River Basin Organizations – Lessons from recent research[1]

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Abstract

Management of any resource becomes increasingly important as the resource becomes scarcer; and there is hardly a situation in which this is truer than in case of water resources. For many years the water policies of many nations have focused on developing water resources; but management was directed at the increasing the efficiency of use of the water infrastructure rather than the water itself. However, the concern is now, increasingly, on optimizing the productivity of water resources use whilst seeking to ensure that basic water needs are met for everyone and adverse environmental impacts are minimized.

River basins have emerged as the unit of management of land, water and other natural resources in an integrated fashion. Many developed countries such as the US, France, Australia have evolved highly advanced and resilient institutional regimes for Integrated River Basin Management (IRBM); but this has taken decades—in Europe and the US centuries-- of gradual change to evolve. In the South East Asian (SEA) region the pressing need to improve water management is driving a rapid development of river basin organizations in many countries. This paper brings together the findings of recent research by IWMI to highlight the prerequisites essential to establishing effective river basin organizations in the context of SEA countries. The paper draws on the results of the ADB RETA 5812 Developing Effective Water Management Institutions and other studies by IWMI.

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Introduction

Many countries are recognizing that they are, or will soon, face problems of water stress, which usually arise from two principle causes: insufficient *quantities* of water, in relation to the numbers of people and the uses they want to make of water; and reduced *quality* of water, due most often to pollution that is brought into the system by return flows of used water [1].

Management of any resource becomes increasingly important as the resource becomes scarcer; and there is hardly a situation in which this is truer than in case of water resources. For many years the water policies of many nations have focused on developing water resources; but management was directed at the increasing the efficiency of use of the water infrastructure rather than the water itself. However, the concern is now, increasingly, on optimizing the productivity of water resources use whilst seeking to ensure that basic water needs are met for everyone and adverse environmental impacts are minimized.

Integrated water resources management [2] has gained increasing acceptance as the water management paradigm to bring about sustainable use. Simultaneously river basins have emerged as the unit of management for land, water and other natural resources in an integrated fashion [3]. However, the ADB has identified areas of weakness that adversely impact water resources development and management in the region [4] at basin level, namely (i) institutional weakness, (ii) inappropriate policy and regulatory frameworks, (iii) inadequate data and information, (iv) problems in coordination, and (v) lack of community involvement.

Research by IWMI, IFPRI and other partners in the region, supported by ADB under RETA projects 5812 and 5866, have revealed a number of generic issues that must be addressed when the principles of IWRM and improved river basin management strategies are implemented [5]. The research results also confirm the intuitive conclusion that there is no “one-size-fits-all” solution to river basin management, requiring careful local analysis to match the governance structure to the actual conditions in the basins [2, 3, and 6].

The paper firstly considers the characteristics of river basins and the stage of development in the basins studied after Molden et al [7]. We then discuss the existing water governance structure of the five basins and recommended strategies to establish effective organizations to manage the basin water resources. We consider the potential of river basin organizations to contribute to the vital goals of poverty alleviation and productive use of water resources in the region and conclude with a discussion of the potential for NARBO to help achieve these goals.

What do we need to know to manage river basins effectively?

Starting with the premise that there is no “one-size-fits-all” approach to river basin management, what are the factors that make this the case? It is becoming more generally recognized that the hydrological, hydraulic and, above all, the socio-

economic conditions in basins are distinct and to be successful any program to introduce Integrated Water Resources Management (IWRM) and water management organizations must be designed with the local conditions to the forefront.

Simply transposing a successful management model from one basin to another is unlikely to be successful. Shah et al {3} present the hypothesis that the effectiveness of institutional development is determined by at least four realities of a river basin viewed in conjunction with each other: hydro-geological reality, demographic reality, socio-economic reality, and the organization of the water sector. Thus to be effective we need to understand each of these realities for the basin being considered if any new form of water governance is to be successfully implemented.

Molden et al [7] presented a conceptual vision of how a river basin and water use develop over time, illustrated in Figure1. They identify three key stages:

1. *Development*. In this stage the amount of naturally occurring water is not a constraint. Rather, expansion in demand drives the need for construction of new infrastructure. Institutions are heavily concerned with building infrastructure for providing supplies. Institutions typically emerge to serve a single function, like construction organizations.

