8 Water

For the past nine years, Caroline has been growing rice on a four-hectare plot of land in a sprawling area of rice production near the banks of a river. Until recently, irrigation water pumped from the river allowed her to add an extra season of rice production per year, almost doubling her prior annual income. However, this year, the water level is significantly lower than average, and Caroline doesn't think she can grow anything this season. Some neighboring farmers believe that upstream users are extracting more than their allocated share of the river's water. Caroline agrees and notes that several large farms and industrial plants have appeared upstream in the past few years, but when she complained to the local river basin office tasked with allocation decisions, an official told her that they don't have information on those users—they "just sell water." She is now concerned that her water permit is useless.[1]

Water is an essential input for crop production and vital to the task of increasing yields and feeding the world's growing population. Farmers must have access to sufficient quantities of water, at an adequate quality level and at the appropriate time and location, for crop production to be commercially viable. The availability of water for crop production depends on many factors: water scarcity, pollution, climate variability and increased demand for alternative uses. These factors necessitate improvements in water management.

At the farm level, although rain-fed agriculture remains predominant in many climates across the world,[2] increased crop production in developing countries is expected to be achieved predominantly through irrigation. Irrigated land can be as much as twice as productive as nearby rain-fed land, and in developing countries irrigated agriculture already provides for approximately half of crop production, while comprising only 20% of all arable land.[3] However, the availability of water for irrigation is constrained both by climatic conditions and the effectiveness of public water management. Moreover, any increase in the use of water for irrigation has important consequences for the overall water balance and the broader environment. It is also important to recognize that farmers' access to water for irrigation is also impacted by legal frameworks that extend beyond the direct relationship between regulators and water users to include measures affecting the resource itself as well as the infrastructure used to deliver water to the place of use at the time needed.[4]

Water Projects, Lesotho.
Photo: John Hogg / World Bank.

What do the water indicators measure?

The water indicators measure key elements within the legal and regulatory frameworks that impact farmers' access to sufficient quantities of water, at an adequate quality level and at the time and location needed for crop production (table 8.1). The indicators are organized as follows:

Integrated water resources management: Water scarcity and degradation present significant practical constraints to both irrigation and agricultural development.[5] In addition, while irrigation poses a variety of benefits for agricultural growth such as increased crop production, it can also heavily impact the availability of water resources. To this end, integrated water resources management (IWRM) promotes a view towards managing water in conjunction with land and other interconnected resources to achieve equitable and sustainable use.[6] This indicator measures the regulatory framework applicable to water management in each country, including the establishment of institutions at the basin level, water planning, the development of information systems and water resource protection.[7]

Individual water use for irrigation: Systems for water use permits are critical tools for managing and allocating water resources, including water for agriculture.[8] Effective water use permit systems provide secure rights to water users and allow resource managers to review existing water uses and make meaningful allocation decisions in pursuit of broader planning and management goals.[9] This indicator measures requirements for water use permits, as well as the quality of these permit requirements by examining public notice requirements, transfers, water use charges and enforcement measures.

How do countries perform on the water indicators?

Countries that have developed a strong legal framework for IWRM also tend to have a strong legal framework for individual water use for irrigation, with top- and middle-scoring countries only displaying minor deficiencies across the range of features covered by the water indicators. In these countries, the most common gaps include the absence of mandates to periodically update plans and information systems, limited promotion of water conservation and efficiency, and the absence of water use permit trading. In contrast, countries with weaker frameworks tend to have one or more concentrated areas of weakness impacting their frameworks, rather than across-the-board weakness. For example, Nepal's legal framework for broader water resources management is largely absent with no planning or information systems in place, but it is relatively more comprehensive in supporting individual water use for irrigation; in contrast, the opposite is true in Bangladesh and Mali where water use permit requirements for medium-size farms are currently absent, but their water resource management frameworks are relatively stronger.

