


Water governance challenges at a local level: implementation of the OECD Water Governance Indicator Framework in the General Pueyrredon Municipality, Buenos Aires Province, Argentina

María José Martín Velasco^a, Gabriela Calderon ^{b,*}, María Lourdes Lima^c, Cecilia Lucía Matencón^d and Héctor Enrique Massone^e

^a Agencia Nacional de Promoción Científica y Tecnológica (Agencia I + D + i). Instituto de Geología de Costas y del Cuaternario, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata/CIC (IGCyC, FCEyN, UNMdP/CIC), Dean Funes 3350, Mar del Plata 7600, Argentina

^b Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET). Instituto del Hábitat y del Ambiente, Facultad de Arquitectura, Urbanismo y Diseño, Universidad Nacional de Mar del Plata (IHAM, FAUD, UNMdP), Dean Funes 3350, Mar del Plata 7600, Argentina

^c Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET). Instituto de Geología de Costas y del Cuaternario, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata/CIC (IGCyC, FCEyN, UNMdP/CIC), Dean Funes 3350, Mar del Plata 7600, Argentina

^d Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Instituto de Investigaciones Marinas y Costeras (IIMyC/CONICET) and Instituto de Geología de Costas y del Cuaternario, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata, Dean Funes 3350, Mar del Plata 7600, Argentina

^e Instituto de Geología de Costas y del Cuaternario, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Mar del Plata, Dean Funes 3350, Mar del Plata 7600, Argentina

*Corresponding author. E-mail: gabcalderson.arq@gmail.com; gabrielacalderson@mdp.edu.ar

 GC, 0000-0002-4948-1314

ABSTRACT

Considering that the current water crisis is largely a governance crisis, improving water governance will help to address current and future water challenges. Water governance is defined as the range of political, institutional and administrative rules, practices and processes through which decisions are taken and implemented, stakeholders can articulate their interests and have their concerns considered, and decision makers are held accountable for water management. The Water Governance Principles proposed by the Organisation for Economic Co-operation and Development (OECD) contribute to the creation of tangible public policies oriented toward effectiveness, efficiency, reliability and participation. The aim of this research is to apply the OECD Water Governance Indicator Framework at a local level and to identify gaps and challenges for water governance in the General Pueyrredon Municipality (GPM), Buenos Aires Province (BAP), Argentina. This framework was used as a diagnostic tool to assess water governance policy frameworks (what), institutions (who) and instruments (how). In general terms, there is a robust legal framework, there are enforcement institutions regarding water management and there is a good connection with them. However, the main challenges identified were in the 'how', since most of the instruments are partly or not implemented.

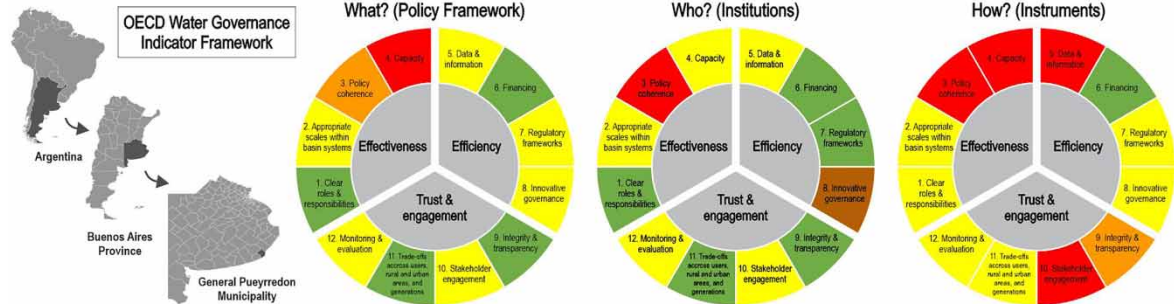
Key words: Groundwater, Policy analysis, Water governance principles, Water management

HIGHLIGHTS

- The OECD Water Governance Indicator Framework was applied in the General Pueyrredon Municipality, Buenos Aires Province, Argentina.
- Gaps and challenges for water governance at a local scale were identified.
- The policy framework is robust and the institutions that implement it are in place.
- The main challenges regarding water governance are linked to the implementation of water policy instruments.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Licence (CC BY 4.0), which permits copying, adaptation and redistribution, provided the original work is properly cited (<http://creativecommons.org/licenses/by/4.0/>).

GRAPHICAL ABSTRACT



INTRODUCTION

Human health, food security, urban and rural settlements, energy production, industrial development, economic growth and ecosystems are all water-dependent and thus vulnerable to the impacts of water resources management. The combined effects of growing populations, rising incomes, changing consumption patterns and expanding cities will see demand for water rise significantly (Echeverría, 2015), combined with a more erratic and uncertain supply (Álvarez Cobelas *et al.*, 2006; World Bank, 2016; UNESCO & UN-Water, 2020). Also, the different competing uses of water and climate change increase the pressure on the resource (Intergovernmental Panel on Climate Change [IPCC], 2014). Therefore, a more efficient use (and reuse) of water and more equitable processes for sharing the benefits of its use need to be fostered through participatory, just and transparent approaches. Recognizing that the current water crisis is largely a governance crisis, numerous authors have highlighted the importance of improving water governance to help address current and future water challenges (Global Water Partnership [GWP], 2000; Dourojeanni & Jouravlev, 2001; UNESCO-World Water Assessment Programme [WWAP], 2003; Rogers, 2006; Hill *et al.*, 2008; Lautze *et al.*, 2011; De Stefano *et al.*, 2014; Camkin & Neto, 2016; Jiménez *et al.*, 2020).

