Integrated Water Resources Management: STRIVER Efforts to Assess the Current Status and Future Possibilities in Four River Basins

Per Stålnacke, Geoffrey D. Gooch, Udaya Sekhar Nagothu, Ingrid Nesheim, Line J. Barkved, Bruna Grizzetti, Alistair Rieu-Clarke, Johannes Deelstra, Haakon Thaulow, Dag Berge, Antonio Lo Porto, Dang Kim Nhung, S. Manasi, and Santiago Beguería Portugués

P. Stålnacke (✉) • U.S. Nagothu • J. Deelstra
Bioforsk – Norwegian Institute for Agricultural and Environmental Research Norway
e-mail: per.staalnacke@bioforsk.no; usn@bioforsk.no; johannes.deelstra@bioforsk.no

G.D. Gooch
Linköpings University, Linköping, Sweden
and
IHP-HELP Centre for Water Law, Policy and Science (under the auspices of UNESCO), University of Dundee, Dundee, Scotland, UK
e-mail: geoffrey.gooch@liu.se

I. Nesheim
The Centre for Development and the Environment, University of Oslo, Norway
e-mail: ingrid.nesheim@sum.uio.no

L.J. Barkved • H. Thaulow • D. Berge
NIVA – Norwegian Institute for Water Research, Oslo, Norway
e-mail: hth@niva.no; lba@niva.no; dag@niva.no

B. Grizzetti
Joint Research Centre of the European Commission, Ispra, Italy
e-mail: bruna.grizzetti@jrc.it

A. Rieu-Clarke
IHP-HELP Centre for Water Law, Policy and Science (under the auspices of UNESCO), University of Dundee, Dundee, Scotland, UK
e-mail: a.rieuclarke@dundee.ac.uk

A.L. Porto
Water Research Institute – National Research Council, Bari, Italy
e-mail: antonio.loporto@ba.irsa.cnr.it

D.K. Nhung
Institute of Geography, Hanoi, Vietnam
e-mail: nhungtuti@yahoo.com

S. Manasi
Institute for Social and Economic Change, Bangalore, India
e-mail: manasi@isec.ac.in

S.B. Portugués
Consejo Superior de Investigaciones Científicas, Zaragoza, Spain
e-mail: sbegueria@eead.csic.es

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1 Introduction

The contemporary concept of Integrated Water Resources Management (IWRM) was primarily conceived for the purpose of promoting sustainable water management. There are many elements included in modern IWRM perceptions, e.g., natural resource utilization planning combined with at strategy to balance between social, economic and environmental objectives based on an overall sustainability concept. However, the concept behind IWRM is not new. The historical development of the concept of Integrated Water Resources Management (IWRM) can be found in Rahaman and Varis (2005). The Technical Advisory Committee of Global Water Partnership (GWP-TEC 2000) has adopted the following definition of IWRM that has so far, received the most citations:

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

The European Union Water Initiative (EUWI) launched at the Johannesburg Summit in 2002 had the overall objective to promote the implementation of IWRM based on a river basin approach and to support – as advocated in the Johannesburg Plan of Implementation – the adoption of water resource management strategies and plans by 2005. As a follow-up to this, the European Commission (EC) via Directorate-General Research launched a "twinning" mechanism in Framework Programme 6 with the overall goal that it should be a science-based contribution to the EUWI. The aim was to "twin" European river basins with basins outside Europe to facilitate a platform for the sharing of experiences around IWRM. So far seven twinning projects have been introduced, one of which is STRIVER.

This chapter first provides an overview of the STRIVER project, followed by a selection of overall findings in an IWRM-setting, before providing a final discussion on the implication of the findings in the context of research and sustainable development. To large extent this chapter is a summary of two recently launched text-books on sustainable water management derived from the STRIVER project (Gooch and Stålnacke 2010a; Gooch et al. 2010).

2 Methodology and Study Area

2.1 Methods

Given that water and river basin management demands a combination of information produced by different scientific disciplines, a particular goal of the project was to develop methods to integrate results from three different scientific standpoints; namely (1) a natural science perspective, involving studies of ecological flows, nutrient and sediment loads and its impact on ecology, (2) an information and knowledge perspective, involving e.g., collation of data and mechanisms to disseminate scientific information, and (3) a policy and social science perspective, involving studies of policy and legal instruments, water pricing and economic valuation, and stakeholder participation. It was assumed that a viable approach for IWRM involves the creation of a framework that combines inputs from the various scientific disciplines, policy and management communities as well as local water use communities.

