong

Marko Keskinen

Dissertation for the degree of Doctor of Science in Technology

Aalto University
School of Science and Technology

Water & Development
Research Group

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Supervisor	Professor Olli Varis

Water management is changing: the narrowly defined management practices that have for long been dominating are being replaced by more comprehensive approaches. Integrated approaches –including the Integrated Water Resources Management (IWRM)– represent the forerunners of this change, and they are thus loaded with expectations. The reality is, however, more complicated, with many of the integrated processes failing to live up to their promises.

This Thesis looks at integrated approaches used in water management and impact assessment, with a focus on the transboundary Mekong River Basin and the related Tonle Sap Lake area in Cambodia. The seven appended articles discuss an array of water management and assessment contexts in the region, sharing practical experiences on the use of integrated approaches. The synthesis places the current integrationist drive into the broader context through an analysis of the development of integrated approaches as well as through a review of multi-disciplinary research approaches. Despite their emphasis on integration between different sectors and disciplines, integrated water management approaches are found to have surprisingly weak linkages with similar approaches in the other fields. In terms of the actual implementation of integrated water management, the Thesis recognises six key elements to be particularly critical: Comprehensiveness, Institutions, Politics, Methods, Team and Inclusiveness. Experiences from the Mekong on all these elements are summarised, and their significance and contribution to the practices of integrated water management is described.

The Thesis concludes by noting that while the current integrated water management practices are often strong on practical integration methods, they at the same time partly neglect the broader philosophical and contextual aspects related to integration. Yet, since integrated management always involves a range of actors with their intricate interconnections, integration is not just a mechanical procedure, but very much a personal and political issue as well. What really matters are therefore not only the technical methods for integration, but also the ways the management and research teams in specific management contexts communicate, collaborate and interact with their various stakeholders as well as –an issue that is frequently forgotten– internally within their teams.

Keywords integration; integrated water management; impact assessment; Integrated Water Resources Management (IWRM); multi-disciplinarity; transboundary river basin; Mekong; Tonle Sap

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Integroidut lähestymistavat veden hallinnassa: käytännön kokemuksia Mekongjoelta

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Työn valvoja	Professori Olli Varis

Veden hallinta on muuttumassa: pitkään vallalla olleet kapea-alaiset hallintamenetelmät ovat antamassa tilaa kokonaisvaltaisemmille lähestymistavoille. Integroidut eli yhdennetyt lähestymistavat –mukaan lukien ns. integroitu vesivarojen hallinta (IWRM)– ovat tämän muutoksen edelläkävijöitä ja niihin on siksi ladattu suuria odotuksia. Todellisuudessa monet integroiduista prosesseista eivät kuitenkaan saavuta niille asetettuja tavoitteita.

Tämä väitöskirja tarkastelee veden hallinnassa käytettäviä integroituja lähestymistapoja Mekongjoella sekä Tonle Sap –järvellä Kambodzhassa. Väitös käsittelee erilaisia veden hallinnan ja vaikutusten arvioinnin muotoja Mekongin alueella, kuvaten käytännön kokemuksia integroitujen menetelmien käytöstä. Väitös myös asettaa vesialalla käynnissä olevan integraatioprosessin laajempaan kontekstiin tarkastelemalla integroitujen lähestymistapojen kehittymistä sekä kuvaamalla monitieteisiä tutkimusmenetelmiä ja niiden kytköksiä veden hallintaan. Vaikka integroidut lähestymistavat korostavat eri sektoreiden ja tieteenalojen välistä yhteistyötä, tutkimuksessa huomataan veteen liittyvien integroitujen menetelmien kytkeytyvän yllättävän heikosti vastaaviin lähestymistapoihin muilla aloilla. Väitös tunnistaa kuusi keskeistä elementtiä, joita voidaan pitää erityisen tärkeinä integroidun veden hallinnan toteuttamisessa: kokonaisvaltaisuus, instituutiot, politiikka, metodit, tiimi ja osallistaminen. Väitös vetää yhteen Mekongilta saatuja kokemuksia näihin elementteihin liittyen sekä kuvaa niiden kytkeytymistä integroitujen lähestymistapojen käytäntöihin.

Johtopäätöksenä on, että vaikka integroidun veden hallinnan käytännön menetelmät ovat yleensä vahvalla pohjalla, integroidut lähestymistavat laiminlyövät usein niihin liittyvät laajemmat filosofiset ja kontekstuaaliset ulottuvuudet. Koska veden hallinnassa on kuitenkin aina mukana useita toimijoita ja vuorovaikutussuhteita, integraatiossa ei ole kyse vain mekaanisesta menettelystä vaan myös henkilökohtaisista ja poliittisista prosesseista. Tärkeää ei siis ole vain se miten integraatio teknisesti toteutetaan, vaan myös se millä tavoilla veteen liittyvät hallinta- ja tutkimustiimit erilaisissa konteksteissa kommunikoivat, tekevät yhteistyötä ja ovat vuorovaikutuksessa niin sidosryhmiensä kanssa kuin –usein vähälle huomiolle jääneenä– tiimien sisäisesti.

Asiasanat integraatio; integroitu veden hallinta; vaikutusten arviointi; kokonaisvaltainen vesivarojen hallinta; yhdennetty vesivarojen hallinta; monitieteisyys; rajajoki; Mekong; Tonle Sap

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LIST OF APPENDED ARTICLES

This thesis consists of this synthesis and the following peer-reviewed scientific articles that are referred to in the synthesis text by their Roman numerals:

I: Keskinen, Marko, Katri Mehtonen & Olli Varis (2008). Transboundary cooperation vs. internal ambitions: The role of China and Cambodia in the Mekong region, In: Pachova, Nevelina I., Mikiyasu Nakayama & Libor Jansky (Eds.): International Water Security: Domestic Threats and Opportunities, United Nations University Press, Tokyo, Japan. Pages 79-109.

II: Sarkkula, Juha, Marko Keskinen, Jorma Koponen, Matti Kummu, Jussi Nikula, Olli Varis & Markku Virtanen (2007). Mathematical modeling in integrated management of water resources – Magical tool, mathematical toy or something in between? In: Lebel, Louis, John Dore, Rajesh Daniel & Yang Saing Koma (Eds.): Democratizing water governance in the Mekong region, Mekong Press, Chiang Mai, Thailand. Pages 127-156 + references 253-255.

III: Keskinen, Marko (2006). The Lake with Floating Villages: Socio-economic Analysis of the Tonle Sap Lake, International Journal of Water Resources Development, 22(3): 463-480.

IV: Varis, Olli & Marko Keskinen (2006). Policy Analysis for the Tonle Sap Lake, Cambodia: A Bayesian Network Model Approach, International Journal of Water Resources Development, 22(3): 417-431.

V: Keskinen, Marko (2008). Population, natural resources & development in the Mekong: Does high population hinder development? In: Kummu, Matti, Marko Keskinen & Olli Varis (Eds.): Modern Myths of the Mekong – A critical review of water and development concepts, principles and policies, Water & Development Publications – Helsinki University of Technology, Espoo, Finland. Pages 107-121.

VI: Keskinen, Marko, Mira Käkönen, Prom Tola & Olli Varis (2007). The Tonle Sap Lake, Cambodia: water-related conflicts with abundance of water, The Economics of Peace and Security Journal, 2(2): 49-59.

VII: Keskinen, Marko (2008). Water Resources Development and Impact Assessment in the Mekong Basin: Which Way to Go?, Ambio, 37(3): 193-198.

The contribution of the author to the appended articles from I to VII is as follows:

I: The author is mainly responsible for writing the article. The idea for the article comes from the author, Mrs Mehtonen and Professor Varis, with the author coordinating the writing process. The author was responsible for the section on Cambodia and wrote major parts of the sections on introduction, the Mekong River Basin, regional cooperation and conclusions. Mrs Mehtonen wrote the section on China as well as the discussion on the GMS Program and contributed to all other sections. Dr Varis contributed particularly to the sections on regional cooperation and conclusions.

II: The author is partly responsible for writing the article. He carried out the socioeconomic analysis and wrote the section on it, contributing also for the sections on introduction, policy analysis, integration and conclusions. The author also took active part in the coordination of the writing process as well as in the structuring and editing of the article. Dr Sarkkula was responsible for coordinating the writing process, contributing particularly to the sections on integrated modeling and assessment, integrated model on Tonle Sap and conclusions. Mr Koponen, Mr Kummu and Mr Virtanen carried out the actual modelling work, wrote the sections related to modelling and contributed also to other sections. Mr Nikula carried out most of the research on the integration of socioeconomic, ecological and hydrological information and contributed extensively to that section. Dr Varis carried out the work on policy analysis, wrote that chapter and contributed also to other sections.

III: The author is fully responsible for the article and the analysis presented in it.

IV: The author is partly responsible for writing the article. The idea for the article comes from Dr Varis, who also carried out most of the model development work. The author contributed to the model development and carried out the actual analysis work together with Dr Varis. The author was also responsible for the expert consultation process, and wrote majority of the sections on technical outline and data acquisition, contributing to the other sections of the article as well.

V: The author is fully responsible for the article and the analysis presented in it.

VI: The author is mainly responsible for writing the article. The idea for the article comes largely from the author, and he was also responsible for the structure of the article and for the coordination of its writing process. The author contributed to all sections of the article, including major parts for the sections on Cambodia, Tonle Sap, Case 1, discussion and conclusions. Ms Käkönen contributed significantly to the overall structure of the article, wrote mainly the sections on water-related conflicts and Case 3, and contributed to all other sections, in particular to discussion and conclusions. Mr Tola wrote major parts of the section on Case 2 and contributed also to the other sections of the article. Dr Varis contributed to all sections of the article, particularly to introduction, discussion and conclusions.

VII: The author is fully responsible for the article and the analysis presented in it.

PREFACE

The title of this dissertation, "Bringing back the common sense?", captures several important themes I wish to emphasise with my Thesis. First of all, the reference to common sense indicates that the use of integrated approaches in water management have usually as much to do with personal understanding and attitude as with technical integration methods. At the same time it refers to the different types of knowledge used in water management and assessments, including non-scientific forms of knowledge. Common sense also underlines the practical approach towards both integration and water management, reminding us that each and every theory –however advanced and elaborate– must make sense in practice. In other words, the reference to common sense aims to capture the positive connotation of the phrase, meaning decisions that are based on prudent judgement and comprehensive –indeed, common– view on the issues at hand[i].

The reference to bring back, on the other hand, points towards the realisation that the basic idea behind most integrated approaches is not entirely new, as the past decades have seen various kinds of integrated theories and practices. Consequently, integration can be seen partly to represent a return to a mindset that was for long lost in the arena dominated by narrowly defined objectives, sectoral expertise and fragmentation. Yet, as is emphasised by the question mark included in the title, integrated approaches provide no silver bullet, but they are rather just one water management framework among many. The question mark also points towards the challenges that integrated approaches face, particularly in terms of their actual implementation.

This Thesis aims to contribute to the discussion about water management by looking at the integrated approaches used in water management and related impact assessments. At the same time the Thesis presents a personal journey into the field of water management: a voyage that has took me to a long, winding road not without dead ends and u-turns. Consequently, parallel to more scientific findings, this Thesis aims also to convey more personal experiences along the road.

Water management is a continuous process that involves various, often conflicting, views. Consequently, no approach can exhaustively describe how to achieve successful water management, as even the very definition of success varies greatly. I therefore don't even try to define the approach –the solution– for integrated water management, although when starting to write the first articles for this Thesis this certainly crossed my mind. Instead, I seek to share my experience from the Mekong Region on developing and using practical approaches for integrated management and impact assessment and, based on these lessons learnt, look more generally at the integrationist drive prevalent in the present-day water management.

By doing this, I hope that this Thesis encourages discussion on integrated water management practices, facilitating their use towards more sustainable and equal directions. With the increasing pressures that particularly population growth, urbanisation, pollution, climate change and changing patterns of food and energy production bring to the world's waters, it is clear that such a route needs to be taken. It is not therefore really a question of where we should go, but how.

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[i] This means that I don't regard common sense as something that would render the complex realities of water management into simplified truths or beliefs. Common sense is also by no means seen to reduce the significance of sound science, but rather to complement it.

ACKNOWLEDGMENTS

This Thesis has not only been a remarkable possibility to study and learn about water management and the Mekong, but first and foremost a unique opportunity to collaborate and interact with various people. People who have helped, guided, encouraged and inspired me during this process are numerous, and I can here thank only part of them by name.

I would like to express my greatest gratitude to my instructor, supervisor and mentor Professor Olli Varis, without whom I would have never made it this far. Olli's unvarying support, constant encouragement and almost unlimited trust to my research have simply been extraordinary. I have enjoyed very much our collaboration both in Finland and in the Mekong: thank you for that. I'm also extremely thankful to Professor Pertti Vakkilainen for his continuous support as well as for the fascinating discussions we have had on water, its management and several other issues.

Special thanks to my colleagues at the Water & Development Research Group who have during these years enabled a very inspiring working environment. In particular Matti Kummu, Muhammad Mizanur Rahaman, Ulla Heinonen, Katri Mehtonen, Virpi Stucki, Tommi Kajander, Mira Käkönen and Jussi Nikula have been invaluable in their support and friendship: thank you very much for this. Thank you also to Aura Salmivaara, Mirja Kattelus and Timo Räsänen for our collaboration and interesting discussions. I would also like to thank everyone at the (former) Water Resources Laboratory for their support. In particular Professor Harri Koivusalo, Professor Ari Jolma and Professor Riku Vahala are thanked for their encouragement, and the 'Four As' –Anne-Maj Seppälä, Aino Peltola, Ari Järvinen and Antti Louhio– for helping with all those practical matters. Thank you also to Tiina Merikoski for the layout and the cover of the Thesis.

A great deal of my research was carried out in relation to the so-called WUP-FIN Project. Thank you to the Finnish Environment Institute, EIA Ltd. as well as to all the team members of this very special project for making it happen. Thank you very much to Juha Sarkkula for your guidance and inspirational ideas, to Jorma Koponen for your encouragement, and to Matti Kummu for your support (including all those maps) and useful comments.

The WUP-FIN socio-economic team, including Yim Sambo, Noy Pok and Huon Rath as well as Olli Varis, Ulla Heinonen, Jussi Nikula and Mira Käkönen deserves a particular mention, as a majority of the research presented in this Thesis builds on the work carried out with that very team. It has been a real pleasure to work with you, thank you very much for that. A special thanks to Mira for our discussions and collaboration: I have learned a great deal from you. Thank you also for the WUP-FIN collaborators and partners: Pech Sokhem and Dirk Lamberts are particularly thanked for their wise words and support. I would also like to express my sincere thanks to those numerous people –the true water experts– in the villages of the Tonle Sap and the Mekong Delta for sharing your knowledge and ideas with me.

During my years in the Mekong Region, I have had a pleasure to work with various individuals that have provided important support and guidance for my research. Thank you to my Cambodian colleagues, including Prom Tola, Mak Sithirith, Try Thuon, Sour Sethy, Suong Leakhena, Tes Sopharith, Say Samal and Neou Bonheur as well as the staff at the CNMC. Thank you also to my Vietnamese colleagues at the Can Tho University, the Southern Institute of Water Resources Research and elsewhere. Special thanks to Le Van Khoa, Pham Le Thong, Vo Khac Tri and Trinh Thi Long as well as to our wonderful field study team: Ngo Thi Thanh Truc, Ngo Thuy Diem Trang, Tran Thi Trieu, Le Duc Toan, Le Truong Giang and Nguyen Van Lanh.

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My deepest thanks to my wonderful colleagues at the M-POWER network that has provided a very inspirational environment to learn, discuss and debate issues related to water management and water governance in the Mekong. A particular thanks to John Dore for the energy, encouragement and comradeship you have offered over the years. Thank you very much to Louis Lebel, Kate Lazarus, François Molle, Pech Sokhem, Kanokwan Manorom, Surichai Wun'gaeo, Dipak Gyawali, Yang Saing Koma, Chu Thai Hoanh, Babette Resurreccion, Edsel Sajor, Xu Jianchu, Lu Xing, Tira Foran, Rajesh Daniel, Carl Middleton, Bach Tan Sinh and Masao Imamura for all those interesting discussions.

Thank you also to my colleagues at different institutes here in Finland: especially Eero Kontula, Kai Kaatra, Hannele Nyroos, Jyrki Nissilä and Kari Kinnunen are thanked for the interesting discussions on IWRM and international waters. In addition, I've had an exceptional opportunity to get guidance from a number of esteemed scholars working on water issues: Asit K. Biswas, Cecilia Tortajada, Anthony Turton and Tony Allan are particularly thanked for the support and ideas they have provided.

I'm extremely grateful to my two pre-examiners, Associate Professor Richard D. Margerum and Professor Joakim Öjendal, for reviewing my manuscript and –most importantly– for providing insightful comments on it. In addition, thank you very much to Professor Anthony J. Jakeman for agreeing to be my opponent in my doctoral defense.

Research is never possible without funds. While a major part of the research presented in this Thesis was done in relation to WUP-FIN and other research projects, I have benefited from the generosity of several funding agencies and organisations as well. Thank you very much for the Academy of Finland, the Finnish Ministry for Foreign Affairs, the Graduate School of the Helsinki University of Technology, the Foundation of Technology (TES), SNIL ry. and Maa- ja vesitekniikan tuki ry. for your important support to my research.

Finally, thank you very much to my friends and my family for supporting my research and, even more importantly, for offering me the possibility to take my thoughts off from it. My friends from Jalasjärvi, TKK, Hujut and elsewhere –Teemu, Olli, Yves, Gerald, Tare, Salora, Jussi, Kalle, Yyjii, Mark, Ilikka, YP, Kimmo, Tomi, Liisa and all the others– are thus remembered in particular for all those moments when we were not talking about my work. Thank you very much to my mother and father for your trust and encouragement. Thank you also to Hanna-Leena, Anssi/Eetu and Miro as well as to my wonderful nephews Pieti and Kuura. I would also like to remember my late Matti-pappa and Saara-mummo, who were always interested in my research, even when I now and again had difficulties to explain what I was exactly doing.

The biggest thanks go to my wife Leena –for being there with and for me– as well as to our daughter Kaisla for reminding me that there are, after all, much more important things in life than a doctoral thesis.

In sunny Helsinki on June 24th, 2010,

Marko Keskinen

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ABBREVIATIONS

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
AWM	Adaptive Water Management
BDP	Basin Development Plan of the MRC
CBD	Convention on Biological Diversity
CNMC	Cambodian National Mekong Committee
CSIRO	Australian Commonwealth Scientific and Research Organization
DAC	OECD Development Assistance Committee
DDP	Dams and Development Project of UNEP
DFID	Department for International Development, United Kingdom
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization of the United Nations
GIS	Geographic Information System
GMS	Greater Mekong Subregion Program
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GWP	Global Water Partnership
IA	Integrated Assessment
IAIA	International Association for Impact Assessment
IEM	Integrated Environmental Management
INBO	International Network of Basin Organizations
IUCN	International Union for Conservation of Nature
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
MDG	Millennium Development Goal
MGT	Management
MEA	Millennium Ecosystem Assessment
M-POWER	Mekong Program on Water Environment and Resilience
MRC	Mekong River Commission
MRCS	Mekong River Commission Secretariat
MREG	Mekong Regional Environmental Governance research and dialogue group
OECD	Organisation for Economic Co-operation and Development
PRA	Participatory Rural Appraisal
SEA	Strategic Environmental Assessment
SEA START RC	Southeast Asia START Regional Center
SIA	Social Impact Assessment
START	Global Change SysTem for Analysis, Research, and Training

TAC	Technical Advisory Committee of GWP
TEC	Technical Committee of GWP
TKK	Helsinki University of Technology (now part of Aalto University)
TSBA	Tonle Sap Basin Authority
TSBMO	Tonle Sap Basin Management Organisation
TSBR	Tonle Sap Biosphere Reserve
UN	United Nations
UNCED	UN Conference on Environment and Development
UNECE	UN Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-Water	UN inter-agency mechanism on water
USAID	U.S. Agency for International Development
USER	Unit for Social and Environmental Research, Chiang Mai University
WCD	World Commission on Dams
WCED	World Commission on Environment and Development
WHAT	World Humanity Action Trust
WUP-FIN	Lower Mekong Modelling Project
WSSD	World Summit on Sustainable Development
WWAP	World Water Assessment Programme
WWF	World Wide Fund for Nature

PART I: INTRODUCTION

1 Towards greater integration in management and research

Integration is the buzzword of the day in environmental management[1]. Whether one is talking about management practices, assessment methods or research, integration frequently emerges as a common nominator: it is something to seek and strive for. The proponents of integration suggest that theories, practices, methods, sectors, disciplines and even institutions need to be integrated: otherwise we are not able to understand comprehensively –and therefore to solve– the complex, interlinked challenges of today[2]. While there are very valid motives for the drive towards greater integration, the reality is more complicated, with many of the integrated processes failing to live up to their promises.

The drive towards greater integration is well visible in the field of water management. And for a good reason: water management is, after all, much more than managing water. Water provides the source of livelihood, income, food and energy for millions, and its excess, lack and pollution leads to disasters, health problems and deaths. In addition to direct economic values, water and related resources have remarkable social, cultural and spiritual values and attributes. The world's diverse water bodies support important aquatic and terrestrial ecosystems and, consequently, extremely rich flora and fauna. Water management is also closely connected to the broader aspects of governance, power and politics, and water therefore forms a potential source of conflict –but also cooperation– between different countries and social groups.

Yet, water management was during most of the 20th Century dominated by a relatively narrow view that didn't really capture the full diversity of the relations that people have with water. Such a view considered water merely as a physical resource to be developed and managed for mainly (macro-)economic purposes, often for just one main function such as hydropower production or irrigation. In this kind of setting, water resources management was commonly done through centralised, government-led efforts that build on sectoral approaches and 'objective' scientific analyses carried out by water engineers and other specialised experts. While such approaches have undoubtedly brought well-being for millions of people, they have also created serious environmental and social problems due to their limited view to the use, development and management of water. The last decades have therefore meant increased recognition of other dimensions –social, political, institutional, cultural as well as environmental– related to water and its management, together with better appreciation of other forms of knowledge production.

Consequently, various kinds of integrated frameworks have been proposed for water management to incorporate the different water-related aspects and perspectives more comprehensively together. Such frameworks

[1] I use the term 'buzzword' to refer not only to the prevalence of integration, but also to the challenges included in such keywords that –although being seemingly well-intentioned and neutral– are also frequently used to lend the legitimacy to certain kinds of actions. For more information, see Cornwall & Brock (2005) and Molle (2008).

[2] There are varying views on the reasons of the perceived complexity of today's world. I'm attracted to the view that such complexity stems at least partly from the so-called second industrial revolution –the one based on information, instead of energy– that has taken place after the Second World War. As noted by Checkland (1994: 87): "Since that time the trends have been towards much increased capacity for communication, greater complexity of goals as economic interdependence has increased, much reduced deference towards authority of any kind, and the dismantling of monolithic institutionalized power structures". When complemented with an additional trend central to this Thesis –sustainable development–, I believe that such an account captures quite well the background for the emergence of the present-day global village. See also McNeill & McNeill (2003) for an interesting analysis of the importance of communication and human networks throughout the times, and Max-Neef (2005) for fascinating views on the complexity and linear simplicity as well as on the challenge of 'too much knowledge and too little understanding'.

KEY TERMS: concise definitions

Integration = a process of combining different items and issues together to form a whole, usually with an aim to gain a comprehensive, systemic view.

Water (resources) management = a set of activities –including e.g. planning, assessment, regulation, operation, monitoring and communication– that aim to balance the diverse uses, users, functions and values related to water.

Impact assessment = a process of identifying the consequences of a proposed action on a defined entity, commonly before making decisions on its implementation.

Multi-disciplinarity = a general term for the knowledge production approaches that make use of several scientific disciplines and forms of knowledge.

For more detailed discussion, see Chapter 2.

typically make use of multidisciplinary teams, and emphasise the importance of a sound institutional setting and stakeholder participation. Also common is the consideration of catchment level as the main management unit[3]. In the present-day water field, the most common example of this integrationist drive is the concept called Integrated Water Resources Management (IWRM)[4]. The IWRM has been endorsed by the United Nations as well as several governmental agencies, water management institutions and river basin organisations, and it is often claimed to be the best way forward for water resources management (see e.g. MRC 2006a; UNESCO-WWAP 2006; Lenton & Muller 2009a). Similar trend towards integration is also visible in the field of impact assessment, where the concept of Integrated Assessment –originating from the climate change studies– is getting increasing attention also in the other fields of environmental management, including water.

A shift towards greater integration is taking place at the universities as well. The conventional forms of knowledge production through separate disciplines are being criticised to lead to overspecialisation and too narrowly defined research questions. Such limitations are particularly visible in the fields where different disciplines are naturally closely connected and have intimate linkages with the society – such as water[5]. As a result, the contemporary modes of scientific knowledge production are increasingly being supplemented with the ones that connect ideas, methods and views from several disciplines and modes of knowledge, aiming for research approaches that are more problem-driven, cooperative and reflective of the needs of the society (Gibbons et al 1994; Scholz & Marks 2001).

1.1 THE STRUCTURE OF THE THESIS

This Thesis looks at the integrated approaches used in water management and related assessments, with a specific focus on transboundary river basins shared by several countries. The Thesis comprises of seven scientific, peer-reviewed articles and this synthesis that summarises the objectives, methods and results of the research.

The synthesis is divided into three parts: Part I – Introduction, Part II – The Context, and Part III – Outcomes. While Part I introduces the research objectives and methods, Part II places the research into the broader context through discussion about integrated approaches, water management and the Mekong. Part III summarises the main results of the seven appended articles related to integrated management practices and draws conclusions based on their findings and the analysis presented in this synthesis. Consequently, integrated

[3] The increased emphasis on the management at the catchment level can also be seen as one of the driving forces for integration. As noted by Warner (2007: 3): "Now that hydrology and ecology rather than territorial administrative or cultural boundaries dictate the management scale, states and regional authorities are forced to work together across boundaries".

[4] Although having slightly different connotations, the term 'water resources management' is used in this Thesis side by side with the more general term 'water management': I personally prefer the latter, as it indicates that management also deals with issues going beyond the concept of resource. Related to this, the term 'integrated water management' is used to describe the integrated approaches of water management in general, while IWRM refers then to one such approach.

[5] These limitations have been highlighted e.g. by Funtowicz & Ravetz (1991: 151, quoted in Kötter & Balsiger 1999), who already in 1991 noted that: "We have now reached the point where a narrow scientific tradition is no longer appropriate to our needs. Unless we find a way of enriching our science to include practice, we will fail to create methods of coping with environmental challenges, in all their complexity, variability and uncertainty."

water management is in this Thesis considered simultaneously from two differing viewpoints, with one focusing on the broader development and background of such approaches, and the other on their actual practices in management, impact assessment and research.

The research presented in this Thesis takes as its starting point the much-discussed gap between the theory and the practice: many have claimed that while the need for integrated approaches used in water management –most importantly IWRM– is essentially well recognised, their actual implementation remains a real challenge[6] (see e.g. GWP 2000; Lahtela 2002; UNESCO-WWAP 2003; Biswas 2005; Rahaman & Varis 2005; Watson 2007; UN-Water 2008; Lenton & Muller 2009a). Particularly difficult seems to be to broaden the scope of modelling and other technical management approaches towards more comprehensive directions. This Thesis looks at how the social, political and institutional aspects related to water can be linked with the conventional view that sees water primarily as a resource, studying its quantity and quality trough variety of technical methods[7]. The emphasis is on the lessons learnt, and therefore on practical applications of the integrated approaches in the actual management contexts.