Much confusion abounds over the meaning of the term 'governance' in general and water governance in particular (De Stefano *et al.*, 2014). The term became popular in the academic and political spheres in the 1980s and continues to present conflicts in its definition. These uncertainties occur for various reasons: the context in which it is used, the country that defines it and the different application scales (Bueno, 2013; Organization of Latin American and Caribbean Supreme Audit Institutions [OLACEFS], 2015; Urriza *et al.*, 2016). According to Pahl-Wostl *et al.* (2008), the notion of government as the single decision-making authority has been replaced by multi-scale, polycentric governance approaches that recognize a large number of stakeholders (nonstate and private corporate actors) functioning in different institutional settings and participating in the formulation and implementation of public policy.

Despite the persistent ambiguity of the definition of water governance, the concept continues to be important in discourse, policy and research (Tropp, 2007; Lautze *et al.*, 2011; Barbosa Ribeiro & Formiga Johnsson, 2018; Jiménez *et al.*, 2020). In 2003, the GWP defined water governance as 'the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society' (Rogers & Hall, 2003: 16). Later, the United Nations Development Programme (UNDP) stated that 'the term water governance encompasses the political, economic and social processes and institutions by which governments, civil society, and the private sector make decisions about how best to use, develop and manage water resources' (UNDP, 2004: 10). In line with these definitions, the

Organisation for Economic Co-operation and Development (OECD) defined it as ‘the range of political, institutional and administrative rules, practices and processes (formal and informal) through which decisions are made and implemented, stakeholders can articulate their interests and have their concerns considered, and decision makers are held accountable for their water management’ (OECD, 2015: 5). This practitioner-oriented definition is adopted for the purposes of this article.

The notion of water governance embraces a wide range of processes and their interaction that set the context in which water management operates (Pahl-Wostl, 2017). Given the complexity of water use within society, developing, allocating and managing water equitably and efficiently and ensuring environmental sustainability requires that the disparate voices are heard and respected in decisions over common waters and use of scarce financial and human resources (Rogers & Hall, 2003).

Water governance is the way in which actions regarding the management of water resources are decided and implemented, from the political, social, economic and administrative sectors (Rogers & Hall, 2003; Batchelor, 2007), its main components being laws, policies and the organization of water. In order to manage water resources in an integrated and successful manner, effective water governance is required, which provides an administrative, economic and legal framework (Saleth & Dinar, 2005; Akhmouch & Clavreul, 2016; Frimpong *et al.*, 2021).

According to Pagani (2012), water governance is complex since it requires communication and coordination, because various actors are involved. Therefore, governance must facilitate a relevant formal and informal institutional framework, establishing itself in a context of policies that take into account the regulatory frameworks that identify the objectives related to water. However, the tools to do so are scarce (De Stefano *et al.*, 2014) and there is an inability of water governance regimes to adapt to new changing circumstances (VanNijnatten, 2020).

In 2015, the multi-stakeholder Water Governance Initiative, chaired by the OECD, reinforced this concept through a set of water governance principles which highlight that water resources management is often hindered due to governance gaps in policy, administration, coordination, funding, information and accountability (Jiménez *et al.*, 2020). The OECD Water Governance Indicator Framework is a useful and effective diagnostic tool which can help stakeholders to overcome governance challenges (Akhmouch & Clavreul, 2016). The 12 Principles on Water Governance (Figure 1) consider that water governance is context-dependent and, therefore, water policies have to be adapted to different circumstances taking into account water resources and places (Solanes, 2015). Also, these principles consider that governance is an efficient tool for the elaboration and implementation of solid public policies which are necessary to face current and future challenges (Akhmouch & Clavreul, 2016; Frimpong *et al.*, 2021).

One of the advantages of the 12 Principles is that they recognize that global water challenges must be solved through options based on the diversity of each country’s legal, administrative and organizational systems, since governance is contextual and therefore policies and governance responses must be tailored to circumstances (Elias, 2018). In turn, the implementation of the Governance Framework provides greater water security and better services and access to water and sanitation (Ukpai, 2022), and helps to improve policy design and implementation by contributing to the governance process (Keller & Hartmann, 2020). Moreover, it is a self-assessment tool so that the actors can dialogue, detect gaps, monitor progress and plan the necessary actions (Akhmouch *et al.*, 2018). At the same time, it allows isolating and evaluating particular attributes of water management more efficiently (Garrick & De Stefano, 2016; VanNijnatten & Johns, 2020).

