KEEPING ASIA'S WATER TOWER ALIVE

Strengthening Integrated Water Resources Management with River Basin Organizations

DECEMBER 2020

ADB

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A glimpse of the tower. At the base of Jichu Drake, a mountain in the Himalayas, is the source of Paachhu, one of the rivers in Bhutan (photo by Yeshey Dorji).

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Strengthening Integrated Water Resources Management with River Basin Organizations

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BACKGROUND AND CONTEXT

The Region

The Hindu Kush Himalaya Region is approximately 4.2 million square kilometers and includes parts of Afghanistan, Bangladesh, Bhutan, India, Myanmar, Nepal, Pakistan, and the People's Republic of China (PRC). The region is dominated by a long chain of mountains, including the highest peaks in the world. With significant snowpack and ice, it is the source of 10 major river basins.[1] It is home to around 1.9 billion people, while a total of 3 billion people consume food produced by the associated water resources.[2] The area is, thus, widely regarded as the "water tower of Asia."

The topography of mountainous river basins clearly defines the extent of resources and management areas. Yet the same steep terrain often presents difficulties for the communication and travel required when developing coordinated management actions. This topography also presents challenges in water resources development and protection, with unstable landforms and limited flatter areas to improve access to water for communities and agriculture. The high mountain areas in these river basins provide areas of natural water storage in snow and ice but this natural resource is at risk from the effects of climate change.

Well-planned and coordinated water management is important in mountainous river basins to overcome the issues of communication and the need for source and catchment protection. Water management also encourages efficient use of water in the limited areas of flatter land found in such river basins and brings opportunities for multipurpose developments.

Integrated water resources management (IWRM) can serve as the framework for the necessary well-planned and coordinated management. IWRM is a process that promotes the coordinated development and management of water, land, and related resources. IWRM aims to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.[3]

Countries in the region need bolstering in all aspects of water resources management as they are reliant on highly vulnerable water resources. The region has had either too much or too little water due to its seasonal variation of precipitation and steep terrain, which will be intensified by the impacts of climate change through changing volumes, rates, and patterns of precipitation, snowfall, melting, and evapotranspiration.

[1] The 10 major river basins include Amu Darya, Brahmaputra, Ganges, Indus, Irrawaddy, Mekong, Salween, Tarim, Yangtze, and Yellow River.
[2] E. Sharma et al., 2019. Introduction to the Hindu Kush Himalaya Assessment. In P. Wester, et al., eds. *The Hindu Kush Himalaya Assessment.* Kathmandu, Nepal: International Centre for Integrated Mountain Development (ICIMOD). pp. 1–16.
[3] Global Water Partnership. What is IWRM? https://www.gwp.org/en/GWP-CEE/about/why/what-is-iwrm/.

River Basin Organizations

Historically, water resources have been managed either at the administrative level, by national, provincial, or district governments for example; or by sector, such as hydropower, irrigation, and flood risk. In recent decades however, there have been moves globally to recognize the river basin itself as the best management unit for promoting IWRM. Management of a river basin area according to the IWRM principles requires a well-coordinated management structure. A river basin organization (RBO) can be an effective body for such coordination, or can be charged with additional functions as well, depending on the types of RBOs (Table 1). An RBO is a body that can be formed to consider both the upstream and downstream users within a river basin in an equitable manner. These organizations look to maximize resource use efficiently and bring varied stakeholders together.

The roles and responsibilities of RBOs throughout the world have changed through time. They tend to fall into the following three broad functional groups:

- monitoring, investigating, and coordinating river committees (oversee conditions and trends in the use and quality of basin resources and suggest methods to coordinate management for improved governance);
- planning and management commissions (more prescriptive than the first); and
- development and regulation authorities (regulatory bodies and enforcement agencies).

There are many combinations of these three broad types, and more comprehensive types are provided in the following table:

Table 1: Types of River Basin Organizations

Advisory Committee. This is a formalized or quasi-formal organization in which individuals take responsibility for undertaking action planning and provide advice; governments "hand over" strategic planning to such organizations and they frequently have no or limited legal jurisdiction.

Authority. This is an organization that makes planning decisions at a central or regional government level, may set and enact regulations, or have development consent authority.

Association. Similar to an advisory committee, this is an organization of like-minded individuals and groups with a common interest. In a river basin they have varying roles: (i) providing advice, (ii) stimulating basin awareness, (iii) education and ownership of basin natural resources management issues, and (iv) educational functions and information exchange.

Commission. This is an organization delegated to consider natural resources management matters and/or take action on those matters. A basin commission's powers vary, and include advisory or education roles, monitoring roles, undertaking works, and fulfilling goals of a specific government's charter or an international agreement.

continued on next page

Table 1 *continued*

Council. This refers to a formal group of experts, government ministers, politicians, nongovernment organizations, and lay people brought together on a regular basis to debate matters within their sphere of basin management expertise, and with advisory powers to government. A council is contrasted with a commission which, although also a body of experts, is typically given regulatory powers in addition to their role as advisor to the government.

Corporation. This is a legal entity created by legislation that permits a group of people, as shareholders of for-profit companies or members of non-profit companies, to create an organization. The organization can focus on pursuing set objectives, and are empowered with legal rights that are usually only reserved for individuals, such as to sue and be sued, own property, hire employees, or loan and borrow money. A corporation is also known as a "company." The primary advantage of a for-profit corporation is that it provides its shareholders with a right to participate in the profits by dividends without any personal liability because the company absorbs the entire liability of the organization.

Tribunal. This is a basin entity that has formalized procedures and quasi-judicial powers. There is a heavy emphasis on bureaucratic decision-making and stakeholders may formally participate through hearings. Major decisions are taken by independent bodies, like a water pricing tribunal. A tribunal acts as a special court outside the civil and criminal judicial system that examines special problems and makes judgments; for example, a water tribunal resolves disputes between water users.

Trust. A trust is a legal device used to set aside money or property of one person for the benefit of one or more persons or organizations. It is an organization that undertakes river basin works and develops and implements a strategic plan. Its mandate is to be the river basin "advocate." It coordinates local programs through a memoranda of understanding or other agreements and raises local levies funds for its works and programs. A trust keeps monies raised in "trust" for the benefit of its citizens.

Federation. This is a collaboration of organizations or departments within one government or between state and national governments to establish and undertake actions for river basin management. Governance actions at national, state, and local levels include agreements on water sharing and water quality management, shared statements of intent, shared policy development, information exchange, and joint actions for management of ecosystem degradation.

Source: B. Hooper. 2005. *Integrated River Basin Governance: Learning from International Experience.* London: IWA Publications.

Meeting of the minds. In Bhutan, the Wangchhu Basin Committee discuss water management.

The Project

Overview

The Asian Development Bank (ADB), with financing from the Japan Fund for Poverty Reduction, supported the governments of Afghanistan, Bhutan, and Nepal to mainstream RBOs and strengthen IWRM in the Hindu Kush Himalaya Region. The technical assistance (TA) project, Strengthening Integrated Water Resources Management in Mountainous River Basins, aimed to improve water security—threatened by climate change and increasing rural and urban populations—to support economic growth.[4]

Afghanistan, Bhutan, and Nepal are landlocked and have mountainous river basins at the middle to upstream portion of major river basins (Amu Darya, Brahmaputra, and Ganges) in the Hindu Kush Himalaya Region. RBOs have been legislated and are emerging in some river basins in Afghanistan and Bhutan but are yet to be fully formed in Nepal. River basin management includes a process of devolution of responsibility and capacity for management. These changes need tailored support, including

- benchmarking performance assessment of RBOs to demonstrate progress and define capacity development needs; and
- using relevant technologies such as water forecasting, databases, and Decision Support Systems to improve practice.