Water management is always context-specific, and all findings presented in this Thesis are therefore closely related to the broader context within which the use, development and management of water is taking place. The geographical and political context of this research is the Mekong Region in Southeast Asia, with a specific focus on the Tonle Sap Lake area in Cambodia. The Mekong Region is defined by –but not limited to– the transboundary Mekong River Basin that is shared by six riparian countries of China, Burma/Myanmar, Laos, Thailand, Cambodia and Vietnam. Hence, the Thesis also looks at water management and impact assessment at different geographical scales, from local scale (the households and villages of Tonle Sap) to sub-national (the Tonle Sap Lake area), national (Cambodia) and to regional i.e. transnational scale (Mekong Region). The Thesis therefore relates closely to the discussion about transboundary water management, including the additional dimensions brought by larger geographical scales and the complex political dynamics between the riparian countries.

Consequently, the Thesis looks at the connections between several dimensions that can be considered critical for integrated water management. First of all, the Thesis looks at the linkages between different aspects related to management of water. Secondly, the Thesis examines multi-disciplinary research approaches and the linkages between different forms of knowledge production. Thirdly, the Thesis looks at water management within a transboundary river basin, considering the different geographical and temporal scales included in such setting. Finally, the Thesis seeks to link the theoretical considerations on integrated approaches better with the actual management practices.

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[6] In reality, however, theory and practice cannot really be completely separated in a field as applied as water management. As noted by Checkland (1985), all management studies essentially focus on the processes of inquiry that require steady interaction between theory and practice: theories lead to practices, which, in turn, generate new theories. Neither theory nor practice is therefore a prime, but the interaction between the two forms a closely connected –and groundlessness– circle.

[7] As discussed in Article II, such technical approaches are surrounded by an interesting dualism: the mathematical models and other technical methods are often seen either as tools for scientifically sound, data-based management or as 'weapons of mass-depoliticising', misused by the decision-makers to justify certain decisions and to hide the highly political nature of management decisions. See also van Daalen et al. (2002) and McIntosh et al. (2007) for interesting analyses on the different types of models and their use in environmental decision-making.

1.2 RESEARCH FRAMEWORK

The research presented in this Thesis has from the very beginning been influenced and guided by the practical applications related to water management in the Mekong Region[8]. The research doesn't therefore build only on certain theories and analytical frameworks, but also very much on the needs –actual and presumed– in specific water management and assessment contexts. Consequently, while leaning on the long tradition of water resources management studies, this Thesis is not really based on any single analytical framework, but makes use of several research frameworks. The general research framework for this Thesis can thus be seen to consist of a multi-approach and multi-method process that has used and adapted ideas from various disciplines and theories.

Given the focus of the Thesis, the theories of water resources management form together with the concept of Integrated Water Resources Management the theoretical and analytical foundation of the entire research (see e.g. Mustonen 1986; Äijö et al. 1992; Maidment 1993; Wilcock 1999; GWP 2000; Jønch-Clausen & Fugl 2001; Dingman 2002; UNESCO-WWAP 2003; Hall 2005; GWP & INBO 2009). During my research, I have used this foundation to –literally– build on, adding ideas, views and methods from related theories and concepts. The most influential concepts that have inspired my research in this regard include Integrated Assessment (see e.g. Rotmans & van Asselt 1996; Rotmans 1998; Jakeman et al. 2005), adaptive management (see e.g. Folke et al. 2007; Pahl-Wostl et al. 2007; Medema et al. 2008; Huitema et al. 2009), environmental flows (see e.g. Dyson et al. 2003; King et al. 2003; Meijer 2007), as well as river basin management (see e.g. Downs et al. 1991; Jaspers 2003; Miller 2003; Molle 2003; Svendsen et al. 2005; Warner et al. 2008).

These theories have then been complemented with the ideas and methods derived from the approaches related to livelihoods, participation, policies and politics. Particularly useful have been the theoretical frameworks related to participatory research and sustainable livelihoods (see e.g. Chambers 1987, 1994; Mukherjee 1993; Scoones 1998; Farrington et al. 1999; Nicol 2000; DFID 2001), political ecology (see e.g. Bryant & Bailey 1997; Miller 2003), hydropolitics (see e.g. Elhance 1999; Sneddon & Fox 2006) and other water-related political and institutional analyses (see e.g. Bakker 1999; Öjendal 2000; Allan 2003a, 2003b; Mollinga 2001, 2008; Mollinga et al. 2007; Warner 2007b; Molle 2008).

As water management is an issue with multiple dimensions, it is necessary to define at bit more detailed level the actual focus of this research. Following the definitions given in Chapter 2.3, this Thesis mainly deals with the strategic dimension of water management, focusing on the application of one specific management framework (IWRM) in the context of a transboundary river basin (the Mekong) and of a national lake basin (the Tonle Sap)[9]. The emphasis in both of these basins is on basin level processes as well as on management structures consisting of number of interconnected institutions –formal and informal– at different levels. Given the current development pressures on the Mekong, the water-related policies and plans, different forms of impact assessment and the issue of participation are of specific interest for this research.

Figure 1 seeks to provide a visualisation of the basic setting of this research. While the diagram may at first sight look relatively simple, it actually includes several layers. First of all, the diagram demonstrates the basic idea behind IWRM (and most integrated

[8] There is also a pragmatic reason for such a focus, as a major part of the research was done in connection to different research projects. By far the most important such a project was the so-called WUP-FIN Project that from the very beginning –since 2001– maintained an integrated view in its implementation and had therefore close linkages to IWRM and integrated assessment approaches. The fact that my research is so closely related to different research projects can also be seen to create a certain ethical dilemma, as the project work has undoubtedly influenced the focus of my research. I personally believe, however, that this has not had an effect on the integrity of the research *per se*, as the appended articles were all written as scientific articles –not e.g. as project reports– that presented and, importantly, critically analysed the research activities carried out within the different research projects. For more information on the WUP-FIN Project, see the appended articles as well as Varis & Keskinen (2003) and MRCS/WUP-FIN (2003, 2007).

[9] The two basins are naturally closely connected and cannot therefore be really considered as two completely separate contexts.

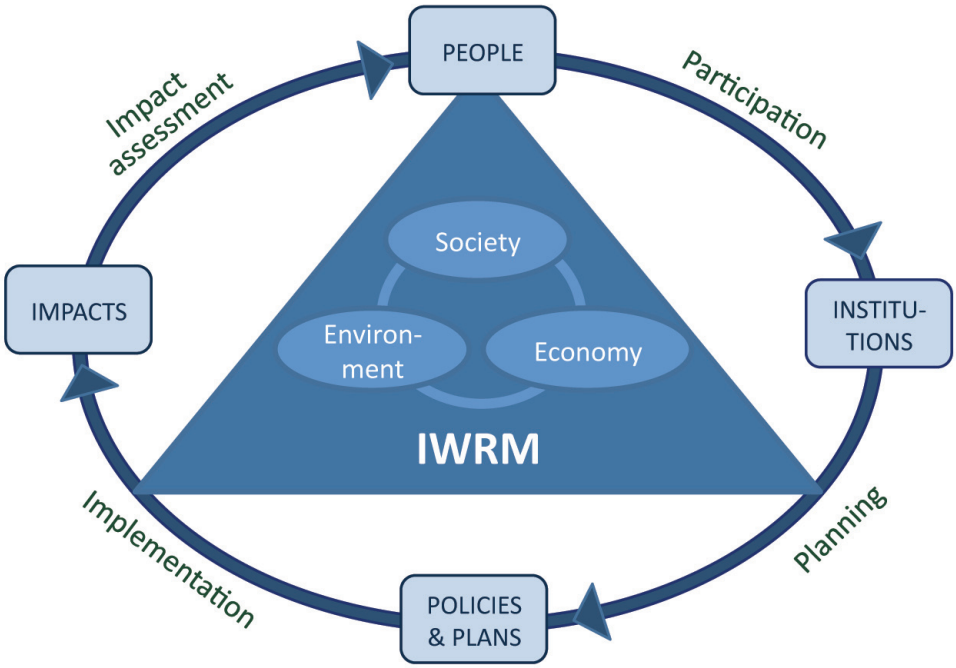

Figure 1 A diagram indicating the basic setting of this research, bringing together the IWRM triangle and one version of the water management cycle. Politics related to water management are seen to crosscut through all the components

approaches) in trying to maintain a balance between environmental, economic and social aspects, creating thus a linkage to the concept of sustainable development. Secondly, the diagram includes an example of a water management cycle, presenting some common relations between the different components and dimensions of management. Finally, the diagram illustrates the basic linkage between the theoretical foundation of integrated water management (IWRM triangle) and the actual water management practices (management cycle), indicating that the two should always be looked at together.

A research framework drawing on several approaches and theories has naturally both strengths and weaknesses. I personally see that the main strength of such a framework is that my research has largely been guided by an idealistic –naïve, even– notion to 'study the things as they are'[10]. Such a view is, I believe, particularly important in this kind of research due to the strong multisectoral character of water and its management. Indeed, I would argue that water-related research can never limit itself to certain disciplines and theories alone, but should take as it starting point the specific context where water is being used and managed[11]. A research framework using multiple approaches and methods has also enabled different research methods to be used in differing research contexts and –as was the case for instance with the policy setting in the Tonle Sap (*Article III*, *Article IV*, *Article VI*)– the same context being studied with different research methods.

The decision not to restrict this research under one distinct, commonly agreed research framework brings naturally challenges as well. Overall, it has made the entire research process more laborious, and has led to both frustration and dead-ends due

[10] I do recognise that this kind of view builds largely on the notion of objective research that, I believe, is in reality impossible to achieve, as research –and knowledge overall– is always in one way or another subjective and socially constructed. For more discussion on the positivist (seeing science objective, linear and separated from politics) and constructivist views of science (seeing science as a social process), see Hastie (2007).

[11] As discussed in Chapter 2.5, the focus on certain contexts –instead of certain theories or disciplines– links closely to the ideas of transdisciplinary research as well.

to the lack of clear reference points. The broad scope brought by such a framework approach leads unavoidably to only partial inclusion of the elaborate ideas discussed in the different frameworks, making the Thesis prone to simplifications regarding the theories it uses and refers to. The lack of a clear analytical framework has also made the presentation of my research more difficult, as sticking with one common framework would provide practical means for the presentation of my research, too. In order to go around these weaknesses, I have paid a special attention to structure this synthesis so that it conveys the main messages of my research in as clear and understandable manner as possible.

Research methods

Due to the number of theories and analytical approaches included in this research, the research methods used in this Thesis are various as well. The actual methods applied depend very much on the focus and analytical setting of the specific research activities and contexts, as discussed in the appended articles.

Overall, the research methods can be categorised into the following main groups:

- Analyses of hydrological conditions and water resources
- Socio-economic & livelihood analyses
- Institutional & policy analyses
- Impact assessment studies
- Integration exercises

The different research methods used within these five main groups are next summarised briefly: more information on them can be found from the articles indicated in the parentheses as well as from Chapter 4. I also want to point out that most of the research methods presented here were developed together with my colleagues, many of whom are also co-authors in the appended articles. My specific role in the development and use of these methods is described in more detail in the articles as well as at the beginning of this synthesis under the section 'Author's contribution'.

As the research presented in this Thesis focuses on water management and related impact assessments, the general analyses of hydrological conditions and water resources in the Mekong and the Tonle Sap Lake area form a natural starting point to my research. Such analyses were carried out in close cooperation with my colleagues, and they made use of existing hydrological data as well as new measurements (*Article II*). In addition, the results from the hydrological, hydrodynamic and water quality modelling and impact assessment carried out within the WUP-FIN Project played a particularly central role in the analyses (*Article II*, *Article III*, *Article IV*).

The socio-economic and livelihood analyses focused on water-related social and livelihood issues, and made use of both quantitative and qualitative research methods. The methods used for the analyses included participatory village surveys (building on participatory research methods such as PRA), key-informant discussions, expert interviews as well as statistical analysis of different socio-economic databases and other quantitative information (*Article II*, *Article III*, *Article VI*). The quantitative analyses were closely linked with geospatial analysis, where Geographic Information System (GIS) was used to organise the results from the socio-economic analyses according to the geographical location of the study villages (*Article II*, *Article III*).

The institutional and policy analyses built on extensive literature reviews as well as on selected key-informant interviews and expert consultations (*Article II*, *Article V*). The analyses also utilised a probabilistic, Bayesian network model –so-called Tonle Sap Policy Model– that was tailor-made for this particular analysis (*Article II*, *Article IV*). The institutional analyses were complemented by historical reviews of past water resources management regimes and related events (*Article I*, *Article II*, *Article V*).

Impact assessment studies were primarily based on the concepts of Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA), focusing on the linkages between hydrological changes and

their environmental and social consequences (*Article II*, *Article III*, *Article VII*). The different impact assessment approaches were also reviewed, and their validity and applicability for the Mekong Region discussed (*Article VII*).

So-called integration exercises are closely related to the impact assessment studies, aiming to facilitate the linkages between information derived on hydrology, environment, and people and their livelihoods. The Thesis discusses two such exercises: geographic zoning (also called quantitative integration) and impact tables (also called descriptive integration). The idea in geographic zoning is to use GIS to arrange the mainly quantitative information available on issues such as hydrology, environment, land use and social and economic indicators according to geography, rather than administrative boundaries (e.g. provinces) or hydrological entities (e.g. lake). With the so-called Impact Tables, on the other hand, the causal linkages between hydrological indicators, ecological impacts and livelihood activities are described in a systematic manner, using expert judgement building on both quantitative and qualitative information (*Article II*, *Article III*).

1.3 RESEARCH QUESTIONS

The research for this Thesis has been a true learning process, and also my research questions and hypotheses have changed over the years. While starting my doctoral research some six years ago, my understanding of the research themes described in this Thesis was in many ways different than today. In my very first research plan back in 2004, I considered the scarcity of scientific information –and particularly the lack of integration of such information– to be the most important challenge for water management. I strongly believed in a comprehensive approach for analysis of water-related data, and set to create a kind of ultimate information integration tool for analysis and assessment.

Surprisingly, things turned out not to be that straightforward. Drawing on my own experiences as well as the excellent analyses on the challenges of water management in the Mekong and elsewhere (see e.g. Öjendal 2000; Allan 2003a; Miller 2003; Svendsen et al. 2005; Sneddon & Fox 2006; Mollinga et al. 2007; Molle 2008; Warner et al. 2008; Käkönen & Hirsch 2009), I came to realise that while such a view for water management entails many important dimensions, it also easily becomes too one-sided and technocratic. Most importantly, such a view commonly fails to understand that water management is inherently political, and may also fall short in acknowledging the other, non-scientific forms of knowledge. It also neglects the strong normative content of most integrated approaches, visible particularly in their attempt to integrate issues that in many contexts are not really commensurable.

At the same time, I do believe that any change taking place in water management is likely to occur slowly and gradually, building first and foremost on the existing institutions, approaches and forms of knowledge – even when they may be the main reasons for the problems of today. We therefore need to consider and build on the current management practices, seeking possibilities to improve them based on our past experiences, including both successes and failures.

Building on these notions, I drafted together four research questions: a main research question and three supporting research questions. The three supporting questions can be seen to resemble a staircase, taking the discussion about integrated approaches step by step towards the main research question:

> ***What are the main reasons for the emergence of integrated approaches such as IWRM in the water management field?***
>
> ***What are the key elements that need to be considered in the implementation of integrated water management approaches?***
>
> ***What kind of requirements, if any, integrated approaches put on water-related research?***

The first research question focuses on the background of integrated approaches, and aims to

understand the actual reasons for the emergence –and current prevalence– of such approaches: why were such approaches developed, and what kind of approaches they are seeking to replace? The second research question is then more practical, focusing on the variety of issues that have to be considered in the actual implementation of integrated water management. While noting that each management context is different, the question builds on the assumption that there are some general elements that can be considered to be particularly important for the overall success of integrated water management. The third supporting research question looks at the role of research, and the science in general, in supporting management practices, focusing on the requirements that integrated approaches put on research – and vice versa.

The three supporting research questions are relatively easy to comprehend, as they are framed narrowly and have a clear focus (historical development, key elements and the role of research, respectively). There is, however, even bigger question related to the integrated approaches, namely what is their *raison d'etre*. To help to understand this, the main research question of this Thesis aims to relate integrated approaches to the ultimate objective –as I would define it– of water management:

> ***Can integrated approaches help in finding the ways towards more sustainable and equal water management?***

Despite its grandiose tone, such a question may sound simplistic and trivial. Yet, it is not. By focusing on such a question, I wish to make an argument that the discussion about water management theories, practices and methods slips often to over-detailed issues, forgetting the bigger picture. One fails to see the forest for the trees, as we would say in Finnish. Consequently, for all the methodological and technical arm-wrestling, it is important to keep the focus on the big themes as well. For this reason it is essential to keep asking ourselves whether integrated approaches –or, for that matter, any other management framework– are actually helping us to facilitate the way towards more sustainable and equal management practices[12].

[12] I want to emphasise that although the two themes included in the main research question –sustainability and equality– are nowadays ubiquitous, I did not choose them for their popularity. Instead, I do see that the two words capture the ultimate objective of any water management practice: water management should be sustainable (both in terms of nature and people) and it should be equal (taking into account the differing views and relations that different people have with water). While practically impossible to reach entirely, they both are definitely worth striving for – and therefore also worth including into the main research question of this Thesis.

PART II: THE CONTEXT

2 Integrated approaches: the quest for comprehensive views

The thematic focus of this Thesis is on the so-called integrationist drive that, I argue, is one of the most dominant trends in the present-day water management – and, more broadly, in environmental management. A prime example of such prevalence is the influence that Integrated Water Resources Management (IWRM) currently has in guiding the water management policies and practices at both national and international levels. IWRM is therefore also the methodological focus of this Thesis. However, as will be discussed below, IWRM is just one integrated approach among many, having similarities with other such approaches. For this reason I often refer in this synthesis to integrated approaches and integrated water management practices in general, instead of discussing just IWRM.

This Chapter starts with an overview of integrated approaches in environmental management, and then discusses their actual application through case studies on water management (case: IWRM) and impact assessment (case: IA). In addition, the emergence of integrated approaches in research is addressed through a concise review of multi-disciplinary approaches. Together with the following chapter on Mekong, the two chapters set the methodological and geographic context for the entire Thesis.

The focus on integrated approaches means that this Thesis connects to, and critically studies, the so-called integrationist agenda that highlights the need to manage and to study the different resources in an integrated, holistic way (Medema et al. 2008). Indeed, one of the key points I wish to make with this Thesis is that the drive towards greater integration is not taking place only in the water field, but integrated frameworks and approaches have been developed in several related fields as well. Similarly important is to realise that the quest for integrated approaches is not something entirely new, but that such approaches have been around in different forms already for several decades[13]. What is new, however, is how widely –and, often, uncritically– integrated approaches have been accepted as the most suitable approach for management, and how strongly they therefore guide and frame current management practices.

2.1 DEFINING INTEGRATION

Before proceeding to the detailed discussion about integrated water management, it is useful to look at the concept of integration and integrated approaches at bit more general level. Overall, the verb 'integrate' can be defined as 'to combine or be combined to form a whole', while integration is usually defined as 'the process of integrating' (Oxford University Press 1999). From such definitions it is clear that integration has mostly

[13] The emergence of contemporary integrated approaches represents thus in many ways re-emergence, as such frameworks build partly on the practices applied already decades and even centuries earlier. For instance Rotmans & van Asselt (1996) note that the Egyptian farmers made use of integrated land and water management techniques already thousands of years ago. Also integrated water management approaches can be seen to bring together the practices that have been used already for decades in different parts of the world. Often quoted –and partly contested– examples of such practises include Spain's system of *confederaciones hidrográficas* adopted in 1926, the setting up of the Tennessee Valley Authority in 1933 as well as the basin-wide water development plans developed in Germany, Finland, New Zealand and several other countries in the 1960s and 1970s (National Boards of Waters 1977; Mitchell 1990a, 2007; Downs et al. 1991; Lahtela 2002; Rahaman & Varis 2005; Snellen & Schrevel 2005; Varis et al. 2008a; Lenton & Muller 2009b; Rahaman 2009). However, also earlier references exist, and for instance Weber & Hufschmidt (1962: 299) note that in the United States "a philosophy of integrated, multiple-purpose river-basin planning" was established already in the 1908 with the publication of the report of the Inland Waterways Commission, while Mitchell (1990b) refers to watershed conservancy districts established in Ohio, the United States in 1913. Such examples of past integrated systems also relate to the conclusion of Walther (1997, quoted in Medema et al. 2008) that the success of IWRM is primarily a function of the historical situation into which a project is placed and only secondarily of its professional design.

to do with combining 'things' together, and that integration is a process rather than an on-off action. Consequently, for the purposes of this Thesis, we can define integration generally as 'the art and science of combining different items and issues together to form a whole, commonly with an aim to gain a holistic, systemic view'[14].

More detailed definition is, however, needed to understand what kinds of 'things' the integrated approaches used in environmental management actually aim to integrate, and how the integration is done. While different approaches have their own specific characteristics, most focus on the human-nature interactions, with an aim to facilitate deeper understanding of natural systems as well as the intricate socio-political structures related to their use and management[15]. Margerum & Born (1995) take this view further, identifying four central themes for Integrated Environmental Management approaches: inclusive, interconnective, strategic and goal-focused. Building on these themes, integrated approaches can in the context of this Thesis be seen to encompass –ideally– the following five general characteristics:

- Comprehensive
- Interconnected
- Participative
- Goal-orientated
- Strategic

Comprehensiveness indicates that integrated approaches build on the understanding of the broad context within which they are implemented, emphasising the need for coordinated management practices and the consideration of different dimensions relevant for integration. Interconnectedness relates to the fact that such approaches have to appreciate the intricate interconnections that the different systems and functions within that context have, instead of focusing just on simplistic causal relationships. To achieve these objectives, integrated approaches need to consider differing views and perspectives related to the management, and therefore also to find linkages with and encourage participation of different stakeholders relevant in that specific context. Integrated approaches are also goal-orientated in a sense that their focus is on some commonly defined goal –for example a research problem or a management objective–, rather than for instance on detailed technical methods. Finally, integrated approaches are strategic as they maintain a broad, long-term view on the issues they are addressing, and, to be feasible, they also need to focus their implementation on certain key aspects of such issues.

Integrated approaches are therefore characterised by an interesting dualism: while having as their ultimate objective a more comprehensive, systemic view, they at the same time have to focus to selected key issues, and must do this through certain practical steps. While this kind of reductionism may seem incompatible with a comprehensive view, the experience from for example reduced planning, strategic planning and mixed scanning has demonstrated that they can actually be used together (Margerum & Born 1995; Allmendinger et al. 2002).

Integration does not therefore mean connecting all elements and issues –'things'– forcibly together, since such situation becomes easily unworkable due to remarkable amount of different issues, scales and actors included[16]. Instead, it becomes critical to recognise the key issues that need to be considered and integrated in specific management situations (Mitchell 1990b; Margerum & Born 1995; Watson 2007; Lenton & Muller 2009a). This also helps to

[14] The inclusion of term 'art' into the definition highlights the fact that the integrated approaches are not just simply technical processes bringing together various forms of data and information, but that their implementation also requires the consideration of different views and forms of knowledge as well as understanding, wisdom and creativity, making integration also a clearly personal matter.

[15] Indeed, different approaches using the term 'integrated' are not always comparable as the depth of their integration varies greatly: while most integrated approaches –including those discussed in this Thesis– focus on broad nature-human interactions, some approaches may use the term to indicate a research methodology that just integrates different types of technical methods. Similarly, many integrated approaches are not defined explicitly with the term 'integration', but through terms with similar meaning, such as comprehensive, holistic, systemic, unified and total.

[16] See e.g. Mitchell (1990b: 4), who notes that "Experience at many countries with the comprehensive approach at an operational level has indicated that it results in inordinately lengthy periods of time for planning and in plans which are often not sufficiently focused to be helpful to line managers".

explain why integration and comprehensiveness cannot be seen to be synonymous: while a comprehensive approach requires consideration of all the different elements within a management system, an integrated approach focuses on the elements that are relevant in that particular management context (Mitchell 1990b; Watson 2007). Hence, as suggested by Mitchell (1990), a comprehensive approach should be used in more strategic levels of planning and management to ensure that the widest possible perspective is maintained, while at operational level a more focused –namely integrated– approach is usually more feasible.

Integration is also seen to have different dimensions, depending on the context and level where the integration takes place. In terms of water, the GWP (2000) recognises two basic categories for integration: natural system (essentially defining the availability and quality of water) and human system (determining water use and management). Kidd & Shaw (2007) divide the integration within the human system into three specific categories: sectoral integration, territorial integration and organisational integration. They note that the first two categories tend to be the main focus of integration efforts, with the latter category usually dealing with the consequences of such efforts in terms of organisational culture and practice[17].

2.2 THE ROAD TOWARDS INTEGRATED APPROACHES

While the discussion about integrated frameworks and approaches in water management –and in environmental management more generally– has been on-going already for decades, such approaches have become more widely accepted and applied only during the past two decades or so. What have been the main reasons for the emergence and current popularity of integrated approaches in environmental management?

While there are differing views on the actual reasons for the emergence of integrated approaches, their popularity can be connected to two broad, interlinked issues: the emergence of the concept of sustainable development, and the frustrations with the outcomes of narrowly focused, sectoral environmental management practices. While both of these issues were discussed in different forms already throughout the 20th Century, they really gained ground in the 1970s and the 1980s, largely thanks to the environmental movement and the growing concerns about environmental degradation and pollution.

The concept of sustainable development was introduced to the international policy arena in 1987 by the World Commission on Environment and Development (WCED) through its seminal report 'Our Common Future'[18]. The discussion leading to the concept started, however, already earlier with the increased recognition of the unsustainability of the development patterns at the time. Year 1972 included two important milestones in this regard: the publication of the Club of Rome report 'Limits to Growth' with its stern warning about the limits of current development trends as well as the United Nations Conference on the Human Environment held in Stockholm, Sweden[19]. These two milestones were followed by other initiatives highlighting global environmental concerns, including 'The Global 2000 Report' published by the United States government in 1980, the adoption of the World Charter for Nature by the United Nations General Assembly in 1982, and the establishment of the WCED in 1983 (Ryding 1992).

[17] Organisational integration can be further divided into two dimensions, namely strategic integration and operational integration. While the former deals with the alignment of interlinked strategies and policies, the latter considers the integration of the actual delivery mechanisms related to such strategies, including stakeholder participation (Kidd & Shaw 2007).

[18] The concept of 'sustainable development' was actually coined already in 1980 in the World Conservation Strategy, published by the IUCN in cooperation with WWF and UNEP (Vig 1999).

[19] The Club of Rome report can be seen as a first systematic attempt to understand where the on-going development trends are leading. The report famously concluded that the limits of the growth of our planet will be reached sometime within the next one hundred years. Even more importantly, however, the report noted that it is possible to alter the present growth trends and to establish a condition of ecological and economic stability that is sustainable far into the future (Ryding 1992). The Stockholm Conference, on the other hand, was particularly important for bringing the twin imperatives of ecological sustainability and the development of the world's poorest economies for the first time on the global agenda (Vig & Axelrod 1999).