A difference between these indicators and other indicators is that they can provide a greater knowledge to support goals and objectives, to collect data, and allow the creation of links between academic research and ‘real

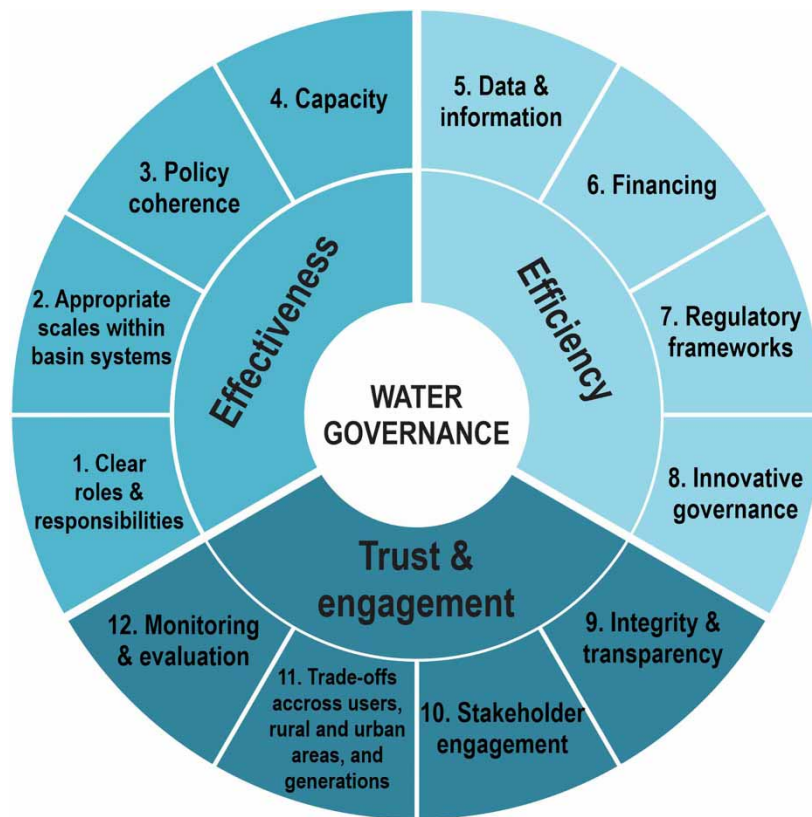


Fig. 1 | OECD principles on Water Governance. *Source:* OECD (2015).

world' governance, building on diagnosis and analysis, and constant improvements (Langhans *et al.*, 2014; Muriithi *et al.*, 2015). In addition to working with the perception of experts and key stakeholders, these indicators also work on data analysis. This is achieved through the use of questionnaires, interviews, workshops and data review in order to reach consensus on subjective judgments. The aim is not to carry out surveys of many people, but to achieve a deeper participation of those who are involved in water management. Furthermore, this framework is useful for decision makers and helps water managers to diagnose the strengths and weaknesses of their governance system (VanNijnatten, 2020).

In Argentina, the Report of the Argentine National Workshop on the Sustainable Development Goals (SDGs) Indicator 6.5.1 on the Degree of Integrated Water Resources Management (IWRM) implementation was carried out in 2017. The results showed a medium–low implementation (Gonzalez Aubone, 2020). In 2019, the National Secretary of Infrastructure and Water Policy of the Ministry of Interior, Public Works and Housing and the OECD, in cooperation with the Inter-American Development Bank (IDB), engaged in a multi-stakeholder dialogue to assess the strengths and weaknesses of Argentina's water governance considering the OECD Principles on Water Governance, and to enhance national and provincial capacity to deliver effective, efficient and inclusive water policies. According to this document, the country's multi-level governance system implies a highly decentralized and complex water policy setting, which is primarily driven by the 23 provinces and the city of Buenos

Aires, including shared rivers. Nevertheless, it also provides opportunities to tailor policies to the diversity of places, and align strategies in a shared responsibility across levels of government (OECD, 2019).

The aim of this study is to apply the OECD Water Governance Indicator Framework at a local level and to identify gaps and challenges for water governance in the General Pueyrredon Municipality (GPM), Buenos Aires Province (BAP), Argentina.

Consequently, this pilot case study will contribute valuable knowledge to the international research community on water governance. At the local level, such an assessment is a precedent, where the aim is to highlight governance challenges that could support decision makers and promote good governance in the upcoming water strategy. In addition, there are no prior studies regarding the use of this methodology in this study area.

Problem in context

Mar del Plata (MdP; 38°0' S, 57°33' W) is the head of the GPM and the main tourist destination on the Argentine Atlantic coast (Figure 2). GPM has 682,605 permanent inhabitants (INDEC, 2023) and, besides Mar del Plata, it is made up of several settlements with diverse socioeconomic characteristics. The city is surrounded by natural assets such as the high landscape value of the Tandilia mountain range, the biodiversity present in the Los Padres Lake Nature Reserve, and the availability and quality of water and soil resources (Lima *et al.*, 2019). During the last two decades, the population has grown significantly, resulting in a notable socio-spatial dynamic and various transformations such as urban densification, agricultural intensification and the expansion and consolidation of the residential land use in rural areas, mainly near the horticultural and fruit belt (Sagua *et al.*, 2014; Daga *et al.*, 2017). The excellent agroecological conditions in this area allow the production of a wide range of vegetables of high quality and diversity to supply both the local market and several provinces (Belderrain *et al.*, 2015).