The Target River Basins and River Basin Organizations

Afghanistan

The Panj Amu River Basin is located in the northeastern part of Afghanistan, bordering Tajikistan and Uzbekistan to the north, and Pakistan and the PRC to the east. The Panj Amu river flows into the Amu River, which drains to the Aral Sea. This river basin is responsible for a big portion of Afghanistan's agricultural production. It has a large potential for hydropower production and there are plans to construct some major reservoirs, but it currently relies solely on the natural water storage in the mountains. Irrigation in this river basin is from canals that divert water mainly from the middle and lower sections of the river across the floodplain and terraces. Although the focus of water management work to date has been on irrigation, there are several other water management needs in the river basin. These include management of flood- and water-related disasters, urban and rural town water management, rural development and management of upper catchment areas, hydropower development, and environmentally friendly management of the river channel and its ecosystem.

[4] ADB. Regional: Strengthening Integrated Water Resources Management in Mountainous River Basins. https://www.adb.org/projects/46257-001/main (TA 9095).

Wet and dry lands. The Panj Amu River Basin in Afghanistan includes heavily irrigated areas as well as arid hillslopes.

The Panj Amu River Basin Agency (PARBA) is an established decentralized agency of the Ministry of Energy and Water, responsible for planning and managing water resources defined by the river basin. It has established six sub-basin agencies that carry out delegated functions on behalf of PARBA. The RBO design provides for a River Basin Council that will act as the main decision-making and coordinating agency for water resources in the river basin. The council is to guide the water management actions of the PARBA. As yet, the council is not formed and thus the RBO is still in development, although PARBA will act as a secretariat to the River Basin Council in the future.

Nature's bounty. The Wangchhu River Basin in Bhutan is heavily forested and predominantly rural.

Bhutan

The Wangchhu Basin is located in the western part of Bhutan, bordering the PRC to the north and India to the south. The Wangchhu Basin comprises the drainage basin for one river and is divided into 19 sub-basins covering four districts (Chukha, Haa, Paro, and Thimphu) and 30 *gewogs* (group of villages). As the host to the capital city (Thimphu) and the only international airport (Paro), the basin area is the hub of governance, administration, and economy for the country. A significant amount of water in the basin is also used for hydropower. While the basin occupies only 12% of Bhutan's area, it produces 47% of the national revenue generated from hydropower. Managing water use between these different users is a difficult task that requires an integrated approach.

The Wangchhu Basin Committee has been established, building on work undertaken under a previous project.[5] The committee is a coordinating body for matters related to water resource management in the basin. It is responsible for developing and updating water management plans and ensuring that these are implemented by respective districts in a coordinated manner to ultimately achieve water security. The National Environment Commission Secretariat functions as the secretariat of this RBO.

Nepal

The Bagmati River Basin in central Nepal contains the country's capital, Kathmandu, which is expanding to occupy most of the almost circular Upper Bagmati Basin. This area is also known as Kathmandu Valley. The river was extensively used for irrigation, domestic water, and to a limited extent, hydropower generation in the past. However, due to rapid urbanization, the agricultural area has been shrinking and there has been an unsustainable demand for drinking water. Urbanization has also led to pollution. Many people in Kathmandu dispose of their solid waste into the river and its tributary channels. Direct disposal of domestic sewerage and

[5] ADB. Bhutan: Adapting to Climate Change through Integrated Water Resources Management. https://www.adb.org/projects/46463-002/main.

Perils of population growth and pollution. The Bagmati River in Nepal is heavily urbanized with associated water quality issues.

industrial wastewater into the Bagmati River and its tributaries is one of the drivers of water pollution and environmental degradation in the valley. Poor drainage and sewerage systems as well as insufficient water use and pollution controls further complicate the issue. Together these activities have created the need for a complete restoration of the river system with proper policy, legal, and institutional reforms and structural interventions.

Efforts have been made over the last 2 decades for the present High Powered Committee for Integrated Development of the Bagmati Civilization to act as an RBO. The existing High Powered Committee for Integrated Development of the Bagmati Civilization was reformed with an executive order from the government to act as an RBO for the Upper Bagmati in January 2017. In the formation order, several functions that are supposed to be performed by a typical RBO have been listed; however, most of them cannot be carried out without requisite legal instruments and due to clashes with relevant laws. The development of this RBO for the Upper Bagmati Basin requires meaningful involvement of the municipalities along with various other stakeholders.

RIVER BASIN ORGANIZATION PERFORMANCE ASSESSMENT

Why Assess River Basin Organization Performance?

RBOs are believed to be the best way of managing water in the context of the region with its competing resource demands and changing climate, because a basin-level perspective enables integration of downstream and upstream issues, quantity and quality, surface water and groundwater, and land use and water resources in a practical manner.[6]

RBOs can assess their performance once they are established and have become more functional. Like any entity that is tasked with a mandate, understanding the strengths and weaknesses of an organization's performance allows a targeted approach to capacity development. Measuring the achievement of objectives provides indicators of advancement.

During the project, the results of the performance assessment were used in the design of human resource capacity development plans for the RBOs.