Drawing on the WCED report, the concept of sustainable development is commonly defined as follows: it is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED 1987). Building on this notion, sustainable development is seen to call for a balance between three core themes: social, environmental and economic issues. Reaching such a balance is seen to require integrated approaches, and for example the two most influential international summits on sustainable development –the UN Conference on Environment and Development (UNCED) in Rio in 1992 and the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002– both highlighted the importance of integrated views in achieving sustainable development[20].

The concept of sustainable development is, however, not without problems, with the biggest challenge being the inherent contradictions between the concepts of sustainability and development (see e.g. Sachs 1992a; Vig & Axelrod 1999; Jackson 2009; Ulvila & Pasanen 2009). This fundamental contradiction has led many to conclude that while the concept of sustainable development is nowadays widely agreed with, it hasn't really changed the unsustainable patterns of development in many parts of the globe. As noted by Park et al. (2008: 2-3): "few can claim seriously that the period since the Rio meeting [in 1992] has been one of great accomplishment on global environmental governance, human development, or the chimerical notion of 'sustainability'".

Another main factor behind the emergence of integrated approaches –and, indeed, of sustainable development– are the traditional management approaches that dominated the natural resources management field during most of the 20th Century. Such approaches emphasised sectoral approaches and specialised scientific expertise, building largely on the idea of the man's control and mastery over nature (Mitchell 1990a; Margerum & Born 1995; Hooper et al. 1999; GWP 2000; Allmendinger et al. 2002; Toope et al. 2003; UNESCO-WWAP 2006). While such sectoral approaches meant increased disciplinary knowledge and possibility for in-depth insights, it also led to fragmentation and, consequently, to the partial loss of comprehensive, systemic view on resource management[21].

Integrated approaches complement and also challenge these more sectoral approaches, building on concepts such as resilience thinking and systems theory, and highlighting the consideration of entire systems rather than their specific components (see e.g. Miser & Quade 1988; OECD 1989; Margerum & Born 1995; Hooper et al. 1999; Medema et al. 2008). The foundation of the integrated approaches is thus found be in the concept of sustainability as well as that of comprehensiveness and non-fragmentation. This process leading from the theoretical foundations (why?) to actual integrated approaches (what?) and, ultimately, to the practical integration methods (how?) is illustrated in Figure 2[22].

The increasing importance of sustainable development and non-fragmented, decompartmentalised management practices has meant that integrated approaches are nowadays omnipresent in environmental management. Integrated approaches have been proposed, developed and

[20] The Agenda 21 of UNCED starts with a notion that (United Nations 1992: 1.2) "This global partnership must build ...on the acceptance of the need to take a balanced and integrated approach to environment and development questions", while the Plan of Implementation of World Summit on Sustainable Development notes that (WDDS 2002: 14): "Managing the natural resources base in a sustainable and integrated manner is essential for sustainable development". See also Esteva (1992), who in his critical account on the concept of development notes that integration was originally –particularly during the First UN Development Decade in the 1960s– used as the watchword for linking the social and economic aspects together, and environmental issues were included only later on with the emergence of the concept of sustainable development. Interesting is also "the ladder of sustainable development" shown in Vig (1999: 8) that includes four different views, or phases, of sustainable development, with the most ideal view building on "holistic intersectoral integration".

[21] For example Margerum & Born (1995: 371) conclude that earlier, narrowly-focused management approaches "usually failed to deal with interconnections, complexities, multiple perspectives, multiple uses and the resulting cross-cutting externalities". In addition, GWP (2000: 23) emphasises that: "The concept of Integrated Water Resources Management [is] in contrast to 'traditional', fragmented water resources management", while Allmendinger et al. (2002: 175) note that "[Integrated coastal-zone management] is part of an increasing recognition that successful environmental resource management is dependent upon an ability to achieve a shift away from sectoral management approaches".

[22] See also Jønch-Clausen (2004), who uses the same questions to describe the basic setting of IWRM.

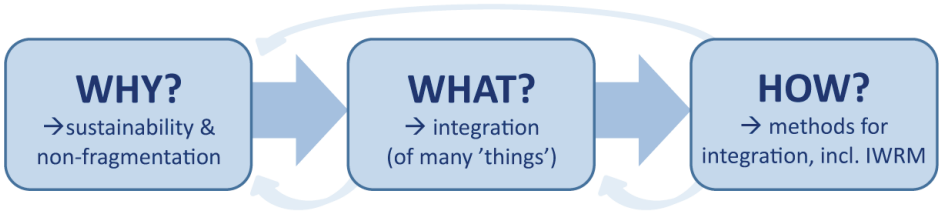

Figure 2 A diagram showing the simplified process connecting the theoretical foundation (why?), the actual concept (what?) and the practical methods (how?) of integrated approaches.

implemented in fields such as land use planning, ecosystem management, rural development, forest management, community planning, and, more generally, environmental and resource management (see e.g. Naveh 1978; Walther 1987; Loh & Rykiel Jr. 1992; Cairns & Meganck 1994; Karlen et al. 1994; Hytönen 1995; Margerum & Born 1995; Bellamy et al. 1999; Hooper et al. 1999; Penning de Vries et al. 2003; Kostov & Lingard 2004; Twery et al. 2005; Ling et al. 2009; Norgaard et al. 2009).

Similarly, Integrated Water Resources Management (IWRM) is not the only water-related concept building on integration, but several other, partly overlapping integrated frameworks and approaches exist as well. These include Integrated River Basin Management, Integrated Catchment Management, Integrated Watershed Management, Integrated Coastal Zone Management, Integrated Water Management, Integrated Water Resource Systems, and Total Water Management (Downs et al. 1991; Mitchell & Hollick 1993; Keller et al. 1996; Johnson 1999; Allmendinger et al. 2002; Miller 2003; The World Bank 2006; Patwardhan et al. 2007; Watson et al. 2007; MRC & GTZ 2009).

The current popularity of integrated approaches illustrates the vigour of the integrationist drive, demonstrating how widely the concept of integration has extended into the field of environmental management. At the same time, however, it also represents a great irony, as the large number of similar but separate approaches leads easily to overlapping, competing initiatives that are actually not facilitating more holistic, systemic practices. Indeed, most of the integrated approaches still seem to consider integration predominantly from their own specific disciplines and sectors, even when they at the same time call for increased integration also beyond their own specific field[23]. Overall, the various integrated approaches seem often to be developed and used in a kind of vacuum, with surprisingly weak connections with each other. This, naturally, also prevents the possibilities for collaborative learning between the approaches.

2.3 INTEGRATION IN WATER MANAGEMENT – CASE IWRM

Water and its management

Before proceeding to the theory and practise of integrated water management, let us briefly discuss water and its management more generally. Water is the fundamental element of our blue planet: without water there simply would be no life in Earth. While the amount of water in the globe is fixed, water will never run out as it is renewed continuously through the hydrological cycle. The main elements of the hydrological cycle are precipitation, evaporation and run-off. Consequently, three major sub-systems for water are commonly defined as atmospheric water system, surface water system and subsurface water

[23] This has also led to rather absurd situations, where for example integrated water management is reaching towards land management, while integrated land management is reaching towards water management – both largely through their own approaches and methods and without proper dialogue with each other (see e.g. Naveh 1978; Allmendinger et al. 2002; Penning de Vries et al. 2003; Biswas 2010).

system[24] (Maidment 1993; Dingman 2002). The focus of this Thesis –similarly to most studies on water resources management– is on surface water and its multiple uses, functions, roles and values.

The multiple uses and users of water indicate a need for its management. With increasing pressures and changes facing the world's waters today, the water management has become an increasingly important –and contested– topic[25]. The much-debated global water crisis, for example, is increasingly being seen as a crisis of poor water management and water governance, rather than of physical water scarcity. As famously stated in the first World Water Development Report of the United Nations: "This crisis is one of water governance, essentially caused by the ways in which we mismanage water"[26] (UNESCO-WWAP 2003: 4). The promotion of integrated management approaches –and, hence, of crossboundary views and approaches– further enhance the importance of management, as the major management challenges are often present at the boundaries of different issues, including the different themes and disciplines, spatial and temporal scales, and the levels of governance (Mitchell 1990b).

Water governance

Water governance and water management are closely linked, with governance forming a kind of umbrella for different management activities. Governance can be generally defined as the framework of social and economic systems and legal, political and administrative structures –formal and informal– through which humanity manages itself[27] (WHAT 2000; Callway 2005). Following from this, water governance is usually seen to comprise "all social, political and economic organizations and institutions, and their relationships, insofar as these are related to water development and management" (UNESCO-WWAP 2003: 372).

UNDP (2009) complements this definition by noting that water governance "compromises the mechanisms, processes, and institutions through which all involved stakeholders, including citizens and interest groups, articulate their priorities, exercise their legal rights, meet their obligations and mediate their differences". Interestingly, the current definitions of good water governance[28] link closely to the integrationist agenda as well, as "water governance should enhance and promote integrated and holistic approaches" (UNESCO-WWAP 2003: 373; see also Rogers & Hall 2003; UNESCO-WWAP 2006). Overall, effective governance systems are believed to enhance water policies and enable the management tools to be applied correctly (UNESCO-WWAP 2003, 2006).

At the same time governance is increasingly seen as a vehicle for empowerment and participation[29]. As a result, the above-mentioned, traditional ways of defining and seeing governance are being

[24] There are also other ways to describe the hydrological cycle. WWAP (2009), for instance, divides the waters into blue water (liquid water above and below the ground), green water (soil moisture available for uptake by plants and evapotranspiration) and white water (water that evaporates directly into the atmosphere). Linton (2008: 630), on the other hand, provides a critical analysis of the entire concept, suggesting that: "[hydrological cycle] internalizes the historical and geographical circumstances in which it was formed; namely a northern temperate society in the throes of modern, state-led industrial development. These circumstances, however, no longer pertain to a majority of people, whose experience of water is different from that represented in the standard hydrologic cycle".

[25] Environmental management as a concept is loaded with different meanings. For example Shiva (1992: 207) sees that "'Management of natural resources' has ... been a managerial fix for resources scarcity resulting from the uncontrolled destruction of nature". The existing water management regimes have also faced severe criticism, as they are seen to frequently lead to overspecialisation and depoliticisation of water management (see e.g. Öjendal 2000; Mollinga 2001; Allan 2003b; Molle 2008).

[26] Similar concerns were naturally raised already earlier. A UN Report on international waters, for example, noted in 1975 that "Human survival ...is conditioned upon much better management of this indispensable resource" (United Nations 1975: 6).

[27] Also more authoritative definitions exist, including that by UNDP (1997): "Governance can be seen as the exercise of economic, political and administrative authority to manage a country's affairs at all levels". As noted by WHAT (2000), however, governance is not a synonym for government, and governance thus requires cooperation between government and different actors representing the diversity of interests in any given society. Such a view is reflected in the concept of polycentric governance that emphasises the advantages of nested, self-organized resource governance systems (Ostrom 2001; Ostrom & Janssen 2004; Huitema et al. 2009) as well as in the literature of different community-based governance systems (see e.g. Weber 2003) and multi-stakeholder platforms (Dore 2007; Warner 2007b).

[28] As noted by Hirsch et al. (2006), good water governance –another buzzword of the day– is commonly assumed to involve at least the following principles: decentralization to local government and the principles of subsidiarity; enhanced roles for civil society; a place for the market; participation, accountability and transparency; transboundary management; and holistic approaches. They also note, however, that the concept remains highly contested and that behind its official definitions often lie highly-charged subtexts: good governance can for example simply be a byword to tackle corruption or to increase the role of state.

[29] For example UNESCO-WWAP (2003: 352) notes: "The [Dublin] principles [of 1992] reflect a shift in conventional water governance from a top-down towards a bottom-up approach. Participation opens up the way for more informed decision-making, and offers people opportunities to claim their rights as well as to meet their responsibilities."

complemented by more diverse views highlighting also the political and, overall, increasingly complex and messy dimensions of governance (Rogers & Hall 2003; UNESCO-WWAP 2003; Weber 2003; Hall 2005). Reflecting this, for example Dore (2007: 211) defines (water) governance in a bit different way: "Multi-layered interplay of negotiations, agenda-setting, preference-shaping, decision-making, management and administration between many actors and institutions in the state-society complex, at and between different levels and scales".

Water management

Water management can be generally defined as set of activities –including planning, assessment, regulation, operation, monitoring, conflict resolution and communication– with an aim to balance the diverse uses, users, functions and values related to water (GWP 2000; UNESCO-WWAP 2003; Lenton & Muller 2009a). Such activities can be performed by different groups of people as well as through cooperation between the groups (Carlsson & Berkes 2005). The means and mechanisms to implement such management activities are similarly many, ranging from technical to environmental, from economic to social, and from legal to political.

Management is not, however, only about methods and mechanisms, but it depends and builds on the people involved in the management activities. Management has therefore been described also simply as the art of getting things done through people, and it thus includes also the coordination, resourcing and scheduling of the people carrying out the different management activities (Sutherland 1983; Olum 2004).

In water field –like in any other field– numerous management frameworks have been developed to respond to the various needs related to water use. While the focus of this Thesis is on one such framework (IWRM), also several other, partly overlapping management frameworks exist. These include for example different forms of river basin management, Adaptive Water Management[30], ecosystem-based approaches as well as numerous integrated management frameworks (see Chapter 2.1 and Dyson et al. 2003; King et al. 2003; Pahl-Wostl 2007; Medema et al. 2008; Raadgever et al. 2008). While such frameworks differ in terms of their focus, objectives and methods, most have similarities as well. For the analysis presented in this Thesis, particularly important is the finding by Medema et al. (2008), who in their study about IWRM and Adaptive Water Management noted that similar issues are affecting the lack of success that practitioners have experienced throughout the implementation processes of both management frameworks[31].

THREE MANAGEMENT DIMENSIONS

Operational management = most practical management dimension: focus on predefined technical day-to-day routines, commonly at the project level.

Tactical management = broad, longer-term view to the existing management context: focus on expected pressures and trends affecting management routines, commonly at the program and policy level.

Strategic management = most strategic management dimension, often with little technical focus and strong political nature: focus on long-term planning and decisions including radical changes –externally and internally induced– in the management context, commonly at the policy level.

Management has also different dimensions that depend on the scope and timeframe of the management activities. The management dimensions are in this Thesis categorised into three general groups, following the classification of the decisions used in the decision theory (Sutherland 1983; Varis 1996): operational,

[30] Adaptive management can be defined as a collaborative process to cope with uncertainty through a learning model where natural resource management actions are taken not only to manage, but also explicitly to learn about the processes governing the system (Shea et al. 1998; Medema et al. 2008; Kallis et al. 2009). Some see also adaptive management to be an integrated management framework, as it is seen to provide a holistic view of specific research problems (Johnson 1999).

[31] Four main barriers common for the implementation of both approaches were found to be institutional; evidence of success; ambiguity of definition; and complexity, cost and risk (Medema et al. 2008).

tactical and strategic management[32]. Operational management represents the most practical and detailed management dimension, as it consists of the management of the day-to-day processes and operation routines with an aim to maintain their efficiency and predictability. Tactical management has then longer-term view, as it aims to understand and define responses to the expected pressures and trends affecting the management routines. Strategic management represents the most strategic management dimension, with focus on long-term planning that considers alternative changes in for instance technologies, user preferences and environment, together with their potential implications to the entire management structure[33] (Sutherland 1983; Gupta 1996; Varis 1996). While the methods used, activities implemented and –most importantly– the problems addressed differ greatly between the three management dimensions, they are rarely explicitly described in the guidelines related to integrated water management.

Waters can also be managed at different geographical scales, ranging from the local scale to sub-national, national and regional i.e. transnational scales. Different scales bring different kinds of challenges and opportunities to management, including the types of management institutions and stakeholders as well as the differing availability of information. Transboundary river basins have been of particular attention lately, as the multiple spatial and temporal scales are together with the inclusion of the differing views and the needs of riparian countries –each of them with their own cultural, social, economic, institutional and political characteristics– considered to make transboundary water management particularly complex[34] (Wolf et al. 1999; GWP 2000; UNESCO-WWAP 2003; Wolf et al. 2003; Phillips et al. 2008; Jägerskog & Zeitoun 2009).

Overall, basin is commonly considered as the most appropriate unit for water management, particularly when talking about rivers[35] (United Nations 1992b; GWP & INBO 2009; WWAP 2009). Related to this, Svendsen et al. (2005) recognise two basic organisational models for basin governance. In a centralised (unicentric) management structure, a single unified public organisation is empowered to make decisions regarding management of the basin, whereas in a decentralised (polycentric, coordinative) structure the actions of existing organisations, layers of government and initiatives are coordinated to cover an entire basin. Both have their advantages and disadvantages, and in reality most river basin management structures are hybrids between the two (Svendsen et al. 2005). As noted by Kidd & Shaw (2007) and Watson (2007), however, most advocates of integrated water management –including the GWP– seem to be promoting the decentralised management model as the most politically feasible, realistic and effective starting point for integrated water management.

Development of IWRM

Let us then turn to the focus of this Thesis, namely the concept of Integrated Water Resources

[32] While Sutherland (1983) and Varis (1996) define four decision categories for management systems (operational, tactical, strategic and directive), I have here combined the two latter categories under the term 'strategic management'. Both authors emphasise that while the operational category relies on deterministic view, tactical and strategic categories make use of probabilities and adaptation, and the directive category depends then on heuristic discovery processes. The authors also define typical methodologies for the four categories, consisting, respectively, of discrete-state (e.g. operations research tools), finite-state (e.g. statistical decision theory), stochastic-state (e.g. decision theory) and sequential-state (e.g. prescriptive model building) methodologies.

[33] Naturally also other, rather similar categorisations for different management dimensions and levels exist. For example Sage (1986, quoted in Jolma 1999) divides management actions into four levels (strategic planning decisions, management control decisions, operational control decisions and operational performance decisions), while Faludi & van der Valk (1994) use similar categories for the three levels of planning. Gupta (1996) refers to the so-called pyramid structure including three levels (top management focusing on strategic decisions, middle management focusing on tactical decision, and lower-level management focusing on operational decisions), providing also a table of the main characteristics of each decision-making level. Garcia (2008) recognises three levels of action related specifically to IWRM, consisting of operational level (execution), associate level (rules & strategies) and constitutional level (enabling), while Mitchell (1990b) notes that the concept of integrated water management may be applied to different levels of analysis, including normative (what ought to be done), strategic (what can be done), and operational levels (what will be done).

[34] Transboundary water management touches many areas and groups of people, as the world's 263 international river basins cover some 45% of the earth's land surface and contain nearly half of the available surface water (Wolf et al. 2003; Raadgever et al. 2008). Related to this, Wolf et al. (2003) identify 17 transboundary river basins with settings that suggest the potential for tensions in the near future – one of such basins being the Mekong.

[35] It must be noted, however, that in some instances –such as with the water management of large cities or of a transboundary river basin– basin may actually not be the most appropriate management scale, as the trends and driving forces impacting the management extend far beyond the actual basin areas.

Management (IWRM). Overall, the development of IWRM did not happen in vacuum, but it links closely to the conceptual development of water management as well as to the general discussion about integrated approaches in water management that was on-going most of the 20th Century[36]. The modern-day origins of IWRM are often found to be in the 1920s and 1930s, when a basin-wide, integrated planning approach gained acceptance in several countries, including Spain and United States[37] (Mitchell 1990a, 2007; Downs et al. 1991; Rahaman & Varis 2005; Watson 2007). An article prepared for the United Nations in 1962, however, refers even earlier dates, noting that the "philosophy of integrated, multi-purpose, river-basin planning"[38] was developed in the United States in a "remarkably complete form" already in the 1908 report of the Inland Waterways Commission (Weber & Hufschmidt 1962: 299). As a thought-provoking reference to the present-day discussion about IWRM, the article also emphasises "the interrelations between the land resources and surface and ground water flows", notes that the practice of integrated planning lags behind its principles and concludes that "broad, interdisciplinary team approach is essential to effective planning for comprehensive river basin development" (Weber & Hufschmidt 1962: 306, 310).

It is important to note, however, that these early versions of the integrated water management approach differ quite remarkably from the approaches we use and discuss today. While the early initiatives such as the Tennessee Valley Authority were largely about resource development, the focus of many integrated approaches shifted already in 1950s from comprehensive resource development to unified resource management. The approach has since then been further fine-tuned and diversified, including better incorporation of land into the concept in the 1980s as well as the increasing amount of nuances during the 'IWRM boom' in the 1990s and 2000s (Mitchell 1990a; Watson 2007).

Gaining international recognition

Among the first international calls for more integrated water management practices was the report published by the United Nations in 1958 on integrated river basin development. The report called for integrated management of river basins, recognizing the challenges of the dominant, narrow view on water: "Engineering measures are not likely to bring the desired improvements in level of living unless they are accompanied by secondary measures affecting other aspects of resource use" (United Nations 1958, quoted in Kates & Burton 1986). Integrated water management was also discussed in other contexts around that time, including international waters[39] (see e.g. United Nations 1971, 1975).

The first concrete steps towards the IWRM concept as it is known today were taken in the United Nations Conference on Water that was organized in 1977 in Mar del Plata, Argentina[40]. The conference and its Action Plan are due to their holistic view on water management considered to be the first internationally coordinated approach to the actual IWRM (Biswas 2004; Rahaman & Varis 2005; Snellen & Schrevel 2005). After that, the discussion about integrated approaches in

[36] Such discussions were naturally closely related to the broader concern about the limitations of narrow, technocratic view on water – a view that Allan (2003a: 2) links to the "hydraulic mission of industrial modernity". See also the fascinating analysis of Molle (2008: 131) on how IWRM eventually became a hegemonic "nirvana concept" as well as the interesting account of Linton (2006) on how naming water as a resource at the beginning of the 20th Century made the disposition of water a technical rather than a political problem, creating also an increased need for its management.

[37] The Tennessee Valley Authority –established in 1933 in United States– is usually referred to be among the first truly integrated management initiatives (see e.g. Weber & Hufschmidt 1962; Mitchell 1990a, 2007; Down et al. 1991; Rahaman & Varis 2005; Watson 2007), with Weber & Hufschmidt (1962: 302) defining it as "our [United States'] first fully-integrated river basin development".

[38] Integrated river basin planning was in the report defined as follows: "the concept of integrated river-basin planning … has two major elements: multiple-purpose use … and treating the river basin as a hydrological and physiographic unit" (Weber & Hufschmidt 1962: 299).

[39] United Nations (1975: 174), for example, notes that: "The prevalence of such interaction [between water and various actions related to environment and human activities] and the multiple uses to which a given water resource is increasingly put, accentuate the importance of integrated water resources management in national and regional development programmes".

[40] As noted by Biswas (2004), the conference was part of the series of eight mega-conferences that the UN organised in the 1970s at high decision-making levels on what was then considered as critical global issues. Other conferences focused on Environment (Stockholm 1972), Population (Bucharest 1974), Food (Rome 1974), Women (Mexico City 1975), Human Settlements (Vancouver 1976), Desertification (Nairobi 1977), and New and Renewable Sources of Energy (Nairobi 1979).

water management took place mainly at national and regional levels[41], and it was only in 1992 in Dublin, Ireland at the International Conference on Water and Environment for the 21st Century that IWRM really returned to the international arena (Biswas 2004; Varis et al. 2008a). The conference supported an integrated approach for managing waters, and called for a holistic, comprehensive, multidisciplinary approach to respond to water resources problems worldwide[42] (Solanes & Gonzalez-Villarreal 1996; Snellen & Schrevel 2005; GWP 2000).

The Dublin Conference acted as a preparatory meeting for the UN Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil in June 1992. The UNCED Conference –also called the Earth Summit– endorsed a program document, Agenda 21, that forms "a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, Governments, and Major Groups in every area in which human impacts on the environment" (United Nations 2009a). Notable was that although the Earth Summit had no specific focus on water, the Agenda 21 included a separate chapter on freshwater, calling for integrated water resources planning and management. Agenda 21 also proposed "integrated water resources development and management" as one of the program areas for the protection of freshwater resources, emphasizing the need to integrate the sectoral water programs with the national economic and social policy frameworks (United Nations 1992b: 18.5).

After the Earth Summit, the concept of IWRM was further developed and fine-tuned in a set of water-related conferences, including the International Conference on Freshwater in Bonn in 2001 as well as the series of World Water Forums[43] (Rahaman & Varis 2005, 2008). Remarkable was also that the World Summit on Sustainable Development in Johannesburg in 2002 –another major international event with no specific focus on water– recognized the importance of IWRM, putting it high into the international agenda (Varis et al. 2008a). The Summit's Plan of Implementation notes that as part of meeting the Millennium Development Goals (MDGs), the participants of the Summit agreed to "Develop integrated water resources management and water efficiency plans by 2005" to major river basins of the world, including actions to "Develop and implement national/regional strategies, plans and programmes with regard to integrated river basin, watershed and groundwater management" (WSSD 2002: 15).

Following these events and international endorsements, IWRM has during the first decade of the 21st Century arguably become one of the most widely recognized and applied concept in water management[44] (see e.g. Kindler 2000; UNESCO-WWAP 2003; Hall 2005; Rahaman & Varis 2005; UNESCO-WWAP 2006; UN-Water & GWP 2007; Keskinen 2007; Kidd & Shaw 2007; CSD 2008; Varis et al. 2008a; Lenton & Muller 2009a; GWP & INBO 2009). Due to the recognition of the UN system and various governmental agencies, IWRM also has an 'official' status as a management framework. The concept of IWRM has, however, also seen increasing criticism (see e.g. Allan 2003a, 2003b; Biswas 2005, 2010; Medema et al.

[41] For example the UN Economic Commission for Europe noted in 1984 in its Declaration of Policy on the Rational Use of Water the critical value of comprehensive water policies, highlighting the importance of multi-purpose uses of water as well as coordination of land-use planning and water management (United Nations 1985). In 1985, the OECD Environmental Ministers agreed that the management and protection of water, soil, forest and wildlife resources must be improved, suggesting that "an integrated approach in the management of these resources with the view to ensure long-term environmental and economic sustainability" should be used (OECD 1989: 3).

[42] A keynote paper prepared for the conference presented also one of the first visual illustrations of IWRM concept, consisting of four elements: water resources system, water users, social and economic development, and environment (Snellen & Schrevel 2005).

[43] Altogether five World Water Forums have been organised by the World Water Council so far: Marrakesh (1997), Hague (2000), Kyoto (2003), Mexico (2006) and Istanbul (2009).

[44] Biswas (2010: 13) summarises the powerful position of IWRM in the present-day water field as follows: "Everyone is for integrated water resources management: no matter what it means, no matter whether it can be implemented, or no matter whether it would actually improve water management processes".

2008; Molle 2008), and its actual implementation still lags behind the expectations – a fact that is recognized even by the promoters of the concept[45] (see e.g. UNESCO-WWAP 2006; UN-Water & GWP 2007; UN-Water 2008).

IWRM and its definitions: what actually to integrate?

Integrated Water Resources Management (IWRM) can be contemplated in several different ways depending, for instance, on the dimensions and needs of management. This also means that despite its popularity, there exists no commonly agreed definition for IWRM. However, clearly the most widely used –and analysed– definition is that of the Global Water Partnership (GWP) that defines IWRM[46] as follows (GWP 2000: 22):

> *"IWRM is a process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems."*

Building on this definition, IWRM is seen to help to manage and develop water resources in a sustainable and balanced way, taking into account social, economic and environmental issues and interests[47]. The GWP also emphasise that the equitability included in the definition indicates that IWRM recognises the competing interest groups, the sectors that use and abuse water, and the needs of the environment (GWP 2000; GWP & INBO 2009). At the same time the GWP's definition emphasises that IWRM is a process, not a goal in itself. Thus, as noted by Jønch-Clausen & Fugl (2001), IWRM is a means to an end, providing a process of balancing and making trade-offs between different goals in an informed way[48].