2. *Utilization*. Significant construction has taken place, and the goal is to make the most out of the facilities. Water saving and improved management of water deliveries are important objectives. Managing supply of water to various uses is a primary concern. Early in this state, scarcity is not a major problem, and inter-sectoral competition is minimal. Institutions are primarily concerned with sectoral issues such as managing irrigation water, or managing drinking water supplies.

3. *Allocation*. As basin closure approaches, i.e. depletion approaches the potential available water there is limited scope for further development. Efforts are focused on increasing the productivity or value of every drop of water. An important means of accomplishing this is to reallocate water from lower to higher value uses. Managing demand becomes increasingly critical. Infrastructure construction is limited to those that aid in regulation and control. Little scope remains for "real water savings." Institutions are primarily involved in allocation, conflict resolution, and regulation. Several important management and regulatory functions gain prominence, including inter-sectoral allocation. To effectively carry out these functions, either a single entity emerges (like the Brantas River Basin Organization in Indonesia), or several inter-linked organizations manage these functions (as in the South Platte River Basin in Colorado). Co-ordination becomes important, involving significant transaction costs.

This model provides a useful framework to in which to develop an understanding of the four realities of the basin, Shah et al [3]. Clearly we must have a good understanding of the water resource conditions in the basin, defined by the basic water endowment of the hydrological system as well as the existing usage of those resources. For our research on the Development of effective water management organizations (ADB RETA 5812) we selected five basins at contrasting stages of this development trajectory and with different levels of water abundance [8], from open to closed basins in the terminology of Molden [9], Table 1. The water accounting framework of

Molden and Sakthivadivel [10] was used to investigate the current water use in each of the basins.