More specifically, based on the development of a multidisciplinary knowledge base in all the case basins, and an IWRM conceptual framework, the project carried out an IWRM assessment in four case basins (see Sect. 2.2). Then specific problems or focus areas were covered; namely (1) transboundary water governance, (2) pollution modelling, (3) environmental flows, and (4) land and water use interaction. The target beneficiaries of the project results were – besides the research community-, water managers, basin authorities, policy makers, and water users in the case basins. Stakeholder-interaction, communication and dissemination aspects have been particularly strong in STRIVER (see Sect. 3) thus increasing the likelihood of producing tailor made recommendations. How this was done is further shown in Sect. 3. The partners have invested substantial efforts in order to understand the various “paradigms” and view-points raised by the local communities, managers and policy makers.

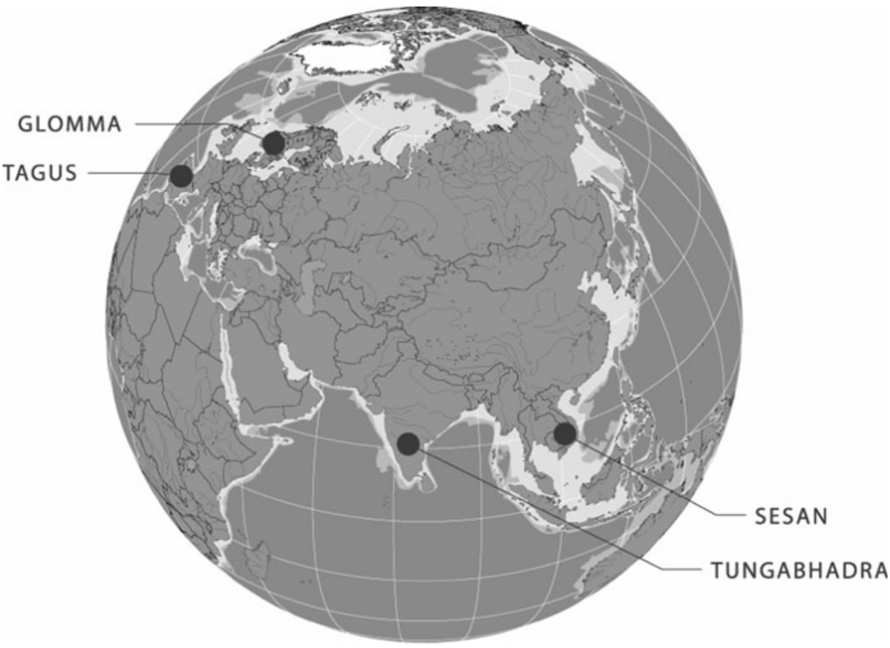

Fig. 1 The selected four river basins in STRIVER: Glomma (Norway), Tagus (Spain and Portugal), Tungabhadra (India) and Sesan (Cambodia and Vietnam) (*Source*: Gooch and Stålnacke (2010b))

2.2 Study Area

The four project river basins in which information, knowledge and competence were twinned, were the: Glomma (Norway), Tagus (Spain and Portugal), Tungabhadra (India) and Sesan (Vietnam and Cambodia) (Fig. 1). The basins where selected according to the following criteria: (1) transboundary, (2) pollution issues (3) hydropower development evident, and (4) varying degrees of IWRM implementation, including public participation and institutional frameworks. A more detailed description of the basins is given in the text-book by Gooch and co-workers (2010).

3 Results

In the following sub-sections, we first elaborate on the science-policy-stakeholder interface experiences gained in the project. This is followed by the IWRM status assessment in the four basins and a summary of various IWRM-topics addressed in STRIVER. The more detailed results can be found in two recently published textbooks (Gooch and Stålnacke 2010a; Gooch et al. 2010).

3.1 Science-Stakeholder-Policy Interface and Scenarios

A major problem in the move to IWRM is the incorporation of different forms of knowledge into the part of the policy process known as the science-policy-stakeholder interface. This knowledge can be scientific, local, or a combination of both. Despite the considerable amount of effort put into research into the factors influencing IWRM, the results of this research, as well as inputs from scientific and local knowledge, are often not included into policy making (Gooch and Stålnacke 2010b). The reasons for this are many, and still in many cases uncertain. The initial formulation of problems, often a process steered by scientists, is usually heavily influenced by the need to develop or refine problem solving procedures that fit into scientific disciplines, or that can be judged by others in the scientific community. Policy makers and managers, faced with practical problems and the demands of their electorates, look for quick answers to immediate problems. Both of these approaches are perfectly relevant and logical for the concerned parties, but the gap between them often seems insurmountable.