Another often used definition for IWRM is the one given by the World Water Council (2000):

> *"[IWRM is] philosophy that holds that water must be viewed from a holistic perspective, both in its natural state and in balancing competing demands on it – agricultural, industrial and environmental. Management of water resources and services need to reflect the interaction between these different demands, and so must be coordinated within and across sectors. If the many crosscutting requirements are met, and if there can be horizontal and vertical integration within the management framework for water resources and services, a more equitable, efficient, and sustainable regime will emerge."*

The differing definitions[49] for IWRM show that the different 'things' that are to be integrated within the IWRM are actually not clearly defined. The World Water Council –that interestingly sees IWRM more as a philosophy rather than as an approach– considers integration first and foremost as a sectoral matter, even though noting the importance of vertical and horizontal integration

[45] For example UNESCO-WWAP (2006: 54-55) notes that "It has proven difficult to integrate or coordinate land and water in a meaningful way, particularly for the rural and urban poor", while UN-Water & GWP (2007: 1) note that "many countries still had a long way to go in achieving the [IWRM] target, and most countries still faced considerable challenges in implementation".

[46] GWP (2000) does recognise the importance of water resources development as well, noting that the 'M' in the acronym IWRM actually refers to both development and management of water.

[47] Yet, as noted by Svendsen et al. (2005), such an objective has a strong normative content: it implicitly suggests that environmental, economic and social aspects can be made commensurable and compatible, although in reality they are frequently in conflict with each other and it is often impossible even to assess them in similar terms. Related to this, Molle (2008: 133) notes that as a "woolly consensual concept" IWRM can obscure the political nature of natural resources management and may thus be easily hijacked by groups seeking to legitimise their own agendas.

[48] Jønch-Clausen & Fugl (2001: 503), summarizing the thinking of the GWP, also highlight the differences that IWRM has with other "new approaches to water resources management and development", most importantly river basin management, water demand management and the ecosystems approach. They note that while IWRM is closely related to such approaches, it is broader in its focus and deals with more complex problems.

[49] Naturally also other definitions exist. For example Thomas & Durham (2003: 24) define IWRM as: "a sustainable approach of the water management that recognises its multidimensional character –time, space, multidiscipline and stakeholders– and the necessity to address, embrace and relate these dimensions holistically so that sustainable solutions can be brought about", while USAID (2007) defines it grandiosely as "a participatory planning and implementation process, based on sound science, that brings stakeholders together to determine how to meet society's long-term needs for water and coastal resources while maintaining essential ecological services and economic benefits". Mitchell (1990b) takes much broader –and less definite– view, recognising three different ways to see integrated water management: systematic consideration of the various dimensions of water, interaction with other systems such as land and the environment, and the interrelationships between water and social and economic development.

of the management structures as well. The GWP, on the other hand, gives two main categories for integration: the natural system and the human system. Integration within the natural system is seen to consist of several well-defined categories, including integration of freshwater management and coastal zone management, of land and water management, of green water and blue water, of surface water and groundwater management, of water quantity and quality and of upstream and downstream water-related interests. Integration within the human system is defined more vaguely, and includes for example cross-sectoral integration in national policy development, integrated policy-making and integration of all stakeholders in the planning and decision process (GWP 2000; Jønch-Clausen & Fugl 2001).

Also other, partly overlapping classifications for the 'things' to be integrated exist. The World Bank (2006), for example, defines integration to have the following dimensions: integration of different boundaries; integration of economic, social and environmental issues; integration of stakeholder and community views; and sectoral integration. Warner (2007a: 2) sees that the concept integrates four different kinds of relations: those between surface and groundwater as well as between quantity and quality; between water and land use; between water and stakeholder interests; and between water institutions. Jakeman et al. (2005), on the other hand, recognise altogether six dimensions for integration in water resources management: issues (e.g. agriculture, land management, biodiversity, population); parts of a river basin; major drivers; different disciplines; people involved or interested in a management problem; and models, methods, data and other information. Finally, Biswas (2010: 11) recognises "at least 41 sets of issues which different authors and/or institutions consider to be the issues that should be integrated under the aegis of integrated water resources management".

This ambiguity of the IWRM's definition is often seen to be one its major challenges: IWRM is seen as a kind of one-approach-fits-all concept that can be used in different ways depending on the needs and desires of different actors. While such a context-specificity is naturally important (and an inherent part of the entire concept), the vagueness of the very definition of IWRM makes the discussion about its theoretical underpinnings and the actual practices more challenging – and also exposes the entire concept for intentional and unintentional misuse. This challenge has in a way been intensified by the GWP, who through its guidelines –including the IWRM ToolBox– can be seen to be promoting a certain, rather technical way of seeing IWRM, making its implementation largely a technical and methodological issue[50] (GWP 2009, No date).

Yet, I personally see that it is simply impossibly –and also utterly useless– to try to define exhaustively what IWRM is and what it should integrate. Indeed, it can even be argued that the vagueness of IWRM's definitions is at least partly deliberate, as it allows the idea to be adopted in various different contexts as well as at the different levels of management[51]. This also means that –similarly to the definition of sustainable development (Vig 1999)– IWRM is more a political and social construct, rather than a strictly defined approach or blueprint.

At the same time it is still important to consider what IWRM ultimately seeks to achieve. IWRM –like most other integrated approaches– can be seen to build essentially on the concept of sustainable development, representing a way to put sustainable development into practice in the water field[52]. Consequently, the main issues to be integrated in an IWRM process include social, environmental and economic dimensions related to water, and the IWRM can be described first and foremost through its general objective: to

[50] While many IWRM practices have moved towards this direction, this has actually not been the objective of the GWP. GWP ToolBox textbook (No date: 1), for instance, emphasises the limitations of such a fixed guidelines: "Although the ToolBox aims to be a key reference instrument for the practical application of IWRM, it is neither a sacred text, where all truth can be found, nor a manual, from where an answer for any problem at hand can be lifted".

[51] Indeed, vagueness can also be the strong point of the IWRM, particularly if it results in improved consideration of local circumstances in specific management situations (see also Butterworth et al. 2010).

[52] For example a recent background document for the UN General Assembly noted that "Evidence strongly points to the fact that water management needs to be embraced as a crosscutting sustainable development issue, where actors from different fields –agriculture, industries, energy, health and the environment– together with national security experts within and across countries need to come together" (United Nations 2009b: 2).

achieve sustainable water management and, more broadly, sustainable development. The additional issues –sectors, disciplines, stakeholders, scales, institutions, types of information and so on– to be integrated are naturally relevant as well, but they can be seen mainly as a practical, context-specific means to achieve the overarching objective of integration, namely sustainability.

Following from this, it is possible to define IWRM in less technical and more philosophical ways, escaping the traps set by exact word-by-word definitions (see e.g. critique by Biswas (2005, 2010)). Instead of comprehensively describing the entire IWRM process, these kinds of broader definitions aim to understand what kinds of processes IWRM actually seeks to initiate and what kinds of outcomes it wants to achieve. For example Warner (2007a: 2) takes this kind of view when he considers IWRM as "a multi-layered systems approach to water management" and concludes that "IWRM is about decompartmentalising water management, respecting the interactions and internalising the externalities that come with a sectorial approach". Grigg (2008) takes similarly general approach when he notes that IWRM is essentially about balancing viewpoints and improving management. Mitchell (2007: 51), on the other hand identifies "10 generally accepted characteristics of IWRM"[53] that can be seen to represent the ultimate objectives of an IWRM process. These characteristics can be summarised as follows: holistic view; analytical; dynamic and continuous; interdisciplinary; balance between ecosystem protection and water-related economic development; stakeholder involvement; evolutionary and iterative; conflict reduction; awareness promotion; and capacity building (Kindler 2000; Mitchell 2007).

2.4 INTEGRATION IN IMPACT ASSESSMENT – CASE IA

Assessing the impacts

Assessing the estimated impacts of planned development to water and related resources forms an increasingly important part –and a precondition– of the current water management practices. The situation is similar to other forms of planning and management, and Rayner (2003: 164) has even called the present era the "age of assessment" due to the increasing dominance of the assessments in planning and decision-making processes. Consequently, although the main focus of this Thesis is on the theories and practices of water management, impact assessment forms an important part of the research as well.

Impact assessment can be generally defined as a process of identifying the consequences of a current or proposed action on a defined entity –such as environment, health or livelihoods–, usually before making decisions on their implementation[54] (United Nations 1992a; IAIA 1999; Vanclay 2004; Kummu 2008; CBD 2009). While the specific aims of impact assessment naturally differ depending on the context, they are generally carried out in order to ensure that the proposed actions and their impacts are economically viable, socially equitable and environmentally sustainable – an objective thus perfectly in line with the concept of sustainable development. The possible assessment actions may include individual projects, but also more broadly policies, plans and programmes (United Nations 1992b; Vanclay 2004; Nooteboom 2007).

Impact assessment has, however, relatively different meanings in different settings, and as a result more specific terms are used depending on

[53] While generally agreeing with most of the characteristics Mitchell presents, I would argue that they are still far from being "generally accepted" (or at least generally understood), as exemplified by the continuous challenges with the IWRM practices.

[54] Separately, the term 'assessment' can be defined as a process in which the significance, value or likelihood of something is being estimated, while the term 'impact' can be defined as the effect or influence of one thing on another (Rotmans & van Asselt 1996; Oxford University Press 1999). Impact assessments can also be done ex post, meaning assessing the impacts of past actions. In this Thesis, however, the focus is on ex ante impact assessments that focus on the impacts of current and, in particular, future actions (Shiferaw et al. 2004).

the focus of the assessment. The most common impact assessment approach is Environmental Impact Assessment (EIA), but also other, partly overlapping approaches exist. These include for example Integrated Assessment, Cumulative Impact Assessment, Strategic Environmental Assessment, Social Impact Assessment, Participatory Impact Assessment, Vulnerability Assessment and –specific for the water field– Hydrological Impact Assessment. Although sharing similar overall objective, the different approaches differ in terms of their scope as well as the methods they use. As the different impact assessment approaches are, however, already discussed extensively elsewhere (see e.g. Sadler 1996; Rotmans 1998; UNECE 2003; MRCS/BDP 2005; OECD/DAC 2006; Catley et al. 2007; Kummu 2008; MRCS/WUP-FIN 2008), this Thesis focuses on the approach that is particularly relevant for this Thesis, namely Integrated Assessment.

Integrated Assessment (IA)

Integrated Assessment (IA) is an impact assessment approach that, similarly to other integrated approaches, builds on a holistic view and considers multiple issues involving many stakeholders and interests. While Integrated Assessment has been most extensively used in climate change studies, it is increasingly applied also in other fields: particularly those related to environmental management and sustainable development (Rotmans & van Asselt 1996; Rotmans 2006), but also in the water field (Letcher & Jakeman 2003; Letcher at al. 2005). Although its ultimate scope is different, Integrated Assessment thus provides an interesting reference point for integrated water management approaches, most importantly for IWRM.

Integrated Assessment has been defined as[55] (Rotmans 1998: 155):

> *"a structured process of dealing with complex issues, using knowledge from various scientific disciplines and/or stakeholders, such that integrated insights are made available to decision makers."*

The main difference to other types of impact assessment is that Integrated Assessment looks at particularly complex and multifaceted issues, with an aim to understand and communicate further these complexities through the utilisation of multi- and interdisciplinary approaches in a process- based context (Rotmans 1998). IA is thus essentially about combining and communicating knowledge, and the so-called IA toolkit therefore includes two kinds of methods: analytical and participatory (Rotmans 1998, 2006; Harremoës and Turner 2001). Analytical methods are supply-driven, and provide analytical framework for presenting knowledge in an integrated manner with the help of methods such as models, scenarios and risk assessment. Participatory methods, including for instance policy exercises, dialogues and mutual learning, are more demand-driven, building on deliberative, communicative processes with an aim to increase the interaction between scientists, decision-makers and stakeholders (Rotmans 1998; Harremoës and Turner 2001).

Integrated Assessment does not necessarily require new research, as it aims to review and analyse information derived from already existing research (van der Sluijs 2002). Consequently, IA can be seen to build on following three elements: scientific basis, methods and practice (Rotmans 1998; Toth and Hizsnyik 1998). Following from this, Integrated

[55] Later on, Rotmans has also provided a more detailed definition (Rotmans 2006: 38-39): "Integrated Assessment is the science that deals with an integrated systems approach to complex societal problems embedded in a process-based context. IA aims to analyse the multiple causes and impacts of a complex problem in order to develop policy options for a strategic solution of the problem in question. IA itself involves a process whereby IA tools form the equipment to perform the assessment". Similarly to IWRM, there are also alternative definitions, and for example Lee (2006: 58) notes that "integrated assessment covers three types of integration: Vertical integration of assessments i.e. linking together separate impact assessments, ...Horizontal integration of assessments i.e. bringing together different types of impacts, and ...Integration of assessments into decision-making".

Assessment seeks to find a balance between various contradictory issues, including simplicity vs. complexity; aggregation vs. disaggregation; stochastic vs. deterministic; quantitative vs. qualitative; exogenous vs. endogenous factors; and social sciences vs. natural sciences (Rotmans 1998).

It is apparent that Integrated Assessment shares many similarities with IWRM. Both approaches aim to integrate differing views, sectors and disciplines, and both are also struggling with maintaining a balance between the theory and the practice. In addition, both include 'toolboxes' that seek to provide practical guidance on how to carry out the integration. At the same time Integrated Assessment also has interesting distinctions from IWRM. The literature on IA, for instance, includes detailed discussions about the strengths and weaknesses and general applicability of the proposed IA methods. The analytical methods of IA put equal emphasis to more technical analysis methods such as models and to more innovative, qualitative methods such as scenario building. For me, however, the most important difference between IA and IWRM is the prominence that IA puts on communication: integration in IA is not just about combining things together, but also very much about interaction between different groups of people in different settings. Related to this, IA considers analytical and communicative methods in an equal manner, the latter meaning methods used for cooperation, communication and dialogue between different people.

2.5 INTEGRATION IN RESEARCH – MULTI-DISCIPLINARY APPROACHES

Along with management and impact assessment, also research is seeing increasing calls for more comprehensive and systemic views and, consequently, for integrated approaches. This integrationist drive is most visible in the development of multi-disciplinary research approaches that aim towards greater integration between different disciplines and research practices. Such approaches are often open and interactive, involving also non-scientific forms of knowledge.

This chapter provides a brief overview of four such multi-disciplinary approaches. Although the approaches are here discussed at general level, they are well applicable in water-related research due to the multidimensional nature of water and its management. Indeed, the disciplines that are considered critical for water management are usually seen to include at least economics, sociology, law, engineering, hydrology as well as several 'sectoral' disciplines such as forestry, land use and agriculture[56] (COHS et al. 1991; Dingman 2002; Max-Neef 2005). Research approaches that are actively interacting with non-researchers –most importantly managers and decision-makers– are also critical in bridging the much-discussed gap between the theory and the practice in environmental management (Lee 2006). It is therefore no surprise that the significance of multi-disciplinary research practices is frequently highlighted by integrated management and assessment approaches, including IWRM and Integrated Assessment.

Scientific disciplines[57] can generally be defined by their core conceptions and assumptions as well as by the acknowledged methods for valid inquiry and problem formulation (Attwater et al. 2005). A discipline thus provides the scientist with an identity: it maintains an institutional order and has its own professional standards as well as publication and education procedures. Disciplines are not, however, characterized only by their subject matter, but also by the principle of scientific reduction: disciplines usually focus their analysis to certain, predefined elements (Janssen & Goldsworthy 1996). The science has during the past decades experienced an unprecedented

[56] Most of these disciplines naturally build on so-called basic –or empirical– disciplines such as mathematics, statistics, biology, economics and soil science (Dingman 2002; Max-Neef 2005).

[57] The term 'discipline' can be defined as a specific field of study that creates its own branch of scientific knowledge.

period of differentiation to disciplinary units, with the amount of disciplines counting already several hundreds, if not thousands[58] (Kötter & Balsiger 1999).

Yet, as noted by Campbell (1969, quoted in Ramadier 2004), the division of research into separate disciplines is due to historical development rather than to genuine scientific necessity. Indeed, the current dominance of scientific disciplines and their narrow and reductionistic focus has in many cases led to overspecialisation with weak connection to the actual challenges that the societies are facing (see e.g. Janssen & Goldsworthy 1996; Kötter & Balsiger 1999; Bruun et al. 2005; Taylor 2009). As elegantly summarised by Scholz & Marks (2001): society has problems, whereas universities have departments[59].

The current limitations in the production of scientific knowledge are particularly visible in the fields where different disciplines are naturally closely connected, such as studies on land use, urban development, natural resources and water[60]. Consequently, there is a rising demand to supplement the contemporary modes of scientific knowledge production with ones that connect ideas, methods and knowledge from several different disciplines, aiming ultimately for more problem-driven, context-specific and cooperative research approaches (Gibbons et al. 1994; Scholz & Marks 2001; Nowotny et al. 2003).

Similarly to environmental managers, the scientists are thus experiencing a drive towards greater integration. Also the reasons for the integration are analogous: integration aims to go around the challenges with separate, disciplinary research traditions, but it also seeks to facilitate sustainable development. For it was the Agenda 21 of the Earth Summit in 1992 that opened up a new area of activity for the sciences –the one dealing with the theme sustainability–, and also emphasised that research on environment and development should be carried out in an interdisciplinary and integrated manner[61] (United Nations 1992b; Kötter & Balsiger 1999).

These new, integrated modes of knowledge production can be described in different ways. Janssen & Goldsworthy (1996), for example, name the main types of disciplinary integration as additive, nondisciplinary, integrated and synthetic. This Thesis, however, builds on the commonly used notion of 'multi-disciplinarities' that are usually seen to include multidisciplinarity, crossdisciplinarity, interdisciplinarity and transdisciplinarity[62]. As there is not a clear, commonly agreed definition for these partly overlapping approaches, I will next present my own definitions and visualisations for them, drawing on information from various sources (Gibbons et al. 1994; Janssen & Goldsworthy 1996; Rapport 1997; Scholz & Marks 2001; van den Besselaar & Heimeriks 2001; Lawrence & Després 2004; Pinson 2004; Attwater et al. 2005; Bruun et al. 2005; Max-Neef 2005; Willamo 2005; Mäki 2007; Mikkeli & Pakkasvirta 2007). While unavoidably insufficient, such definitions will hopefully nevertheless assist in understanding the main differences between the research approaches, and help to highlight their potential applicability in the field of water management.

[58] German philosopher Jürgen Mittelstrass counted already over a decade ago that the increasing differentiation of the scientific system has led to approximately 4000 different disciplines (Mittelstrass 1996, quoted in Kötter & Balsiger 1999).

[59] It can even be questioned whether the term 'university' is actually accurate, as the current universities are more like 'multiversities' divided into separate departments and disciplines (Mikkeli & Pakkasvirta 2007). Related to this, Taylor (2009) makes an interesting argument to replace permanent university departments with problem-focused programs that could have different themes, one of them water. See also discussion by Delanty (1998) about the role that universities should have in today's society focused on –even obsessed with– information as well as Max-Neef (2005: 5), who notes that "uni-disciplinary education is still widely predominant in all universities".

[60] For example Noss & Cooperrider (1994: 80) note that the so-called disciplinarianism –by which they mean the partition of environmental issues into separate disciplines and sectors– "has resulted in a fragmented and inefficient pattern of natural resource management. Individuals trained in one discipline work on problems in isolation from other specialists, even within the same agency".

[61] Agenda 21 notes that the countries –developing countries in particular– should "develop specialists capable of working in interdisciplinary programmes related to environment and development" and that "countries, assisted by international organizations, non-governmental organizations and other sectors, could strengthen or establish national or regional centres of excellence in interdisciplinary research and education in environmental and developmental sciences, law and the management of specific environmental problems." (UN 1992b: 35.22, 36.5).

[62] Also other terms exist, including pluridisciplinarity, intradisciplinarity, co-disciplinarity, condisciplinarity and even post-disciplinarity (Janssen & Goldsworthy 1996; Kötter & Balsiger 1999; Ramadier 2004; Max-Neef 2005; Mäki 2007). In addition, for example Kötter & Balsiger (1999) use the term 'supradisciplinarity' in a similar way than I use here the general term 'multi-disciplinarity'.

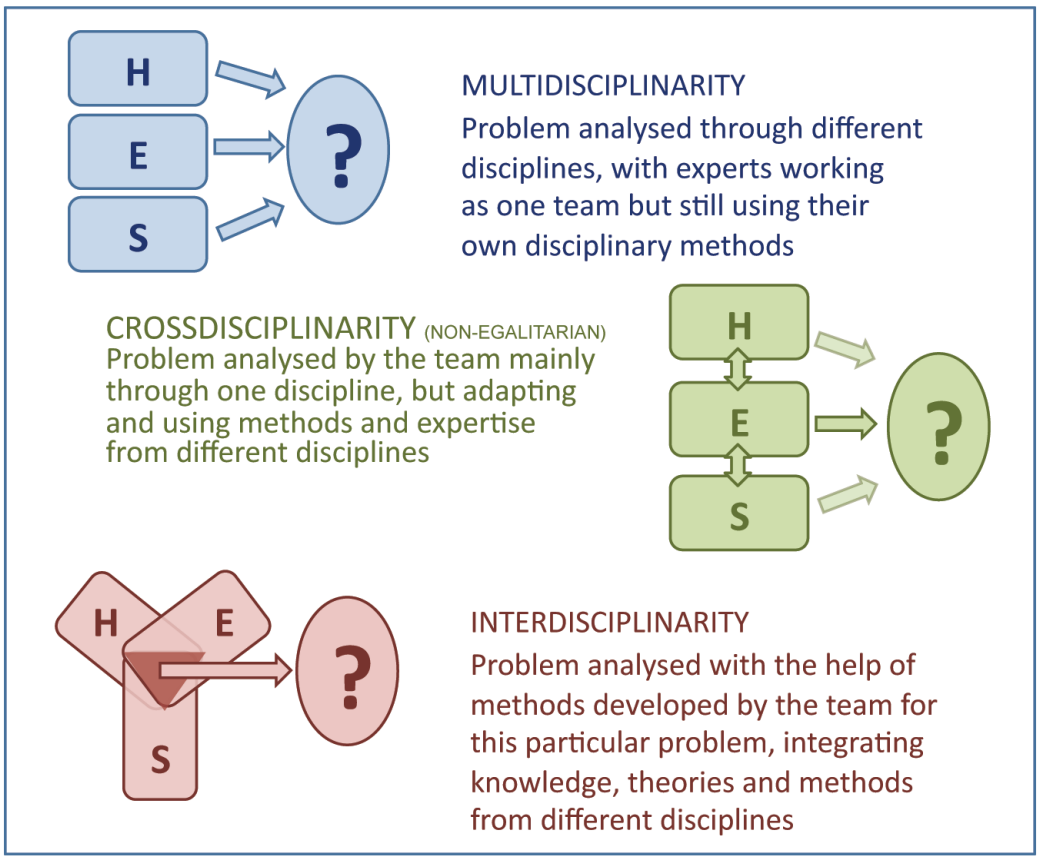

Figure 3 Simplified visualisations on how scientific disciplines (H, E, S) are used in an analysis of a research problem under the three specific forms of multi-disciplinarity.

Multidisciplinarity

Multidisciplinarity can be seen to be the simplest form of the four multi-disciplinary research approaches, as it indicates viewing the topic from a variety of disciplinary perspectives, but producing specific disciplinary knowledge on it using methods common for each discipline (Figure 3). The members of a research team thus perform their research separately and speak with separate voices, and the disciplinary identities and contents remain largely unchanged. In water management, an example of this kind of multidisciplinarity is a research team that includes experts from several different disciplines –e.g. hydrologist, limnologist, agricultural economist, sociologist and botanist–, with the different experts studying the research problem (e.g. potential impacts of a proposed hydropower dam) independently, using methods from their own disciplinary research traditions.

Given the focus of this Thesis, it is important to note that most of the current management and research teams in the Mekong Region –and indeed in general in water management– fall into this category (see *Article VII*) – in case they are not 'unidisciplinary', in other words including members from just one main discipline such as water engineering (see also Max-Neef 2005).

Crossdisciplinarity

Crossdisciplinarity takes one step forward from multidisciplinarity, as it also includes crossing disciplinary boundaries and interacting with

neighbouring knowledge domains and methods of knowledge production (Figure 3). This interaction can be either egalitarian or non-egalitarian: in the former, the contents of different disciplines are fused so that major parts of both are integrated with one another, while in the latter the contents of one discipline override those of other disciplines (Mäki 2007). In both cases, the research topic is viewed with different disciplinary angle and possibly also with different methods than with a single discipline. In many cases, crossdisciplinarity takes a non-egalitarian form, and the research topic is thus analysed primarily from a certain discipline's point of view, with the analysis drawing on methods, ideas and expertise from other disciplines as well.

Interdisciplinarity

Interdisciplinarity differs clearly from multi- and crossdisciplinarity. Interdisciplinary approaches[63] integrate separate disciplinary data, methods, tools, concepts and theories to create a holistic, systemic view of a complex issue. Interdisciplinarity is thus more than a simple sum of the parts, going beyond single disciplines and doing much more than "merely bringing other points of view into the picture, as in multi- or cross-disciplinary studies" (Rapport 1997: 289). For this reason, interdisciplinarity also connects to the concept of integration, and the noun 'integration' and the adjective 'integrative' are both used to describe this specific form of disciplinarity (Bruun et al. 2005).

Interdisciplinarity thus aims to address the research topic without the constraints of different disciplines, using methods that seem to be most appropriate for a particular problem and context (Figure 3). An interdisciplinary research approach is thus application-orientated, and it views critically the underlying assumptions of different disciplines and can create its own theoretical and conceptual identity – and even new discipline-free theories and methods. An example of interdisciplinary research team would be one with multiple disciplinary experts that comes together, starts by defining jointly the research problem, and then decides by which kinds of theories and methods –existing or entirely new– the team is going to tackle the problem together.

Transdisciplinarity

Transdisciplinarity provides one significant step forward from the other forms of multi-disciplinarity, shifting from the mixing of disciplines towards the fusion of disciplines (Lawrence & Després 2004). Transdisciplinarity is commonly considered as a process of creative 'transcendence' of disciplinary perspectives, whereby a framework for characterizing larger level processes transcends the frameworks used to characterize its parts (Rapport 1997; Attwater et al. 2005). As noted by Max-Neef (2005: 15): transdisciplinarity is "a different manner of seeing the world, more systemic and more holistic".

Similarly to interdisciplinarity, transdisciplinarity thus draws on a particular context of application with its own theoretical structures and methodological practices that are often not locatable on the prevailing disciplinary map[64] (Gibbons et al. 1994). Contrary to the other forms of multi-disciplinarity, transdisciplinarity also forms a collaborative research and problem solving approach that crosses both disciplinary boundaries and the different sectors of society, including their ways of producing and using knowledge. Consequently, as noted by Nicolescu (1996, quoted in Ramadier 2004), transdisciplinarity is at the same time between the disciplines, across the different disciplines and beyond the disciplines.

