



Advancing toward water security: addressing governance failures through a metagovernance of modes approach

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Abstract

Water security (WS) is a desirable goal of ensuring a sufficient quantity and quality of water for life-supporting processes and the development of society. However, achieving WS is a complex challenge that must be addressed in an integrated and interdisciplinary way. Integrated River Basin Management (IRBM) could be a means to achieve WS if it is supported by the development of an appropriate adaptive governance process that emphasizes more collaborative and coordinated actions and recognizes river basins as complex social-ecological systems. In this paper, we analyze the relationship between WS and the hybrid conceptualization of hierarchical, market and network governance, namely metagovernance of modes. Here the three governance modes are best coordinated by a public metagovernor, who is a key actor in avoiding typical governance failures, helping it become an effective approach to implement adaptive river basin management. The context-specific attribute of metagovernance of modes, and the situationally optimal mixtures that it provides, seem to make it the most suitable alternative to deal with complexity, uncertainty and constant change. We propose that social-ecological components and processes in river basins must be integrated through sound combinations of these three governance modes, which could determine the adoption of a specific adaptive management instrument, according to the problem to be solved. Further research is needed to understand how metagovernors could achieve better coordination and how to best address context-specific intervention strategies.

Keywords Water security · Metagovernance of modes · Adaptive management · River basins

Introduction

The core idea underpinning water security (WS) is ensuring a sufficient quantity and quality of water as a key driver of life-supporting processes and a determining factor in

society's development, balancing human and environmental demands (Global Water Partnership 2016). This concept has been addressed in both academia and public policy, is frequently used in many disciplines in the natural and social sciences (Cook and Bakker 2012; Varady et al. 2016; Adeel 2017), and it is also closely related to United Nations Sustainable Development Goal 6 (SDG 6) (UN 2015). Furthermore, WS has been promoted by international organizations such as the United Nations (UN Water 2013), the Global Water Partnership (Global Water Partnership 2016) and the World Economic Forum (World Economic Forum 2018).

The WS concept has been defined in several forms, some examples of which are listed in Table 1 (Grey and Sadoff 2007; Norman et al. 2010; Cook and Bakker 2012; UN-Water 2013; Scott et al. 2013). Although these definitions differ, they contribute to the construction of the following ideas: (i) WS looks to guarantee systems' functional properties that are vital to society; (ii) in changing contexts, societies' capacity to properly manage water resources is a necessary condition for achieving WS; and (iii) the river basin

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Table 1 Some definitions of the term water security

| Definition | Focus | Source |
|--|--|------------------------|
| Availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies | These authors propose that WS not only implies having access to water for subsistence, but also for dealing with water-related risks | Grey and Sadoff (2007) |
| Sustainable availability of adequate quantities and qualities of water for resilient societies and ecosystems in the face of uncertain global change | Adoption of the concept of resilience, associated with achieving adaptive capacity to deal with uncertainty | Scott et al (2013) |
| Sustainable access, on a watershed basis, to adequate quantities of water, of acceptable quality, to ensure human and ecosystem health | A concept that emphasizes the access to water at the basin level | Norman et al (2010) |
| The capacity of a population to safeguard sustainable access to adequate quantities of and acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability | This definition includes the political dimension of WS, aiming to achieve it in a climate of peace and political stability | UN-Water (2013) |

seems to be the proper territorial unit for water resources management in a WS context.

WS refers to the goals proposed by society, an aspect of growing significance given the important social transformations the world is undergoing (Peña 2016). Considering this interplay, reaching WS is a complex task. On the one hand, as society develops, social goals could change, eventually becoming more demanding, with institutions playing a key role in addressing these new demands. On the other hand, the access to water is worsening and the supply is decreasing due to the impacts of climate change, hindering the achievement of WS (OECD 2015). In this paper we shed light on these issues by assessing the relationship between WS and society's institutional settings, within a climate change adaptation framework.

We analyze how a hybrid conception of metagovernance, namely metagovernance of modes (Gjaltema et al. 2019), could contribute to advancing toward WS. Our focus is on understanding the complex dynamics of adaptive capacity, and we analyze in depth the way in which hierarchical, market and network governance modes are combined to address them, and how metagovernance of modes could address the governance failures that are typical of their exclusive application. Based on our findings, we propose the adoption of situationally optimal mixtures of hierarchical, market and network governance modes (Meuleman 2010) as an effective approach to advance toward WS.