The demands on stakeholder and public participation, which are a central aspect of IWRM, have attenuated these problems, and the question now is how to include inputs from these different groups in policy processes? How can stakeholders and the public contribute to policy making in such scientifically complicated fields such as water management and IWRM? Are stakeholders and the public able to understand the complexity of these issues? The results of the work undertaken in the STRIVER project show that the answer to this question is yes, under certain conditions they can. There are today a number of tools that enable stakeholders to participate in environmental management (Gooch and Huitema 2008) although often they facilitate discussions and comments on existing proposals more than direct input into scientific approaches. While these may enable non-experts to understand complex problems, they do not provide a means of providing stakeholders and the public with ways to provide direct input in planning for the future. Planning for the future is also a major challenge for the scientific community as a lack of information about future conditions makes modelling exercises dependent on expectation of future developments. There is always uncertainty. At the same time, the effects of successful or unsuccessful water management through IWRM can be quite simply a matter of life and death in many parts of the world. As such, those most affected by the management of this vital resource should morally be involved in discussions as to how best to manage it. One way of involving stakeholders and the public in the formulation of possible futures is through the use of scenarios. These are projections of possible futures (Alcamo 2001; Shell International 2003), not necessarily the most likely futures.

In STRIVER stakeholders and the public were included in the formulation of scenarios for sustainable water management on the Sesan (Vietnam-Cambodia) and Tagus (Spain/Portugal) rivers, and to a lesser degree in the other basins. Water management regimes were first examined and it was seen that the combination of law, policy, actors and institutions was vital to these regimes. Communication processes were also of central importance as it within these that information, knowledge, and mutual understanding of problems and their solutions, are formed. Law plays a vital role in conferring rights and obligations on actors in support of IWRM. However the formal adoption of appropriate laws is meaningless without securing their effective implementation and for this it is necessary with the support of stakeholders and the public. In STRIVER, qualitative scenarios were used as a means of involving stakeholders in the formulation of policies, as well as a way to improve social learning processes and the potential of policy implementation. As a first step, the most important influences on future water use were discussed in groups and stakeholder meetings. These drivers were then combined into four scenarios, which there then presented to the stakeholder groups for discussion, changes, and refinement. This process was repeated three times, so that the final scenarios were a combination of scientific and local knowledge. A major achievement of this interactive, participatory process was that groups with radically differing views were able to express their desired or feared futures for each other, something which then provided a base for discussion.

Obviously stakeholder participation and analysis is a crucial element for practical IWRM implementation. In the STRIVER project, stakeholder participation was given an important place as demonstrated through the series of stakeholder workshops that were conducted in all the four case basins each year. In all, 12 stakeholder workshops were conducted (three within each basin), in addition to a range of targeted discussions with key stakeholders. During the first year, the workshops provided a platform for reviewing the initial stakeholder analyses and identifying the key stakeholders; introducing stakeholders to the project objectives and mapping stakeholder expectations, interests and problems; and fostering synergies with ongoing activities within each of the basins. In the second year, stakeholder workshops were used to steer research objectives and activities, including developing policy scenarios. The final year workshops were essential as a tool for collaboratively reviewing project outputs with stakeholders and the STRIVER team, as well as identifying avenues for further exploitation of STRIVER results.

The workshops not only helped in the integration of various perspectives of stakeholders from different sectors, but also different user groups with varied and conflicting interests. Experience showed that there was a relatively strong willingness among stakeholders to embrace the IWRM process irrespective of country, sector and/or occupational background; although the modalities remained fuzzy. The group dynamics observed at the workshops proved that it was possible to bring stakeholders that shared the waters for constructive dialogue, although the political, cultural and institutional context within each of the basins had a major impact on participation. Research project focused stakeholder workshops proved to be a useful tool for enabling soft negotiations on transboundary management of water resources and identifying opportunities for resolving other water use conflicts. It was also noted that projects such as STRIVER could play a "neutral role" in moderating the stakeholder workshops and motivating stakeholders with conflicting interests, by presenting research findings that were perceived to possess a strong heir of legitimacy. The stakeholder workshops also played an important role in offering insights on IWRM practice from other basins around the world and thus promoting awareness and, to some extent, also capacity building. Ultimately, the stakeholder workshops helped in fostering linkages between the STRIVER researchers, managers, end users and policymakers, and at the same time improve acceptance of project outcomes.