The Process: Balanced Scorecard Approach

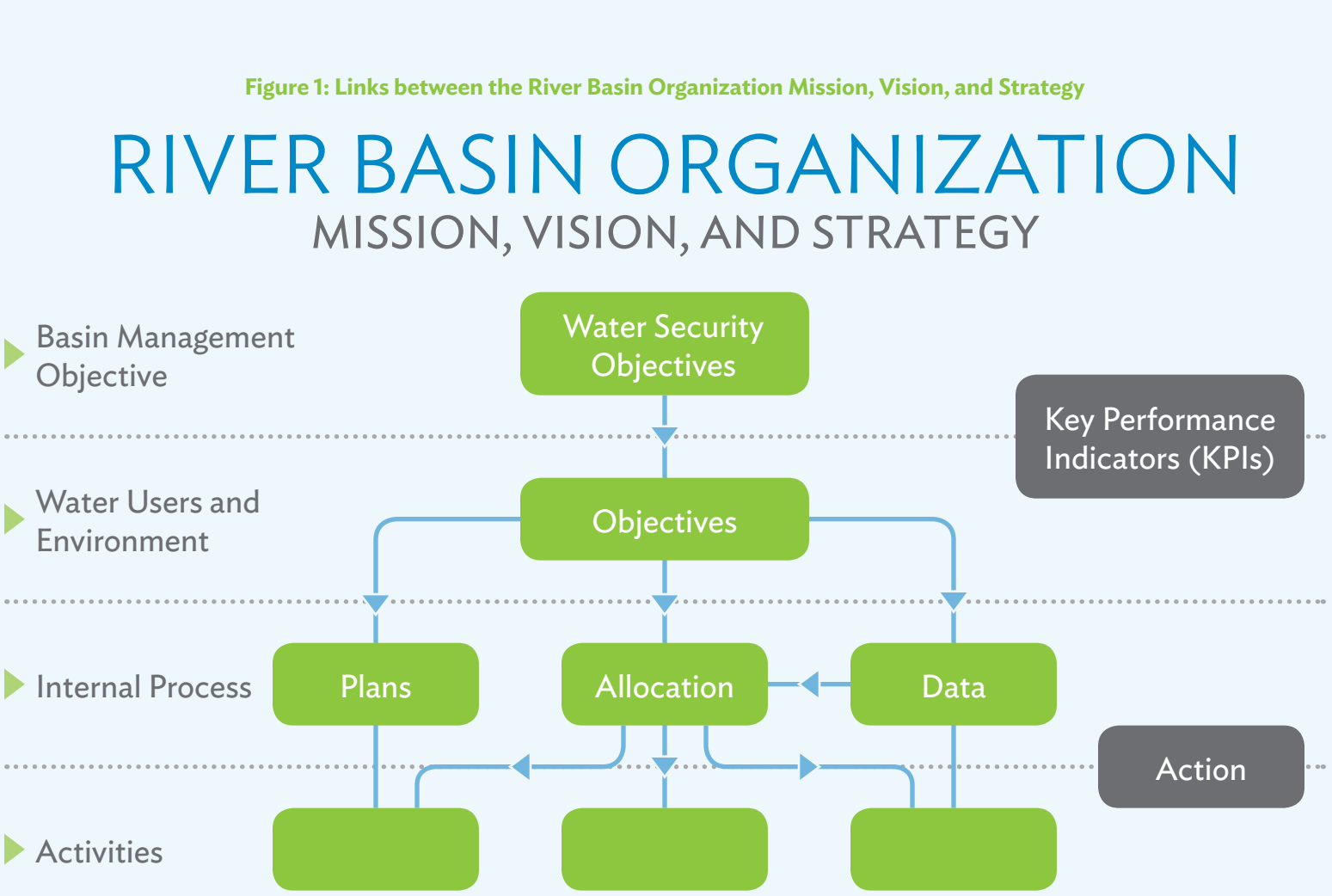
The Network of Asian River Basin Organizations (NARBO)[7] developed a system of measuring the performance of RBOs. The NARBO methodology for performance assessment uses a balanced scorecard (BSC) approach. The BSC approach connects the "big picture" strategy elements—such as the mission (purpose of the RBO), vision (what the RBO aspires for), core values (what the RBO believes in), and strategic focus areas (themes, results, and/or goals)—with the more operational elements, such as objectives (continuous improvement activities), measures (key performance indicators that track strategic performance), targets (the desired level of performance), and initiatives (projects that help the RBO reach their targets) (Figure 1).[8]

[6] United Nations Educational, Scientific and Cultural Organization et al. 2009. *IWRM Guidelines at River Basin Level, Part 1: Principles*. https://unesdoc.unesco.org/ark:/48223/pf0000186417.

[7] NARBO, established in February 2004 to promote IWRM in monsoon areas of Asia, comprises of 92 member organizations from 19 countries that implement or promote IWRM. NARBO. https://www.narbo.jp/.

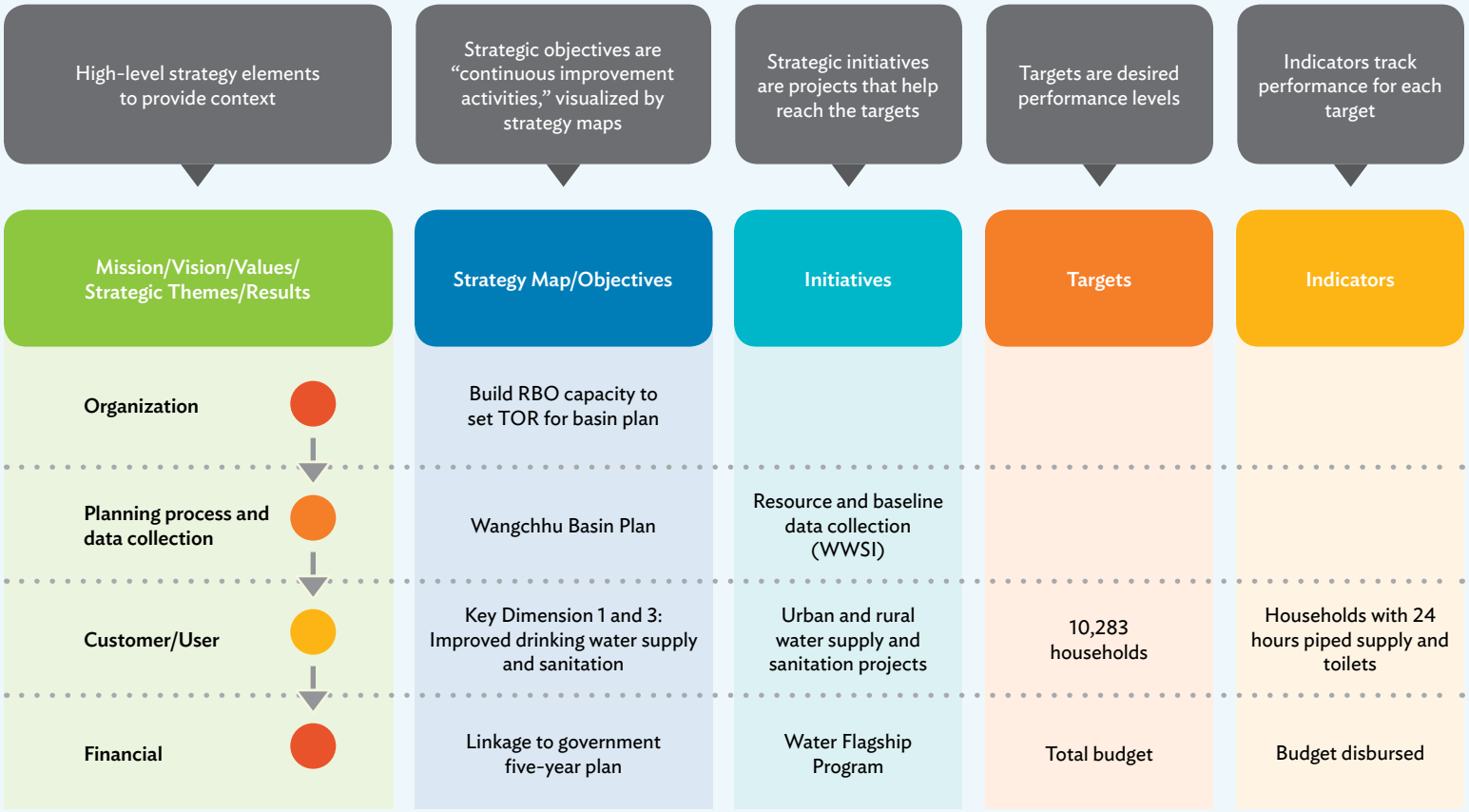
[8] Balanced Scorecard Institute. https://balancedscorecard.org/bsc-basics/.

Figure 1: Links between the River Basin Organization Mission, Vision, and Strategy



Source: Asian Development Bank.