WS challenges are related to water scarcity, inadequate infrastructure, population growth, pollution and more intense and frequent extreme events, among other issues (UNESCO 2019). Water governance is a means to deal with WS challenges, which can be adequately addressed through an integration of institutional roles, water management instruments and different stakeholders at the basin level (Global Water Partnership 2016). Further, water governance is a concept that has been defined in multiple ways (United Nations 2002; OECD 2015; Pahl-Wostl 2015), which, together, construct the idea that it is a process that involves different perspectives in a dynamic and contextual decision-making practice, including institutional and organizational aspects (mechanisms, systems and traditions). In this sense, water governance implies the existence of different arguments about how to best carry it out, as well as different modes to achieve effective solutions.

Some studies have addressed all three water governance modes: hierarchical, market and network governance, analyzing how they are applied in water resources management (Rudolph and Rudolph 1979; Zilberman and Schoengold 2005; da Silveira and Richards 2013), and exploring the advantages of using each mode in a hybrid way (Meuleman 2008). Other scholars have studied the concept of metagovernance, defined as the “governance of governances” (Jesop 2011), which is a process that promotes coordination

through different governance modes to achieve positive outcomes (Meuleman 2008). Within this context, scholar contributions include systematic reviews of different definitions of and perspectives on the metagovernance concept (Gjaltema et al. 2019), exploring opportunities for metagovernance to promote public value and the related challenges (Ayres 2019), analyzing its multispatial character (Jessop 2016) and studying the relationship between metagovernance and the achievement of the Sustainable Development Goals (Meuleman 2018).

It is important to highlight that network governance has been regarded as a means to achieve adaptive capacity (Dietz et al. 2003). For instance, Carlsson and Sandström (2008) state that dense and heterogeneous network structures are better prepared to ensure adaptability, maintaining the necessary diversity to prepare for unexpected changes; and densely connected networks promote coordination and collective action to achieve resilience and respond to uncertainty (Newman and Dale 2005). However, the network governance mode has some failures that could be addressed if it is complemented with hierarchical and market governances in a hybrid way (Meuleman 2008; Jessop 2011).

In a systematic literature review, Gjaltema et al. (2019) provide four ideal types of metagovernance emerging from the literature: network metagovernance, multilevel metagovernance, metagovernance of multiplicity and metagovernance of modes. In our study we focus on this latter type, which seeks to balance hierarchical, market and network governances in a hybrid way, according to the context and specific problem to be solved within a river basin. In this

sense, avoiding governance failures becomes an attribute of metagovernance of modes, which we believe makes it more suitable than network governance in implementing adaptive river basin management and advancing toward WS.

Metagovernance of modes seems to be suitable to achieve adaptive capacity, because its context-specific nature is appropriate to deal with complexity, uncertainty and change. We advance the literature by focusing on analyzing the failures of each governance mode, and how a metagovernance of modes can help overcome them. To the best of our knowledge, the relationship between metagovernance and WS has not been studied.

Integrated River Basin Management: spatial scale and complexity

In our understanding, a governance process that promotes the integration of different perspectives in water resources conservation is essential to address WS. As shown in Fig. 1, WS is achieved through a cross-sectoral integration in which decision-makers work together with key actors to implement social change through the development of clear institutional roles, management instruments and an enabling environment (Global Water Partnership 2014). In this sense, Integrated River Basin Management (IRBM) could be a suitable means to achieve WS.