Besides the activities mentioned above, the approach also included in the development of a series of Policy and Technical Briefs that were produced in order to communicate the main technical and policy messages to the stakeholders. The content of the Briefs has been presented in a form that the stakeholders can easily understand. Attempts were made to present the Briefs to managers and policy makers in various meetings and workshops. Some of the briefs were translated into local languages to benefit the end users. The main objective was to disseminate the project results to the most relevant stakeholders. In total, 22 Policy Briefs and 13 Technical Briefs have been published. The basin-specific briefs have been presented at the stakeholder meetings and also disseminated at larger events such as the World Water Forum 5 in 2009. The effectiveness of the briefs is yet to be monitored but it is likely that such Briefs can target end-users compared to ordinary research articles and lengthy reports.

3.2 Environmental Flow Methodology with Science-Stakeholder Interactions

Another example of how STRIVER has tried to integrate between scientists, non-scientific experts and stakeholders can be found in the work with developing a new environmental flow methodology for hydropower regulation in rivers (Barton et al. 2010; Berge et al. 2010). Since the early 1970s, ecological aspects by the introduction of concepts around minimum or environmental flow (EF) have been given increased attention world-wide, both with respect to assessing the nature of the impacts as well as introducing abatement measures to reduce the negative impacts from hydropower development. EF is defined as "a flow that as far as possible takes care of the entirety and integrity of the ecosystem, the different user interests, and the future resource base in the watercourse" (Halleraker and Harby 2006). There exist more than 200 methods of assessing environmental flows, many of which were too complicated or demanding for use in developing countries (Berge et al. 2010).

A relative simple EF methodology was therefore developed in the STRIVER project. The method entitled "Pressure Impact Multi Criteria Environmental Flow Assessment" (PIMCEFA) seeks to set water release rules that would ensure favourable water levels for river ecology and livelihoods, within the constraints of economic feasibility. The PIMCEFA method does not require comprehensive field investigations such as habitat and aquatic biological registrations and detailed river cross-section descriptions (Berge et al. 2010). According to this method, scientific inputs from river ecologists, hydrologists, environmental scientists, economists are first used to produce the basic knowledge about the functions, values and problems of the river basin. Then an expert panel is established where the scientists, non-scientific experts and stakeholders jointly: (1) define policy-relevant alternatives, (2) identify river ecological and user interests (for which impacts are to be determined), (3) draw optimal water level curves for each ecological value and user interest chosen; and (4) discuss and develop pressure-impact curves for various flow regimes. Finally, the results are translated into a multicriteria tool that pools the information; which can then be discussed with stakeholders in an accessible manner. The methodology itself requires a high level of collaboration with a range of stakeholders and the outcome of the work definitively integrates the knowledge of different expertise and the trade-off of contrasting interests. In the STRIVER project, the methodology was successfully developed in the Glomma and the Sesan river basins (Berge et al. 2010; Barton et al. 2010). It was concluded that Environmental Flow has to be considered as one of the most important measures to reduce negative impacts from hydropower development. In the Sesan River, it is important for preserving aquatic productivity, biodiversity, as well as livelihoods for the local people in downstream reaches (Nesheim et al. 2010a).

3.3 Pollution Modelling with Stakeholders

Accuracy in the quantification of pollution sources and pathways is a major challenge facing the research community as well as managers and policy makers. In the evaluation of environmental changes and management actions river basin models are getting increasingly important. In a science-policy context this implies both selecting the appropriate tools and making sure that the management scenarios have real relevance. In the STRIVER project, these aspects were considered in addressing water pollution related to phosphorus (P) and nitrogen (N) loss from agricultural dominated catchments. Modelling nutrient pollution in Glomma (sub-basins Hunnselva and Lena) and Tungabhadra was carried out using the same methodological approach, i.e. applying the same river basin modelling tool(s) (Grizzetti et al. 2010a). Of major importance was the involvement of local stakeholders at different stages in the modelling process, including the preparation of input related to farming practices, scenario development and analysis. The overall objective of applying models was to obtain information about its suitability to quantify changes in nutrient loss under different management scenarios and whether these changes could meet surface water quality targets. Of major importance was also the evaluation of data availability in the twinned basins, the mutual transfer of know-how (e.g. experiences, concepts, results), technology (e.g., methodologies, models) and modelling procedures. The important role of reliable data such as water quality measurement is indisputable. This is not only a natural scientific dogma but also largely recognized by various international water management bodies (Stålnacke and Gooch 2010). Moreover, it is paramount that modeling tools have to provide reliable results, to be able to provide sound scientific advice to the managers and that economically defensible decisions can be made based on the results. Therefore, the quantification tools have to be accurate in predicting existing nutrient loss and be responsive to changes in land use and land management. A general guideline in the selection of models should be its compliance with the data available. In addition, modellers should preferably have local knowledge about the physical conditions and management practices in the basin, and have a continuous ongoing dialogue with stakeholders to guarantee obtaining reliable scenario results.