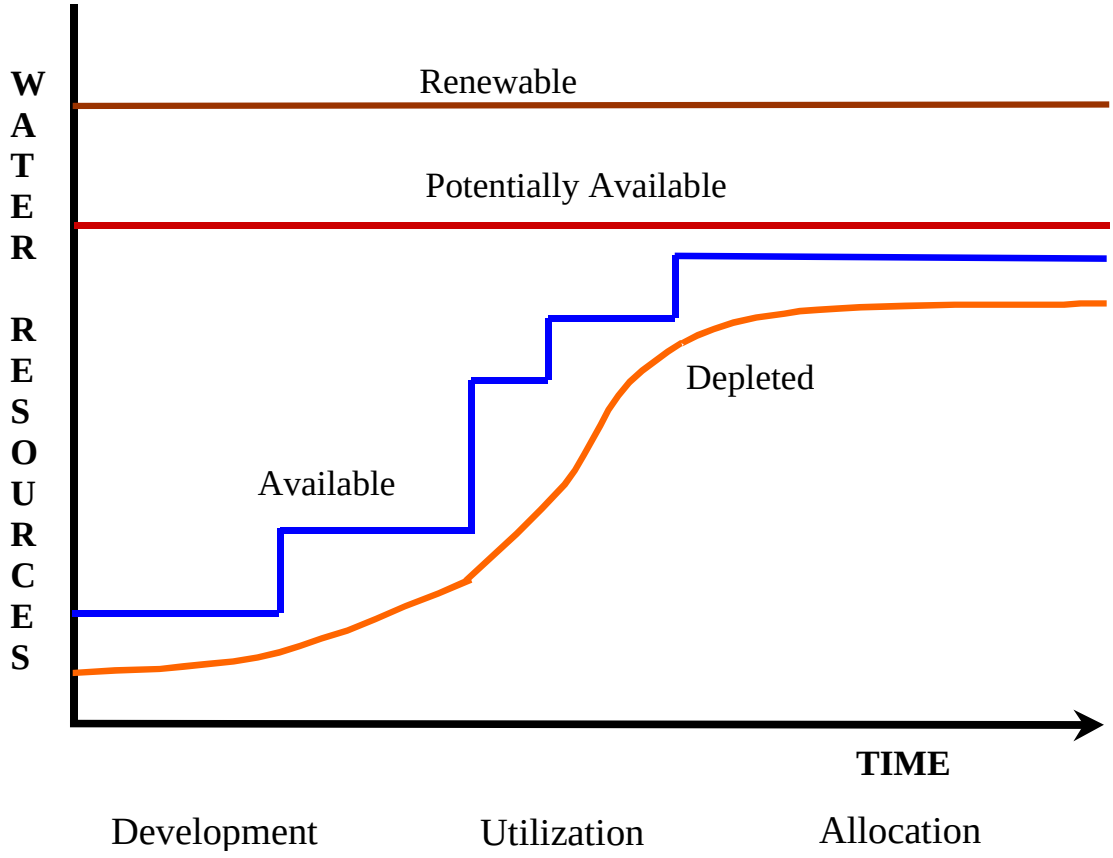


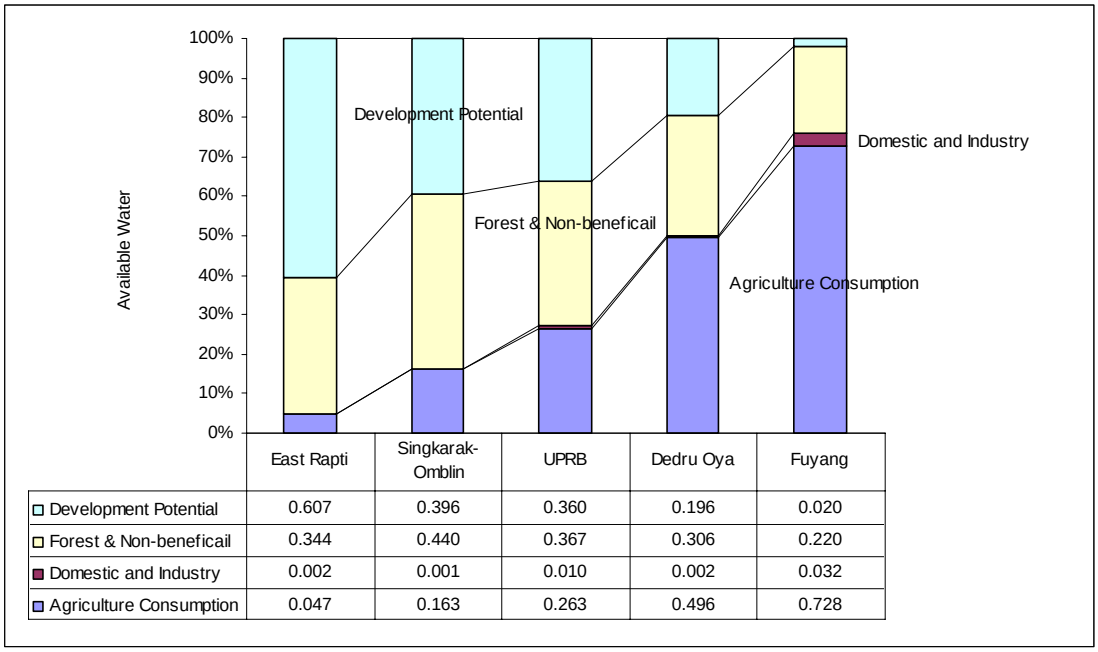
Figure 1 Stages in river basin development (after Molden et al [7])

On the basis of the water accounting analysis [7], the East Rapti basin in Nepal was classified as in the *Development* stage with about 60% of the water resources available for development if required. The Fuyang basin was classified as closed and in the *Allocation* phase of development. In this basin, to all intents and purposes no water remains unallocated and any development implies a shift of water from one use or user to another. The other three basins, Singkarak-Omblin (Indonesia), Upper Pampanga (Philippines) and the Dedru Oya (Sri Lanka) are each in the transition phase with water available for development ranging from about 40% to less than 20% respectively, Figure 2.

In addition to the driving hydrological conditions, the demographics and socio-economic conditions also constrain the options for river basin management. In the five basins studied the agriculture remains a major source of employment and the majority of the populations continue to live in the rural areas. However there are marked contrasts in the incidence of poverty from about than 6% in Fuyang to approximately 60% in the Deduru Oya basin, measured against national poverty lines. In all cases we found spatial differences in the incidence of poverty. Water and water governance are

increasingly recognized as key determinants in the fight to reduce the incidence of poverty [11].