As for surface water, GPM has very scarce surface resources, which are not significant from the point of view of supply, but from the dynamics of hydrological processes (Calderon, 2019). The population develops its different activities through the hydrogeological exploitation of the Pampeano aquifer, with groundwater being the only source of supply for human consumption, irrigation, industrial use, among others (Massone & Grondona, 2018), constituting these activities in potential aquifer polluting sources. *Obras Sanitarias Mar del Plata Sociedad del Estado* (OSSE) is in charge of the exploitation, collection and use of water, but also of providing drinking water, sanitation and maintenance of storm drains. The GPM has 290,175 dwellings with water connections through the network. This means that 97% of the population of the municipality have access to drinking water, according to OSSE (Massone & Grondona, 2018). However, this situation is aggravated in the peri-urban area due to the lack of a sewage network, the lack of piped drinking water supply and the inappropriate use of agrochemicals in crops, thus increasing the potential contamination of the groundwater resources (Baccaro *et al.*, 2006; De Gerónimo *et al.*, 2014; Bedmar *et al.*, 2015). In this urban-rural interface, water for human consumption is mostly extracted from domestic wells that generally do not meet the requirements in terms of construction quality, depth, and distance from cesspools, septic tanks, or animal confinement pens, increasing the chances of consuming nonpotable water (Baccaro *et al.*, 2006; Calderon, 2019). In this context, numerous conflicts between different stakeholders have been evidenced around the management of water resources, mainly related to the availability of water and the contamination of the Pampeano aquifer (Calderon, 2019; Lima *et al.*, 2019).

METHODOLOGY

To achieve the aim of this research, a scientific literature regarding governance, water governance and the OECD Water Governance Indicator Framework was reviewed. On the other hand, official documents were collected at the international, national, provincial and local levels, as well as documents from the written press, mainly at the

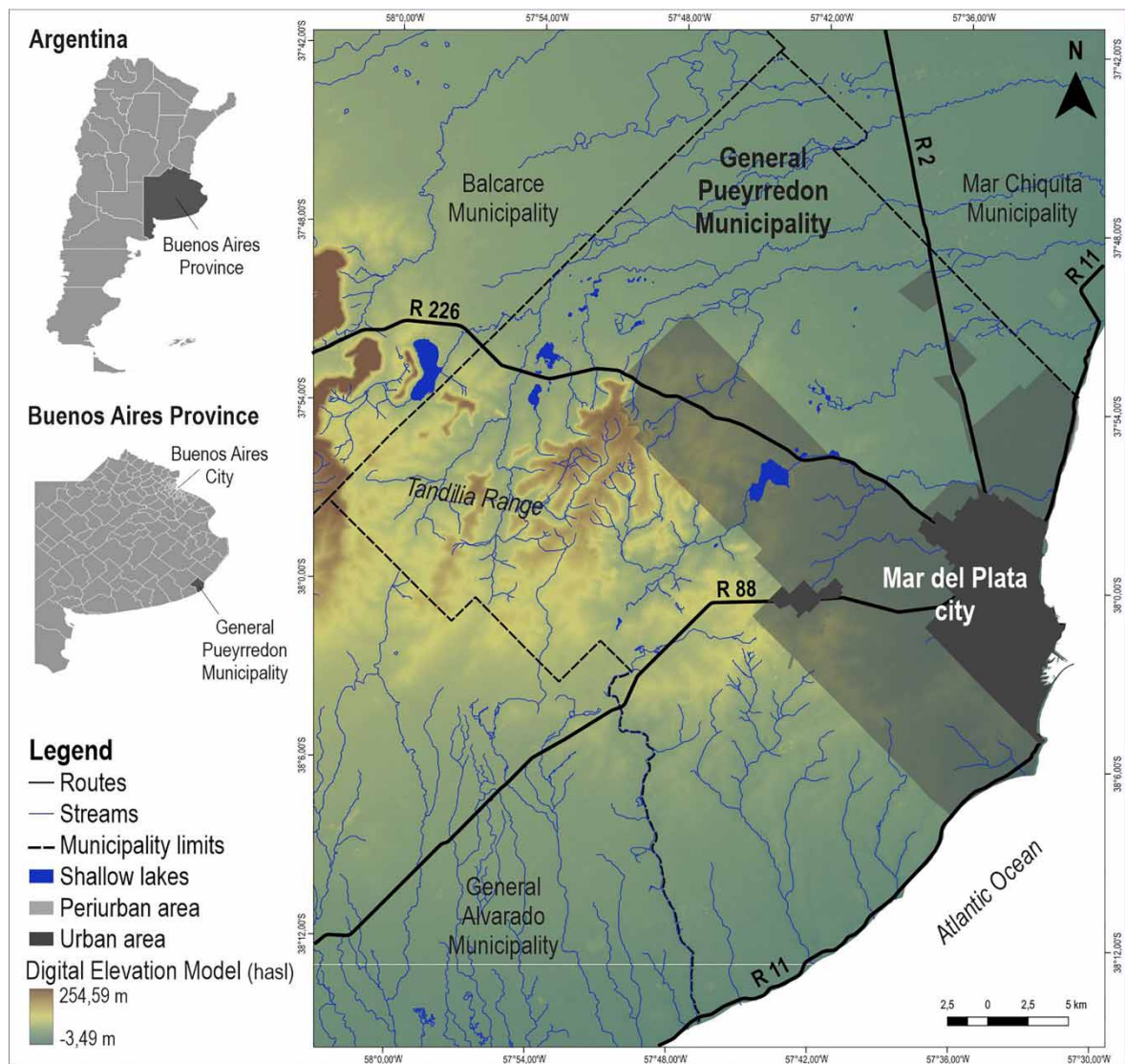


Fig. 2 | General Pueyrredon Municipality.

local level, in order to analyze the legal framework related to water governance in the GPM and BAP. International official reports related to water governance from UNESCO, UNDP, GWP, OECD, IPCC and the World Bank were taken into account. At the provincial and local levels, water policy official documents, such as norms, regulations, budgets, plans and projects, were reviewed. For this, more than 30 policy documents were exhaustively analyzed.