Two models were applied, i.e. the TEOTIL (Tjomsland et al. 2009) and SWAT (Neitsch et al. 2002) respectively. SWAT relies on detailed spatial input data, among others soils, cropping systems and climatological data. Less information is needed for the TEOTIL model, which operates mainly on the basis of so-called export coefficients for nutrient loss from different land use types. The overall modelling performance was found to be reasonable. However, at several stages of the modelling process, shortages and gaps in the required data were identified, leading to assumptions and data constructions. Especially in those stages of the modelling process, contact and dialogue with stakeholders was important. Modelling results and management recommendations for the Glomma and Tungabhadra river basins are reported in Grizzetti et al. (2010c) and Lo Porto et al. (2010) respectively.

A participatory modelling approach implies involving stakeholders in model exercises, thereby incorporating local knowledge and understanding of the natural system. In such a process a good communication and interaction between scientist and stakeholders is important to be able to identify and understand the values and motives of a wide range of stakeholders, thereby arriving to logical decisions and management actions. The STRIVER project, interaction and co-operation between scientist and local stakeholders of the respective basins in the development and implementation of scenario modelling was a prerequisite in IWRM (Grizzetti et al. 2010a, b). In the case of the Glomma sub-basins Hunnselva and Lena, measures related to agricultural practices to comply with environmental policy objectives were selected, including among others conservation tillage and optimal fertilization application. Hunnselva is part of Phase 1 in the implementation of the EUs Water Framework Directive (WFD) and as such, the modelling results have been used as supporting knowledge in the planning of mitigation measures in the basin. In the Tungabhadra river basin, the stakeholders were interested in modelling the impacts of climate change, improved sewage treatment, irrigation technology and changed rice production.

The major experience in pollution modelling in the Glomma and Tungabhadra river basins was that stakeholder involvement at different phases of the modelling process, such as input preparation, scenario building and discussions of modelling outcome, played a key role.

3.4 IWRM Assessment in the Four STRIVER Basins

A comparison of IWRM status assessment of the four basins was undertaken (Nesheim et al. 2010a) with a focus on the environmental, socio-economic and institutional dimensions based on the IWRM principles and components suggested by GWP and the 1992 Dublin conference, preparing for the Earth Summit in Rio de Janeiro the same year. In addition, capacity building and transboundary issues were analyzed as they were considered important for the STRIVER project and for implementing IWRM.

The following major conclusions were drawn (Nesheim et al. 2010a):

- Socio-economic development was the common driving force in all the STRIVER river basins, although the role played by each sector varied according to the local conditions. As a consequence, in some cases the river basins face similar pressures and comparable impacts. Negative changes in water quantity and quality were the two common factors in all the conflicts and all the river basins had developed plans or policies to protect most of the environmental aspects. However, it was difficult to assess their level of implementation and the effectiveness of the planned measures. The extent to which problems of water scarcity and water pollution are effectively mitigated depends not only on the existence of relevant law and policy, but also on the degree to which such instruments are implemented. In other words, it is the management and the institutional situation which ultimately determines the outcome. The case basin situations show that there are numerous issues of pollution, environmental flow, water allocation, and more, where laws and policies are not always implemented. This situation may be partly due to weak institutions (particularly in the Sesan and Tungabhadra), but also due to poor coordination between institutions (Nesheim et al. 2010a; Manasi et al. 2010; Gooch and Rieu-Clarke 2010). The latter problem is evident in almost all basins, caused by the multitude of different bodies involved, and unclear definition of roles and functions as well as (in some cases) a lack of financial capacity. In Sesan and Tungabhadra basins, less sufficient monitoring (e.g. crucial water quality parameters) and control and also poor implementation of the prescribed actions were registered.