Figure 2: Example of the Balanced Scorecard Approach Applied to Water Supply and Sanitation in Bhutan



RBO = river basin organization, TOR = terms of reference, WWSI = Wangchhu Water Security Index.
Source: Adapted from the Balanced Scorecard website. Balanced Scorecard Institute. https://balancedscorecard.org/bsc-basics/.

Customizing the Approach

The NARBO Performance Assessment process or the BSC approach was customized to suit each of the three basins in the TA project (Figure 2). Stakeholders in each country customized the basic indicators to ensure they were appropriate for the basin (for example, the Upper Bagmati is much more urban than the Panj Amu) and reflected the governance of each RBO (for example, the River Basin Council role in Afghanistan). These indicators were selected as they were seen as being best suited to a young basin organization. Not all indicators can be used for young basin organizations but they can be adopted as the RBO develops and matures in its functions. A gender equality and social inclusion indicator was added to the original NARBO list to explicitly measure progress for each of the target countries.

Indicators

Critical Performance Area: Mission

Indicator 1: River Basin Organization Status. This is a measure of the development of the RBO and the quality of the organization's decision-making process, as well as the extent of stakeholder involvement in said process (Figure 3).

Indicator 2: River Basin Organization Governance. This is a measure of the different frameworks (national; regional, provincial, or district; and organizational) that support and enable good governance.

Indicator 3: Gender Equality and Social Inclusion. This is a measure of the RBO and its effectiveness in mainstreaming Gender Equality and Social Inclusion (GESI) in its organizational operations, policies, plans, projects, and programs.

Critical Performance Area: Stakeholders

Indicator 4: Customer Involvement and Feedback. This is a measure of how involved customers are in the decision-making of the RBO, including their ability to share feedback and their acceptance of the goals and operations of the RBO.

Indicator 5: Environmental Audits. This is a measure of the level of environmental awareness and intention to protect against environmental degradation using environmental indicators.

Indicator 6: Basin Livelihoods. This is a measure of the overall level of change in livelihoods and jobs in the basin, as well as concerns on the human capital (health and hygiene) and the financial capital (economic elements of water services), or the lack of the same.

Indicator 7: Resilience to Climate Change and Disasters. A measure of the resilience to climate change and disasters in the communities and environments of the river basin.

Critical Performance Area: Learning and Growth

Indicator 8: Human Resources Development. This is a measure of the capability and effectiveness of human resources development systems in an RBO, and its contribution or support to achieving the objectives of the RBO.

Indicator 9: Technical Development. This is the degree of commitment to adopt relevant technological solutions that will enhance the delivery of the mission.

Indicator 10: Organizational Development. A measure of the commitment to quality management as evidenced by the use of Quality Management Systems or similar management improvement tools.

Critical Performance Area: Internal Business Processes

Indicator 11: Planning Maturity. This is a measure to identify the level of planning within the organization and its possible effect on the delivery of its mission and targets.

Indicator 12: Water Allocation. This is a measure of water resource allocations in the river basin that determine delivery and performance of water services.

Indicator 13: Collection and Data Sharing. This is a measure of the level the RBO is committed to effective data management and information dissemination and its implementation.

Critical Performance Area: Finance

Indicator 14: Cost Recovery. This is a measure of customer service and strength of budget management.

Indicator 15: Financial Efficiency. This is a measure of the commitment to the most efficient use of financial resources in pursuit of fulfilling the RBO's mission.

Each indicator can be scored on a spreadsheet by different RBO stakeholders, using a point scoring system unique to each indicator. The results can be compared and discussed to reach common agreement (or disagreement) on progress achieved and areas where more effort is needed.

Figure 3: Example of Indicator 1 on River Basin Organization Status

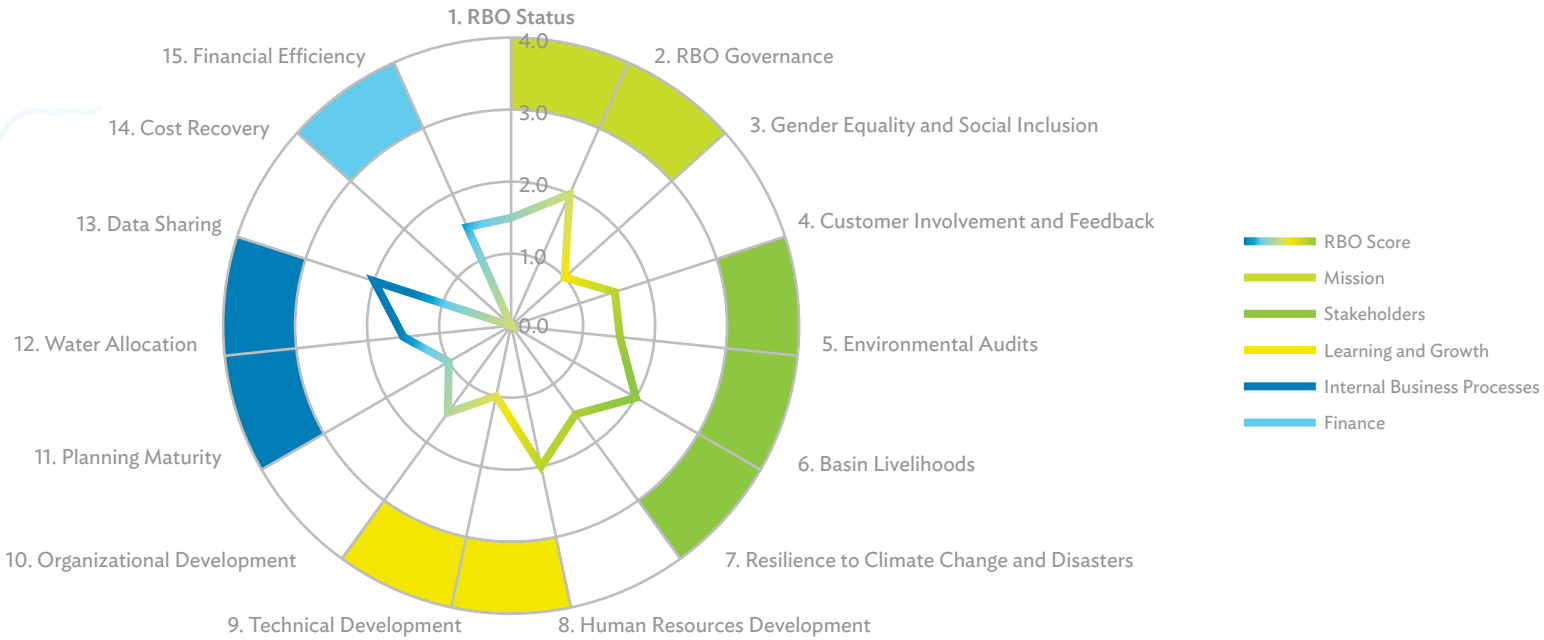
IWRM = integrated water resources management, RBO = river basin organization.
Source: Asian Development Bank.