Soussan [11] notes that water management plays an important part in many aspects of livelihood processes and is essential to many activities, both productive --- such as agriculture and manufacturing – and household maintenance activities. Water is plays a central role in many employment ventures that are vital to the rural and urban poor as well as contributing to national economic growth. Hussain et al [12] have shown that irrigation helps reduce permanent and temporary poverty and plays a key role in reducing the worst form, chronic poverty. Irrigation is productivity enhancing and growth promoting. However, Hussain also notes that a range of broad policy and targeted pro-poor interventions are required to ensure the potential benefits of irrigation investments do reach the poor and disadvantaged sectors of the community. Involvement in water management decisions through appropriate and effective water governance structures is a vital step to improving the livelihoods of the poor.



	East Rapti	Singkarak-Omblin	UPRB	Dedru Oya	Fuyang
Development Potential	0.607	0.396	0.360	0.196	0.020
Forest & Non-beneficail	0.344	0.440	0.367	0.306	0.220
Domestic and Industry	0.002	0.001	0.010	0.002	0.032
Agriculture Consumption	0.047	0.163	0.263	0.496	0.728

Figure 2 Basin water use and remaining development potential (Sakthivadivel and Molden [8])

In each of the five countries in the case studies, under RETA 5812, there was an explicit recognition of the need to consider the river basin as the unit for developing and managing water resources. However none of the five basins studies were managed by a formal river basin organization during the period of study. The management of the water resources in these basins was effectively on a purely sectoral basis through a multiplicity of government organizations with little coordination [13].

In all the basins a range of attempts have been made to encourage greater participation by the farming communities in Operation and Maintenance (O&M) of the irrigation system, however the active participation of the water user community in basin level water management planning and decision making remains largely untested. ADB [14] make the observation that one of the greatest obstacles to successful participatory development and, perhaps by implication to, participatory management is convincing

Table 1. Salient characteristics of the river basins selected for study

Basin Characteristics	Fuyang	Singkarak-Ombilin Subbasin	East Rapti	Upper Pampanga	Deburu Oya
Country	Peoples Republic of China	Indonesia	Nepal	Philippines	Sri Lanka
Catchment area (sq. km)	22,814	2,210	3,135	3,742	2,623
Location : Province	Hebei	West Sumatra	Not applicable	Nueva Ecija	North Western
Districts	Shijuazhang, Handan, Xingtai	Solok, Tanah Datar and Sawah Lunto Sijunjung	Makawanpur Chitwan	Bulacan Pampanga	Kurunegala Puttalam
No. of urban centers	345	4	3	3	2
No. of villages	9,092	400	Not known	325	2,663
Average annual rainfall: Normal year	570 mm	2,025 mm	3,576 mm	1,994 mm	1,494 mm
Dry year	200-300 mm	1,163 mm	1,778 mm	1,100 mm	1,152 mm
Per capita water availability (m^3)	868		9,034	3,630	1,046
Facilities / Assets					
No. of irrigation schemes (surface irrigation)	3 (major) and a number of small storage systems	None (Ombilin Subbasin)	214	37	3, 4, 3,596 major, medium and minor systems respectively
No. of lift irrigation units (groundwater & river lift)	185,527 (groundwater)	14 pump and 184 water wheel (Ombilin subbasin)	Shallow tube wells = 589; Dug wells = 1,809; treadle pumps = 47	9	Shallow wells = 2,450
Domestic water supply schemes	41	2 (Ombilin subbasin)	45	17	37 pipe-borne 1,199 tube wells
No. of hydropower plants	14	Hydroelectric, 4 micro hydroelectric power plants	None	2	None
Land use and agriculture					
Cultivated area (ha)	1,239,000	130,291	85,578	254,490	201,585
Grassland / Savannah (ha)	-	11,234	10,500	4,117	55
Forestland (ha)	119,000	45,498	120,959	37,425	8,035
Area covered with water bodies (ha)	223,800	1,956	17,275	9,600	1,410
Surface irrigated area (ha)	150,000	32,180	32,388	98,222	47,150
Groundwater irrigated area (ha)	875,000	-	7,743	25,135	1,515
Main irrigated crops	Wheat, corn, cotton, rape seed	Rice, mungbean, groundnut	Rice, maize, wheat	Rice, vegetables, corn, onion	Rice, chili, pulses, vegetables
Annual cropping intensity (%)	155	Rice irrigation = 200 Other field crops = 38	Irrigation from main river = 274 Irrigation from tributary = 257	Surface irrigation =156 Groundwater irrigation=200	Surface irrigation = 133-165 Groundwater irrigation = 180-300
Irrigated area (%)	45	14.8	12.8	33	18.5