- Generally it can be argued that in areas where water shortage was evident, measures were taken for water saving and reuse.
- In all the STRIVER basins, access to information and decision-making was present – in particular through environmental impact assessment procedures – at varying degrees. Information laws or the right to information also allowed stakeholders to access information through public authorities. Whilst a number of conventions and national laws and policy provide for stakeholder participation in water management, practice demonstrates that government officials, hydropower, industry and urban interests tend to dominate decision-making (Rieu-Clarke et al. 2010). As a result interest groups representing environmental concerns and communities tend to have less influence in decision-making despite the procedural rules allowing them access to relevant information and procedures, such as public inquiries.
- Capacity building was officially emphasized as part of many water policies and strategy documents in the Sesan, Tungabhadra and Tagus case study basins. However, it was evident that these official statements were seldom operationalised to any larger degree by the authorities. Competence building which includes NGOs are increasingly becoming a part in basins and covers information campaign brochures for the public and training programs for certain sectoral groups (especially for local communities, farmers). In Cambodia, foreign donors were an important actor being responsible for training programs.
- The case basins represent a full spectrum of alternative transboundary contexts/situations, from inter-states (Tungabhadra) to international (Tagus and Sesan). The cases illustrate that the extent of conflict decreases as we move along the continuum from international to local and the extent of conflict varies by type: e.g. competition over the quantity of water was more controversial then conflict over quality. Hydropower development is perhaps the most important issue in a transboundary context, as it may potentially have detrimental effects on the river downstream of the border.
- There exists a considerable number of “IWRM-initiatives”, IWRM-plans and policies in all the four basins, but practical full IWRM implementation is generally lacking, except in the case of Glomma (Nesheim et al. 2010b).

3.5 Land and Water Use Interactions

In the two river basins, Tagus and Tungabhadra where the comparative study was conducted, land and water use interactions and its implications for IWRM is very closely linked. It is obvious that, and changes in land use exerts pressure on water resources, for e.g., introducing irrigated agriculture in river basins has significantly altered the water allocation patterns and usage, including the water quality. The latter is impacted by use of more chemical fertilizers in irrigated agriculture. On the other hand, changes in water cycle, due to climate change impacts or other local factors, may also lead to changes in land use.

A study by Begueria et al. (2008) has shown a significant land use change in the last decades in both the Tagus and the Tungabhadra basins, due to new water demands. While urbanization has increased in the Spanish part of the Tagus, the increase in natural vegetation in the upstream part of Tagus in Portugal is clearly evident, showing a change in the land use (CORINE Land Cover 1985/1990 and 2000). In the Tungabhadra basin, irrigated agriculture has been the main focus since 80s replacing dryland agriculture, with the construction of the irrigation infrastructure. As a consequence, natural forests and grazing lands have been brought under agriculture. Overall, there has been more urbanization in the peri-urban areas in the Tungabhadra basin.

Although, the changes are not new, the land and water management institutions do not work together. At the basin level, there is a lack of an authority that can integrate the management initiatives. Integrating the efforts of various relevant sectors, could provide a better management option in both Tagus and Tungabhadra, where the challenges appear more complex, and cannot be addressed by sectoral approach. IWRM can be a practical tool in both the basins to resolve transboundary issues and water conflicts between sectors. This may be feasible at least at a sub-basin level to start with as a management unit, if properly planned. In the two basins, we have observed that water management and planning, does not adequately take into consideration the linkages between land and water use.

There are several options, as analyzed by our teams in the STRIVER project that can be recommended, such as improving the efficiency of water use, reducing competition between sectors and introducing new cropping systems and practices that would need less water than the current systems. For example, crop rotation between irrigated and dry land crops, new irrigation methods like drip and sprinkler systems that increases the productivity, introducing inland fisheries and aquaculture, and water and soil moisture conservation measures. Farming and small-scale fishery is predominant livelihood source in many developing countries. However the latter group is a marginal group that is not integrated with activities of other sectors, for example water for irrigation or considered when Water Resources Department make water allocation priorities (Joy et al. 2010).

We have observed new initiatives in the two basins, and efforts to move towards integrated management. However, some of these efforts are still not in practice, and in fact, the stakeholders have not been prepared for such a change. The change has to come from bottom up, with a top down institutional supportive mechanisms.

There is some willingness to change in both the basins, as observed from the new policy documents, new programs attempting to bring the relevant stakeholders at the planning phase and capacity building initiatives. At least in the Tagus, the governments are bound by the EU Water Framework Directive and are required to comply with some of the directive regulations that require integrated management. In Tungabhadra, no such directives exist. It is still a long way to go in both the Tagus and Tungabhadra basins before we can claim that IWRM is in practice and stakeholders are actively involved in managing water resources.