Applying to Target River Basin Organizations

Afghanistan

The Panj Amu River Basin Agency did self-evaluation of its performance through a series of workshops. Fifteen indicators with customized scoring system (scale: 1–4) were used for the assessment. The agency scored themselves best on RBO Governance, Basin Livelihoods, Human Resources Development, and Data Sharing. The first three of these indicators have been heavily invested on by the donor community and as such, the progress being made has been reassuring. The zero score given for Cost Recovery at the workshop reflects the participants' understanding that Afghanistan has no legal mechanism for recovering water management costs from water users since the Water Law (2009) does not establish the river basin agencies as water service providers.

Figure 4: Panj Amu River Basin Agency Performance Assessment (Indicator Scores for 2019)



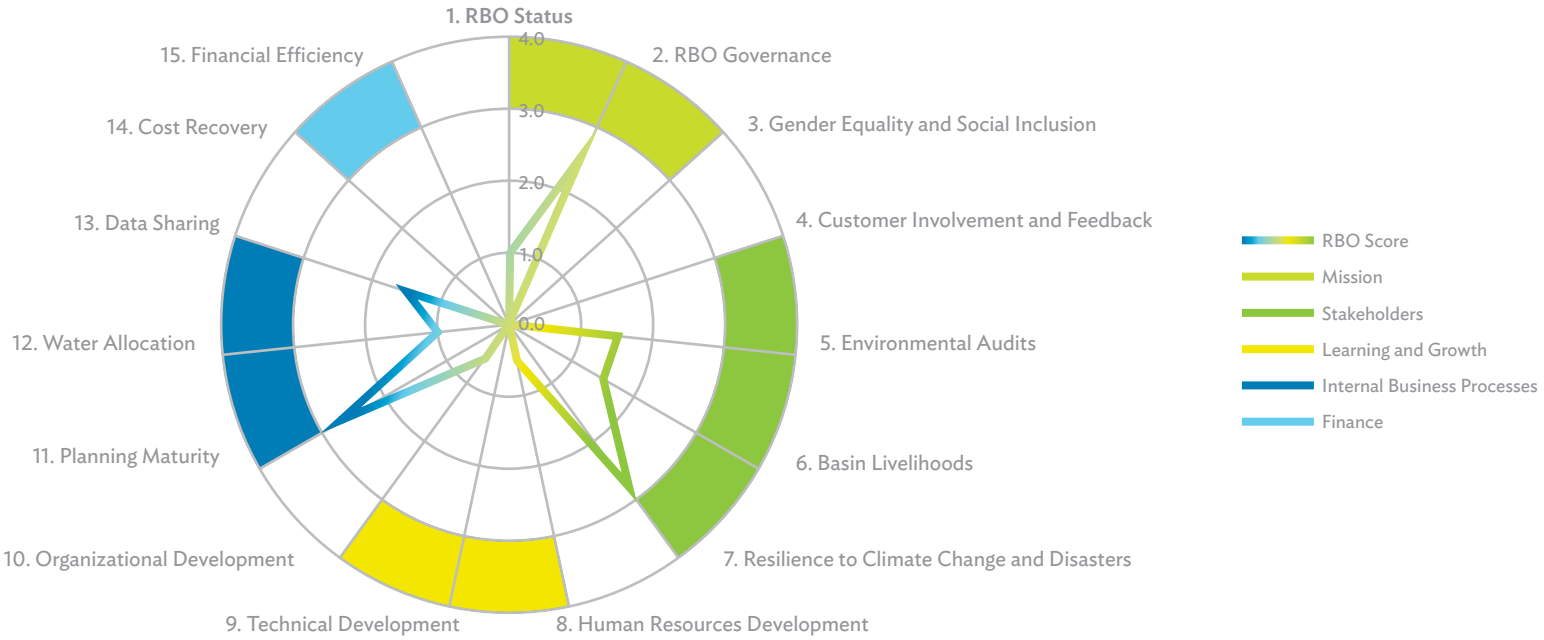
RBO = river basin organization.
Source: Asian Development Bank.

Bhutan

The scores for the Wangchhu Basin Committee (WBC) were determined on the basis of self-assessment and supported by relevant verification materials. These scores reflect the very early stage of development of the WBC but RBO Governance, Resilience to Climate Change and Disasters, and Planning Maturity were deemed to be the main strengths of the WBC's performance.

The members of the RBO gave zero scores for Gender Equality and Social Inclusion and Customer Involvement and Feedback, one of three indices in Learning and Growth, and both indices in Finance. It is understood that these zero scores reflect the WBC members' understanding that they are yet to consider GESI issues and a belief that the National Environment Commission Secretariat is yet to commit to significant support from the national government. For Learning and Growth, the low scores are due to the lack of dedicated staff, equipment, and resources. Thus, there is a need to develop rules and procedures for the organization.

Figure 5: Wangchhu River Basin Agency Performance Assessment (Indicator Scores for 2020)



RBO = river basin organization.
Source: Asian Development Bank.

Nepal

A benchmarking system was customized and developed through workshops in Nepal. The GESI indicator was especially customized to make it more objectively measurable and effective. However, actual performance assessment with indicator scoring was not done during the project period because issues regarding the RBO's legal status resulted in the reluctance of workshop participants to provide scores. The customized indicators will be used for performance assessment by RBO officials in the future.

Strengthening management by building capacity.
A technology training session was held in Kathmandu, Nepal.

USING TECHNOLOGY IN RIVER BASIN ORGANIZATIONS

Assessing performance is a key step towards strengthening RBOs and ultimately, managing water resources. The RBO performance assessments in Afghanistan and Bhutan show relatively low scores on technical development, which need to be addressed. Once gaps are identified, the use of appropriate technologies serves to boost performance. It can create efficiencies and lead to better decision-making.

The specific institutional situation in each country influenced the recommendations and training on use of relevant technologies:

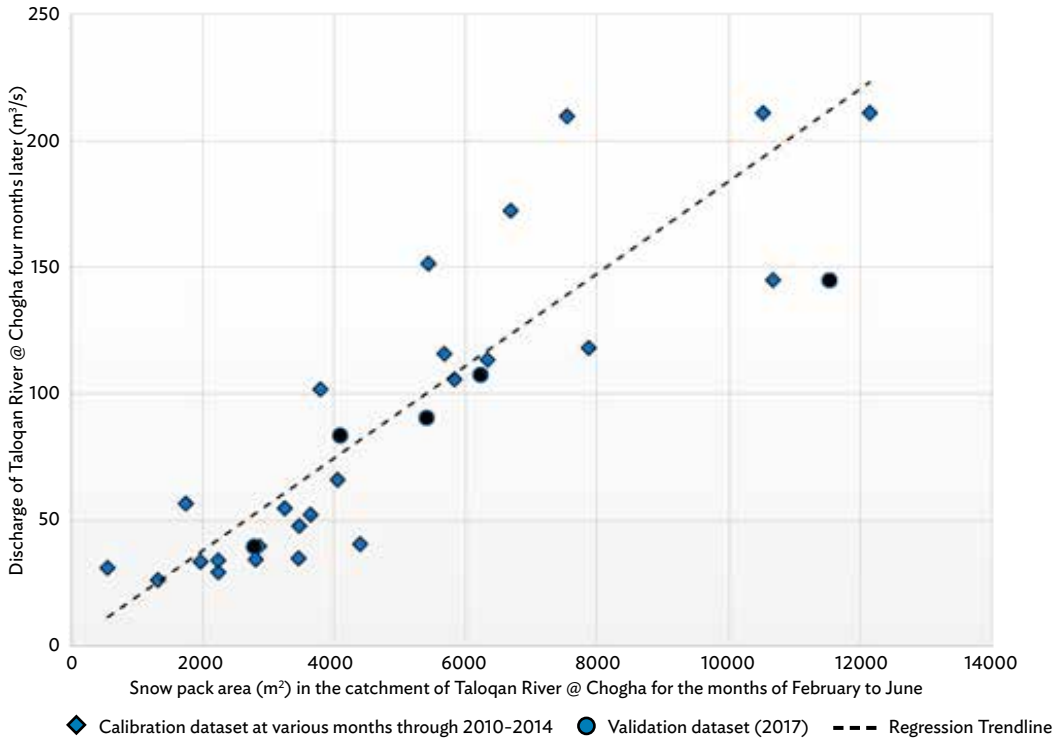
- In Afghanistan, technical capacity building had to be tailored to the capability of the staff of the RBO and the available budget. Almost all higher-level technical skills and tasks are still retained at the national level.
- In Bhutan, the RBO is established as a coordinating body and responsibility for technical capabilities lies with the agencies responsible for different aspects of water resources management and development. The capacity building work in Bhutan, therefore, focused on providing understanding and capability of water resource management objectives, data gathering, processing and use, and strategy development and monitoring.
- In Nepal, where the capital city is in the target river basin, greater resources and skills were available and could be anticipated for the emerging RBO.