River basins have been widely accepted as the most appropriate territorial units for water resources management (Jaspers 2003; Parkes et al. 2010; Wang et al. 2016; Kaval

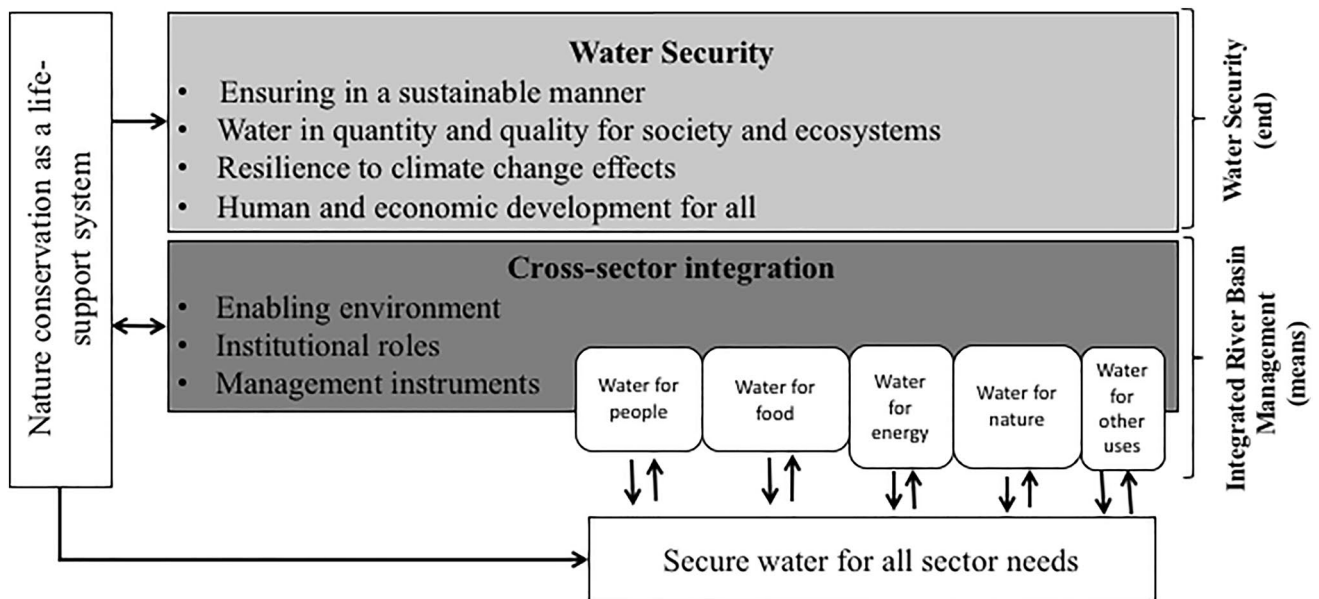


Fig. 1 Water security is achieved through the adoption of Integrated River Basin Management (IRBM), where the priority is the conservation of nature as a life-support system, to ensure water for the needs of all sectors. Source: adapted from the Global Water Partnership (2014)

2019; Everard 2019). For the purposes of our analysis, we agree with Molle (2009) in considering river basins not only as geographical units, but also as political and ideological concepts that are connected to ecological and regulatory frameworks that are changing in terms of scale. Thus, we consider the need to relate WS to the territorial factor and spatial dimension, stressing that WS is a multi-scale problem that can be appropriately addressed if actions are integrated and implemented locally, at the river basin level. However, Julio et al. (2021) identified some scholars that question this idea, who propose that in some cases implementation challenges could arise such as inconsistencies regarding hydrological and political-administrative boundaries (Norman and Bakker 2009), and social, economic and physical factors that could have an effect outside the boundaries of the river basin (Cohen and Davidson 2011). In these specific cases, other political-administrative and/or geographical boundaries may be considered as proper units of management to effectively advance toward WS.

Ensuring sustainable access to water in terms of both quantity and quality is a complex task since achieving this goal entails dealing with many issues that are multivariate and difficult to solve (Bierbaum and Cowie 2018), there are complex or ‘wicked problems’ related to situations where there is no consensus on either values or knowledge to propose a solution, and where there are no criteria as to whether all solutions have been considered (Rittel and Webber 1973). Thus, because the problems related to WS are complex, they must be addressed through an adaptive approach to sustainably ensure water quantity and quality (Allan et al. 2013). Some authors argue that IRBM is determined by the development of adaptive capacity, which is the capacity of an appropriate governance process to be sustainable and operate at multiple scales (Lautze et al. 2011; Pahl-Wostl 2015; Monkelbaan 2019), to regard river basins as complex social-ecological systems (Berkes et al. 2003; Chapin et al. 2009) and to have multiple responses to changes and uncertainty (Fischer et al. 2007; Chaffin and Gunderson 2016).