3.6 Transboundary Conflicts and Water Governance

Transboundary settings are especially sensitive in IWRM, as conflicts over the use and sharing of water and the demands placed on water governance increase in transboundary waters (Gooch and Stålnacke 2006). Different national and sectoral interests from different countries must try to cooperate in the use of transboundary water and while water laws and systems of administration are mostly unified in national contexts, in international rivers, there are with a few exceptions no unitary authorities that can legally or politically force actors in the water sector to comply to laws and agreements. Competition between different agencies does of course also exist in national contexts, where different agencies and departments often compete over resources, funding and information. The special conditions involved in sharing a common resource such as water between different countries also creates conditions that are especially dependent on efficient legal systems and communication. The challenge is that these often do not exist, which makes cooperation between the different organizations and institutions, such as governmental agencies and departments, more complicated. Transboundary conditions can also result in challenges for NGO's and other stakeholder groups to create efficient means of communication and influence with these groups of policy-makers and managers (Gooch and Rieu-Clarke 2010). Transparent water management and the involvement of stakeholders and civil society need functioning channels of communication through a number of networks which may consist of official and unofficial actors, formal and informal institutions. These networks may include different official departments and agencies, funding agencies, NGO's, village and community informal organisations etc., as well as infrastructures in the river basin such as hydroelectric power plant dams (Gooch 2008a). Within these networks, the world-views and understanding of the actors and groups of actors strongly influences their treatment of information and knowledge. The scientific information provided by a project such as STRIVER may be accepted or rejected according to these mind-frames (Gooch 2008b).

While a significant body of research has sought to examine governance in general, little work has been done to tailor such work to the specific context of (transboundary) IWRM. The STRIVER work related to governance therefore sought to develop a robust set of indicators, capable of assessing laws, policies and institutions related to (transboundary) IWRM. An important first phase of the work was to review the applicability of existing theory related to governance, IWRM and indicator analysis (Rieu-Clarke et al. 2008; Allan and Rieu-Clarke 2010). This research was the basis by which STRIVER developed a set of indicator questions. The question focused on examining the extent to which good governance principles, e.g., accountability, transparency, participation and predictability, were embedded within the laws at multiple-scales (international, regional, national and provincial). The work also analysed the degree to which good governance principles – enshrined within the law – were translated into practice. Clearly such an examination required extensive empirical analysis, which was secured through collaboration with stakeholders via workshops and interviews. Such empirical analysis was vital in order to ascertain the extent to which laws were implemented. Stakeholder engagements also offered an important means by which to "validate" the research outputs from the project. An underlying theme running throughout the research findings related to governance was the need to account for, and fully understand, the wider governance context in which decision around IWRM are taken (Rieu-Clarke et al. 2008; Allan and Rieu-Clarke 2010).

4 Concluding Remarks

4.1 STRIVER Findings in an Overall IWRM Context

We have claimed in this paper that IWRM seeks to achieve a balance between economic efficiency, social equity and environmental sustainability (see e.g., Gooch et al. 2010). As pointed out by Gooch and Stålnacke (2006), the definition of IWRM and what is usually understood as the main contents of the ideas behind it, have a strong focus on the concept of sustainability,, yet little is, however, provided as to how this integration, balancing of interests and co-ordination is to be achieved. The practical implementation of IWRM, its operationalisation, and how to achieve measurable criteria of its success or failure, have also been questioned (e.g., Jeffrey and Gearey 2006; Lankford and Cour 2005; Biswas 2004). Others have claimed that the benefits and added-values of the idea must be clearly shown in order to achieve political and public acceptance for IWRM (Ballweber 2006). The need within IWRM to include the full range of physical, biological, and socioeconomic variables has also been stressed as central to the IWRM process (Hooper 2003). Unfortunately, such a knowledge base is usually lacking or not accessible, or it is scattered across various sectoral agencies which may be unwilling or unable to cooperate with one another. Other fundamental attributes usually considered part of IWRM include social and motivational feasibilities (Chess and Gibson 2001). The important role of science has lately also been emphasised (Gooch and

Stålnacke 2010a; Quevauviller 2010). More specifically, it has been claimed that scientists can play a key role as a neutral third party (Gooch and Stålnacke 2010a), especially in local capacity building (Breen et al. 2004).