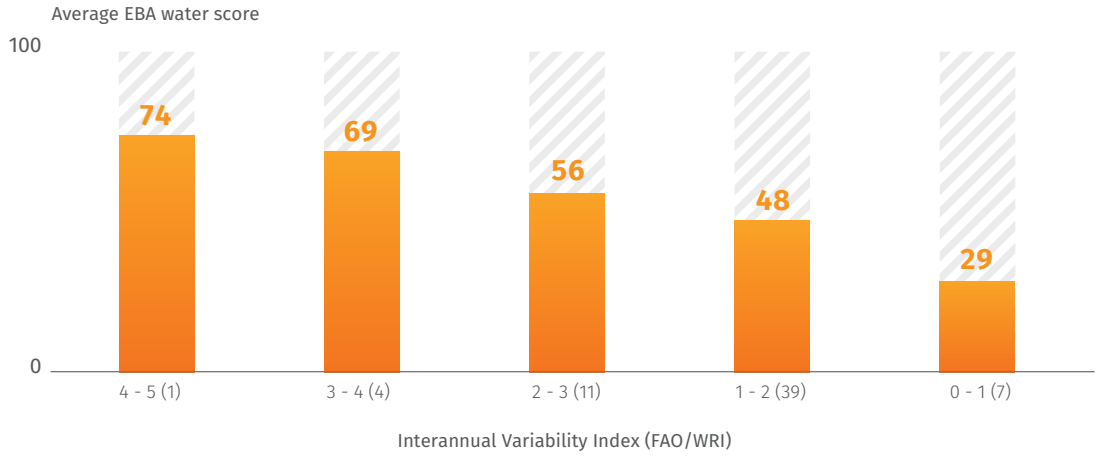
Spain's legal framework represents the most comprehensive enabling framework for water management and use. Overall it provides for strong legal mechanisms that drive integrated water resources management (such as institutional frameworks, water inventorying and monitoring activities). In addition, it provides for a dynamic permit system for water use activities that facilitates transfer of water permits and other mechanisms that allow the system to adapt in response to changed circumstances (table 8.2).

Table 8.1 | What do the water indicators measure?

INTEGRATED WATER RESOURCES MANAGEMENT	• Institutional mandates to manage water at basin levels • Water planning at the national and basin levels • Information systems on water resources and water use to support management decisions • Resource protection mechanisms in cases of depletion or pollution
INDIVIDUAL WATER USE FOR IRRIGATION	• Abstraction and use permit requirements for medium-size farms (2–10 hectares) • Transfers of active permits separate from land transactions • Charging for the abstraction and use of water resources • Enforcement of permit-related obligations

Source: EBA database.

Figure 8.1 Countries with more variable water availability tend to have stronger legal frameworks



Sources: EBA database; FAO Aquastat/WRI 2016.

Note: Sample size in parentheses. A normalized indicator of the variation in water supply between years, created by WRI, ranges from 0-5, where 0 is lowest and 5 is highest (most variable). Correlation coefficient is 0.335, significant at 1% level after controlling for gross national income per capita.

Context-specific concerns that may impact a country's regulatory priorities include inter-annual water variability and water stress issues related to population growth and/or water scarcity. Countries with higher water variability tend to have developed stronger legal frameworks for water management and use in response (figure 8.1). Both Kenya and Mexico, for example, perform well on the water indicators, which illustrates how challenges identified in a country's water resources situation can be a driver to adopt a strong legal framework for water management and use. Recognizing its water variability challenges, Kenya began a series of legal and regulatory reforms in 2002 with the introduction of a new Water Act (Cap. 372) and supporting regulations that upgraded and repealed outdated colonial-era legislation. In response to rapidly growing demand and overexploitation, Mexico has developed comprehensive legislation anchored by the 1992 National Water Law.[10] In contrast to both Kenya and Mexico, Denmark's relative abundance of stable, high-quality water resources and the absence of acute water stress issues[11] may be one factor to explain why their legal framework for water management and use is currently less comprehensive than that of either Kenya or Mexico.

Table 8.2 | Where are water regulations strongest?

STRONGEST		WEAKEST	
1	SPAIN	58	GUATEMALA
2	MEXICO	59	SUDAN
3	COLOMBIA	60	THAILAND
4	KENYA	61	LIBERIA
5	ARMENIA	62	MYANMAR

Source: EBA database.

What are the regulatory good practices?

Box 8.1 highlights regulatory good practices and some countries that implement these practices.

Informed institutions and planned water management

Institutional entities that manage water at the level of basins and aquifers are a critical component of IWRM and the starting point for improved planning, management and allocation of water among different water users.[12] Across the countries studied, many have created institutional entities that manage water at the level of basins and aquifers, but fewer have taken steps toward the planning and information systems necessary to sufficiently inform those institutions and water users.