In addition, an interdisciplinary panel of experts was convened, composed of a geologist, an environmental engineer, an environmental science graduate, a spatial planner and a lawyer. This group of experts evaluated the current situation of the water governance policy frameworks (what), the institutions (who) and the

instruments (how), using a traffic light system of 36 water governance indicators and the checklist proposed in the OECD Water Governance Indicator Framework (OECD, 2018). Regarding the traffic light system, data were collected by means of a five-scale assessment (plus a 'not applicable' option) (Figure 3). Respondents were required to choose the color corresponding to the level of implementation at the moment in which the assessment was carried out (OECD, 2018). An Excel database was used for data processing and analysis. Results were represented in three wheel graphs (Policy Framework, Institutions and Instruments) with the 12 Principles containing the color corresponding to the evaluation.

Likewise, interviews were conducted with representatives of public water management agencies at the local and provincial levels: the Water Resources Manager of the local public water and sanitation company, OSSE, and a regional delegate of the BAP Water Authority (*Autoridad del Agua, ADA*), in order to complement and verify the obtained information. These interviews were designed to find out the internal dynamics of management, since often some practices are carried out informally. Each semi-structured questionnaire had more than 35 questions, which can be found in the Supplementary Material of this article. Based on the analysis of the indicators, the challenges for water governance in the GPM were identified.

RESULTS AND DISCUSSION

To evaluate the applicable legal framework and its effectiveness, it is necessary to take into account how the hierarchical order of norms works in Argentina, a federal system, where constitutional powers are distributed between the National State and the Provincial State. Likewise, the constitutional reform of 1994 incorporated significant changes such as the notion of plurality of systems by establishing among the attributions of Congress (National Constitution [NC], Article 75, Subsection 22) the principle according to which treaties and concordats have a higher hierarchy than laws. Moreover, Article 41 determines that it is up to the Nation to dictate the norms that contain the minimum environmental protection standards, and to the provinces, those necessary to complement them, without these altering the local jurisdictions by establishing a new distribution of competences in which the provinces retain the original domain over the natural resources of their territories (NC, Article 124). In this sense, Argentina's multi-level governance system implies a highly decentralized and complex water policy setting, which is primarily driven by the 23 provinces and the city of Buenos Aires, including for shared rivers (OECD, 2019). On the other hand, municipalities are under the orbit of provincial regulations. The BAP has 135 municipalities (*partidos*, in Spanish), some of which have the technical and logistical capacity to administer water and sanitation services through municipal service providers (including GPM); although always under provincial supervision and regulations.

Next, the analysis of the 12 Principles on Water Governance is presented and a graphic representation is shown with the colors of the traffic light system of the respective analysis of each principle (Figure 4).

Principle 1: Clear roles and responsibilities

In Argentina, legal frameworks for water resources management vary widely across the country (OECD, 2019). At the provincial level, the Water Code (Law 12257/99) establishes the system for the protection, conservation



Fig. 3 | Traffic light system adopted in the OECD Water Governance Indicator Framework. *Source:* OECD (2018).



Fig. 4 | Result of the analysis of the Principles on Water Governance using the traffic light system, according to OECD (2018).

and management of the BAP's water resources and the rights and responsibilities of users. The BAP Water Authority is constituted by this law as an entity for the application of the functions entrusted to the Executive Power.

At the local level, the autonomous water and sanitation municipal company OSSE, whose capital is 100% public, has as its object the supply, administration, operation, maintenance, control, expansion, renovation, construction, studies, research and application of new technologies for provision services of drinking water, home, sewage, industrial and/or any other type of drainage and, in general, of basic sanitation in the GPM, as well as the exploitation, collection and use of water destined for this purpose (Municipal Ordinance [MO] 7445/84 and 7446/84). In 1991, MO 8423/91 was sanctioned and promulgated regarding the police power of OSSE regarding groundwater control.

Although the policy framework (what) and the institutions (who) are in place and functioning, some instruments (how) are partly implemented. For example, the collection of the water canon for irrigation and industrial use by the ADA (Law 12257/99, Article 43) or the declaration of domestic and irrigation water drillings, which are often not controlled.

Principle 2: Appropriate scales within the basin system

According to the guidelines of the Environmental Water Management Regime (Law 25688/02, regulation still pending) and according to the BAP Water Code, the ADA should create the Water Basin Committees. Each Committee is made up of a representative from each municipality that is part of it. In turn, it must be assisted by an Advisory Commission made up of various organizations and sectors, public and private that operate within the Committee's influence area.