[63] There are different forms of interdisciplinarity, and for instance Bruun et al. (2005) recognise instrumental, strategic, pragmatic, opportunistic, critical and reflexive forms. They also note that when a combination of two or more disciplines has a relatively long history of integration as well as established structures, traditions, methods and a paradigm, such combination may turn into a new discipline altogether. Indeed, as noted by Mikkeli & Pakkasvirta (2007), many fields of science –such as sociology or water sciences– have by their very nature always been interdisciplinary.

[64] The concepts of interdisciplinarity and transdisciplinarity have plenty in common and they are sometimes used interchangeably. However, as noted by Lawrence & Després (2004), the difference between the two is visible already in the Latin prefix 'trans', indicating transgress of the boundaries defined by traditional disciplinary modes of enquiry. In transdisciplinary research the focus is thus on the organisation of knowledge around complex heterogeneous domains, rather than around the disciplines into which knowledge is commonly organised (as is the case with other multi-disciplinary research approaches, including interdisciplinarity).

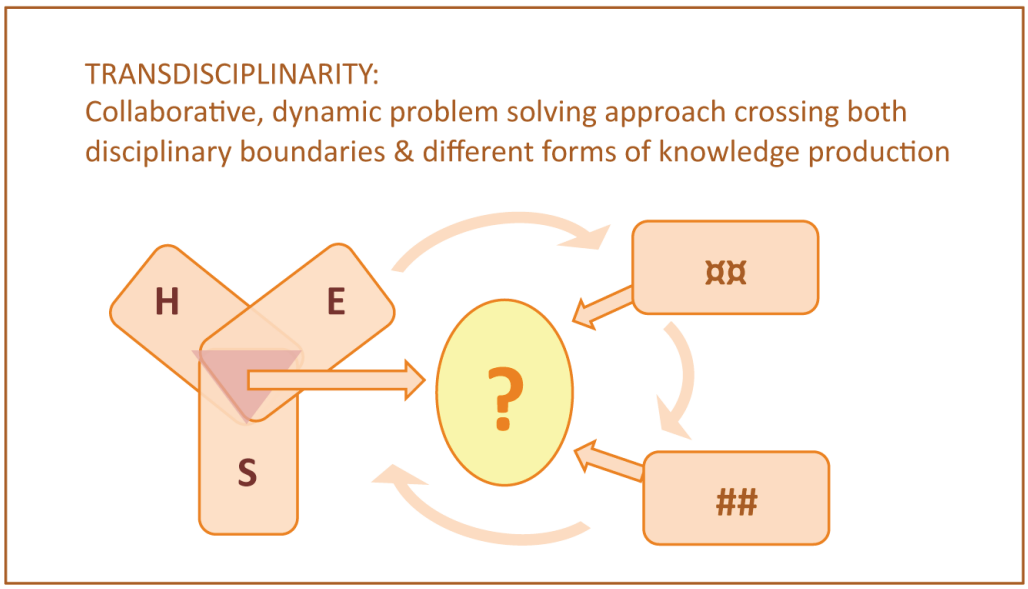

Figure 4 A simplified visualisation on how scientific disciplines (H, E, S) and other forms of knowledge production (¤¤, ##) are used in a transdisciplinary analysis of a research problem.

In this way, transdisciplinarity moves away from the idea of science about the society towards science for and with the society (Gibbons et al. 1994; Scholz & Marks 2001). It thus challenges and expands the traditional concept of expertise, shifting it from the limited sphere of scientists to include also other actors within the society (Figure 4). Transdisciplinarity has close linkages –similarly to other multi-disciplinary approaches– to the broader discussion about the ways to produce knowledge, including the roles of non-scientific forms of knowledge in enhancing the understanding of the society and its interactions with nature (see e.g. Kuhn 1970; Gibbons et al. 1994; Nowotny et al. 2001). Related to this, Gibbons et al. (1994) include the transdisciplinarity as one fundamental element for their much-discussed Mode 2 of knowledge production[65]. An example of a transdisciplinary research team would therefore extend the idea of interdisciplinary team, with the team consisting not of only scientists, but also other actors having ideas and knowledge on a particular problem.

[65] In their well-known book 'The New Production of Knowledge', Gibbons et al. (1994) named the more application-orientated, socially accountable and transdisciplinary form of knowledge production as Mode 2 to highlight its differences to the conventional, more academic and discipline-based knowledge production (Mode 1). For many, Mode 1 is identical with what is commonly meant by 'science'.

Discussion about different disciplinarities

The discussion presented above sought to provide concise definitions for the different types of multi-disciplinary research approaches to understand better their use and applicability in water management. Such a short introduction is, however, by no means exhaustive, and naturally also other ways of conceptualising different disciplinarities exist. Among the most interesting definitions in this regard is the classification provided by Max-Neef (2005), who defines the different types of multi-disciplinarities with the help of hierarchical levels of disciplines. Max-Neef (2005) recognises four such levels: Empirical level, Pragmatic level, Normative level, and Value level.

Empirical level is seen to include disciplines such as mathematics, chemistry, geology and economics, and it aims to ask and answer the question 'What exists?'. Pragmatic level includes then more applied disciplines such as engineering, agriculture and medicine and focuses on the question 'What are we capable of doing?', while normative level includes disciplines such as planning politics and environmental design and answers the question 'What is it we want to do?'. Finally, value level includes themes such as ethics, philosophy and

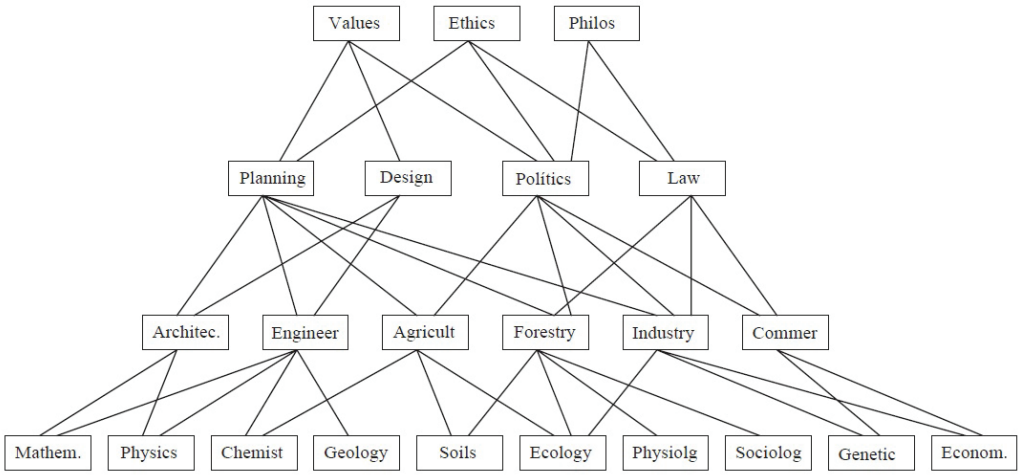

Figure 5 The 'disciplinary pyramid' of Max-Neef (2005), based on the four hierarchical levels of disciplines: empirical (the lowest), pragmatic, normative and value level. Transdisciplinarity is seen to consist of vertical relations including all four levels.

theology, and asks and answers the fundamental question "How should we do what we want to do?" (Figure 5).

Based on these hierarchical levels, Max-Neef (2005) defines multidisciplinarity and crossdisciplinarity (that he calls pluridisciplinarity) in a rather similar way than I have done above. The biggest differences are, however, related to his conceptualisations of interdisciplinarity and transdisciplinarity. For Max-Neef (2005), interdisciplinarity builds around the notion of coordination, indicating the coordination of lower hierarchical levels from a higher one. With the four hierarchical levels presented above, such a definition leads to three different interdisciplinarities: values interdiscipline, normative interdiscipline, and pragmatic interdiscipline. Transdisciplinarity, on the other hand, is the result of coordination between all hierarchical levels, and any multiple vertical relations including all levels can therefore be regarded as a transdisciplinary action (Figure 5) (Max-Neef 2005)[66].

More generally, it is important to note that the move towards greater interaction between disciplines is not without problems either. The understanding of the different multi-disciplinary concepts is often weak, and as a result their actual practices can still be planned and implemented through specific disciplinary views – as seems to be the case in the Mekong, too (*Article VII*). It is also obvious that multi-disciplinary research approaches can never fully replace disciplinary approaches, but they are rather complementing them in the situations where disciplinary views are considered to be inadequate. The real significance of multi-disciplinary research approaches is therefore the fact that they provide an altogether new view for a specific research problem, and that such a novel view may help to find new kinds of solutions for the problem[67] (Mikkeli & Pakkasvirta 2007).

[66] For Max-Neef (2005: 9) this kind of definition for transdisciplinarity is just weak transdisciplinarity, as it is "based on practical and simplified approach, addressed towards the applicability". While this kind of conceptualisation is sufficient in the practical context of this Thesis, Max-Neef (2005) also provides a conceptualisation for much more theoretical transdisciplinarity (so-called strong transdisciplinarity) that builds on three fundamental pillars: the two levels of reality, the principle of the 'included middle', and complexity.

[67] The discussion about multi-disciplinary research approaches also links to the more fundamental debate about science and its role in the society. For example Balsiger (2004) raises the question about the drivers for increased interaction between the science and the society, suggesting that there is actually no real scientific need for transdisciplinarity, but that it has become popular only because it has been favoured by the policy-makers. Weingart (2001, quoted in Balsiger 2004) takes even more radical stance, concluding that the underlying epistemological core of the entire debate is located much deeper than at the level of how to cross disciplinary boundaries: instead, Weingart suggests that the key question is whether there is a new argument emerging in science to prefer practical reason against the traditional pretension of truth.

3 Mekong River Basin

The geographic focus of this Thesis is the Mekong Region in Southeast Asia, and particularly the transboundary Mekong River Basin and the related Tonle Sap Lake area in Cambodia. While the thematic and methodological discussion may be applicable also elsewhere, it is important to note that all studies and analyses described in this Thesis apply particularly to this geographical and geopolitical area. Focus on the Mekong Region also connects this Thesis to the field of development research with its specific implications[68]. As the various aspects of the Mekong Region are, however, discussed in detail in the appended articles, this chapter provides only a summary of the main characteristics of the river basin and its institutional setting.

The Mekong River –also called the Mother of Rivers[69]– is among the greatest rivers of the world: it is the 10th largest in the world both with its estimated length of 4909 km and the mean annual flow of 475 km^3 (Shaochuang et al. 2007; MRC 2005; *Article I*; *Article VII*). The Mekong is also one of the world's most pristine large rivers, as its flow hasn't yet been irreversibly modified by large infrastructure[70] (MRC 2005, *Article II*). The annual monsoon rains are responsible for the so-called flood pulse that annually creates vast and highly productive floodplains into the lower part of the river basin.

The Mekong and its flood pulse system facilitates probably the most abundant freshwater fisheries in the world, with hundreds of fish species and approximately 2.6 million tonnes harvested annually from the Lower Mekong Basin alone (Poulsen et al. 2002; Sverdrup-Jensen 2002; Coates et al. 2003; Hortle 2007). Not surprisingly, the fisheries in the basin are critical for the food security and livelihoods of the entire region. Also the economic value of the Mekong fisheries is remarkable, with the current estimates of the first-sale value being around US$ 2 billion per year (Dugan 2008). Due to the lack of reliable, long-term data, however, the estimates on fish and fisheries in the region remain sketchy, and the reliability of fisheries statistics can be questioned in many areas, including the Tonle Sap Lake (Lamberts 2006). The role of fisheries in supporting the economy and the livelihoods has also been frequently downplayed in the national and regional development plans, particularly in those related to hydropower development (Friend et al. 2009).

The Mekong River is a major transboundary river and its basin reaches to the area of six different countries; China, Burma/Myanmar, Thailand, Laos, Cambodia and Vietnam. The river and its tributaries have different social, economic

[68] Although the developmental dimension of this research is not a particular focus of this Thesis, it has nevertheless been central in guiding the research questions, theories and methods presented. This can also be seen to create certain fundamental challenges, as most of such terms and theories are drawing on the ideas, views and practices of the so-called Global North and are therefore by no means completely neutral. For more discussion on the issue, see the critical views on development by Sachs (1992b), Esteva (1992) and Cornwall & Brock (2005), the critique by Linton (2008) on the one-sidedness of the concept of hydrological cycle, the interesting account of Molle (2008) about the nirvana concepts prevalent in the today's water field as well as the fascinating article of Rahaman et al. (2004) on the mismatches between the EU Water Framework Directive and IWRM.

[69] The Mekong River has different names in different riparian countries. In China, the river is called Lancang Jiang, while in Thailand the river's name originates from the Thai epithet of the river, Mae Nam Khong, which means the Mother of the Rivers. In Laos and Cambodia the river is known with similar name: Menam Khong and Mekongk, respectively. In Vietnam, the river and its delta is referred to by name Cuu Long, meaning nine-tailed dragon (Öjendal 2000).

[70] Strongly modified waterscapes are naturally also found within the basin: the Mekong Delta of Vietnam is a particularly interesting example of water regime intensively regulated by human interventions (see e.g. Miller 2003; Käkönen 2008).

Table 1 The main functions, impacts and threats related to the Mekong River and its tributaries in five Mekong riparian countries (modified from *Article I*). Burma/Myanmar has been excluded from the table due the lack of reliable information and the small significance of the Mekong for the country.

	Main use / function	Major feared impacts caused by the country	Major threats to the country
China	Hydropower, transportation route	Dams causing flow changes (e.g. levelling out the floods) and trapping of sediments and nutrients	Lack of energy and transportation routes
Thailand	Water for irrigation and other uses, incl. hydropower	Environmental degradation, flow changes	Lack of water for irrigation, lack of energy
Laos	Hydropower, navigation, aquatic resources	Dams causing flow changes and sediment trapping, mainstream dams blocking fish migration	Lack of energy and related income + impacts to agriculture and fishing, river bank erosion,
Cambodia	Aquatic resources, irrigation, possibly hydropower	Planned mainstream dams blocking fish migration, negative impacts due to unsustainable fisheries management	Changes in floodplains, particularly in Tonle Sap → impacts to fish & agriculture
Vietnam	Irrigation (Delta), hydro-power (Central Highlands)	Increasing environmental degradation and water quality problems in the delta due to intensive agriculture and aquaculture and dense population	Decreased dry season water flows; increasing saline water intrusion and impacts to irrigation. Sedi-ment trapping by dams affecting deltaic processes.

and cultural roles in different riparian countries (Table 1). In the primarily rural economies of Cambodia, Laos and the Mekong Delta of Vietnam, the river is the lifeline of the local people as it enables the livelihoods for millions of fishers and farmers. Although not accessible for large-scale navigation, the Mekong River is an important navigation route particularly for landlocked Laos and the Yunnan Province of China. The river and its tributaries are also important sources of hydropower, and consequently, energy and income for the riparian countries (*Article I*).

The Mekong River Basin is often divided into two main parts, the Upper Basin and the Lower Basin[71]. China and Burma form the Upper Basin that constitutes approximately 24 % of the total catchment area and 18 % of the total annual flow (MRC 2005; *Article I*). Similarly to many other great rivers of Asia, including the Yangtze, the Salween, the Irrawaddy and the Red, the Mekong River has its origins in the Tibetan Plateau of China at around 4'500 metres above sea level. From there the river flows through the territories of China, Laos, Cambodia and Vietnam –touching on the way the borders of Burma and Thailand– to the South China Sea. The total catchment area of the Mekong is estimated to be around 795'000 km^2 (MRC 2005), although also larger estimate of 816'000 km^2 has been provided more recently by Kummu (2008) (Table 2).

[71] Most international publications on Mekong –including this Thesis– focus on the Lower Mekong Basin. This has much to do with the heavy international involvement in the Lower Mekong that has also made English the *lingua franca* of the area. As noted by Diokno & Chinh (2006), such an emphasis has also historical reasons: the concept of Mekong has been strongly influenced by the mid-19th Century French explorations of the river and the subsequent colonisation over much of the area in the Lower Mekong Basin.

Table 2 The catchment areas and propositional average flows of the Mekong in the riparian countries (modified from MRC 2005).

	China	Burma	Laos	Thailand	Cambodia	Vietnam
Catchment area (km^2)	165 000	24 000	202 000	184 000	155 000	65 000
% of total catchment	21%	3%	25%	23%	19%	8%
% of annual flow	16%	2%	35%	18%	18%	11%

3.1 MEKONG – MORE THAN A RIVER

Although in hydrological terms the focus of this Thesis is on the Mekong River Basin, many of the issues discussed apply to and take place in the broader context of the Mekong Region. While the former is an entity defined by physical boundaries i.e. the watershed of the Mekong River, the latter is commonly defined through administrative –in other words man-made– boundaries of Cambodia, Laos, Burma/Myanmar, Thailand, Vietnam and China's Yunnan Province[72]. Consequently, in this Thesis the Mekong Region is defined to cover the territories as well as environmental, social, economic, political, cultural and institutional aspects of the riparian countries and areas (Kaosaard & Dore 2003).

Such a broad view is particularly important now when the Mekong Region is undergoing rapid transitions socially, economically and environmentally (see e.g. Varis et al 2008b; Molle et al. 2009; *Article I*; *Article VII*). Economies of the riparian countries are stabilizing after the political turbulence of several decades, and development pressures towards region's natural resources are vast. Water is related to these changes in a very profound manner, and the Mekong River and its tributaries are seeing increasing plans for water resources development. The estimated impacts of the planned development vary among regional, national and local levels and across different timescales, influencing societies, politics and the environment in a variety of ways (see e.g. IUCN et al. 2007; MRCS/WUP-FIN 2007; Varis et al. 2008b; Keskinen et al. in press; *Article II*; *Article III*; *Article VI*; *Article VII*). At the same time new driving forces, most importantly climate change, are entering the discussion, affecting the ways the water resources are being used and developed (Eastham et al 2008; TKK & SEA START RC 2009; Keskinen et al. 2010). Decisions about the forms of water development will therefore have profound and far-reaching implications throughout the basin and the region (Varis et al. 2008b; Keskinen et al. in press; *Article I*; *Article VII*).

This kind of broader definition for the Mekong also highlights the need to look at water management in broader institutional and political context (see e.g. Allan 2003a; Molle et al. 2009; *Article I*). While the waters of the Mekong are following the physical boundaries of the watershed, the institutional and political aspects of water management reach far beyond the physical watershed, most importantly to the capitals of the riparian countries and to the offices of regional organisations, development

[72] China is too big a country to be included entirely into the region. Consequently, the Mekong Region is commonly defined to cover geographically only the Yunnan Province of China, and sometimes also the Guangxi Zhuang Autonomous Region. However, institutionally and politically China's central government and related ministries in Beijing are naturally an important part of the Mekong Region as well.

banks, private investors and donors[73]. Both the problems and the solutions related to water management reach thus beyond the physical watershed, to the area that can be referred to as a problemshed (see e.g. Mollinga et al. 2007) or –as I more optimistically prefer to call it– a solutionshed.

3.2 CURRENT PLANS FOR WATER DEVELOPMENT

The human impact on water resources has increased dramatically during the last decades all over the world, with engineering projects producing global-scale impacts on the terrestrial water cycle (Vörösmarty & Sahagian 2000; WWAP 2009). The Mekong River is one of the few large river basins that has not yet been irreversibly modified by large-scale water infrastructure. While the first dams in the Mekong mainstream and several dams in the tributaries have already been built, flow regimes in the lower-reaches of the mainstream are still essentially relatively natural (MRC 2005; Sarkkula et al. 2009; *Article II*).

Such conditions may not last much longer, as the river basin is seeing rapid changes in land use and an increasing amount of plans for large-scale water infrastructure (King et al. 2007; Kummu & Varis 2007; Kummu et al. 2009; MRC 2008a; Rowcroft 2008; Middleton et al. 2009; *Article VII*). Huge hydropower dams as well as water diversions, irrigation structures and roads are planned in different parts of the basin, with number of dams on the tributaries and several also on the mainstream. Out of the different infrastructure projects, large-scale hydropower dams are expected to have the most radical impacts for the river flows and related ecosystems.

There are currently so many plans for hydropower development in the basin that it is challenging to just keep a track of all of them – particularly when such plans have traditionally not really been discussed in the public. A recent inventory of existing and potential hydropower projects in the six Mekong countries came up with a total of 261 hydropower projects in the region, including 122 projects in the Mekong River Basin (King et al. 2007). Out of this total, an estimated 14 projects were under construction and 78 large projects identified as potential sites within the basin. In autumn 2008, the Mekong River Commission published a map indicating the location of dams planned in the Lower Mekong Basin (Figure 6). When combined with available information from China, this data includes 28 existing hydropower dams as well as an estimated 14 dams that are under construction and additional 101 dams that are at the planning stage, most of them in Laos (MRC 2008a).

Notable in this data is that it indicates plans for mainstream dams also outside China, including eight dams in Laos, two in Cambodia and one in the border area of Laos and Thailand (MRC 2008b). These would be the first dams to be located in the Lower Mekong mainstream and also first mainstream dams to be constructed by a MRC member country, influencing profoundly the nature of the decade-long cooperation in the Lower Mekong Basin (*Article I*). Such plans have already led the MRC to strengthen its impact assessment processes, including Strategic Environmental Assessment of mainstream dams, an establishment of "IWRM-Based Basin Development Strategy" (MRC 2009a: 1) as well as an extensive assessment procedure looking at hydrological, environmental, social, economic and fish-related impacts of various different water development scenarios (MRC 2009b, 2009c).

It is therefore clear that the next decades are likely to see an increasing amount of large-scale hydropower development both in the upper and lower parts of the Mekong River Basin. The actual impacts of these dams will naturally depend on their amount, location and storage capacity as well as on their operational procedures. In any case, their cumulative impacts are estimated to be remarkable, with the fish productivity being affected most negatively (see e.g. MRCS/WUP-FIN

[73] Out of the six riparian countries, only Laos and Cambodia have their capitals within the Mekong River Basin, while out of the different regional organisations only the Mekong River Commission has its headquarters in the actual river basin. Most other regional offices –including the GMS Program, the UN organisations and the ADB– are located outside the basin or even outside the entire region.

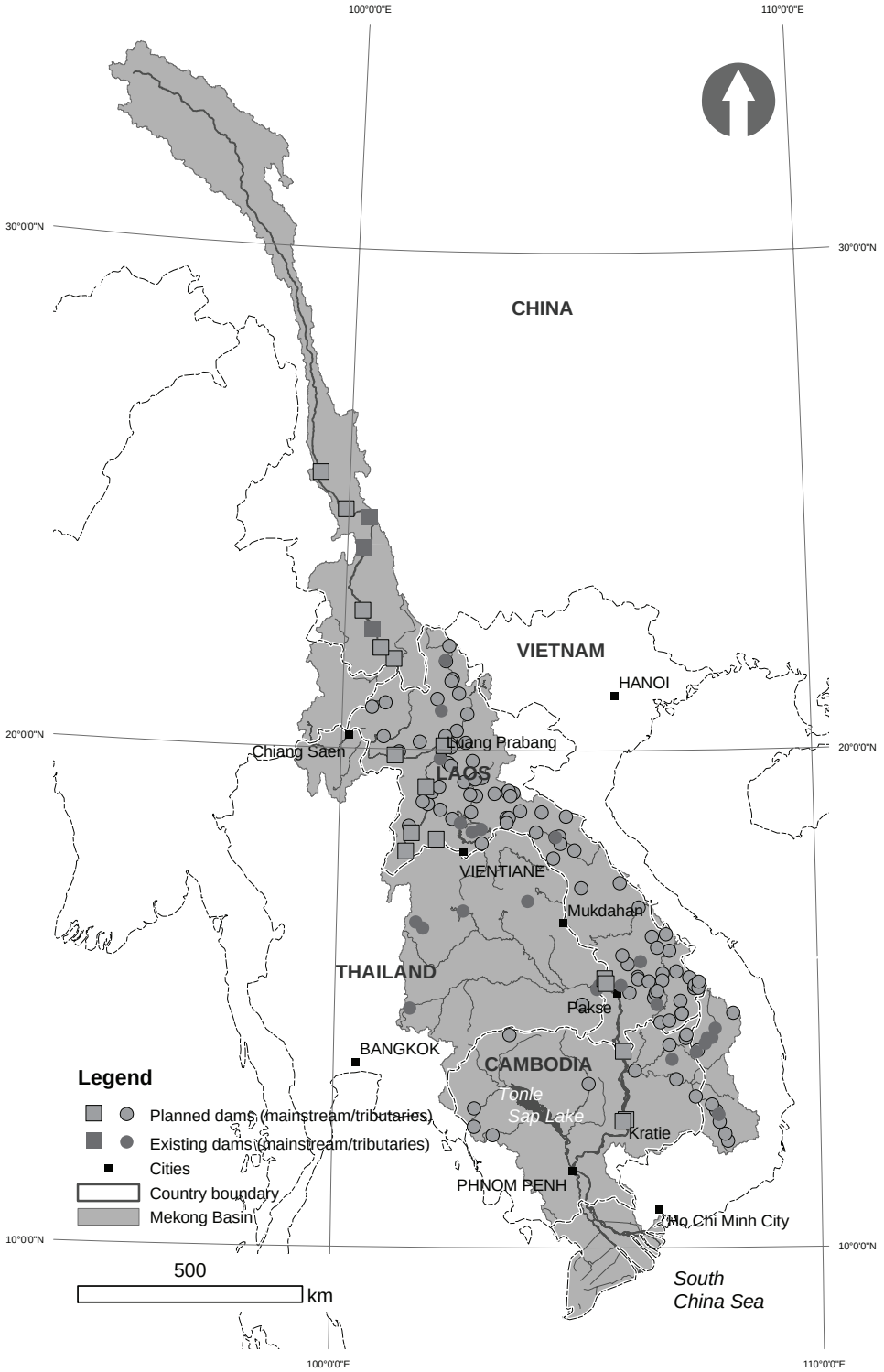

Figure 6 The map of the Mekong River Basin, including existing (darker) and planned (lighter) hydropower dams. Map by Matti Kummu, modified from MRC (2008a).

2007; Dugan 2008; Kummu et al. 2008; Kummu & Sarkkula 2008; Friend et al. 2009; Sarkkula et al. 2009; Keskinen et al. in press; *Article II*; *Article VII*). This, in turn, is very likely to have dramatic negative consequences for the food security and livelihoods of millions of people living in the basin. The planned water development therefore brings entirely new challenges for the water management, challenging the existing institutional settings and assessment practices. Indeed, integrated water management is needed in the Mekong Region more badly than ever before.

3.3 TONLE SAP LAKE

The Cambodia's Tonle Sap Lake is the largest body of freshwater in Southeast Asia and a key part of the Mekong hydrological system (MRC 2005). The lake is known for its exceptional flood pulse system with remarkable seasonal variation between the dry and wet seasons, and the livelihoods that are adapted to this seasonal variation. The importance of the Tonle Sap floodplains extends, however, much further, and the Tonle Sap can be considered to be the most important floodplain complex in the entire Mekong River Basin due to its critical importance for the flood dynamics and its remarkable aquatic production (Poulsen et al. 2002; Keskinen 2003; Keskinen & Varis 2005; MRCS/WUP-FIN 2007; *Article III*). For this reason the Tonle Sap has even been dubbed as the Heart of the Mekong (*Article III*).