Berkes et al. (2003) propose that an adaptive perspective must comprehensively consider the social, economic and ecological dimensions of sustainability within a single social-ecological system. In this view, larger-scale political-economic and biogeochemical conditions influence internal processes and interactions (Chapin et al. 2009), while the ecological and social components interact within a dynamic structure that facilitates feedback, acting at different spatial and temporal scales and integrated through management practices (Virapongse et al. 2016). Thus, within the WS framework, it seems appropriate to look at the river basin as a social-ecological system (Chiluwe and Claassen 2020). The question that arises here is how to sustainably manage river basins as complex social-ecological systems to reach WS.

Social-ecological adaptation to environmental change requires a flexible and dynamic view of water management outcomes related to WS, as a constant goal of ensuring all sector needs. This implies that advancing toward WS requires a water management system able to adapt to the challenges that could threaten it. This means moving from conventional ways of acting (command and control), learning (research is separate from doing), understanding (knowing through reduction) and collaborating (fragmentation and demarcation) toward new ways of acting (integrated and informed), learning (doing-oriented and inclusive), understanding (social learning) and collaborating (integrated and inclusive) (Allan et al. 2013). Within this framework, adaptive management tends to focus on processes rather than ends, improving resilience of the system and adding redundancy to ensure that when one mechanism fails, the other can still prevail (Chaffin and Gunderson 2016).

Since adaptive management within the WS framework promotes more inclusive and participatory forms of collaboration (Pahl-Wostl 2017), it requires the adoption of an appropriate governance system. Such a system is related to the concept of adaptive governance, which emerges from the need to expand the focus from adaptive management to attend to the broader social context that supports social-ecological system management (Dietz et al. 2003). In this sense, the concept of Adaptive River Basin Management is a way to operationalize adaptive governance, sharing power and responsibility between water resource users and government agencies to achieve more collaborative and coordinated actions, emphasizing basins as the most appropriate spatial units for management (Heathcote 2009; Kattel 2019).

Governance modes: main characteristics

We view the adaptive approach to IRBM as an effective way to integrate different stakeholder perspectives to ensure a sufficient water quantity and quality to meet the needs of all sectors, as long as it is guided by an adaptive governance process that combines different modes to govern water. Adaptive governance implies a broad range of stakeholders in decision-making, encouraging a form of social coordination which connects individuals, agencies and institutions at multiple organizational levels (Bakker and Morinville 2013). In this sense, the existence of multiple actors determines in turn the existence of several modes to govern water. Below, we analyze three governance modes in the context of adaptive river basin management: hierarchical, market and network governance.

Hierarchical governance

The hierarchical governance mode is common in government structures (although it is also present in private organizations), where a strong, significant role in regulating and implementing multi-sectoral water management is guaranteed. The main idea is to preserve and strengthen public responsibility to ensure that all sectors of society have access to water (Villamayor-Tomas et al. 2019). This mode uses command-and-control mechanisms to govern, which are instruments of direct regulation based on the coercion-sanction relationship to enforce the law and modify environmental behavior (Pacheco-Vega 2020), influencing individual decisions through written rules.

The concept of hierarchy commonly raises the idea of bureaucracy (Rudolph and Rudolph 1979). According to Thompson et al. (1991), bureaucratic rationality characterizes systematic administration, including the specialization of functions, acting only in terms of a permanent and immobile set of rules and hierarchical authority. Bureaucratic hierarchies include a high degree of centralization in policymaking and resource allocation, suggesting a “*transmission belt*” to apply central guidelines, “*with limited autonomy of the periphery*” (Exworthy et al. 1999, p. 15). However, in the governmental domain, it is easy to find criticism of the idea of bureaucracy. Bureaucrats (often government officials at any level) are criticized for their lack of efficiency, initiative and flexibility in decision-making and their need to constantly consult others above them in the pyramid to make a decision on any action (Thompson et al. 1991).