The GPM is part of the 'East Atlantic Water Basin Committee' formed in 2005 and also made up of the following municipalities: Mar Chiquita, Ayacucho, Tandil, Lobería, General Alvarado, Balcarce, General Madariaga and Maipú. However, according to the information obtained through the interviews, its operation has been highly irregular since then. On the other hand, at the local level, OSSE estimates the hydrological balance at the basin scale, recognizing 16 water basins in the GPM.

Both the policy framework (what), as well as the institutions (who) and the instruments (how) linked to the basin systems are in place, but are partly implemented.

Principle 3: Policy coherence

The Water Code Regulation Decree establishes that the ADA must create an Inter-institutional Coordination Commission with members from the Environmental Policy Secretariat, the Ministry of Agrarian Affairs, the Provincial Directorate of Urban and Territorial Planning, the Provincial Directorate of Mining, and its own representatives. In this commission, sustainable action alternatives and the IWRM should be considered.

Regarding the coherence of policies in the GPM, OSSE separates the services management in order to administer them better, and then an internal committee, called the 'water committee' (which meets weekly), exchanges opinions regarding each of the water management plans and projects to then interact with provincial (ADA and the provincial Environmental Ministry) and national agencies. In addition, according to the decision makers interviewed, managers from different areas also meet regularly.

In this sense, the policy framework (what) regarding inter-sectoral strategies and policies promoting coherence between water policies and key areas are in place, but are not well implemented. In addition, a body or institution (who) for the horizontal coordination of water-related policies does not exist, and the mechanisms (how) to identify barriers that hinder the coherent management of water and related practices, policies or regulations are not aligned.

Principle 4: Capacity

At the national level, in addition to the constitutional requirement of suitability (NC, Article 16), there is the Public Employee Law (25164/99). In the BAP, this is regulated through the Law 10430/96 and regulatory decrees 4161/96 and 4608/93. However, the provincial and local water management agencies do not have specific regulations for hiring their employees. In this sense, various forms of hiring (formal and informal) are used, including: contests, job boards, hiring based on personal relationships.

Both at the provincial and municipal levels, the training of the technical staff is favored. In the BAP, the Directorate for the Use and Development of Water (ADA) has among its functions: 'to prepare the personnel training programs that are necessary'. In the GPM, there are no formally established training programs. However, staff can easily access courses and master's degrees, which has raised in recent times due to the increase in virtual courses and seminars (based on the information obtained in the interviews).

In the study area, the hiring policy framework (what) is not in place. However, the mechanisms to identify the level of capacity of the authorities (who) are in place, but are partly implemented as employees train according to their own will. The instruments (how) are not in place because there are no education and training programs for water professionals.

Principle 5: Data and information

Regarding access to public information, the main national laws are: the Free Access to Public Environmental Information Regime Law (25831/04) and the Access to Public Information (Law 27275/16). Both at provincial and local levels, there are regulations related to public access to information (Provincial Decree 2549/04 and MO 13712/00). In 2016, the BAP launched the Open Data Plan and created the Public Data portal (Open Government Decree 805/16), a space intended for the publication of information that is under the tutelage of the provincial state. In addition, the ADA has developed a platform called 'ADAGIS', which can be accessed through its website (<http://gis.ada.gba.gov.ar/>).

The water information systems are in place (what) but they are partly implemented, since the open government initiative is also developed in the GPM, but OSSE does not have information on its website regarding the characteristics of the resource, nor the results of the monitoring it performs. There is only partial information on the open government site of the municipality referring to the coverage of water and sewage services in the city of

Mar del Plata (<https://datos.mardelplata.gob.ar/>). As for the institutions in charge of the production, coordination and dissemination of standardized, harmonic and official statistics related to water (who), the company OSSE has this data, but its operation is partial, since it is restricted. Regarding the instruments (how), mechanisms to identify and review data gaps, overlaps and unnecessary information excess are not in place.

Principle 6: Financing

Both at the provincial and local levels, the policy frameworks (what) that help OSSE and ADA raise the necessary revenue to fulfill their mandates and drive sustainable and efficient behaviors are in place. In this sense, the specialized institutions (who) in charge of collecting water revenues and allocating them at the appropriate scale are in place. At the local level, the Honorable Deliberative Council (HDC) approves and publishes the budget annually. Also, the mechanisms (how) to assess investment and operational needs in the short, medium and long term and ensure the availability of such financing are in place. According to the OSSE manager, the company generally does not present difficulties in funding its own investments. The works to be carried out are decided through multi-criteria, in which financing is mainly taken into account, followed by social, engineering and environmental factors.

Principle 7: Regulatory frameworks

The BAP and the GPM have solid policy frameworks (what) for water management, but they are partly implemented, since there are difficulties in controlling them. ADA and OSSE are the specialized public institutions (who), responsible for ensuring key regulatory functions for water services and water resources management. In some cases, the participation of provincial or municipal legislative bodies is necessary to pass laws or ordinances. Regarding the instruments (how), regulatory tools to promote the quality of regulatory processes within water management at all levels are in place, but they are partly implemented.