Water Forecasting in Afghanistan

An important technological application in Afghanistan was water forecasting for the Taloqan River, a major tributary in the Panj Amu River Basin. Forecasting river flow for the year is particularly important for farmers planning their crop planting to reduce the risk of water shortage and resulting conflict over access to water in autumn, at the end of the irrigation season. It is also important in the wet years to facilitate preparation for flood response.

Historical satellite monitoring of the snowpack area in the basin was regressed against the past years' river flow (from 2010 to 2015 for calibration, and 2017 for validation) to obtain a relationship that could be used with satellite monitoring data for the current year to give a forecast of expected flow in 4 months' time. Thus, snowpack area data for February could predict the annual peak flow in June (Figure 6).

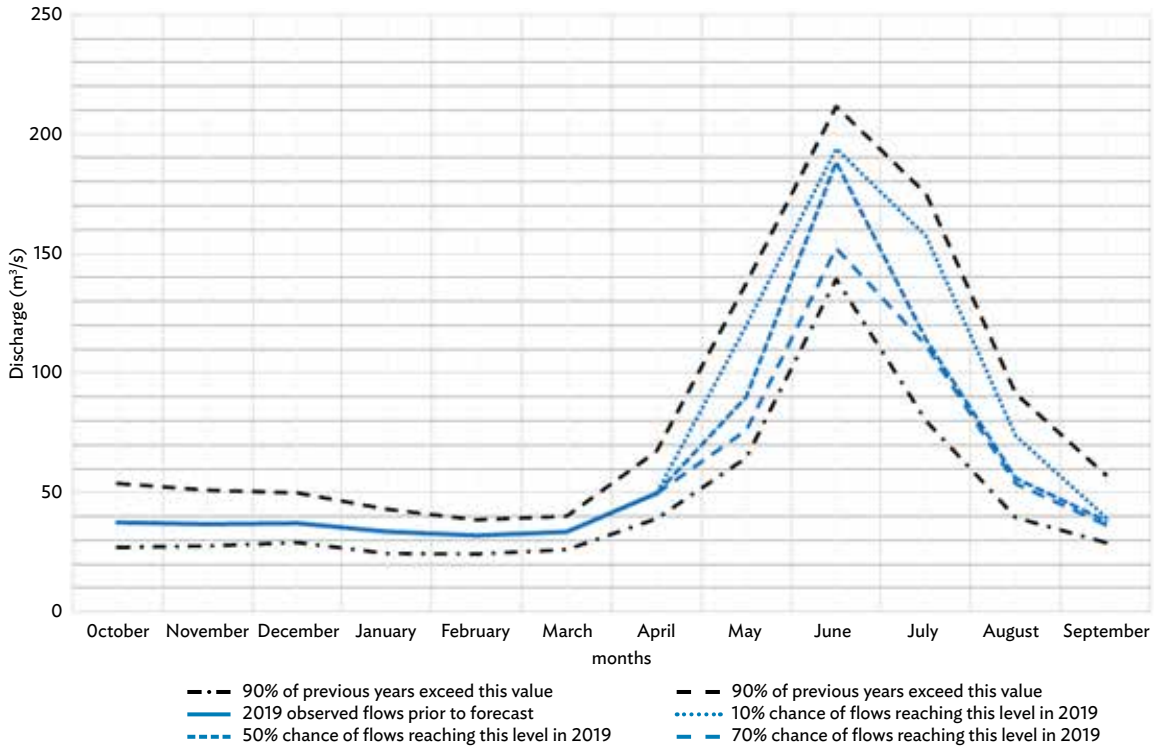
Figure 6: Relationship between Snow Coverage and Discharge in the Taloqan River Sub-Basin



m² = square meter, m³/s = cubic meter per second.
Source: Asian Development Bank.

This forecast process allowed information to be presented to the farming community in the Taloqan river sub-basin at a meeting in March, in time for incorporating it into annual farm plans. Information on the probable change in flow from one month to the next is used to give a further forecast of the river flow. The forecast system allowed updating of the snow-flow forecast month by month, and enabled comparison with the monthly flow change forecast to give a flow projection of improved reliability as the season progressed (Figure 7).

Figure 7: Water Forecast for 2019 (Water Year) at Chogha Gauge Station (with Percentiles Based on 2010–2018)



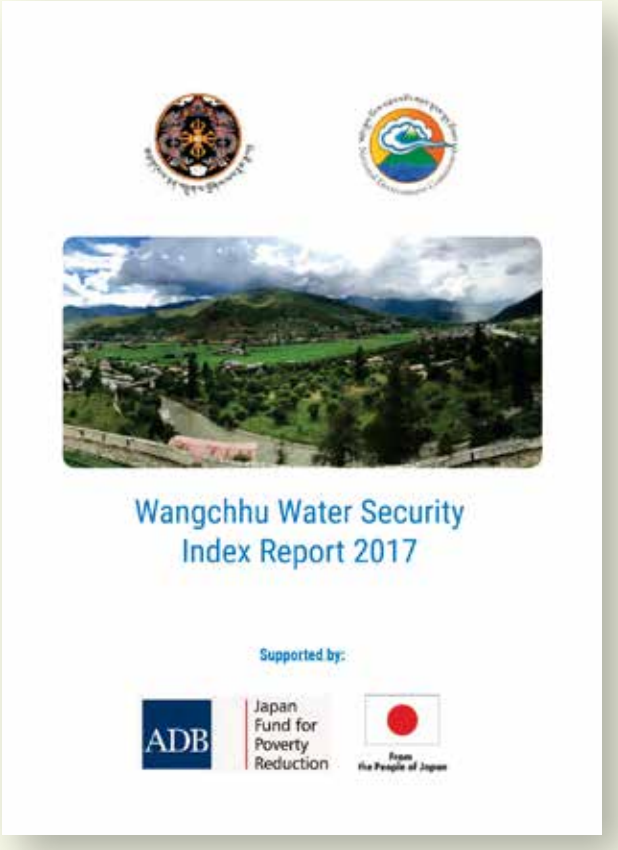
m³/s = cubic meter per second.
Source: Asian Development Bank.

