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Current Opinion in Environmental Sustainability

Improving the role of river basin organisations in sustainable river basin governance by linking social institutional capacity and basin biophysical capacity

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The river basin organisation (RBO) model has been advocated as organisational best practice for sustainable river basin management, despite scant evidence of its effectiveness to manage complex river systems. This review provides a framework which combines functional social-institutional capacities with basin biophysical indicators in a diagnostic tool to determine RBO governance performance. Each of these two capacities are represented by four groups of indicators respectively covering social learning capacity and biophysical capacity. The distance and alignment between capacity and measure of performance scores can be used to prioritise program planning and resource allocation for improving river basin governance, and to undertake periodic evaluations as part of a trajectory analysis. The diagnostic functional framework provides tangible indicators of performance around key concepts in river basin governance. It offers a first attempt to strengthen the position and effectiveness of an RBO in dealing with complex adaptive systems.

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Current Opinion in Environmental Sustainability 2018, **33**:70–79

This review comes from a themed issue on **System dynamics and sustainability**

Edited by **Bojie Fu** and **Yongping Wei**

Received: 23-1-2018; Accepted: 26-4-2018

https://doi.org/10.1016/j.cosust.2018.04.015

Introduction

Governance of river basins is complex and context specific [1], nevertheless, many governance issues are similar around the world: drought (demand exceeds supply), flooding (supply exceeds demand) and water quality degradation (pollution, saltwater intrusion, turbidity, algal blooms, etc.) [2]. Emerging threats to sustainable development of our water resources include changes in hydrology, geomorphology, erosion, sedimentation, and connectivity driven by population pressure, economic development and climate change, and the resulting degradation of freshwater ecosystems and ecosystem services [3,4].

Water crises are evident everywhere, with almost no river basin currently managed sustainably anywhere in the world — a fact which is increasingly recognised as being a failure in *governance* [5]. The crisis of river basin governance has been investigated from the perspectives of *collaborative governance* [6,7] (adaptive governance [8–10] and social learning [5]), *social contracts* (covenant action [11], ecosystem asset management [12], partnership accountability [13]) and *top down regulation* (hydrocracy and overallocation [2], hierarchy theory [14••], politics of knowledge [15]). A central pillar in integrated river basin management (IRBM) has been the establishment of river basin organisations (RBOs), yet the efficacy of those organisations has received relatively little attention, except to the extent that scholars and practitioners alike agree that the objectives of RBOs are often ill defined and governance performance of RBOs are poorly measured [16]. River basins understood as systems exhibit the same characteristics that are captured in Ostrom's Social-Ecological Systems framework [17], and the aim of this paper is to propose a diagnostic functional framework that can be used to strengthen the role of RBOs in sustainable river basin governance.

This paper is structured as follows. The issues section will highlight key governance issues including the role and position of the river basin organisation (RBO), and the various relevant conceptual frameworks and their limitations to address those governance issues. In the next section, a diagnostic framework is conceptualised for the role of RBO in integrated river basin management, including indicators, attributes and trajectory for implementing and using the framework. The discussion and conclusion section highlights the implications of the proposed framework. Finally, the next steps for a more detailed analysis and evaluation of the framework are suggested.

Issues

A RBO can be described as an organisation that is made up of a number of rules related to authority, aggregation, boundaries, information and pay-off (distribution of benefits and costs) of a river basin [18,19]. RBOs are an important component of integrated river basin management (IRBM) and aim to govern a basin's geographic boundaries, using a bioregional approach and allowing a system-wide approach, combined with a coordination function across the often-numerous sub-catchment organisations that can exist in a basin, or even as part of a water transfer scheme. In this way, some RBOs can also exhibit strong elements of polycentric governance in practice [20]. Thus, as a coordinating institution, the RBO can also create the policy space where top-down regulation can meet bottom-up participation to address stakeholder user needs at various spatial scales, despite the wide array of agency it represents. Related integrated water resource management (IWRM) principles include stakeholder participation at local and catchment scales, the need for adaptive management (learning by doing) using an evidence based interdisciplinary approach, and management for sustainable and equitable triple bottom line outcomes (social, economic and environmental) [21]. The definition of IWRM provided by the Global Water Partnership is 'a process which promotes the coordinated 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' [21]. Despite being critiqued by Biswas in 2004 [22] for having no tangible operational value, recent developments facilitating IWRM include downsizing technology, decentralization and subsidiarity, and increasing knowledge around adaptive management and social learning [23–26]. RBO governance types and agency vary widely around the world, resulting in different implementation practices for their three core functions (regulating, planning and managing) [21].

RBOs have been criticised for many different shortcomings. For example, most RBOs have been superimposed on existing governance structures, which often bring them into conflict with national or state policies and institutional interactions when it comes to policy priorities and decision-making power [27]. RBOs can suffer from rigid institutional dependency pathways [28••], bureaucratisation [20], asymmetry of knowledge and power with regard to key stakeholders [15] and overdevelopment [29]. Feasibility and effectiveness of RBO performance remains elusive [15], objectives are often ill defined and success rates are poorly measured and contested [16]. Despite these criticisms, the global water management discourse often still favours strong RBOs as advocated by the Global Water Partnership (GWP) and the International Network of Basin Organisations (INBO) [21]. Nevertheless, RBOs occupy a central, leading role in the governance of river basins by their capacity to govern from an ecosystem perspective including the ability to respond to the controlling spatial and temporal scales at which biophysical processes occur [27]. In order to overcome governance shortcomings, approaches and tools are needed for strengthening the role of RBOs for sustainable river basin governance.

Water governance — as manifest through human intervention — aims at changing water cycles for societal or environmental purposes. The Global Water Partnership [21] defined water governance as '*the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society*.' This definition provides guiding principles for good water governance but does not address sufficiently the complexity of real governance regimes.

Indicators have been used as an important tool to act as 'signposts' to flag where effort can be made for improvement in the management systems of river basins. De Stefano [30] distinguishes two groups of indicators. The first, numeric indicators are usually based on scientific information on the bio-physical system and, it is argued, more ideally identify the impact of management. These include, for example, the indicators developed by OECD, the European Environment Agency (EEA), the World Bank and UNESCO. The second type of indicators provide qualitative assessment and are linked more closely to the question 'what is good governance?'. The World Bank listed five components of good governance: public sector management, a competitive private sector, the structure of government, civil society participation and voice, and political accountability. According to Pahl-Wostl *et al.* [23], good governance should include 'qualities of accountability, transparency, legitimacy, public participation, justice, efficiency, the rule of law, and an absence of corruption.' Hooper [31] in his work took a summary of existing qualitative indicators for integrated water resource management and developed an indicator system for river basin governance assessment with 115 indicators in total from ten aspects of water governance. This is the most comprehensive river basin governance assessment system in the literature.

The realisation that sustainable water management transcends implementation of technical scientific programs and is contingent on concerted actions from multiple stakeholders is well accepted and has focused on the complexity of human-environment interactions. Several interdisciplinary frameworks have emerged to explain the human-environment system relating to water governance. Most of these are grounded in process based conceptual frameworks, such as the Driver, Pressure, State, Impact, Response (DPSIR) framework [12], Management and Transition Framework (MTF) [32], Integrated