Principle 8: Innovative governance

Both at the provincial and local levels, policies that promote innovation related to water (what) are in place, although they are not contemplated in a specific regulation. In the GPM, there is the 'Master Plan', which is a policy framework that promotes new technologies for management innovation. Some of them are: Customer Service (digital invoice, online chat and virtual office), project for wind energy, ecoOSSE, Mar del Plata Open Data, application of geographic information systems for mathematical modeling (Modflow and ModelMuse). In the same way, institutions (what) that foster dialogue and social learning initiatives as well as experimentation in water management are under development. Mechanisms for the exchange of knowledge and experiences that help to overcome the division between science, politics and practice (how) are in place, but are partly implemented, since work tables are held on various topics with the actors involved, opinions are exchanged with nongovernmental organizations, public and private institutions, but strategic planning is lacking.

Principle 9: Integrity and transparency

With regard to integrity and transparency at a national level, a set of regulations (what) and international treaties linked to anticorruption in general are in place, but not specifically linked to water (e.g. United Nations Convention against Corruption, Convention to Combat Bribery of Foreign Public Officials in International Business Transactions of the OECD, United Nations Convention against Transnational Organized Crime, Inter-American Convention against Corruption). The National Law 26944/14 on State Responsibility is in force, but the BAP is not adhered to it. Both at the provincial and municipal levels, there are rules that regulate public tendering. As for the institutions (who) that can investigate noncompliance related to water through audits, in the BAP, there is an Honorable Court of Accounts, while at the local level, the councillors of the HDC of the GPM can request

management reports from OSSE. Currently, the ADA is the control authority for the provision of public drinking water and sewage services in the province, for which it controls OSSE. In turn, the Undersecretary of Water Resources of the province is the one who oversees the operation of ADA. In general, many of the mechanisms (how) to identify integrity and transparency gaps are not implemented, even though the regulations are in place.

Principle 10: Stakeholder engagement

Both in the BAP and the GPM policy frameworks (what) where stakeholders are given participation in the design and implementation of political decisions and projects related to water are in place. This happens through Public Hearings that are contemplated within provincial laws 11723/95 (regarding Environmental Impact Assessments) and 13569/06 (Procedure for Conducting Public Hearings). In the GPM, the MO 12336/98 regulates public hearings at the municipal level. In addition, as mentioned above, the 'East Atlantic Water Basin Committee' should articulate among all the actors the necessary solutions for the preservation of water resources, but lately its activity has decreased. On the other hand, some of the frameworks are in place but they are not implemented, such as the 'Groundwater Users Committee' created by OSSE in 1998, which is currently not functioning. In the GPM, the organizational structures (who) are in place, but they partly function. The participatory mechanism '*Banca 25*' allows citizens and nongovernmental organizations to express themselves, bringing them closer to the decision of the political and management system. Although OSSE interacts with schools, development associations and universities, the few instances of participation with neighbors do not favor an integrated water management process at the municipal level (Calderon, 2019). Finally, formal mechanisms are not in place to review stakeholder engagement challenges, processes and outcomes (how). There are isolated cases regarding the participation of the scientific sector.

Principle 11: Tradeoffs across users, rural and urban areas, and generations

At the national, provincial and municipal levels, policy frameworks (what) that promote equity between water users, rural and urban areas, and generations are in place. In Argentina, there is a social rate for those households that, due to economic problems, cannot afford to pay their water service bills, which is easily accessible and works efficiently. In addition, in the BAP, ADA contemplates and applies distinctions regarding water users, and in turn differentiates between large and small producers and industries. On the other hand, the Provincial Law 14782/15 recognizes the access to drinking water and sanitation as an essential human right. ADA also conducts awareness campaigns. The municipality works toward the fulfillment of the SDGs, particularly within the framework of the Emerging and Sustainable Cities Initiative of the IDB of 2013, which is contemplated within the 'Master Plan'. As for the institutions (who), there are organisms that protect water users, including vulnerable groups, such as the Ombudsman (BAP and GPM) and Consumer Defense, where the main and most efficient mechanism of action is mediation. Mechanisms (how) to manage arbitrations between users are in place, but they are partly implemented, according to the interviews. Cost-benefit analysis is applied, but multi-criteria analysis is not carried out and there are few public debates.

Principle 12: Monitoring and evaluation

Regarding the policy frameworks (what) that promote the monitoring and evaluation of water policies and governance, these are in place but are partly implemented. At the national level, there are General Audit Offices that promote government accountability by providing credibility and transparency. The institutions (who) in charge of monitoring and evaluating policies and practices in the water sector are in place but are partly implemented. The Honorable Court of Accounts is the entity in charge at the provincial level of controlling the administration and management of public resources with the aim of guaranteeing the proper use, determining possible responsibilities and preventing irregularities. In turn, there is an auditor at the ADA and the management of the funds is

subject to the province's general accounting audit, which is carried out once a year. In the municipality, monitoring and evaluation mechanisms (how) are in place, but they are partly implemented. The HDC requests management reports from OSSE and together with the special commission on water resources they work through dialogue and communication. This commission is the one that monitors the plans and each file.

Regarding the results (Figure 4), in the policy framework (what), those principles that are in place but are partly implemented predominate (six principles): appropriate scales within the basin system (2); data and information (5); regulatory frameworks (7); innovative governance (8); stakeholder engagement (10); monitoring and evaluation (12); followed by the principles that are in place and functioning (four principles): clear roles and responsibilities (1); financing (6); integrity and transparency (9); tradeoffs across users, rural and urban areas, and generations (11).