Water Security Databases in Bhutan

The Government of Bhutan has adopted "Water" as one of its flagship programs in its 12th Five-Year Plan. This Flagship Program focuses on safe drinking water for urban and rural inhabitants and on small-scale irrigation development. It considers how the water security index could be applied to monitor and evaluate implementation.

An earlier project (footnote 5) applied the water security index developed for ADB's Asian Water Development Outlook 2013 to Bhutan.[9] In this project, the security index was devolved down to the Wangchhu Basin with data collection for 2017 and 2018. The project then developed a basin level database that linked to the national water security index database and was used by the National Environment Commission Secretariat to publish a report on Wangchhu Basin Water Security in 2017.

Local government staff were trained in data collection for the five dimensions of water security: (i) rural drinking water supply and sanitation, (ii) economic water security, (iii) urban water security, (iv) environmental water security, and (v) disaster and climate change resilience (Figure 8). The collected data were entered into the Wangchhu Basin water security database and became part of the national water security data for that year.



[9] ADB. 2013. *Asian Water Development Outlook 2013*. Manila. https://www.adb.org/publications/asian-water-development-outlook-2013.

Figure 8: Wangchhu Basin Water Security Index Sample

Wangchhu Basin—Rural Drinking Water Supply and Sanitation (2018)

Score: 3.2

△ Score

1. Percentage of rural households with independent functional water supply	72.9 %
2. Percentage of households with access to at least pour-flushed toilets	74.7 %
3. Hygiene by incidence of diarrhea per 1,000 inhabitants per year	170 case(s)

Wangchhu—Urban Water Security 2018

Score: 4.4

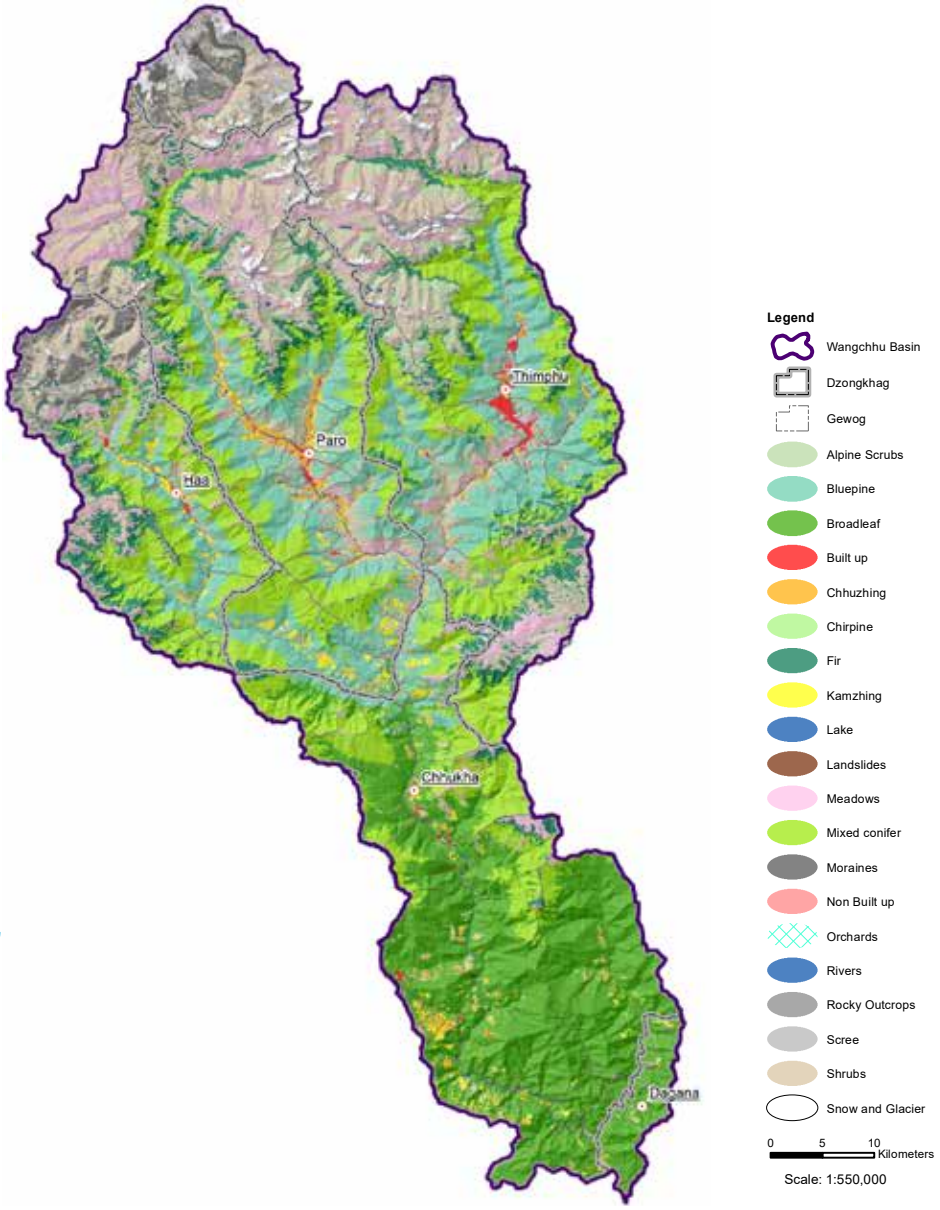
⬠ Score

1. Percentage of urban households having potable water supply	78.8 %
2. Percentage urban water losses	36.0 %
3. Percentage households having improved sanitation facility	98.3 %
4. Percentage of urban households with access to at least weekly solid waste collection and disposal service	98.5 %
5. Damage from urban flooding per capita gross domestic product	0.0 %

Source: Wangchhu Water Security Index System. The website is administered by the National Environment Commission of Bhutan and can be accessed at http://wwsi.nec.gov.bt/.

The technology also allowed for linkage to geographic information systems (GIS) to inform government decision-making. An interactive GIS system was developed and handed over to the government. In addition, the project developed readily usable maps related to administrative areas, forest cover, natural wetlands, agriculture areas, built-up areas, length of rivers and tributaries, dewatered stretch of rivers, and proportion of protected areas in the basin (Figure 9).

Figure 9: Example of the Wangchhu Basin Water Security Index Atlas (Land Use in 2016)



Source: Asian Development Bank.