Market governance

The market governance mode is related to a decentralized decision-making (Jessop 2011), encouraging the regulatory function of the free market in the re-allocation of water to the sectors that place the highest economic value on water resources (Boelens 2008). This mode uses formal and informal rules to guide the behavior of different agents, including individuals and governments (Rey et al. 2019). Water markets belong to this governance mode. Supporters of water markets argue that this form has progressively been used as a strategy to deal with water scarcity, efficiently allocating water resources (McCann and Garrick 2014). Although the implementation of water markets must include political-economy and equity considerations to deliver socially desirable outcomes in water management (Wheeler et al. 2014; Koopman et al. 2017), this governance mode has received criticism regarding the application of free-market mechanisms to water, mainly due to the complexity of considering the externalities associated with different uses (Bauer 2010; Bakker 2010; Budds 2020).

The question that arises then is whether water is an economic good that can be analyzed using the conceptual framework of economics in the same manner as any other good. Hanemann (2006) states that water has some other ‘*economic features*’ that make it different and are often overlooked by economists. According to this author, water is mobile and has several progressive uses since it is not often consumed fully by a particular user; its availability varies during a given time (according to climate conditions and/or institutional actions); water is essential for all life; it has many dimensions (quantity, quality, location, timing, probability of occurrence) and it can be both a public and a private good. This means that including all of the above in the water market framework is a challenging task.

Network governance

Network governance is associated with the management of complex networks composed of many national, regional, and local actors (Meuleman 2008). Sørensen and Torfing (2009) define it as a stable articulation of actors from the government, business and civil society that are mutually dependent but operationally autonomous, interacting through negotiations within a framework of formal and informal institutional rules and knowledge, and enabling the creation of self-regulated policies. Within a network structure, power is distributed more horizontally among actors and organizations, centers of authority are decentralized (vs. more centralized in hierarchical governance) and collective action to govern a common good is encouraged (vs. more individualistic in market governance) (Sørensen and Torfing 2007).

Network governance is closely related to the concept of ‘polycentrism,’ which involves many decision-making centers that are formally independent of each other (Ostrom et al. 1961). Pahl-Wostl (2009) states that polycentric governance systems consist of differently sized governance units with various purposes, organizational aspects and spatial locations, which interact to form a larger self-organized governance scheme. In other words, in networks and polycentric governance systems, responsibilities at different governmental levels must coincide with the scale of the public services they provide (Ostrom 2014).

Governance modes: some failures

Each governance mode has specific strengths; however, they have weaknesses in different contexts, resulting in various governance failures. Meuleman (2018, p. 12) defines a governance failure as “*the ineffectiveness of governance goals, a governance framework or the management thereof, to achieve policy goals,*” involving economic, social and environmental costs. For WS, a governance failure may emerge

when decision-making does not effectively cover the needs of all actors, especially the most vulnerable (Bakker 2008). In our view, these findings are related to a governance system that fails when it does not consider different perspectives in a decision-making process that involves institutional and organizational aspects, which are reflected through mechanisms related to water management.

State/government failures (generally associated with hierarchical structures) occur when political processes determine a situation of inefficiency, also related to a lack of appropriate incentives (Tietenberg and Lewis 2018). For instance, Bakker et al. (2008) claim that water-related failures occur when water supply systems owned and operated by governments fail to function efficiently, due to a rent-seeking situation (officials seek to obtain income by capturing economic rent through the manipulation or exploitation of the political or economic environment). Also, the performance of governments could be weakened in terms of environmental externalities, since they do not have incentives to penalize themselves. This implies that governments must cede regulatory control to water markets, renouncing the ownership and direct management of water supply services (Bakker 2010).

Nicholson and Snyder (2007) indicate that one of the situations that encourages market failure occurs when there is asymmetric information that prevents perfect competition (some participants have more information than others). Tietenberg and Lewis (2018) also include scenarios of imperfect competition, such as monopolies (one supplier, many demanders), oligopolies (few suppliers, many demanders) and monopsonies (many suppliers, no demanders). Regarding these cases, economic theory indicates that it is the state (via the government) that should intervene through command and control and/or market-based mechanisms (Pacheco-Vega 2020).