What then are the main findings of the STRIVER project and how can these findings help us to improve intergrated water management? Stålnacke et al. (2010) have formulated the following main findings from the STRIVER project:

- Stakeholder participation is one of the most critical elements for practical IWRM implementation. It helps not only in the integration of various perspectives of stakeholders from different sectors, but also of different user groups with varied and conflicting interests.
- Research projects such as STRIVER can act as independent facilitators and provide a neutral platform for stakeholder dialogue, which ultimately can help facilitate the IWRM process. During the project life there was seen a relatively strong willingness among stakeholders to participate in the IWRM process during the workshops, irrespective of their country, sector and occupational background. The stakeholder workshops were also seen to play an important role in capacity development initiatives.
- Cross-border cooperation was a difficult process and sensitive to address. In all the three transboundary river basins the challenges of cooperation were seen as a potential hindrance to IWRM and therefore needed to be carefully addressed. It was only in the stakeholder workshops that STRIVER could bring together actors from different countries or provinces sharing the river waters.
- The development and show-casing of various “tools” (e.g., environmental flow, pollution models, water pricing, Actor-Network analyses and scenarios) is of high interest and considered to be of high value for the water managers. One common feature with all the applied and tested tools used in the project were that they helped promote dialogue and integration between the different actors involved in IWRM as well as between scientists and stakeholders.
- There exist a considerable number of “IWRM-initiatives”, IWRM-plans and policies in all the four basins, but practical IWRM implementation is generally lacking, except in the case of Glomma.

4.2 Some Reflections on How to Strengthen European Research in the Perspective of Transformative Research for Sustainable Development

The challenge facing European research is not one of scientific quality, nor one of funding, but of funding and research aimed at interaction with managers, end-users and policy-makers. Despite a number of significant efforts on the part of the European Commission, much of the output of EU funded projects is still not used by the very people who would have most use for it (Quevauviller 2010). Why? Many R&D projects simply do not have the flexibility, or the will, to embark on the process of learning to communicate their results to people who are not experts in their field of study. This is partly a result of the constraints of EU funding, and partly the result of embedded academic traditions that prioritise internal presentations of results in scientific journals, many of them only read by a limited number of people. Another problem in ordinary research projects is that the objectives need to be defined ex ante (Jäger 2011). Compared to many other R&D projects, twinning projects, like STRIVER, did however had the flexibility to change the research focus during the duration of the projects and also interact with water managers and policy makers (see e.g., Sect. 3.1 above). However, this interaction is dependent on scientists taking the role upon themselves of “scientific ambassadors”. In addition, it also demands more time and resources in terms of logistics required for travels, meetings and discussion forums. However, this in itself is not enough; as noted in other sections of this chapter what is needed is the development of an interface, not one-way communication. In other words: the integration of scientific research with policy, management and society has to be considered at all stages of IWRM development, including design, planning, implementation and review (Grizzetti et al. 2010b). Managers and policy-makers must also be prepared to take the time and make the effort to interact with the research community. Managers and policy-makers can be initially are sceptic to “spend” their valuable time with researchers; we observed this in the initial stages of the STRIVER project. In the course of time, STRIVER managed however to establish trust and confidence amongst the stakeholders, and to develop ways to interact with these groups and to integrate their knowledge into the project. Unfortunately, for researchers, these kinds of stakeholder interactions can often only be achieved and developed at the expense of scientific publications, and it is these publications that are the base of a scientific career. If results from projects such as STRIVER are to reach managers and policy makers, it is necessary to spend the resources and to establish formal links with stakeholders (from local level, to high-level water managers and policy makers) and the research community. This is particularly relevant to the implementation of IWRM and other sustainability programmes, and this is something that must be developed during the whole course of the project. Such a link could be win–win situation for both researchers and managers, and also help in a better understanding of the research problems to be addressed It could also lead to the joint development of appropriate tools, scenarios and policy guidelines. Another important result of the STRIVER project that was experienced during the field trips and workshops was that stakeholders were interested in capacity building that could be also formalized in the projects. In more practical terms, it is therefore recommended that funding agencies like DG Research at the EC continue with the twinning mechanisms in the future, but with more emphasis on twinning and interaction between the scientific community, stakeholders and the public. This would involve, in order to be effective, projects with at least 4–5 years project duration. The absence of long-term funding to support iterative and participatory processes for sustainability research projects is also emphasised and further discussed by Jäger (2011).

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