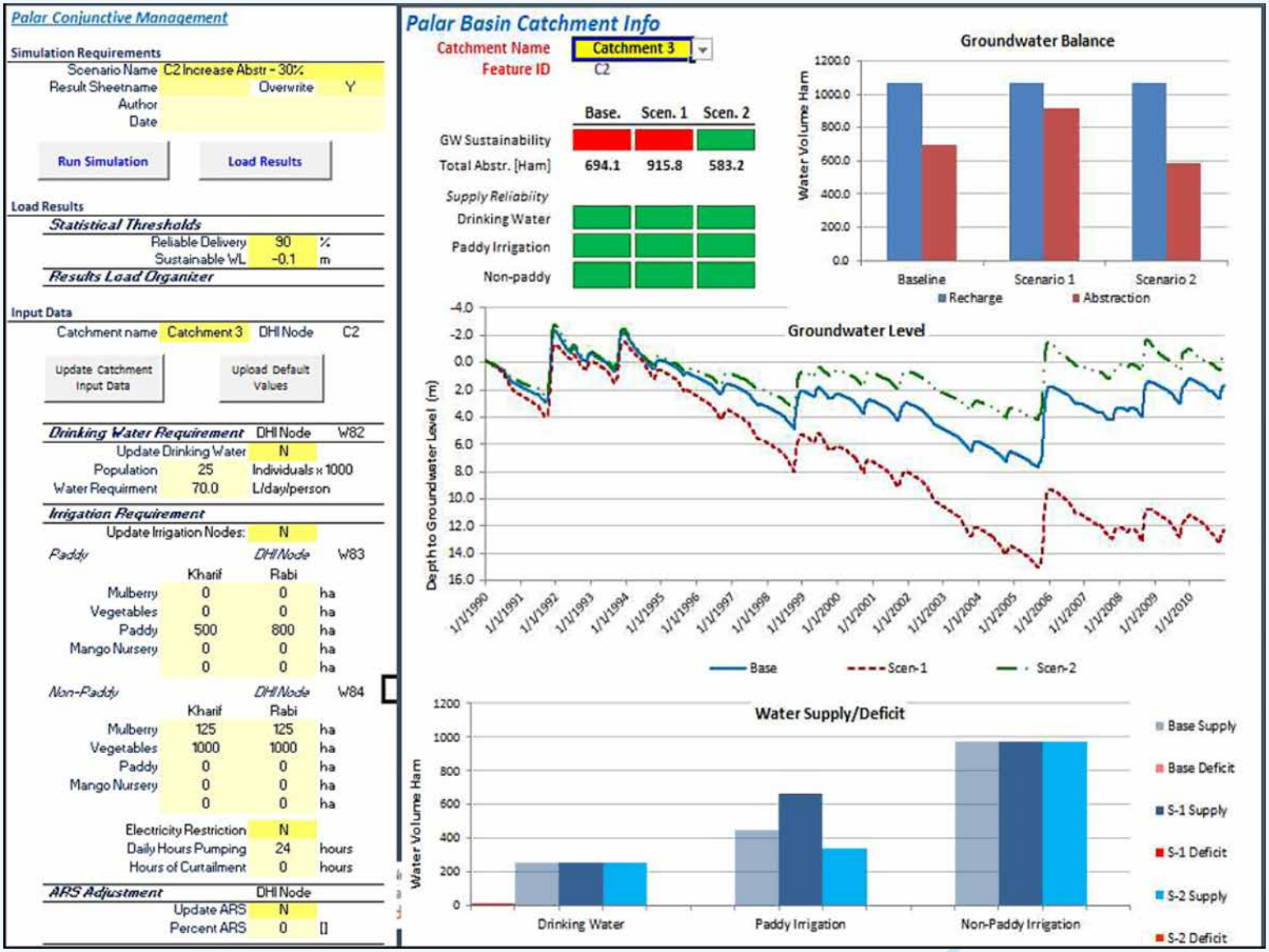
Basin Decision Support System in Nepal

A basin decision support system (BDSS) was developed by a companion project and was designed to support decision-making in the Bagmati River Basin by the RBO.[10] This project developed the BDSS further, trained users, and demonstrated how various management scenarios could be tested. The BDSS is able to organize and publish monitoring data, display spatial data, allow users to test water management strategies, and support decision-making using dashboards. The BDSS comprises a variety of data, databases, GIS, and user interfaces.

The BDSS is used to integrate available water resources information or data within the Bagmati River Basin to enable an understanding of how future changes in the watershed may influence the Bagmati River. Included in the BDSS are tools for data management, viewing GIS data, running scenarios with water resource models, analyzing monitoring data and model results, developing dashboards to report the analyzed data, and publishing the information to the web (Figure 10). One application tested was how changing urbanization could affect water availability and groundwater.

[10] ADB. Nepal: Bagmati River Basin Improvement Project. https://www.adb.org/projects/43448-013/main.

Figure 10: Example of Basin Decision Support System Scenario Testing



Ha m = hectare meter, L = liter, m = meter, S-1 = scenario 1, S-2 = scenario 2, WL = water level.
Notes:
1. C2 and W82–W84 are node IDs of the model developed by the DHI company.
2. ARS is also one of the parameters of the model.
Source: Asian Development Bank.

KEY LESSONS FOR STRENGTHENING RIVER BASIN ORGANIZATIONS

Although separated by country and culture, the rationale for designing and implementing a regional project has been found to be justified by common geographic settings, and by the institutional and development constraints to establishing RBOs. Sharing the differing experiences among the countries and the transfer of knowledge and institutional development strategies proved valuable. The strength of the sharing was in both proximity of the countries, allowing relatively quick travel options, and in pressing needs such as regional demands for potential hydroelectric production.

The following are key lessons for the successful strengthening of RBOs in the Hindu Kush Himalaya region.

A sound enabling environment is required, including an established legal framework.

- Enabling policy, strong political leadership, and a sound legal basis are needed for an RBO to fully grasp its mandate.
- RBOs function best where there are capable, well-trained, and articulate senior administrators.

Performance assessment can lead to improved strategy and implementation.

- The NARBO performance assessment methodology improved the RBOs' understanding of their purpose and mandate.
- In Afghanistan, the process demonstrated that it could motivate RBOs to improve their performance from one year to the next.
- In Bhutan, the assessment enabled the RBOs to clearly identify their strengths and weaknesses using this as evidence to request the funding of a Secretariat.
- In Nepal, although an assessment was not undertaken, the consultative process of agreeing on indicators helped to identify the challenges for the RBO to become fully established.

Engaging the community. A water users' meeting to discuss the 2019 forecast in Afghanistan.

Technology can assist RBOs to make better decisions.

- Targeted technology was shown to improve water allocation, reduce potential conflicts, and bolster RBOs' reputation among stakeholders.
- A simple water forecasting tool was developed for Afghanistan which is easy to use and allowed for effective water allocation decisions to be made.
- The highly successful Wangchhu Basin Water Security Index demonstrated how different stakeholders and levels of government could work together to produce a collaborative assessment report.
- Decision support systems were shown to be effective at allowing water planners in Nepal to hypothesize about future change and consider development control.

Keeping Asia's Water Tower Alive
Strengthening Integrated Water Resources Management with River Basin Organizations

The Asian Development Bank, with financing from the Japan Fund for Poverty Reduction, supported the governments of Afghanistan, Bhutan, and Nepal to mainstream river basin organizations (RBOs) and strengthen integrated water resources management in the Hindu Kush Himalaya Region. This booklet assesses the performance of RBOs in the three countries to facilitate a targeted approach on capacity development, offers recommendations on appropriate technologies to boost their performance, and identifies key lessons that will support strengthening of RBOs in the region.

About the Asian Development Bank

ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 68 members —49 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

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