Network governance also has its failures. One of the greatest challenges of network governance is to address the lack of coordination among national, regional and local scales in water resources management, observed for instance when some countries are not able to implement international agreements or when national policy is not adequately applied at the basin level (Moss and Newig 2010). Meuleman (2018) describes cases where dialogues became never-ending talks without results and where there were too many demands from a small group of members. Pahl-Wostl et al. (2020) state that accountability problems may arise in complex networks when rules do not match the decentralized decision-making processes. Meanwhile, actors who strategically shape networks are not necessarily immune to power abuse (Pahl-Wostl 2015). In addition, there could be cases in which genuine power-sharing is mistaken for mere stakeholder advice (Bell and Park 2006; Sørensen and Torfing 2009).

Taking the different governance failures into consideration, advancing toward WS requires a focus on determining whether a governance system is being developed well (Bakker and Morinville 2013; Srinivasan et al. 2017; Li et al. 2020). The section “*Integrated River Basin Management: spatial scale and complexity*” gave us a clue about the importance of integrating the different governance modes to achieve effective IRBM to reach WS. In order to achieve the complex goal of WS we need effective institutional arrangements and mechanisms of allocation between competing uses to effectively manage water to deal with the impacts of climate change. Thus, achieving WS requires using a hybrid form of governance, namely metagovernance of modes.

Metagovernance of modes as a process to achieve adaptive capacity and advance toward WS

Regarding metagovernance, Gjaltema et al. (2019) performed a systematic literature review, investigating the who, what, why, and how of metagovernance. From their results, these authors then define the concept as ‘*a practice by (mainly) public authorities that entails the coordination of one or more governance modes by using different instruments, methods, and strategies to overcome governance failures*’ (Gjaltema et al 2019, p. 12). Metagovernance is regarded as a reflexive process of social learning to develop, assess, and combine different governance modes to avoid conflicts and address complex societal challenges (Pahl-Wostl 2015).

In their study, Gjaltema et al. (2019) identified four ideal types of metagovernance: (i) network metagovernance, in which a metagovernor, a person or organization who performs this coordination (Meuleman 2008), steers a governance network involving actors from multiple domains; (ii) multilevel metagovernance, in which multiple metagovernors at different levels steer a network; (iii) metagovernance of multiplicity, in which the metagovernor steers multiple networks at the same time; and (iv) metagovernance of modes, which seeks to balance different governance modes in a hybrid way.

Meuleman’s own concept of metagovernance closely resembles metagovernance of modes. This author states that metagovernance consists of design and management of sound combinations of hierarchical, market and network governance to achieve the best possible outcomes from the viewpoint of a metagovernor, according to context-specific situations (Meuleman 2008). In this sense, there is not one best practice to achieve a particular outcome, but different situationally best approaches in governance modes and mixes (Meuleman 2018).

Gjaltema et al. (2019) has pointed out an important difference between metagovernance of modes and the other three ideal types. Network metagovernance, multilevel metagovernance and metagovernance of multiplicity are regarded as first-order metagovernances, because the combination of governance modes is directed towards one specific governance mode: network governance (Jessop 2011; Gjaltema 2019). Metagovernance of modes, in turn, is regarded as a second-order metagovernance, since it focuses on achieving multiple combinations of hierarchical, market and network governance, according to the specific environmental problem (Jessop 2011; Meuleman 2018; Gjaltema 2019). Taking this into consideration, metagovernors must be able to take advantage of each governance mode, applying them jointly and in coordination to deal, for example, with the complexity of WS.

In terms of performing a metagovernance of modes within the context of WS, we highlight then the role of the metagovernor. According to Meuleman, metagovernors must combine governance modes according to their vision and strategy (Meuleman 2008, 2018). They must think about effective formal and informal institutional arrangements, seek to apply appropriate policy tools, organize decision-making processes, and decide which roles should be given to societal actors (from business, civil society, science and the media, among other spheres) (Sørensen and Torfing 2009). This attribute is very important to address WS problems, because, in order to ensure that water is available in quantity and quality to all sectors' needs, decision-makers have to adequately integrate different perspectives and work in collaboration with key actors to achieve social change (Global Water Partnership 2014).

Within an adaptation framework, metagovernors must be informed about the dynamics and possible effects of a decision-making process, understanding that knowing about a system could help them to combine governance modes in a flexible way, thus adapting to constant changes. In this sense, the context-specific attribute, and the situationally optimal mixtures that metagovernance of modes provides (Meuleman 2010) seem to make it the most suitable alternative to deal with complexity, uncertainty and constant change.