The unique hydrology of the Tonle Sap is closely connected to –and dominated by– the Mekong River[74]. The lake is connected to the Mekong through 120 km long Tonle Sap River, with the two rivers meeting in the Cambodian capital Phnom Penh (Figure 7). During the southwest monsoon, the water level in the Mekong River rises faster than that in the lake, and as a result part of the floodwaters runs to the Tonle Sap River. This causes the entire river to reverse its flow back towards the Tonle Sap Lake: a hydrological phenomenon unique for the river of this size. The lake thus loses its only outlet, and the flood waters extend to large floodplain areas surrounding the lake: the average surface area of the lake rises from around 3'000 km^2 during the dry season to a maximum of up to 14'500 km^2 (MRC 2005; MRCS/WUP-FIN 2007a; Article III). The variation of the lake's water level is equally stunning, ranging from less than a metre during the dry season to over 10 metres during the wet season (MRC 2005; MRCS/WUP-FIN 2007a).

The Tonle Sap is therefore exceptional for a lake of its size, as the impacts of any environmental change –whether due to climate change, hydropower development or other drivers– are felt as a combination of changes in its own basin and that of the Mekong River. The actual 'impact basin' of the Tonle Sap Lake is thus not merely the lake basin (86'000 km^2), but the entire Mekong River Basin upstream from the Tonle Sap (680'000 km^2). This, naturally, makes the assessment of potential impacts to the area a particular challenge, and also makes the management of the lake area very much a regional issue as well (Keskinen et al. 2010).

The extraordinary water regime of the Tonle Sap Lake has resulted in an exceptional and highly productive floodplain ecosystem, and the lake is considered to be among the most productive freshwater ecosystems and fishing grounds in the world (Rainboth 1996; Öjendal 2000; Lamberts 2001, 2006). Flooded forests and shrubs offer valuable shelter and breeding grounds for fish, and migration of different fish species between the Tonle Sap Lake and the Mekong River is extensive. During the inflow there is mostly a passive migration of eggs, fry and fish to the Tonle Sap Lake and its floodplains. Later, great amounts of fish follow the receding floodwater back to the lake and finally back to the Mekong River, while numerous species, mainly so-called black fishes, stay in the lake and adjacent water bodies inhabiting them throughout the year (Lamberts 2001; Baran 2005; Nikula 2005; *Article III*).

[74] Out of the total average inflow to the Tonle Sap Lake (79.0 km^3), more than half (57%) originates from the Mekong River either as inflow through the Tonle Sap River (52%) or as overland flow (5%), with the share of the Tonle Sap's own tributaries being around 30% and that of precipitation some 13% (MRCS/WUP-FIN 2007).

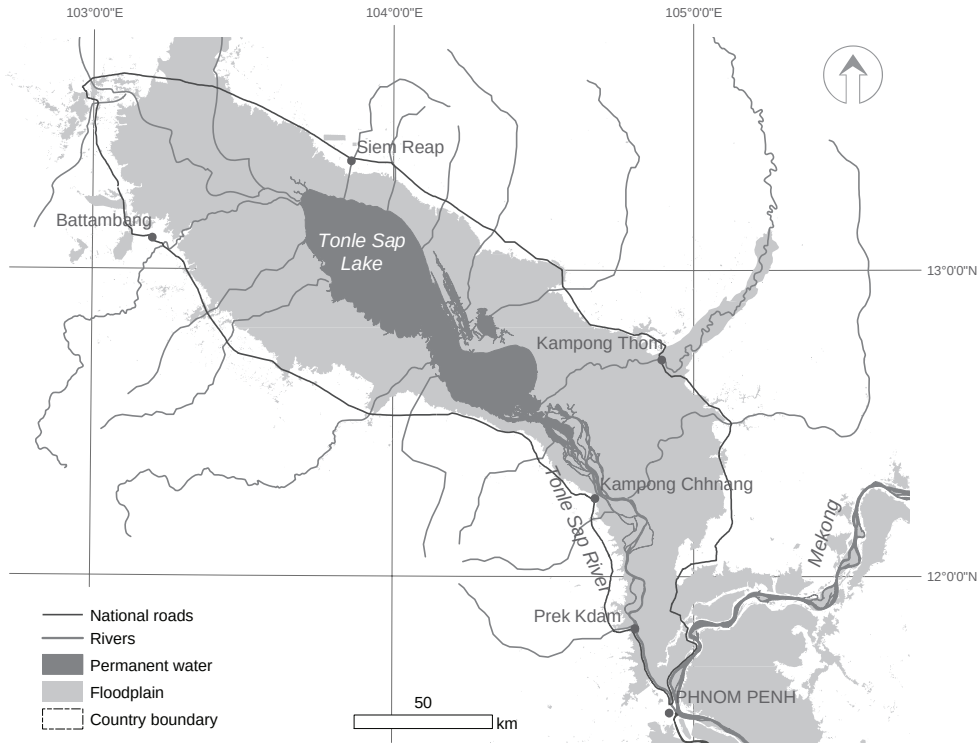

Figure 7 The map of the Tonle Sap Lake area, showing the permanent lake and the floodplain as well as the Tonle Sap River. Modified from Kummu (2008).

The Tonle Sap ecosystem forms a particularly important economic, social and environmental resource for the entire Mekong Basin and for Cambodia in particular. It is estimated that the Tonle Sap's resources form a central source of livelihoods and food for well over million people living in the lake and its floodplains (Bonheur & Lane 2002; Keskinen 2003; Evans et al. 2004; Lamberts 2006; *Article III*). The socio-economic setting in the area is as diverse as its ecosystem, and the local livelihoods are well adapted to the remarkable –and still relatively regular– seasonal variations. The close connection between the flood pulse and the people's livelihoods is emphasised by the fact that the levels of livelihood in the region tend to have similar strong seasonal character as the lake's water level (*Article III*).

3.4 INSTITUTIONAL SETTING

Institutional frameworks play a key role in integrated water management and, more generally, in water governance[75] (GWP 2000; UNESCO-WWAP 2006). Understanding the institutional setting related to the use, development and management of Mekong's resources is therefore one of the prerequisites for making recommendations related to the water management in the region. As the institutional setting and governance issues are, however, discussed extensively in the appended articles (see e.g. *Article I*; *Article II*; *Article III*) and several other documents (see e.g. Ostrom 1990; Bakker 1999; Öjendal 2000; MREG 2001; Badenoch 2002; Öjendal et al. 2002; Ratner

[75] Although the terms 'institution' and 'organisation' are often used interchangeably, there are certain differences between the two. As noted by Svendsen et al. (2005), institutions provide structure and regularity to everyday life by guiding human interaction. Organisations, on the other hand, are structures of recognised and accepted roles, created intentionally within the existing web of institutions and being also greatly influenced by such a web. See also discussion about institutions in Chapter 4.

2003; Sobeck 2003; Goh 2004; Lebel et al. 2005, 2007; Diokno & Chienh 2006; Hirsch et al. 2006; Phillips et al. 2006; Sneddon & Fox 2006; Sokhem & Sunada 2006, 2008; Dore 2007; Dore & Lazarus 2009; Molle et al. 2009), this Chapter provides just a brief overview to the subject.

The waters in the Mekong River Basin are –like in any other transboundary river basin– managed through a plethora of formal and informal institutional arrangements located at different scales, ranging from local water user groups to ministries and to regional organisations and platforms. The institutions located at same scale are equally many, meaning that the number of institutions related to water management is high both vertically and horizontally. As these different institutions have all their own specific views, interests and policies on water, competition and overlaps are usually at least as common as cooperation between the different institutes. This doesn't, however, make Mekong any different to most other water management contexts, as overlaps and rivalries between different management institutions are commonplace in the water field in general. It is therefore no wonder that the institutional development is together with increased cooperation frequently mentioned as a precondition for successful water management (GWP 2000; UNESCO-WWAP 2006; UN-Water 2008; WWAP 2009).

The specific institutional setting of the Mekong Region is next discussed through two case studies; one focusing on the regional scale and the functioning of a regional river basin organisation (the Mekong River Commission), and the other on national and local scale through an overview of the formal institutional setting in the Tonle Sap Lake area in Cambodia (see also *Article I*, *Article II*, *Article III*, *Article VI*).

Regional scale: the case of MRC

The key regional organisation responsible for water management in the Mekong River Basin is the Mekong River Commission (MRC). The MRC was formed in 1995 by the four Lower Mekong countries of Cambodia, Laos, Thailand and Vietnam, and its current strategy emphasises strongly the concept of IWRM[76]. Indeed, the MRC's vision and mission statements are well in line with the general definition of IWRM[77] (Varis & Keskinen 2003; *Article IV*).

The functioning of the MRC and its two predecessors present a fascinating example on the possibilities and the limitations of regional cooperation in a transboundary river basin. The MRC is often considered as one of the most advanced examples of international water cooperation, and the Mekong cooperation has even been cited to be the most successful in the developing world[78] (Öjendal 2000; Jacobs 2002; Phillips et al. 2006; *Article I*). The formal institutional setting of the MRC is well-established, consisting of National Mekong Committees (NMCs) and related governmental ministries in the member countries as well as the regional secretariat, the MRCS[79] (MRC 2006a).

Yet, despite these advanced characteristics, the actual functioning of the MRC has been severely restrained, and the MRC has been largely sidelined from the key decision-making processes related to the water development in the basin. One considerable reason for this is that the MRC operates only in the Lower Mekong Basin, and it is thus not corresponding with one of the most frequently highlighted prerequisites of water management, namely that a management organisation should coincide with the physical watershed of the basin (Phillips et al. 2006). This situation has been particularly critical during recent years with China –the most upstream Mekong country and

[76] The MRC adopted an IWRM approach at its Twelfth Council Meeting in December 2005, with an aim to achieve a balanced approach to development based on contemporary development principles (MRC 2006a). Later on, the MRC has further strengthened its adoption of IWRM, taking it as the foundation for it basin development strategy (MRC 2009a).

[77] According to MRC (No date: i), the MRC's vision for the Mekong River Basin is "An economically prosperous, socially just and environmentally sound Mekong River Basin".

[78] Phillips et al. (2006: 107), for example, note that "International cooperation in the lower Mekong River Basin is historically well-entrenched, institutionally genuine and seemingly comprehensive. The Strategic Plan for 2001–2005 of the MRC could have been taken out of a textbook on transboundary water management".

[79] As discussed in *Article I*, however, the MRC and NMCs have also been criticised for their focus on formal government institutes and processes as well as for the lack of transparency, accountability and participation.

a non-member of MRC– pushing forward with its intensive hydropower dam projects in the Mekong mainstream.

As discussed in *Article I*, however, even bigger challenge for the functioning of the MRC is internal. The governments of four MRC member countries are hesitant to give up even a small part of their national sovereignty, chiefly for the fear that the MRC cooperation would considerably slow down their plans for the utilisation of the Mekong. As a result the MRC has turned into a kind of institutional smokescreen: with the existence of the MRC the water management in the Mekong River Basin looks to be relatively well coordinated, when in reality it is not. In addition, all Mekong countries favour broader economic cooperation mechanisms and institutes over the more narrowly focused MRC. As a result other modalities of regional cooperation increasingly determine the cooperation over the Mekong and its resources and, consequently, also the role of the MRC in the region.

National and local scales: the case of the Tonle Sap Lake

The institutional setting for the Tonle Sap's management consists of an interesting potpourri of institutions with differing interests at various scales. Due to its significance for whole Cambodia and the entire Mekong River, most of the formal management institutions for the Tonle Sap Lake have national dimension, including ministries and area-specific organisations. At the same time the uniqueness of Tonle Sap's biodiversity means that the conservation and the management of Tonle Sap is also a regional and even global issue, and the Tonle Sap is for example included in the UNESCO World Network of Biosphere Reserves (Bonheur & Lane 2002). There naturally exist also diversity of local management institutions, both formal and informal (see e.g. Evans et al. 2004; Middleton & Tola 2008; *Article VI*). However, as the possibilities of local management institutions to participate in the formal decision-making processes related to water are often very weak, the local institutions remain detached from the general management frameworks[80].

Traditionally, the Royal Government of Cambodia and its provincial line agencies have seen the Tonle Sap and its resources as an important source of national revenue, mainly due to the immense fish production of the area. As a result, both the institutional arrangements and the policies related to the Tonle Sap's management have been framed so that the Fisheries Administration under the Ministry of Agriculture, Forestry and Fisheries forms the key management institution in the area (Keskinen & Sithirith 2010; *Article VI*). The Fisheries Administration controls all the fishing activities in the lake and the floodplains, including the peculiar system of commercial fishing lots[81].

Past decade has, however, seen increased calls for diversifying this institutional setting, particularly through better consideration of environment and livelihoods (see e.g. Mareth et al. 2001; Sokhem & Sunada 2006; MRC 2007; *Article III*; *Article IV*). The first concrete step towards this was taken in 2001 with the establishment of the Tonle Sap Biosphere Reserve (TSBR) and its secretariat. Despite its name, the TSBR doesn't focus just on environmental protection, but it was given three complementary functions: conservation, development and logistics. The TSBR Secretariat was set to "strengthen cooperation between ministries, agencies, local authorities and communities concerned for the protection and sustainable management of the Tonle Sap Biosphere Reserve" (Royal Government of Cambodia 2001: 6). Notable is that the TSBR Secretariat was established under the Cambodian National Mekong Committee (CNMC), forming thus an intimate connection to the regional Mekong River Commission.

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[80] Öjendal (2000) links the lack of local participation in water management in Cambodia to following issues: cultural perceptions of power and authority, a legacy from the authoritarian centralist socialist system of the 1980s, a result from weak institutional structures, the legacies of Khmer Rouge era, and an emerging aid dependence syndrome.

[81] Fishing lots are geographical concessions auctioned to the highest bidder for a certain period, providing an exclusive right to catch fish within the lot (*Article VI*).

In reality, the institutional cooperation in the management of the Tonle Sap has remained scarce, and the functioning of the TSBR has been challenged particularly by its competition with the Fisheries Administration over the control of the Tonle Sap. Although the Biosphere Reserve is basically applicable throughout the lake-floodplain area, in practice the TSBR Secretariat has full authority only over the three conservational core areas that form a small part of the entire area. In addition, the three core areas also partly overlap with fishing lots that remain under the control of the Fisheries Administration. The overlaps between the biosphere reserve areas and commercial fishing lots produce conflicts of interests in both the floodplain and the lake proper, and the two key characteristics of the Tonle Sap –fisheries and conservation– are therefore both spatially and institutionally contested (Bonheur & Lane 2002; Keskinen & Sithirith 2010).

One way to solve this kind of institutional impasse could be an establishment of a broad, non-sectoral management institute for the area. Recent years have seen two such initiatives: the ADB-led Tonle Sap Basin Management Organisation (TSBMO) and the Tonle Sap Basin Authority (TSBA). Both of these initiatives aimed to enhance the coordination of different, often conflicting interests on the area. While the establishment of TSBMO was prepared for several years with considerable resources, it was ultimately never established (ADB 2006; Keskinen & Sithirith 2010). Instead, the Government of Cambodia proceeded to establish a stronger and more authoritative management organisation, the Tonle Sap Basin Authority (TSBA), in September 2007.

The objective given for the TSBA is surprisingly similar to that of the TSBR Secretariat, namely the "coordination of the management, conservation and development of the Tonle Sap Basin areas" (Royal Government of Cambodia 2007: 1). While both the TSBR and the Fisheries Administration have focused on the areas surrounding the lake, the TSBA was intended to take a basin-wide approach, aiming to increase the jurisdiction of the Authority to the entire catchment area (Starr 2008). Despite these recent efforts, however, the institutional setting in the Tonle Sap remains by the time of writing utterly unclear, with different institutions continuing to have overlapping and competing agendas[82].

[82] Also the status of the TSBA –now called Tonle Sap Authority– is unclear, with rumours indicating that it has been partly dismantled for the fear that it would have unreasonably expansive membership and mandate (The Cambodia Daily 2009; Keskinen & Sithirith 2010)

PART III: OUTCOMES

4 Results: elements of integrated water management

This chapter summarises the main findings from the seven articles appended to this synthesis. Each of the articles looks at the particular aspects of water management in the Mekong Region, presenting practical experiences and specific conclusions on those aspects[83]. At the same time, however, the articles are complementary, looking at the same overarching issue –integrated water management– through differing, even contradicting viewpoints. Such a diverse approach responds well to the thematic, methodological and geographical diversity inherent in integrated approaches, highlighting the need to look at them with the help of variety of views and methods at various spatial and temporal scales.

Consequently, instead of merely repeating the specific findings of each article, the results are next presented with the help of six elements that can be considered particularly critical for the implementation of integrated water management; at least in the contexts I have studied them in the Mekong. The first three elements –Comprehensiveness, Institutions and Politics– represent general elements, providing the overall context for the integrated management and assessment practices. The three latter elements –Methods, Team and Inclusiveness– are then more practically orientated, being also ones that management teams and individual water experts have a direct influence on.

The key elements described in this chapter also complement the six aspects of integrated water management as defined by Mitchell (1990b), based on the experiences from seven (mainly developed) countries around the world. The six aspects Mitchell (1990b) refers to are: context, legitimation, functions, structures, processes and mechanisms, and culture and attitude[84].

4.1 GENERAL ELEMENTS

Comprehensiveness

Successful implementation of water management requires thorough understanding of the diverse linkages that water has with the environment and the society. It also asks for sensitivity to the differences between different water management contexts. Consequently, there are increasing calls to consider also the broader dimensions related water and its use, development and management. Integrated approaches can be considered to be both the forerunners and the epitomes of this change. At the same time it is important to note that comprehensiveness and integrated approaches are not synonymous, but rather complementary: integration indicates consideration of the issues

[83] Such conclusions are related in particular to transboundary cooperation (*Article I*), integrated modelling and assessment (*Article II*), livelihoods analysis (*Article III*), policy analysis (*Article IV*), the linkages between population and natural resources (*Article V*), water conflicts (*Article VI*), and the impact assessment practices in transboundary settings (*Article VII*). In addition, all articles provide conclusions related to the specific management contexts in the Mekong.

[84] I managed to get hold of the book "Integrated Water Management", edited by Bruce Mitchell back in 1990, only when writing the final updates to my Thesis in May 2010. Seeing how similar my key elements are with the six aspects of Mitchell (1990b), reinforced my feeling that the elements discussed here are most likely relevant also outside the Mekong, in the general context of integrated water management. At the same time there are also important differences: while Mitchell doesn't explicitly address the political nature of most integrated water management activities (which I aim to exemplify), he recognises important aspects that I don't perhaps pay enough attention to; legitimation and processes & mechanisms being the most important such aspects. Reading Mitchell's article also made me think once again how many important things are discussed at different times in different forums, only to be partly forgotten later on in other, related discussions. For I do think that his article –written 20 years ago– still makes a very relevant contribution to the current discussion about the challenges of IWRM, and yet it is rarely referred to in the current discussions about integrated water management.

that are most relevant in a specific management context, with the relevance being defined through a comprehensive understanding (i.e. consideration of all water-related issues) of that very context.

Article II discusses the importance of integrated approaches –most importantly IWRM and IA– used for modelling and impact assessment in environmental management. The article exemplifies how better consideration of water-related ecosystems and social and economic issues makes modelling and impact assessment activities more comprehensive, enhancing their usability for planning and management. *Article II* also discusses the possible ways of integrating the different forms and types of information –socio-economic, ecological and hydrological– needed in water management, concluding that there is a need for approaches that make use of an array of different methods and information sources.

Such a conclusion is supported by *Article III* and *Article IV* that highlight the importance of social and institutional aspects related to water management. Based on practical experiences from the Tonle Sap Lake area, the articles argue that better consideration of such aspects can significantly contribute to water management and related assessment and modelling work, making it more responsive to the local contexts and needs. Both articles also discuss the emergence of the concept of IWRM, noting its similarities to the objectives of regional Mekong River Commission as well as highlighting the challenges in putting it into practice. *Article I*, *Article V* and *Article VI* bring into the discussion an additional dimension, noting that different forms of water use and management have often very different histories. Such conclusion underlines the importance of understanding the historical trajectories: without knowing how we have arrived to the present situation, it is much more difficult to realise the actual reasons behind the present-day management challenges as well as to plan the most suitable ways forward.

Article II, *Article III*, *Article IV* and *Article VII* discuss the more technical and methodological aspects needed to address the different dimensions of integrated water management. *Article VII* focuses specifically on water-related impact assessment, concluding that the assessments focusing on hydrological changes present only the very first step toward more comprehensive impact assessment. A river is much more than a hydrograph, and the estimations about hydrological changes cannot alone be used to draw conclusions about the actual ecological, social, and economic consequences. Instead, proper environmental and social impact assessments require consideration of much broader themes and their linkages across different temporal and spatial scales.

Article II, *Article III* and *Article IV* share experiences from an integrated modeling and impact assessment process –the WUP-FIN Project– that sought to analyse and combine information from hydrological and hydrodynamic modelling, ecosystem studies as well as socio-economic and policy analyses in the Tonle Sap area. The articles discuss the ways of combining this diverse set of information, concluding that none of the rather technical methods developed and tested for integration of the different forms of information is really able to capture the full diversity of the water-related issues and their linkages. Consequently, as pointed out in *Article III*, one the greatest challenge in the implementation of IWRM is related to the letter 'I' in its name: how to integrate the diverse social, economic, environmental and hydrological information in a meaningful and comprehensive way. As concluded in *Article II*, this kind of information integration process is not only a methodological challenge, but also very much a philosophical one.

Institutions[85]

Management is practically always carried out through various institutional arrangements. Consequently, different institutional frameworks –ranging from transboundary river basin organisations to multi-stakeholder platforms, and from ministerial working groups to water users' associations– are considered critical for the success of water management[86]. Yet, institutions are often also seen to hinder water management, as is exemplified by the frequent calls for institutional reforms. Water management institutions can be both formal and informal, and they are located at (and between) various different scales from local to regional i.e. transnational scale. In this Thesis, the focus is mainly on the regional scale as well as on formal management institutions. In addition, the discussion about the Tonle Sap's institutional setting (Chapter 3.4; *Article III*; *Article IV*; *Article VI*) presents a case study about national and subnational institutional arrangements.

Article I discusses in depth the formal institutional setting for the management of the Mekong River. The article reviews the regional institutional frameworks related to water, including ASEAN, GMS Program and, most importantly, the Mekong River Commission (MRC). The analysis shows that while offering a crucial platform for cooperation between the countries, the MRC has not been too successful in integrated management of the Mekong River Basin (finding supported also by *Article II*, *Article IV* and *Article VII*). The functioning of the MRC is found to be very much defined by other regional cooperation mechanisms and institutions, most importantly those focusing on economic development. *Article I* also emphasises the importance of understanding the quality of the existing water management institutions. While having a common management institution such as the MRC in place is a prerequisite for transboundary cooperation, it is not enough: strong political support from the riparian countries is required for the institution to really be able to fulfil its task as a joint cooperation mechanism between the countries.

Article VI extends this conclusion further by presenting a case from the Tonle Sap, where the upstream water development in Laos and China is threatening the local floodplain ecosystem and livelihoods. Yet, these potential impacts have been poorly addressed in the regional level discussions, even when there exists an ideal institutional setting –namely the MRC and its national committees– to initiate such discussions. *Article VI* comes to an interesting conclusion about interstate and intrastate water conflicts, noting that such conflicts may actually emerge more within the country than between the countries. Such a conclusion raises further questions about the functioning of the linkages between the institutions at different scales and, ultimately, about the issues of transparency, representation and power within the existing institutions (see also next section on Politics).

Indeed, water-related institutions easily suffer from both vertical and horizontal discontinuities due to large number of issues and actors related to water. As noted in *Article IV* and *Article VI*, for example water-related issues in Cambodia are handled under several ministries with different mandates, ambitions and policies. The functioning of vertical links with central government, provincial and local authorities and villages is seen to be equally troublesome. At the same time, as noted in *Article I*, water management and transboundary management in particular should

[85] Institutions are often seen to consist of formal and informal organisations and their activities and interactions. GWP (2000: 45), for instance, notes that an institutional framework includes not only organisations, but also "a whole range of formal rules and regulations, customs and practices, ideas and information". Mitchell (1990b), on the other hand, defines institutional arrangements in relation to integrated water management as the combination of 1) legislation and regulations, 2) policies and guidelines, 3) administrative structures, 4) economic and financial arrangements, 5) political structures and processes, 6) historical and traditional customs and values, and 7) key participants and actors. More generally, institutions can be defined as social structures and mechanisms that aim to organise relatively stable patterns of human activity, operating at all levels from the households to the international arena (Matsaert 2002; SEP 2010). As North (1990: 384) puts it: institutions "provide the rules of the game for human interaction", consisting of informal constraints and formal rules and of their enforcement characteristics. There is a very rich literature related to institutional analyses and policy processes, including discussion and case studies on well-known institutional frameworks such as Institutional Analysis and Development (Ostrom 1990; Koontz 2003) and Advocacy Coalition Frameworks (Sabatier 1988; Schlager 1995; Sobeck 2003).

[86] GWP (2000: 22), for example, notes that "the concept of IWRM is widely debated and an unambiguous definition of IWRM does not currently exist. Hence, the regional and national institutions must develop their own IWRM practices using the collaborative framework emerging globally and regionally".

not be considered just as an interaction between monolithic states and government-led institutions. Instead, there also exists a variety of actors and institutions at different scales that simultaneously support and challenge the riparian states and their formal institutions.

Article VII discusses the more methodological aspects related to transboundary institutions, noting that the issue of scales becomes particularly critical in transboundary contexts such as the Mekong. 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 requires essentially a regional approach, preferably with regional management institutions. Also temporal scale needs to considered, as the impacts of water developments often differ greatly between the timescales. As noted in *Article VII*, the challenge with spatial and temporal scales therefore becomes a challenge with scales of institutions, jurisdiction, and, ultimately, of information and knowledge. Such conclusion highlights the importance of institutional cooperation and coordination, but also that of institutional diversity – and of tolerance towards such diversity.

Politics

Better consideration of environmental, economic and social issues provides only a starting point for more integrated management. Water management decisions are, after all, not only about neutral numbers and objective analyses, as the decisions are usually benefiting some social groups while causing negative consequences to others. Consequently, a truly integrated water management also requires the recognition of the highly political nature of water management and, consequently, of related planning, assessment and development practices[87]. The question of politics and power relations is critical also for another reason: through their emphasis on integration and sophisticated methods, integrated approaches may –despite their calls for the opposite– actually strengthen the existing power imbalances, and lead to centralised management structures emphasising scientific expertise at the expense of more diverse views (see e.g. Watson 2007; Biswas 2010).

The importance of political aspects of water management is well visible in *Article VI* that summarises the findings from the case studies focusing on floodplains, agricultural lands and fisheries in the Tonle Sap Lake area. The findings from the three case studies indicate clearly that water-related conflicts in the area are not really about water and its physical availability, but first and foremost about access to and control over water and related resources. In addition, differing valuations attached to the water-related resources as well as the political and historical context where they prevail have a strong influence on the tensions over resource use. Consequently, while each of the case studies has its specific characteristics, a common feature for all cases is found to be the unequal power structures and mechanisms of marginalization within and between different geographical scales.

In terms of transboundary nature of water management, *Article VI* notes that national decision-makers in Cambodia seem not to be aware of –or are even ignorant toward– the concerns about transboundary impacts at the local level in the Tonle Sap. Related to this, the article makes an observation that despite the apparent differences between the six Mekong countries, the political elites, irrespective of their country, have surprisingly similar modernization aspirations and common economic interests. Such a finding relates

[87] The UN Commission on Sustainable Development has noted that "Water issues are not only technical and institutional issues: they have also intrinsic political content which has to be explicitly considered in order to be able to solve effective difficulties linked to competition among stakeholders and interests" (CSD 2008: 30). Radkau (2008: 307), on the other hand, concludes in his global history of the environment that "For five thousand years, since the time of the pharaohs, water policy has been a foundation of political power".

to the idea of Scott (1998) on state simplifications[88], indicating that the trade-offs caused by water management decisions look very different when viewed from the state than from the local level. For this reason, water management should always be examined in its broader context, with a special attention paid to the existing power structures and asymmetries at both local and higher levels of management.