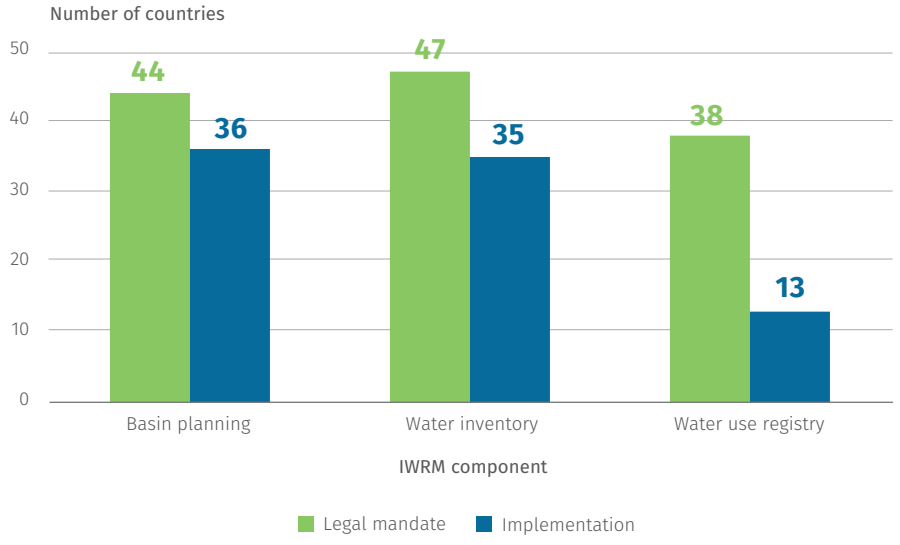
Approximately three-quarters of the countries studied have enacted legal provisions that require the

Box 8.1 | What are the regulatory good practices for water?

	REGULATORY GOOD PRACTICES FOR WATER	SOME COUNTRIES WHICH IMPLEMENT THE PRACTICE
INTEGRATED WATER RESOURCES MANAGEMENT	Institutions exist with an adequate legal mandate to manage water at the appropriate geographical scale.	GREECE, KENYA
	Water planning is carried out at the national and basin levels and involves public consultation, periodic updating and monitoring planning.	NETHERLANDS, SERBIA
	Systems, such as an inventory of water resources and a water user registry, are publicly available, providing information on water availability, location, and use and any changes over time.	DENMARK, KOREA, REP.
	Quality standards exist for irrigation water, and the government can restrict water use in cases of depletion and pollution.	MEXICO, SPAIN
	Legally mandated quotas are in place to ensure the participation and involvement of water users and women in water management.	RWANDA, TANZANIA
INDIVIDUAL WATER USE FOR IRRIGATION	A mandatory permit system applies to water abstraction and use by medium-size and larger farms (larger than 2 hectares). Laws and regulations should set out the application procedure, permit duration and public notice requirements for new applications.	ITALY, TANZANIA
	Water permits are transferable—separate from land—and the procedural rules are clearly stated in the law. Certain limitations, such as notification requirements, also apply to avoid subverting the water allocation and planning process.	ARMENIA, CHILE
	Water users pay for the quantity of water resources used, and governments are obligated to set and collect fees for the use of water resources.	PERU, RUSSIAN FEDERATION
	Individuals keep records, and the government is given powers to conduct inspections for permit compliance.	MEXICO, PHILIPPINES
	Noncompliance with core water management and/or use obligations is an offense.	KAZAKHSTAN, MALAWI

Source: EBA database.

Figure 8.2 | Basin planning and water information systems



Source: EBA database.

Note: Availability of plan, inventory or registry information online is taken as verifiable proxy indicator for implementation. IWRM = integrated water resources management.

establishment of institutions to manage water at the river basin level. Of those countries, 87% have actually established at least one of these institutions. Those countries that have a legal mandate but have not yet created any basin institutions tend to have relatively recent legislative or regulatory enactments, such as Cambodia (2015), Malawi (2013), Rwanda (2013) and Turkey (2012). Overall, 77% of all countries studied have at least one basin-level water management institution in place, taking into account those that have such entities without a legal mandate. Of those countries that do not have a legal mandate to establish basin institutions, 47% have them in practice, including Cameroon, Ghana, Senegal and Uganda. However, without a clear anchor in the legal framework, the role and impact of these institutions are typically restricted to consensus building, rather than exercising the necessary functions for planning and allocation of water resources.