existing institutional players that it is indeed possible for users to play a significant and valuable role.

When planning river basin organizations we should not underestimate the capacity of, even relatively poorly educated, people to quickly grasp the value of sophisticated modeling tools. Cain et al [15] applied Bayesian belief network (BBN) modeling techniques to capture the local knowledge of farmers and line agency staff in Sri Lanka regarding the development options in the Deduru Oya basin. Although the models developed in the reported studied were relatively primitive groups involved where able to capture the essential trade-offs to be made in the development decisions. The use of BBN techniques encouraged a more holistic review of the basin development options than would normally have occurred in a traditional stakeholder consultation.

The importance of obtaining a clear view of what the real development needs in the local context of a river basin is without dispute. Jinapala et al [16] illustrated the potential for participatory techniques to mislead the conclusions if not utilized properly. As the drive for more effective stakeholder participation in the management of river basins and water resources increases, the potential for misinterpretation of stakeholder responses will increase.

The need for properly skilled persons to support the transfer of power from the existing institutions to newly formed river basin organizations is clear. Initiatives, such as CAPNet, aimed at developing highly skilled water resources professionals able to provide sound technical evaluations of water resources issues whilst supporting effective stakeholder participation will be vital. As Apichart and Bernado [17] observe, IWRM exists only at the conceptual level in much of Asia despite notable attempts to introduce it in river basins across the region. Much of the cause of the apparent failure to implement IWRM and river basin management is suggested to be due to a lack of adequately and appropriately trained people to facilitate the implementation beyond pilot scale. The shortage of skilled personnel is due to shortage of technical and financial support systems for capacity building.

Summary and Conclusions

The growing recognition of a river basin as the most appropriate unit for the development and management of water resources has prompted the search for appropriate institutional arrangements for river basin management. This paper argues that there is no single “best” institutional mode, but rather institutional requirements differ at different stages of development of the river basin. Thus, a clear understanding of the stage of development is crucial when formulating institutional arrangements for basin management.

At an early stage of development the institutions required often focus on a single or very limited set of objectives, generally developing the infrastructure to supply water. As the infrastructure becomes more complex, and the task of meeting demands more challenging, greater concern is given to managing water within various sectors.

Further increases in demand leading to increased scarcity cause the value of water to increase.

In addition, changing socio-economic conditions are leading to increased interest in environmental concerns such as pollution. Ultimately the institutions need to deal with multiple functions that require complex institutional arrangements that involve several organizations, and address a set of wide, and often conflicting, set of national objectives. Thus, institutions must be dynamic entities that can adjust to different management demands as water use changes with the progression of time.

The implication is that water resource management institutions must adapt to meet different challenges as patterns of water use change. Common water problems are seen because agencies, fully competent to carry out tasks originally assigned, do not change. When evaluating an institution, we may find that they do seven out of ten tasks fairly well. The seven may not be so important, while the three missing ones may be critical. When analyzing institutions, we need to better understand the mechanisms that exist that either resist or facilitate adaptation to the changing roles and responsibilities [7].

Research has shown that the form of organization required to support effective water resources management the context of the dynamic socio-economic conditions in the river basins of Southeast Asia will change as the conditions change. Inclusion of stakeholders in the decision making process will bring new demands on the skills and approaches to water management required of the staff of line agencies and the emerging river basin organizations. The role of NARBO in providing access to a group of river basin organizations with experience in similar climatic and socio-economic conditions will be invaluable.

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