Taking all the above into consideration, we propose that a metagovernance of modes could be the ideal type of metagovernance that could be the most suitable to advance toward WS, containing these attributes:

- (i) promotes an adaptive approach to governance that enables integrated and inclusive forms of collaboration, relying on a hybridization of hierarchical, market and network governance to achieve context-specific outcomes;
- (ii) takes the form of a second-order metagovernance system, because it prevents network governance

failures, through a conscious design that combines hierarchical and market governance as well.

- (iii) regards river basins as complex social-ecological systems, where social and ecological components and processes act at different spatial and temporal scales and are integrated through adaptive management practices.

Metagovernance of modes: advancing toward SDG 6

The WS concept is closely related to the achievement of the SDG 6 (UNESCO 2019). To provide an example of how adopting a metagovernance of modes could help to achieve this particular goal, we analyze SDG 6.1 (achieve universal and equitable access to safe and affordable drinking water for all) as a target that, in our opinion could be addressed through an efficient water allocation system.

Here is where a metagovernance of modes could provide a solution to address this problem. On the one hand, in times of water scarcity, water markets could help to allocate water in a more economically efficient manner, preferring sectors that place the highest economic value on the resource (Grafton et al. 2011); however, they may not be appropriate in countries that do not have specified legal water rights, clear norms, adequate water supply infrastructure or sufficient monitoring systems and data to make informed decisions. Wheeler et al. (2014) point out that in such situations, water resource allocation should be ensured through an institutional framework in which the state (through a hierarchical governance system) plays a more active role, for instance, through creating financial mechanisms to ensure that people who can not afford private water supply systems may access them, or developing policies that enhance the scope of public oversight of private water provision systems (Bakker 2008). In these cases, solutions prioritize a combination among hierarchical and market governance.

Another way to address WS is the promotion of local traditional knowledge in water management (UNESCO 2019). A characteristic of polycentric governance (based on network structures) is that traditional and local knowledge are considered, emphasizing its connection to experience, promoting social learning and, therefore, encouraging trust and cooperation between actors (Berkes et al 2003; Ostrom 2014; Julio et al. 2021). In this sense, the adoption of a network governance mode has been considered to foster trust among different actors and increase the acceptability of hierarchical interventions when crises arise (Sørensen and Torfing 2007), while hierarchical intervention has been promoted when a prompt decision needs to be taken in network processes (Meuleman 2008). In these cases, solutions could prioritize a combination among hierarchical and network governance.

Conclusions

WS is a desirable goal to ensure a sufficient quantity and quality of water for life-supporting processes and a determining factor in society's development. Unfortunately, reaching WS is a complex challenge that must be addressed in an integrated, holistic and interdisciplinary way. If we regard river basins as suitable spatial units for water management, the adoption of adaptive river basin management could be a means to advance toward WS and deal with the uncertainty generated by global change. Moreover, adaptive management promotes knowledge transfer, inclusion and participation of different stakeholders and can be achieved only through a proper governance system that focuses on processes rather than ends.

Within an adaptive framework, we hold that WS is best approached through a metagovernance of modes: a hybridization of hierarchical, market and network governance modes, which are best coordinated by a public metagovernor, who is a key actor in avoiding typical governance failures. This sort of metagovernance promotes the achievement of WS and can adapt to uncertainty.

We propose that this ideal type of metagovernance should regard interconnections and interrelations among social and ecological variables to perform adaptive river basin management. Social-ecological components and processes in river basins must be integrated through these situationally optimal mixtures of governance modes, which could determine the adoption of a specific adaptive management instrument, according to the problem to be solved.

The uncertainty imposed by climate change often leads us to make unwise decisions that bring about water insecurity, an expression of our limited ability to integrate different governance modes. Thus, further research is needed to understand how metagovernors could achieve better coordination and how to best address intervention strategies, adjusting to the specific context of each river basin. Finally, we support the idea that the development of social capital to educate metagovernors is essential to effectively coordinating hierarchies, markets and networks.

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Declarations

Conflict of interest The authors have no conflicts of interest to declare that are relevant to the content of this article.

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