Article VII supports these findings, concluding that the methodological and thematic dimensions reveal only one –although very dominant– side of management and assessment practices. The article notes that water-related management and assessment activities are often seen to build on neutral information and sound science, and they are thus believed to 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 (see also van Kerkhoff & Lebel 2006; Karl et al. 2007).

Based on an extensive review of planning and impact assessment practices in the Mekong Region, *Article VII* concludes by noting that the underlying reasons –and the solutions– for the current challenges with water resources management in the Mekong lie beyond merely methodological issues, and can instead be found from broader political processes related to water development. Addressing such processes requires altogether different kinds of views, starting from the very methods to address the issues of participation, representation and transparency in the management practices. Hence, the article concludes by noting that integrated water management require the recognition of the highly political nature of water development and related planning processes.

4.2 PRACTICAL ELEMENTS

Methods[89]

Integrated approaches used in water management and impact assessment present also a remarkable methodological challenge: what kinds of methods such integrated approaches actually require? Is it better to have a flexible suite of several methods or a kind of meta-method –for example a mathematical model system– that seeks to bring together and analyse the necessary information under one methodological framework? And what kinds of methodologies are really needed; technical, more traditional methods focusing for example on integrated modelling and assessment, or softer methods with an emphasis for instance on team building, collaborative learning and communication? While it is obvious that both are needed, the articles reveal interesting application about the use –and non-use– of both methods.

Several of the appended articles consider the methods needed for integrated management and impact assessment, sharing experiences on their use and applicability. *Article II*, *Article III* and *Article IV* discuss the integrated impact assessment process used in the WUP-FIN Project for the analysis of water management context in the Tonle Sap. While building on a mathematical model system making use of hydrological and hydrodynamic models, the process also relied heavily on additional methods focusing on ecosystem studies as well as on socio-economic and policy analyses. The articles present powerful examples from the benefits of this kind of multi-method approach, highlighting that it has resulted in findings that are more balanced and better connected to the actual realities on the ground. At the same time the process also revealed the practical challenges in this kind of approach, emphasising that considerable amount of time and resources is needed to facilitate the linkages between the different methods – and consequently between the members of the research team.

[88] Thank you for Mira Käkönen for introducing me to the concept. As summarised by Lebel et al. (2005: 1), in such a process the "states first appeal to wider interests as they go about simplifying diverse local systems, and then use the newly unified systems to rationalize development planning and environmental management. People, institutions, and landscapes are made to fit levels and scales in the states' systems of accounting and monitoring. Local-level knowledge and institutions are seen as local in scope, relevance, and power, whereas the rules and knowledge of the state have much bigger scope and significance".

[89] Please note that two sets of methods are discussed throughout this Thesis in relation to integrated water management: management methods and integration methods. While the two may often be partly overlapping, there are also fundamental differences: the former facilitate the implementation of specific management actions (and therefore may or may not be integrated by their nature), while the latter focus on integration within the management actions, aiming ultimately for integrated management practises. The main focus of this Chapter –and indeed of the entire Thesis– is on the integration methods.

Article II also discusses the different ways to respond to the context-specificity regularly highlighted in water management. Through a review of both tailored and standardised model approaches, the article notes that while standardised modelling and assessment practices have clear benefits in terms of transparency, reliability and applicability, their fundamental weakness is that they confine the entire research approach to the limits of the tool. Consequently, it is concluded that tailored, case-specific approaches are more suitable to emphasise the specific characteristics of different contexts and, overall, to study particularly complex systems – such as the Tonle Sap. Related to this, *Article II* highlights the importance of diversity in both the models and general research approaches: without diversity, progress is not really possible. *Article VII* extends this conclusion by stressing the importance of research taking place at different geographic scales: such a multiscale approach is particularly important in transboundary contexts, where traditional, centralized research efforts are often too insensitive and inflexible to be able to understand the diversities and complexities at different scales (see also Millennium Ecosystem Assessment 2005).

Article III and *Article IV* discuss the water-related livelihoods and policy analyses, noting that social, political and institutional issues are often weakly addressed in the management activities. Yet, as exemplified in the articles, these aspects are often crucial for the success of water management. *Article III* also discusses the benefits of combining different research methods for livelihood analysis, concluding that the experience from the Tonle Sap illustrates that the analysis benefited from an approach combining quantitative studies with more qualitative research methods, as such a comparative approach makes the analysis more extensive and also reveals the weaknesses and biases included in both methods.

Several articles discuss the ways to integrate the diverse information produced by different research methods. *Article III* introduces the concept of geographic zoning, where the idea is with the help of Geographic Information System (GIS) to arrange the information available from different databases and surveys according to geography, in this case topography[90]. This kind of classification differs considerably from normal, as the databases usually classify available information according to man-made administrative boundaries such as provinces and districts. However, as such administrative boundaries do not follow the natural water flows, creating connections with the hydrological characteristics –through information provided by measurements and models– becomes increasingly difficult.

Analysis presented in *Article III* shows that the topographic zoning facilitated remarkably the linkages between the socio-economic analysis and the hydrological and hydrodynamic models, increasing the understanding of the interaction between the lake, its ecosystems and the people. *Article II* and *Article III* introduce another approach –descriptive integration– for connecting the different types of information to assist in impact assessment[91]. The idea in such an approach is to make use of both quantitative and qualitative information in describing an impact process with the help of so-called impact tables. In the impact tables, the causal linkages between hydrological indicators, ecological impacts and livelihood activities –together with the immediacy and the perceived uncertainty of the impacts– are described.

Experiences from these integrative methods provide also important lessons learnt for integrated water management in general. Despite the remarkable efforts put into these two integrative methodologies, they still have clear limitations. As discussed in *Article II* and *Article III* as well as in MRCS/WUP-FIN (2008), the main challenge for both methods is that the intricate interconnections between hydrology, environment and livelihoods cannot be comprehensively

[90] Geographic zoning can also be done based on other factors than topography: for example Keskinen et al. (2005) applied similar approach for the Mekong floodplains in Cambodia, using flooding characteristics to form altogether three geographical zones.

[91] Majority of the research on descriptive integration was done in close cooperation with Jussi Nikula (see also Keskinen et al. 2005; Nikula 2005; *Article II*).

described in quantitative terms, even when grouped into separate zones (as in geographic zoning) or subordinated to detailed causal linkages (as in descriptive integration). The experience from both of the approaches indicates that in both cases the method takes easily over from the aim: although the results can be presented in fancy diagrams, maps and tables, they actually represent only small part of the actual picture – namely the part that can be described with these kinds of methods. Consequently, while such integrated approaches are useful in studying the linkages between different methods and types of information, they should not be used as the only tool for integration[92].

Team[93]

Water management and assessment is not just about the theories, approaches, methods and institutional structures, but very much about the people who develop and use such methods in specific management contexts[94]. Yet, the management and assessment practices still tend to focus on technical and methodological aspects, with much less discussion about the most suitable combinations and forms of interaction of the people –teams– that actually put such approaches into the practice[95]. With the emergence of integrated approaches, it has also become clear that much more emphasis needs to be put on multidisciplinarity of the teams responsible for research, assessment and management. Such multiperspectivity also challenges the ways many teams are used to collaborate and interact, emphasizing the significance of joint learning and team building.

The importance of teams is well visible in *Article II* that concludes that instead of merely methodological issues, the real change towards more integrated approaches comes through the establishment of teams with balanced participation of experts with different backgrounds and disciplinary experience. With its focus on challenges of mathematical modeling, *Article II* discusses particularly the often neglected importance of societal aspects, recognizing the need to include social scientists and other non-modelers as equal members also into technical assessment teams. *Article III* supports this conclusion, noting that IWRM and other integrated approaches require teams where actors from several different disciplines and institutions cooperate in an open and constructive manner. Putting together such teams is not, however, without difficulties. As experiences documented *Article II*, *Article III* and *Article VII* indicate, there is a danger that even with greater diversity of disciplines within a team, the actual research practices remain dominated by disciplinary methods with experts working separately within their own specific fields and having poor interaction with other team members.

Article VII discuss the challenges with multi- and interdisciplinary teams further, noting that while

[92] These two integrative methods represent perhaps the most visible example of the personal learning that has occurred during my research. The methods were originally developed with an ambitious aim to create an analytical framework for how to do the integration (as can be seen from *Article II* and *Article III*). However, when their application in the Tonle Sap ultimately revealed their inherent weaknesses, I started to view the approaches more as the examples of how not to do the integration (see also MRCS/WUP-FIN 2008). Looking at these approaches now, I do appreciate the effort put in them and find them in many ways useful – as long as they are considered as just one approach facilitating integration.

[93] A team can be defined as a group of people that is working cooperatively to accomplish a common goal. Team members have clearly defined roles and responsibilities and are interdependent i.e. rely on one another in reaching the goal (Cannon-Bowers et al. 1993). In this Thesis, most of the discussion about the teams relates to the specific research teams –such as the WUP-FIN team– that carry out research to support certain management and decision-making initiatives at relatively high levels such as a ministry or regional river basin commission (namely the MRC). However, naturally many other forms of teams exist at different scales as well, including both formal and informal arrangements. Examples of different kinds of teams include for instance specialised water management teams in a regional river basin commission, cross-sectoral ministerial working groups, multi-stakeholder platforms as well as teams operating e.g. a common irrigation canal at village level.

[94] As noted by Mitchell (1990b) in relation to integrated water management: people who are inclined to cooperate and are enthusiastic can make a poor system work well, while a well-designed management system may falter if the participants are not determined to work together.

[95] Interestingly, an OECD report published already in 1989 discussed several aspects that have later on not really been addressed in the discussions about integrated water management. Such aspects included prevailing ideologies related to water and its management as well as the quality of the management teams, including their attitude and ability towards integration. Based on over 50 country reports, the report concluded that "Through their education, training, and work experience, many staff are accustomed to think in terms of narrow objectives and strategies, [and] ...as a result, most staff have poor abilities in the important skills of inter-agency communication, negotiation, and bargaining, which are crucial if the integration is to occur" (OECD 1989: 19).

multidisciplinarity is an essential step forward, it is not enough, particularly when dealing with complexities and multiple scales of transboundary water management. The article notes that while multidisciplinary teams and practices are getting more common also in the Mekong Region, the problem is that they are not really challenging the dominance of traditional, sectoral approaches. The management and impact assessment practices need therefore to move towards greater interdisciplinarity and, consequently, towards new kinds of assessment methods building first and foremost on the actual challenges at hand. This, in turn, requires increased attention to the different team building and team interaction methods.

Article VII also acknowledges the fact that developing an interdisciplinary approach is a slow process that requires enough time and resources as well as remarkable flexibility and open-mindedness – all of them factors that are largely absent in this era of fixed plans and tight project deadlines. Yet, as pointed out in *Article II*, the process should be seen at least as important as the end product of any particular project: learning to work interactively and constructively together in a multi-disciplinary team is already an important achievement itself. *Article VII* further discusses this notion, concluding that in a truly interdisciplinary team, the team members must be ready to give up some of their 'disciplinary sovereignty', modifying, developing and even abandoning the methods they are used to apply within their own disciplines and sectors.

This conclusion is supported by *Article II* that underlines the importance of the spiritual side of the integrated approaches. The actual implementation of the integrated approaches necessitates identification of the mental and social barriers that often prevent the integration and interaction between the people involved[96]. *Article II* concludes that the way towards more integrated and interdisciplinary practices is likely to require much better mutual appreciation and listening between the involved individuals, teams, stakeholders and interest groups. The team's success depends therefore not only on the members' expertise, but also on their attitude and communication skills – in other words on their ability to form an interactive, collaborating team.

Inclusiveness

The development, use and management of water involves always a variety of people, including for example farmers, fishers and urban dwellers as well as civil servants, planners, researchers, politicians and other decision-makers. Consequently, looking water management merely from the viewpoints of scientists and other 'water experts' will never be able to capture the diversity of interests, ideas and understandings related to water and its management. The inclusion of different people through various kinds of participatory mechanisms enables –but doesn't automatically ensure– that such views are taken better into account in the planning, assessment and management processes. Ultimately, inclusiveness therefore relates to the issues of transparency, representation and empowerment, connecting water management to the broader issues of governance and democracy.

Almost all of the appended articles discuss some dimensions of inclusiveness –commonly under the term stakeholder participation– in water management. This discussion is largely seen from the researcher's point of view, which basically makes everyone else –the so-called non-researchers– stakeholders. Such stakeholders can be crudely divided into two groups located at fundamentally

[96] Such a finding is a closely connected to the conclusions of Ramadier (2004) and Norgaard et al. (2009). Ramadier emphasises that (2004: 438): "Transdisciplinarity is thus based on the supposition that researchers can step back from the methods and points of view advocated by their own discipline. This is mainly a cultural problem [rather than a methodological one]", while Norgaard et al. (2009: 648) note that "Becoming conscious of disciplinary cultures and their embedded assumptions and presumed certainties and much more consciously choosing new assumptions, or ranges of assumptions, is a difficult form of culture shock. Many scientists refuse to go through the process and retreat back to disciplinary comforts".

different levels: local people, and water managers and decision-makers[97]. While they are often discussed together as one, monolithic group, it is important to note that both the incentives for their participation and the methods used to ensure it are usually very different.

Article II discusses the importance of the managers' and decision-makers' participation as a way to increase the linkages of modeling and assessment work with the actual planning and decision-making practices. In order to ensure this, the modeling and assessment projects need to focus much more on cooperation and communication, including enhanced dialogue with decision-makers and other stakeholders as well as increased transparency and intelligibility of the research methods and their results. The article provides some relatively obvious but frequently ignored recommendations for the way forward, noting that the model developers have to listen the decision-makers from the very beginning of a research project: only in this way the research will be able to answer to the actual questions the decision-makers face. The importance of dialogue with decision-makers is supported also by several other articles, most importantly *Article VII*.

Several articles discuss the different dimensions related to the inclusion of the local people –the actual water users– in the management and assessment processes. As noted in *Article VI*, water-related resources have different histories and are perceived differently by local users. Consequently, without sensitivity to the resource users' own perceptions on their use of water and related resources, it will be impossible to realise the actual possibilities for the resource management. *Article III* also discusses the possibilities to use participation to increase the understanding of particularly complex management systems such as the Tonle Sap. With the insights that local people have on water and related resources, one important attribute of participatory mechanisms is to provide an access to local knowledge on water use and management. Such knowledge can then be used to complement –and also challenge– the information gained from the other research activities. Indeed, based on the experience from the Tonle Sap, *Article III* notes that the participation proved to be crucial for the integration work, as local people provided invaluable insights in the interconnections between water, environment and society, complementing thus the more technical analyses.

Article VII adds into the discussion the more political dimension of inclusiveness, noting that since water development projects bring differing benefits and losses to different social groups, water-planning processes are not only technical, but unavoidably social and political processes as well. The research on water management and assessment is thus not only about neutral numbers, but also about the values given –consciously and subconsciously– to different issues. This, in turn, is seen to call for greater participation as a means to to enhance the legitimacy of the assessment processes, to increase acceptance of assessment findings among the stakeholders, and to make the entire assessment process more transparent.

Participatory mechanisms can also increase understanding of the local level diversities as well as to bring feedback from different stakeholders on the assessment methods and their results. Related to this, *Article VII* concludes that the assessment practices in the Mekong Region should increase their emphasis on public participation to ensure that stakeholders have meaningful ways to participate in the assessment processes, discussing and developing the objectives, methods and assumptions behind such processes. This kind of more open and participatory approach is seen to help to facilitate discussion and information exchange about the different development options, their impacts and consequent trade-offs.

[97] Following the definition given by Rykiel Jr. et al. (2002), decision-making is here understood as the act of reaching a conclusion or passing of a judgment on an issue under consideration, with such a judgement usually being a choice of one option among many. A decision-maker is thus a person with the authority to make such a judgement, to initiate actions to implement it as well as to promulgate policies that other persons are bound to follow.

Processes aiming towards greater inclusiveness and participation have, however, their problems as well. As noted in *Article VII*, participation can actually strengthen existing power imbalances and the dominance of scientific approaches[98] (see also Rayner 2003; Cornwall & Brock 2005; Käkönen & Hirsch 2009). Related to this, *Article VI* highlights the importance of sensitivity to the local level diversity: although often grouped together as 'local stakeholders', the local communities are not homogenous entities, but entail different user groups with differing perceptions and aspirations on the resources they have and use. Consequently, if participatory processes are designed without proper understanding of the local realities and the socio-political structures, they are likely to result in processes that merely reproduce the dominant power structures and fail to understand the diversity of stakeholders involved[99].

[98] See also discussion of Daniels & Walker (2001: 4) about what they call the Fundamental Paradox between the technical and/or scientific competence and an open, participatory process related to particularly complex policy problems: "Citizens demand technically sound solutions, but as situations become more complex, fewer people have the technical background needed to either meaningfully contribute to, or critique, the decisions. By the same token, these complex situations often touch people's lives in fundamental ways".

[99] The term 'stakeholder' is commonly defined as the individuals, groups or institutions who have a legal responsibility, are concerned with or have an interest relative to a decision, and who will be directly or indirectly affected by such a decision (UNESCO-WWAP 2003; Warner 2007b). The term has, however, also been seen to be unnecessarily neutral: many of the stakeholders are not just 'holding' their 'stakes' (e.g. livelihood, food security), but either winning or losing them for instance due to the changes caused to the fisheries by hydropower development. Consequently, as suggested by Dipak Gyawali, in some cases the more political terms 'stakewinners' and 'stakelosers' would actually capture better the situation that people in such contexts face.

5 Discussion: integration and water management

Previous chapters have discussed some of the main challenges related to integrated water management based on the practical experiences from the Mekong. In this chapter, I will take a bit more general stance, discussing the two concepts that form the focus of the entire Thesis; water management and integration. I suggest that one major reason for the challenges described in the previous chapters relates to the confusion about the very essence of these two key concepts, including their actual definitions as well as the nature of their interaction.

5.1 DIFFERENT DIMENSIONS OF WATER MANAGEMENT AND INTEGRATION

Part of the challenges with integrated water management practices is, I believe, due to the general confusion related to the concept of water management. Such confusion seems to be related to two things: to the tradition of seeing water merely as a physical resource, and to the weak consideration –understanding, even– of the different dimensions related to management.

Most water management practices have traditionally focused on the water as a physical and economic resource, seeking to measure and control its quantity and quality for different economic purposes. Water management is not, however, only about managing water per se, but also about managing the interactions between different people with their changing needs, views, valuations and requirements related to water. As noted by Linton (2006), what really matters is not only water as a resource, but also the relations between people and water[100]. Consequently, it is the variety of these relations –or modes of engagement– that management should ultimately address, together with the consideration of the water-related ecosystems and their requirements (see also *Article III*, *Article V*, *Article VI*, *Article VII*). Management also has differing dimensions that depend chiefly from the scope and the timeframe of the management activities. Chapter 2 defined the three main management dimensions as operational, tactical and strategic management, noting that each of them has very different objectives and methodological requirements.

Yet, neither the people and their diverse relations with water nor the different management dimensions are properly addressed in the current discussion about integrated water management[101]. For example the most commonly used definition for IWRM (GWP 2000) focuses on the development and management of water as a resource, with no proper reference to the diversity of other relations and valuations that people have with water. The different dimensions of water management are also not really dealt with in the IWRM instructions and guidelines[102]. This ambiguity in

[100] While such relations predominantly build on the use of water as a resource –e.g. through fishing, farming, navigation or hydropower generation–, they also include other relations, such as considering water as a place of spiritual worship, a space for recreation or source of artistic inspiration (Linton 2006). This conclusion also relates to the discussion about resourcism by Grumbine (1992), who notes that the very idea of natural resources misrepresents the nature just as a resource to be exploited by humans.

[101] Situation hasn't therefore changed too much since 1994, when Checkland (1994: 75) concluded that "Unfortunately, our current ideas of management [in general] are rather primitive and are probably not up to the task. They stem from the technologically orientated thinking of the 1960s, and they need now to be enlarged and enriched".

[102] More recently, however, the importance of different management dimensions has been increasingly recognised by the GWP and related authors (see e.g. Jønch-Clausen 2004; GWP & INBO 2009; Lenton & Muller 2009a, 2009b).

defining the actual meaning of water management is, I suggest, among the main reasons why the implementation of integrated water management remains so challenging. As the understanding of the methods needed for different types and dimensions of management is weak, the methods applied –integrated or not– end up not matching with the problems at hand. This, then, leads easily to either methodological inefficiency or even to methodological ineffectiveness[103].

Similarly challenging seems to be to define what we actually mean by integration and what kind of dimensions it includes (*Article II*). Previous chapters provided general definition for integrated approaches, concluding that integration is much more than a technical process where different 'things' are linked together[104]. It was also noted that in order to be feasible, the actual focus of the integration in each and every context must be carefully studied and defined. As a majority of the education and working practices still emphasise sectoral views, integrated approaches were also seen to challenge the cognitive processes related to the ways of seeing different items, contexts and their interconnections. The prerequisite for implementation of integrated approaches is therefore not only methodological expertise, but also the understanding of the person's own perceptions and ways of reasoning in relation to both the theory and the practice of the integrated approaches (*Article II*, *Article III*).

Nevertheless, the current discussion about integrated water management tend to emphasise the general thematic aspects (what to integrate?) as well as the practical aspects of integration (how to integrate?). Such an emphasis leaves less room for the third key dimension of integration, namely its theoretical foundation (why integration is needed?) (Figure 2). This kind of conclusion may first seem rather surprising, as most of the integrated approaches do build on detailed theoretical and even philosophical considerations. The challenge seems to be, however, that with the increasing popularity of integration, the amount of integrated practices has been rising rapidly and the more theoretical considerations have gradually been left to the background. Management teams and institutions start simply 'to do the IWRM', without proper consideration of why it should (or should not) be done in this specific context as well as what it actually requires from the management processes and –importantly– from the teams responsible for such processes.

5.2 BRINGING MANAGEMENT AND INTEGRATION TOGETHER

The previous section discussed some of the main dimensions of water management and integration, concluding that these dimensions seem not to be evenly addressed in the current practices of integrated water management. Such imbalances are, I would argue, very likely among the main reasons for the much-discussed gap between the theory and the practice in integrated water management. For when integrated practices are implemented with only partial consideration of their theoretical foundations and the linkages to the broader dimensions of management and integration, it is obvious that the theory and the practice are likely to grow increasingly apart.

The increasing gap between the theory and the practice is likely to lead to the practices that connect only vaguely to the original theories and ideas behind the integrated approaches. Looking again at the concept of IWRM, it can be noted that many management and research practices –including most of those that I've been involved in the Mekong– tend to focus almost exclusively on the practical, even mechanical

[103] As noted by Sutherland (1983), methodological inefficiency indicates that the methods applied are too sophisticated for the management issue, while methodological ineffectiveness means that methods are too practically-orientated and therefore not sufficient to tackle the management issue at hand.

[104] See also Kidd & Shaw (2007), who note that usually much more emphasis is put on sectoral and territorial integration than organisational integration. Indeed, they note that "integration in IWRM requires, not only a new perspective on the scope and purpose of water management in many instances, but also significant changes in organisational culture and practice" (Kidd & Shaw 2007: 318-319).

aspects of integration[105]. Yet, as IWRM aims towards sustainability and comprehensive views and seeks to involve a range of actors with their intricate interconnections, integration is not only a mechanical procedure to be implemented through a set of specific integration methods, but also very much a philosophical and also political matter.

Strangely enough, the current IWRM guidelines seem to have partly forgotten these kinds of broader theoretical considerations, promoting instead a certain, relatively narrow approach for its implementation. For instance the World Summit on Sustainable Development took in 2002 a rather technical, task-like view on IWRM: a view that has since been strengthened by the quantitative indicators that the UN agencies and the GWP use for the monitoring of the IWRM implementation[106]. While the experiences in implementing IWRM should indeed be evaluated, these kinds of checklists and rankings easily distort the basic idea of IWRM, rendering it essentially to a technical plan. In addition, due to its focus on statistics and quantitative data (such as the number of IWRM-related plans or pieces of legislation on IWRM), such evaluations fail to address the actual quality of IWRM processes, including the robustness of their theoretical foundation and, ultimately, the rationality of starting to use them in specific management contexts.

Related to this, there is a danger that the IWRM practices actually fail to address perhaps the single most critical issue in integration, namely identifying what kinds of things should really be integrated in each context and what not. While the common IWRM definition does emphasise the holy trinity of economic, social and environmental issues, already the very document giving such definition (GWP 2000) lists a wide range of issues that should be integrated as well. These issues and items are in later publications extended to almost endlessly to serve the different needs, views and context (see e.g. Biswas 2010). Yet, the tools provided for strategic reduction –meaning to systematically recognise and select the issues and the forms of integration that are most critical for the specific context– are entirely lacking from the current IWRM guidelines. Consequently, although the key IWRM documents emphasise the critical importance of context-specificity, they in fact fail to provide the actual means to operate in different contexts, including the ways to recognise the most appropriate methods and tools for the specific contexts.

Such findings indicate the importance of connecting the theories and fundamental principles of integration with the actual water management practises[107] (*Article II*, *Article III*, *Article VII*). Bringing the more practical aspects of water management into the picture is, however, not without problems. While it is often relatively easy to agree on the basic theory of integration (everybody usually agrees that things should be looked at holistically and systematically), reaching a consensus on what it means in reality –including the ways that such an integrated approach influences the existing management practices, structures and methods– is already much trickier[108]. The actual implementation of integration therefore becomes a contested and political topic.

This kind of conclusion has implications to the basic setting of the research presented in this Thesis

[105] The practical and mechanical aspects of integration refer to the range of activities –all relevant and critical for the success of integrated water management– that aim to help in the practical implementation of integration, focusing therefore largely on the technical aspects of how to do the integration. Drawing on the case studies presented in the appended articles, examples of such activities can include the creation of a model system for integration, the development of impact tables facilitating integration between different forms of information, or the analysis of the institutional and legal setting related to a specific management context.

[106] At the World Summit on Sustainable Development in 2002, the countries were encouraged to "develop integrated water resources management and water efficiency plans by 2005" (WSSD 2002: 15). Although Jønch-Clausen (2004) sought to emphasise that these so-called IWRM plans are just one milestone in the longer IWRM process, the GWP and UN-Water have in their recent reports focused on this "IWRM Target" (UN-Water 2008: 1), developing set of technical indicators to measure quantitatively the countries' progress in achieving the IWRM plans and ranking the countries according to their advancement (see e.g. UN-Water & GWP 2007; CSD 2008; UN-Water 2008).

[107] Although this linkage was not explicitly addressed in the first official definitions of IWRM, it has later on been duly recognised. For example Jønch-Clausen (2004: 18-19) introduces the concept of Integrated Water Resources Management Cycle, noting that "IWRM is a cyclical process. ...The cycle starts with the planning processes and continues into implementation of the frameworks and action plans and monitoring of progress".

[108] See also Molle (2008) and his fascinating discussion about IWRM as a so-called nirvana concept.