Effective water planning and information systems guide water allocation decisions and thereby benefit farmers by helping to reduce the likelihood of situations where resources are over-allocated and irrigation needs go unmet.[13] Of the countries studied, 44 require water planning at the basin level and 36 have actually completed at least one basin plan to date. To make good water planning decisions, water managers must have sufficient information about the current state of available resources, as well as the future demand from existing and potential water users. Furthermore, making information about water resources and water users available online helps to inform on-farm decisions to invest in irrigation development. But, whereas approximately 76% of the countries studied mandate the completion of an inventory of available water resources, only 56% currently have any inventory information made publicly available online (see figure 8.2). Similarly, although 61% of the countries studied require the creation and maintenance of a registry of water users, only 21% currently make any registry-related information publicly available online. For example, although more than half of low-income countries currently require a registry of water users, none of them currently makes any registry information available online.

The shared nature of water resources makes farmers dependent on institutions to monitor the ongoing status of water resources and to take actions to protect water resources from water depletion and pollution. These regulatory activities are critical because once resources have become degraded, recovery is complex and expensive, and at times impossible.[14] Of the countries studied, 66% mandate monitoring of both water availability and water quality. However, far fewer of these countries require the government to actively publicize monitoring information. Overall, only 40% of the countries studied require water monitoring results to be made publicly available. In conjunction with inventory and registry information, publication of monitoring results helps to inform farmers about where it is reasonable to invest in irrigation and has important broader implications for the long-term ability to track protection of water-related ecosystems.

Protecting farmer investments through transparent permit systems

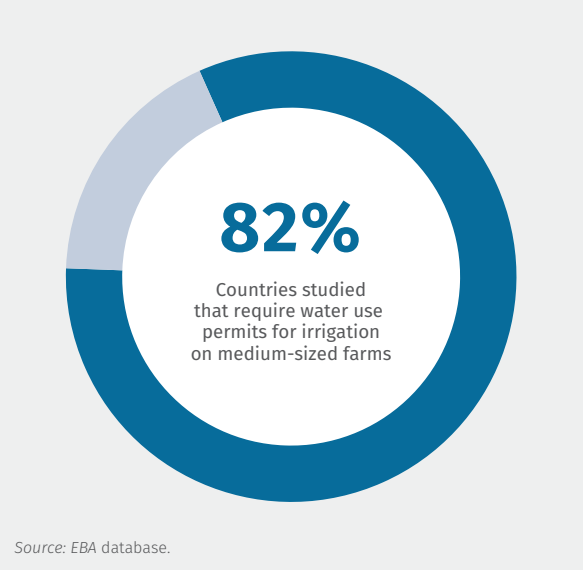
Strong water use permit systems benefit farmers by helping to ensure access to water in the face of potentially competing demands and strained resources. Moreover, at the broader level, as agriculture accounts for approximately 70% of water withdrawals globally and up to 90% in some country contexts,[15] water use permit systems are a critical tool for managing and allocating water resources, including water for agriculture.[16] Accordingly, an overwhelming majority of countries—82%—have put in place water use permit systems that are applicable to irrigation water use on medium-size farms[17] (figure 8.3). Of the remaining 11 countries that do not require permits, four (Benin, Burkina Faso, Côte d'Ivoire and India) have instituted a partial system that requires these users to declare their water use, but offering no allocation control to water resource managers. The final seven countries (Bangladesh, Guatemala, Kyrgyz Republic, Liberia, Myanmar, Thailand and Turkey) do not have either requirement for individual water use for irrigation.

Significant variations are observed with respect to the quality of permit systems used to manage water withdrawals and those features that directly impact investment security for water users. For example, permit systems should require public notice of a new permit application before a decision is made, which promotes transparency and seeks to protect the rights of existing water users. Thus, for example, Armenia's 2002 Water Code requires the agency issuing water permits to publish notice of pending water applications to allow for comments for 30 days prior to making a final decision. Only 27 of the countries studied have this legal requirement and only 21 of those set a mandatory minimum length for public notice. Recordkeeping requirements for water users are an additional transparency feature intended to facilitate water management and support water managers as they try to ensure sustainable water withdrawals. Romania provides an example of this good practice, as its water law requires water users to meter the quantity of water abstracted and keep records to be periodically submitted to the overseeing agency, which in turn must compile and make that information publicly available. Only 45% of countries studied have set a recordkeeping requirement in their legal framework.