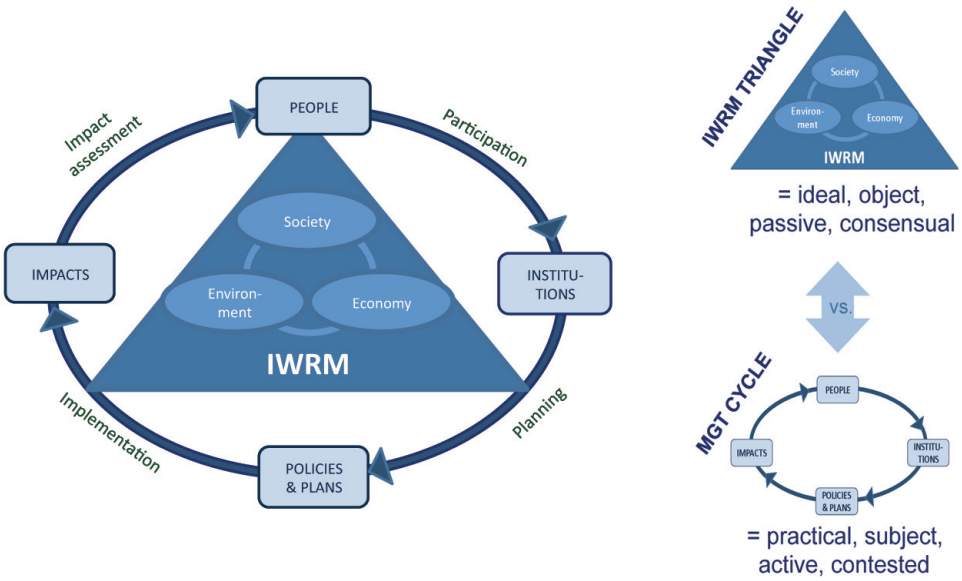

Figure 8 An updated version of the diagram presenting the basic setting of this research, indicating some general characteristics of –and contradictions between– its main components, the IWRM triangle and the water management cycle (cf. Figure 1).

as well. Going back to Figure 1, we can note that the main components of the diagram –depicted by two geometric shapes, namely the triangle and the cycle/circle– represent two elementary aspects of integrated water management: integration and its theory, and water management and its practice. Even more importantly, many of the fundamental contradictions inherent for integrated water management are associated with the two components as well. Such contradictions can be captured for instance with the following (idealised) pairings: ideal vs. practical, object vs. subject, passive vs. active and consensual vs. contested (Figure 8). Consequently, while the two components are by their very nature intimately connected, they are also, essentially, in perpetual contradiction with each other. I believe that this fundamental contradiction helps to explain many of the tensions and disagreements related to integrated water management, and its acknowledgement provides therefore also the basis for reducing the gap between the theory and the practice of integrated water management.

5.3 GETTING PERSONAL: THE IMPORTANCE OF INTERACTION

The previous chapters noted that the actual practices of integrated water management often focus on overly practical, even mechanical methods of integration, neglecting the more political and philosophical aspects. What could be done to address better also these aspects of integration and, consequently, to achieve more balanced integration practices? While the solutions naturally depend very much from the specific management contexts, there is one methodological change that, I believe, would in most contexts enhance the implementation of integrated water management. It is the methodological and also very much personal shift from mere integration towards integration and interaction.

Such a shift means that integrated water management practices need to pay much more attention to the interaction between the individuals, groups and institutions, including the use of

different methods facilitating such interaction[109]. As highlighted in *Article II*, for instance the level of model development is often already (more than) sufficient, and the impediment for the better applicability of model results lies therefore not on the lack of expertise and techniques, but on the poor communication and collaboration between the modellers and decision-makers. In a similar manner, as discussed in *Article VII*, the real challenge with many assessment processes is that they fail to address the issue of participation and engagement, remaining detached from the actual water management issues on the ground. *Article II* and *Article VII*, on the other hand, emphasised that close collaboration between the individuals in a management team –including crossing both disciplinary and personal boundaries– forms one corner stone for the success of integrated practices.

Interaction can therefore be seen to take place at two distinct levels: within certain management and/or research teams (team interaction) and in the broader management context between different actors and stakeholders (stakeholder interaction). The former indicates improved communication and collaboration between the experts working in a specific team, while the latter focuses then on the interaction between the team and its diverse stakeholders, including decision-makers, managers, water users and other actors. As the stakeholder interaction and participation is already well dealt with in the current guidelines and discussions about integrated planning and management (see e.g. GWP 2000; WCD 2000; Daniels & Walker 2001; Schuett et al. 2001; Gregory & Failing 2002; Agranoff & McGuire 2003; Weber 2003; Warner 2007; *Article III*; *Article VII*; Chapter 4.2), I will not discuss it further here. Instead, I will focus on the so-called team interaction that, I argue, remains inadequately addressed in the present-day discussion about integrated water management. This is perhaps most vividly exemplified through the fact that there currently exist almost no instructions on how to facilitate the cooperation and communication –indeed, integration– between the experts working in the same management team aiming for integrated water management[110].

Methodologically, the team interaction indicates increased emphasis on team building and, more generally, on communication, collaboration, joint visioning and mutual learning in the settings including experts with various disciplinary backgrounds (*Article II*, *Article III*). Such methods are, however, in surprisingly short supply among the current practices of integrated water management, and they thus require increased attention and, simply, more resources and expertise. At the same time the integrated water management practices have a possibility to learn from the experiences that other similar approaches –such as Integrated Assessment and Adaptive Water Management– have gained from using such methods.

The good news is that there already exist numerous methods developed specifically for team building, communication and collaborative learning. We in the water field don't therefore have to –and definitely should not– reinvent the wheel, but instead make use of the existing experience on using the different methods and approaches for enhancing team interaction. Indeed, I would argue that practically all of such methods are applicable to –and even already applied in– the water field[111] (see e.g. Senge 1990; Fischhoff 1998; Isaacs 1999; WCD 2000; Siitonen & Hämäläinen 2004;

[109] See also Giordano et al. (2007), who note that in a new, integrated view of resource management schemes, the hard, technical methods and soft, stakeholder-based methods should not be seen to be mutually exclusive but complementary.

[110] Related to this, Mitchell (1990b: 14) concludes that there are usually few explicit incentives for integration, noting that "vertical and horizontal fragmentation creates an environment in which rewards usually accrue to those who concentrate upon, indeed defend, their own areas of interest". Based on the findings by O'Riordan (1976), he also concludes that decision-making for resource management has "little to do with organization, statutory guidelines and co-ordinating arrangements. Rather, it has much more to do with the outcome of the determination, vision, indifference, antagonisms and bloody-mindedness of particular individuals who are in positions to influence. Thus, the combination of organizational structure, personalities and participants' attitudes can pose a major obstacle to integration and co-operation" (Mitchell 1990b: 14-15).

[111] For general discussion about team interaction, see for example Senge (1990) with its five key components of learning organisations (systems thinking, personal mastery, mental models, building shared vision and team learning) as well as the discussion of Isaacs (1999) about dialogue and the art of thinking together. Mostert et al. (2008), on the other hand, provide an interesting introduction to the possibilities of combining social learning and IWRM.

Mostert et al. 2008; Kallis et al. 2009; Le Borgne et al. 2009). Improved incorporation of these kinds of softer, communicative integration methods to the integrated water management practices can, I believe, help in bringing the more philosophical, political and even spiritual aspects of integration better to the fore. Indeed, interaction helps to make integration personal – what it ultimately always is as well.

6 Lessons learnt & implications

The Thesis has two parts: this synthesis and the appended, peer-reviewed scientific articles. While the articles present a rich array of practical experiences on the use of integrated water management approaches in the Mekong Region, the synthesis has sought to place these experiences to the broader context of integration and water management.

The main findings from both the synthesis and the appended articles are summarised below, together with discussion on the research questions presented in Chapter 1. Collectively, these three sections recap –together with the more specific findings presented in the appended articles– the most important new scientific findings provided by this Thesis. This Chapter, and the entire Thesis, is then wound up with a short concluding section.

6.1 MAIN FINDINGS: ARTICLES

The seven appended articles represent the core of this Thesis, and the most important new scientific findings can be found from them. The specific findings related to the particular context of each article can be found from their concluding chapters, and they will thus not be repeated here. Instead, Chapter 4 summarised the articles' main findings more generally in relation to the integrated water management. Such findings were organised under six key elements:

- **Comprehensiveness**

The starting point of all integrated approaches used in water management, and therefore a kind of meta-theme for all other elements. The ultimate aim of integrated approaches is to use institutions, mechanisms and methods to gain more comprehensive and systemic views on water and its diverse linkages with the people and the environment. Such views build on, extend and also challenge the analyses provided by sectoral approaches. Comprehensiveness and integration are not, however, synonymous, as integration indicates consideration of the issues that are most relevant in a specific management context, and not the consideration of all water-related issues.

- **Institutions**

Different institutions –formal and informal– are responsible for the actual implementation of integrated water management, providing structure for different management activities. A functioning institutional setting is therefore a precondition for successful water management. Understanding the possibilities and limitations of existing institutional setting is particularly important in transboundary contexts with their multiple spatial, temporal, institutional and political scales.

- **Politics**

Water management is very much a political issue, although many management and assessment methods still tend to depoliticise –intentionally or unintentionally– the management decisions. Politics is often at least as important factor contributing for the management failures than the much-discussed information deficiency and the lack of sound institutional settings. Integrated water management therefore requires the recognition of the highly political nature of water development and related planning, management and assessment practices. This is important also since many integrated

approaches aim to find a balance between issues –such as the environment and economic development– that in reality are not fully compatible, making their integration highly political.

- **Methods**

A sound methodological foundation for both water management and integration is a prerequisite for the success of integrated water management. Methods should not, however, take over from the management objectives, but remain as tools to be used in the implementation of the management activities. Management and integration tools commonly include technical methods used for example in the assessment and monitoring, but equally important –particularly in integrated management– are softer methods needed for example in team building, communication, deliberation and collaborative learning. Different settings also have differing methodological requirements, and the methods applied should thus be both flexible and sensitive to the specific contexts.

- **Team**

Water management and impact assessment is not just about methods, structures and institutions, but also very much about the people –each one of them with their own expertise, perceptions and attitude– who use the methods in varying institutional contexts. As integration requires an increased interaction between different people –both within the team and between the team and the 'real world'–, the importance of team in the implementation of integrated approaches is even more critical than with the other kinds of management framework.

- **Inclusiveness**

Water management is essentially about dealing with the diverse relations and aspirations that people have for water, and balancing those with environmental requirements. The inclusion of different stakeholders to the management processes and, consequently, the consideration of different views, perspectives and modes of knowledge are therefore crucial dimensions of integrated water management. Enhancing stakeholder participation is not, however, an easy task, and many participatory processes are actually not fulfilling their task to meaningfully involve the diverse set of stakeholders in the management plans and actions.

While the six elements discussed here may seem to be relatively obvious, they are nevertheless based on in-depth consideration of the different aspects related to the implementation of integrated water management in the context of the Mekong Region[112]. They also reflect the general characteristics of integrated approaches discussed in Chapter 2. The elements can be seen to provide a set of practical building blocks for integrated approaches, helping to divide their implementation into parts that are, hopefully, easier to comprehend, discuss and tackle.

6.2 MAIN FINDINGS: SYNTHESIS

In addition to the specific findings derived from the appended articles, there are also more general findings available from this synthesis. While providing a general analytical framework for the research presented in the articles, the synthesis also placed the research into the broader thematic and methodological context through the discussion about integrated approaches in management, assessment and research.

[112] Naturally also other kinds of elements have been considered critical for integrated water management. Most important in this regard are the six aspects of integrated water management defined by Mitchell (1990b), consisting of context; legitimation; functions; structures; processes and mechanisms; and culture and attitude. GWP (2000), on the other hand, recognises three complementary elements –or "pillars of IWRM" (Jønch-Clausen 2004: 16)– for effective water resources management system: enabling environment, institutional framework and management instruments. Rahaman & Varis (2005: 18), recognise in their in-depth analysis of the evolution and prospects of IWRM "Seven Factors Towards a Successful IWRM Implementation", consisting of privatization; water as an economic good; transboundary river basin management; restoration and ecology; fisheries and aquaculture; need to focus on past IWRM experience; and spiritual and cultural aspects of water, while Grigg (2008) gives eight possible elements of integration, including policy sectors; water sectors; government units; organisational levels, functions of management; geographic units; phases of management; and disciplines and professions.

By doing this, the synthesis connected the discussion about specific integrated approaches –particularly IWRM– into the broader trends related to integration. To help to understand what is actually meant by integrated approaches used in environmental management, the synthesis provided a concise definition for such approaches, concluding that such approaches have often the following five characteristics in common: comprehensive, interconnected, participative, goal-focused, and strategic. In addition, the synthesis presented a historical backdrop for the emergence of integrated approaches, noting their close linkages with the concept of sustainable development as well as with the frustrations related to sectoral, compartmentalised management processes.

The synthesis also looked at the definitions of water governance and water management, noting that although both are widely used, their actual meanings are rarely explicitly and unambiguously spelled out. Particularly the different dimensions of management with their differing methodological requirements were concluded to remain often poorly considered, leading easily either to methodological inefficiency or ineffectiveness. In order to avoid this to happen, the synthesis crafted a general classification for water management, consisting of three dimensions: operational, tactical and strategic management.

The different dimensions of both water management and integration were discussed in relation to the practices of integrated water management. It was concluded that such practices easily focus on practical, mechanical aspects of integration, neglecting the more philosophical and political aspects. It was suggested that there is thus a need to connect the theories of integration better with the actual water management practices, including the acknowledgement of the fundamental differences and contradictions between the two. Related to this, integrated approaches would most likely benefit from increased attention to interaction, including actual processes and methods facilitating such an interaction.

Interaction was recognised to be needed at two levels: within a management or research team (team interaction) and between the team and its diverse stakeholders (stakeholder interaction). While the importance of latter is already rather extensively understood and discussed, the former still remains surprisingly poorly addressed within the water field. Consequently, the synthesis provided some general references to the rich literature on team building, collaboration and joint learning, concluding that bringing these experiences firmer into the water field would most likely enhance also integrated management practices.

Finally, the synthesis looked at integration in science, connecting the discussion about integrated management practices to the more fundamental discussion about the role of research and researchers in such practices. The different forms of multi-disciplinary research approaches were examined, and definitions for four such approaches –multidisciplinarity, crossdisciplinarity, interdisciplinarity and transdisciplinarity– were given. As the different definitions given for such approaches tend to be unclear and partly contradictory, a novel visualisation for all four approaches were developed to highlight their elementary differences as well as their applicability to integrated water management.

6.3 ANSWERING THE RESEARCH QUESTIONS

This Thesis has sought to understand the current practises of water management, assessment and research as well as to find possible ways to use integrated approaches in improving such practices. To help to achieve this, the research questions presented in Chapter 1 aimed to look at some selected aspects of integration as well as their contribution for water-related management and research.

The three supporting research questions defined in Chapter 1 were:

> ***What are the main reasons for the emergence of integrated approaches such as IWRM in the water management field?***
>
> ***What are the key elements that need to be considered in the implementation of integrated water management approaches?***
>
> ***What kind of requirements, if any, integrated approaches put on water-related research?***

The first research question was discussed mainly in Chapter 2 of this synthesis. The reasons for the emergence of integrated approaches in water management were concluded to be found from both inside and outside the water field. Indeed, it is important to realise that the drive towards greater integration is not taking place just in the field of water management, but that it connects closely to the general integrationist drive in environmental management and research. As discussed in Chapter 2, such a drive stems mainly from two interlinked reasons: the concept of sustainable development, and the inherent weaknesses of traditional, sectoral forms of management and research.

The chapter also illustrated that the 'new' integrated approaches are not always that novel, but that they are partly building on practices dating back decades and even centuries. Consequently, experiences from other fields as well as from the past practices can provide a helpful reference for the integrated approaches in the water field. While such a conclusion is almost too obvious, it seems to be surprisingly often forgotten in the current discussion about integrated water management. This was considered rather paradoxical, as integrated approaches themselves are strongly emphasising the importance of linkages between the different sectors, disciplines and methods.

Many would argue that the second research question has an inbuilt bias in it: as every management context is different, the key elements required are practically always context-specific. While fully agreeing with this view, I also argue that there are some general elements that are critical in most water management contexts – or at least in those that I have been studied in the Mekong. Even more importantly, recognising such key elements provides an important step forward for the implementation of integrated approaches: they help to divide the abstract objectives of integrated management into more practical aspects that are easier to comprehend, debate and develop further. I believe that the most important elements for integrated water management were the six elements discussed in Chapter 4: three general ones (Comprehensiveness, Institutions, Politics) and three practical ones (Methods, Team, Inclusiveness).

While the general elements form the overall context for most integrated water management activities, the three practical elements are critical for the actual implementation of such activities. The three practical elements are thus also the ones that individual water experts and management teams have a direct influence on, and that therefore differ most greatly between the management contexts. Overall, the six elements must be in balance: for example the current discussion on IWRM seems to focus largely on just two elements –Institutions and Methods–, neglecting partly the other elements. Yet, integrated water management is not only about practical methods and institutional settings, but about the people – decision-makers, water managers, researchers and different stakeholders– using as well as misusing and abusing both the institutions and the methods. Accordingly, Politics, Team and Inclusiveness form equally important elements in the implementation of integrated water management.

Discussion on the third supporting research question can be found from the appended articles (particularly *Article II*, *Article III* and *Article VII*) as well as from Chapter 2 of this synthesis. The experiences presented in the articles show that integrated management approaches do place new kinds of expectations to research as well, highlighting the need for increased interaction

and integration between the disciplines. The integrationist drive in environmental management is thus matched by a similar trend in research, and the two were also found to be closely related[113].

A prime example of this trend is the shift from separate, disciplinary research traditions towards multi- and crossdisciplinarity and, increasingly, towards interdisciplinary research approaches. Yet, even this is not enough, but research supporting integrated water management needs to connect to the views, ideas and approaches originating outside the academic disciplines as well. This means increased engagement and participative research approaches, and therefore consideration of other, non-scientific ways of producing knowledge. Ultimately, integrated water management therefore requires transdisciplinary research approaches that connect in entirely new ways the knowledge of various disciplines and groups of people, and by doing this, make research more responsive to the needs of the society.

Finally, we come to the main research question of this Thesis:

> ***Can integrated approaches help in finding the ways towards more sustainable and equal water management?***

The answer to this question is obvious, yet not straightforward. Based on the discussion presented in this Thesis, I argue that integrated approaches are fundamentally important in reaching more sustainable and equal water management. Indeed, integrated approaches such as IWRM have already now been influential in diversifying our understanding about the various relations that people have with water. Such approaches have emphasised the importance of comprehensive views, participation and interconnectedness related to water and its use, development and management. These all are crucial building blocks for sustainability and equality.

Yet, there is a danger that integrated approaches may in some occasions actually maintain unsustainable and unequal management practices. The experiences presented in this Thesis indicate that there are at least two reasons for such a conclusion: the combination of the vagueness of integrated approaches and the highly political nature of water management, and the fact that the integrated approaches often build on existing, formal management institutions and require sophisticated know-how of the methods used for both management and integration.

The first reason refers to the realisation that while integrated approaches such as IWRM are usually consensual concepts, they at the same time are defined so vaguely that their actual practices take several different forms. Due to highly political nature of water management –as exemplified by the current situation with the hydropower development in the Mekong–, the integrated practices can thus be (mis)used to justify certain management decisions at the expense of truly integrated views (Figure 8).

Secondly, the incorporation of integrated approaches into existing institutional settings –although important for continuity– can lead to situations where the approaches are actually used to strengthen the institutes responsible for their implementation. This, in turn, is likely to sustain the existing imbalances and challenges related to water management and even lead to increased centralisation of water management[114]. Similarly, the increasing need for sophisticated integration and management tools can favour technical

[113] The reasons for the development of multi-disciplinary research approaches are naturally many, including but by no means limited to the expectations placed on research by integrated environmental management approaches. The relation between multi-disciplinary research approaches and integrated management practices works naturally also other way round: increased discussion about inter- and transdisciplinary research has undoubtedly contributed to the development of more integrated approaches for management.

[114] As noted by Biswas (2010: 14, 20), "many people and institutions have continued to do what they were doing in the past, but under the guise of integrated water resources management in order to attract additional funds, or to obtain greater national and international acceptance and visibility" and "the consolidation of institutions, in the name of integration, is likely to produce more centralization, and reduced responsiveness of such institutions to the needs of the different stakeholders". See also Warner (2007b).

expertise and scientific knowledge production at the expense of other views and forms of knowledge, even when integrated approaches aim to increase the emphasis on the latter. The threat of integrated approaches actually maintaining unsustainable and unequal management practices is particularly evident if such approaches are simplified into sheer technical, expert-driven processes without the recognition of their strong political nature.

6.4 CONCLUDING REMARKS

I have argued in this Thesis that integration is, even given its challenges, the right way forward in water management. Integrated approaches provide one –but naturally not the only– framework through which water management activities can be planned, implemented and analysed. Essentially, the use of integrated approaches means that we need to consider in a more comprehensive and sustainable manner the use, development and management of water, and that we must better understand the diverse interconnections between water, the environment and the different groups of people.

Integration also means that we need to cross the boundaries: those between sectors and disciplines, those between institutions and organisations and, most importantly, those between the ideas, views and perceptions of different people. Indeed, I would suggest that among the most important achievements of integrated approaches is the way they are gradually changing the mindsets of water experts and decision-makers towards more holistic, systemic view on water and its management.

In the specific context of research, integration connects to the broader discussion about scientific knowledge production, including rethinking the role of science and its relations with the society. Integrated management approaches emphasise the significance of interdisciplinary and, ultimately, transdisciplinary research approaches in supporting the management practices. This shift from reliable scientific knowledge to socially robust knowledge (Gibbons 1999) places new expectations also for research, highlighting transparency and participation. Making the scientific sense common must be common sense also for scientists!

At the same time it is obvious that water and environmental issues are becoming increasingly complex and interconnected – in other words, messy. Such messiness is particularly clear in integrated management approaches due to their crossboundary nature, as most major management problems are found at the boundaries of, for example, different sectors, disciplines, institutions and scales (Mitchell 1990b). Consequently, it can be questioned whether it makes sense to try to manage such complexity under one management framework – even when such a framework would be both broad and well-intentioned. In fact, I would argue that the entire water field is increasingly moving to the 'era of multiplicity', where multiple institutions and actors with multiple interests are managing water with the help of multiple theories, frameworks and practices in multiple simultaneous processes.

Accordingly, to be able to respond to this complexity and multiplicity, it must be acknowledged that what ultimately matters are not so much the means (different approaches and frameworks), but the ends (what is actually achieved) (Biswas 2010). This also indicates that in some circumstances the most suitable management framework may actually not be the one emphasising integration. Instead, the most appropriate way forward may be provided for instance through Adaptive Water Management with its emphasis on collaborative learning, or even through non-integrated water management practices taking place at several different layers in polycentric management contexts[115]. This also means that integration should not be seen to indicate a disregard of sectoral views, as also integrated management practices must build on in-depth understanding of the system components and they therefore have to make use of the relevant disciplinary expertise as well.

[115] For more information, see e.g. Kindler (2000), Ostrom & Janssen (2004), Lankford (2007), Pahl-Wostl et al. (2007) and Huitema et al. (2009). See also FAO (2006: 1) for an interesting discussion about so-called embedded watershed management as a "new generation of watershed management programmes" that are seen to be replacing integrated watershed management and are (again) promoting more sectoral approaches.

Both the theory and practice of integrated water management approaches need thus to be continuously improved, updated and adapted so that they correspond to the differing, continuously changing management contexts. They also need to consider much better the current era of multiplicity and complexity, including number of parallel management processes with variety of different actors. This also necessitates the recognition of the fundamental differences between the theories of integration and the actual water management practices, calling for an increased emphasis on the understanding of the intricate connections between the two.

At the same time it is tempting to put the blame of the problems with integrated water management either on the theory or on the practice – or at least on the much-discussed gap between the two. Such scapegoating is, however, not really addressing the main challenges with integration, particularly not in a field such as water management where the theory and the practice form a tightly interwoven circle[116]. Instead, we need to look beyond the theory and the practice, to the issue that really hinders the integration to take place: the people behind both the theory and the practice. Whether talking about the detailed theories of integrated approaches or about their actual implementation during day-to-day management routines, different people make decisions on how to do integrated management, including the diverse ways to link the different integration methods with actual management practices.

Consequently, instead of mere methods and approaches, what really matters is the mindset: the ideas, views, values, beliefs and attitudes of different people towards both integration and water management. Naturally, we need to be better aware of what kinds of methods there are available for integration and what kinds of institutional settings it requires. We also need extensive expertise on developing and using the different integration and management methods. At least as important is, however, to continuously discuss the ultimate objectives of integration: what we actually want to achieve by integrated management in this specific context, and what this requires from us and other people involved?

Such a dialogue requires getting out of our own comfort zones: putting our fixed ideas and strictly disciplinary methods aside, and starting to discuss and argue with our colleagues and with the various stakeholders about our views, motivations and understandings related to integration and water management. The importance of this kind of dialogue and cooperation has for long been discussed under the themes of stakeholder involvement and participation. However, at least as important –but much less discussed– is the interaction taking place at the level of different teams responsible for actual management and integration.

This makes integration also a very personal matter, as each person involved in an integrated management process needs to remain critical to their own working practices and open towards those of others. Maintaining such an attitude is not easy, and is very likely to lead to personal culture shocks on how we consider and value ourselves as well as our theoretical backgrounds and actual management and research practices.

Yet, I do believe that better consideration of these interactive and, ultimately, personal aspects of integration is the right way forward to balance out the dominance –as I see it– of the technical and even mechanical emphases of the current integrated water management practices. Indeed, I suggest that we need to understand that the letter 'I' in the acronyms of integrated approaches does not stand just for integration, but for integration and interaction.

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[116] Obviously, this doesn't mean that the addressing the gap between the theory and the practice would not be important as well: as was discussed above, in many situations such a gap is indeed among the main reasons for the underperformance of integrated approaches. There are also good, practical initiatives to try to systematically to reduce such a gap, including e.g. the common assessment framework proposed by Lee (2006) in improving the quality of Integrated Assessment.

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BRINGING BACK THE COMMON SENSE?

Integrated approaches in water management: Lessons learnt from the Mekong

Marko Keskinen

Dissertation for the degree of Doctor of Science in Technology

Water management is changing: the narrowly defined management practices that have for long been dominating are being replaced by more comprehensive approaches. Integrated approaches –including the Integrated Water Resources Management (IWRM)– represent the forerunners of this change, and they are thus loaded with expectations. The reality is, however, more complicated, with many of the integrated processes failing to live up to their promises.

This Thesis looks at integrated approaches used in water management and impact assessment, with a focus on the transboundary Mekong River Basin and the related Tonle Sap Lake area in Cambodia. The seven appended articles discuss an array of water management and assessment contexts in the region, sharing practical experiences on the use of integrated approaches. The synthesis places the current integrationist drive into the broader context through an analysis of the development of integrated approaches as well as through a review of multi-disciplinary research approaches. The Thesis recognises six key elements to be particularly critical for the actual implementation of integrated management: Comprehensiveness, Institutions, Politics, Methods, Team and Inclusiveness.

While the current integrated water management practices are often strong on practical integration methods, they at the same time seem partly to neglect the broader philosophical and contextual aspects related to integration. Yet, integration is not just a mechanical procedure, but very much a personal and political issue as well. What really matters are therefore not only the technical methods for integration, but also the ways the management and research teams in specific management contexts communicate, collaborate and interact with their various stakeholders as well as –an issue that is frequently forgotten– internally within their teams.

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