Promoting efficiency and conservation through resource pricing

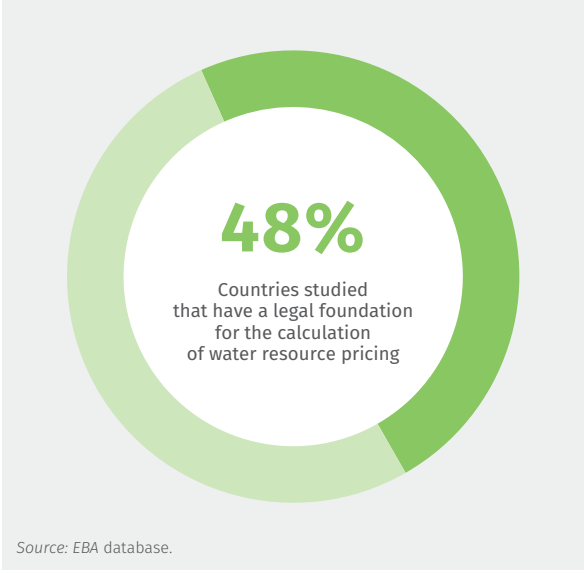
In response to water scarcity concerns and increasing demand, many countries are establishing the legal foundation necessary to charge user fees for the individual abstraction of water resources. An appropriate fee structure is one tool for water managers to promote efficient water use and water conservation, but, to this end, it is especially important to tailor any proposed legal approach to the specific country context, as defined by socioeconomic factors, the needs of smallholders and the most vulnerable water users, and the general profile of water users and farm sizes in the country.[18] Nonetheless, when tailored to each country's context, managing water as an economic good can

Figure 8.3 | Widespread adoption of permit systems for sustainable management of water withdrawals



Source: EBA database.

Figure 8.4 | Legal foundation to calculate water pricing



Source: EBA database.

Terraced rice paddies near a Red Zao village, northern Vietnam. Photo: Tran Thi Hoa / World Bank.

lead to efficient and equitable use, as well as promote water conservation.[19] Morocco's legal framework demonstrates good practices in this field by placing both an obligation on the user to pay charges and an obligation on the agency to collect charges, as well as by clearly defining how charges are calculated. In 40 of the countries studied, the legal framework requires medium- and large-size farms to pay a charge for water resources abstraction, but in only 29 of those countries does the legal framework specify the method for calculating the charge due (figure 8.4).

Conclusion

Water-related challenges vary widely between countries. One of the most important qualities of a country's regulation for water management is the ability to meet the specific needs presented by the relevant country (and even basin) context. Nevertheless, while allowing for adequate tailoring, comprehensive laws and effective institutions generally contain a common range of tools and systems that allow for resilience in the face of challenging and/or changing conditions, such as water scarcity, fluctuations in availability or growing demand. Comprehensive regulation also supports the long-term durability of core practices for water management and use, which in the absence of a legal mandate may be compromised by future challenges related to available funding and/or political will.

NOTES

1 Adapted from Mdee et al. 2014.

2 IWMI 2007.

3 FAO 2011.

4 OECD 2010.

5 IFAD – UNEP 2013; HLPE 2015.

6 Integrated water resources management can be defined as "a process which promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems." (GWP 2010).

7 Vapnek et al. 2009.

8 Permits can also be referred to as licenses, concessions, or authorizations, all of which convey a "water right"—that is, a right to use water, subject to the terms and conditions of the grant. (See Burchi and D'Andrea [2003], chapter 1 [1]).

9 Cap-Net 2008.

10 Grey and Sadoff 2006.

11 Danish Ministry of Foreign Affairs 2012; OECD 2015.

12 Vapnek et al. 2009.

13 Pegram et al. 2013.

14 Vapnek et al. 2009.

15 HLPE 2015.

16 Burchi and D'Andrea 2003.

17 "Medium-size farms" are defined as being between 2 and 10 hectares in area in the case study assumptions used for data collection.

18 Johansson et al. 2002.

19 Tsur 2004; Rogers et al. 1998.

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