With regard to the institutions (who), those principles that are in place and functioning (five principles) predominate in the same way: clear roles and responsibilities (1); financing (6); regulatory frameworks (7); integrity and transparency (9); tradeoffs across users, rural and urban areas, and generations (11); with those that exist but partly function (five principles): appropriate scales within the basin system (2); capacity (4); data and information (5); stakeholder engagement (10); monitoring and evaluation (12).

While for the instruments (how), the principles that are in place but are partly implemented prevail (six principles): clear roles and responsibilities (1); appropriate scales within the basin system (2); regulatory frameworks (7); innovative governance (8); tradeoffs across users, rural and urban areas, and generations (11); monitoring and evaluation (12); followed by those that are not in place: policy coherence (3); capacity (4); data and information (5); stakeholder engagement (10).

In addition, the category 'Framework in development' was only identified for a single principle in the analysis of the institutions (who): innovative governance (8).

All of the above reflects the fact that, at a general level, in the BAP and GPM, there is no new legal framework being developed because a robust one already exists in terms of water policy. It is also observed that there is a good correlation and optimal functioning between the policy framework and the institutions that execute them. However, the main challenges regarding water governance at the local level are linked to the implementation of water policy instruments (how).

In this sense, a challenge that was observed is the one related to data and information. The information is dispersed, not easily found nor accessible for the public despite the regulations that compel the State in its three functions (executive, legislative and judicial) to provide it freely. This directly affects the involvement of interested parties, since the lack of information and access to data makes it difficult for interested parties to get involved in water resource management issues. This is how a clear breach of the legislation that guarantees citizen participation in environmental issues is evident. Although participatory instruments are present in the regulations, it is essential that their opinions are taken into account when making decisions, which generally does not happen.

At the same time, the limited territorial presence of the provincial water management authority, the insufficient instances of participation that they propose, the overlapping between provincial and local entities and the scarce controls, show the lack of an IWRM process at the municipal level (Martín Velasco *et al.*, 2022). Furthermore, this demonstrates the lack of policy coherence and effective cross-sectoral coordination.

Regarding the sociopolitical context of Argentina, the fluctuating nature of the Argentinean economy both affect continuity and predictability of public policies at large, and water is no exception. Insufficient use of economic instruments, patchy and insufficient data and information to guide water allocation, regulation and investment decisions, and insufficient stakeholder engagement (OECD, 2019), which occur at a national level, could explain that some instruments are partly or deficiently implemented at the local level.

Results of the study show a complex panorama in water governance and management in the region highlighted a dispersion and insufficient political priority. There is a dispersion of water management in multiple institutions with various roles (extractors/producers, distributors/suppliers, regulators, inspectors and users). At the same time, there is the territorial distribution of the institutions (national, provincial, municipal, urban/rural), which often makes it difficult to effectively coordinate, duplicate functions and reproduces gaps. On the other hand, community, municipal and community managers/providers coexist with markets and private companies. Obsolete regulatory frameworks, which impose limitations on innovation, make water management suboptimal with insufficient supervision capacity.

CONCLUSIONS

In the present study, the water governance of GPM was assessed by applying the OECD Water Governance Indicator Framework at a local level, and the governance gaps were identified. To address this analysis, a comprehensive approach was adopted and an interdisciplinary group of experts was formed. In addition, water management decision makers were consulted.

Regarding the applied methodology, some challenges were presented. Despite the fact that it was designed to be implemented at different scales (OECD, 2018), there were some difficulties in its application due to the overlapping of national, provincial and municipal regulations. The traffic light system defined in the methodology was also difficult to apply to the case study due to the implementation on a local scale. However, application of the OECD traffic light system in the case of the GPM highlights the capacity of the indicators to point out the strengths and weaknesses of water governance in the municipality, as well as to project future improvements. In this sense, the methodology is very useful for analyzing water governance during a certain period of time, because when the country's government changes, the policy framework (what), institutions (who) and instruments (how) can be modified, so it is a dynamic methodology that must have continuous evaluation.

On the other hand, despite the existence of policy framework, institutions and instruments, efforts must be made to guarantee the human right to water, mainly in developing countries such as Argentina in general, and in General Pueyrredon in particular, where a high percentage of the population lives in urban-rural areas that do not have basic services such as water and sanitation. The OECD water governance principles can be a valuable tool to guide decision makers and professionals to identify aspects to improve, enhance those that work correctly and thus work to reduce these social gaps.

This study shows that the policy framework has the necessary elements to reach its maximum potential in terms of good water governance; but efforts must be directed so that the institutions function properly and support it. It is important to understand that the correct governance of water is a very useful and necessary tool to reduce inequality, and address current and future water challenges in the context of climate change, demographic change and urbanization (informal settlements, in particular).

By applying the qualitative approach of the water governance framework proposed by the OECD at the local level, this work contributes substantially to the national and regional scientific literature, which in general is limited and scarce. At the same time, it also provides support to improve the current water governance in the GPM, in the BAP and in Argentina in general.

Being an approximation to the application of the OECD Water Governance Indicator Framework at the local level, in this work only the first phase was applied (assessment of the existence and level of implementation of the framework conditions of the water governance system), but the level of consensus on the assessment made among stakeholders was not elaborated nor were the expected changes over time in the water governance system, which are also part of this methodology. In future studies, it will be essential to delve into these pending issues and propose governance recommendations.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict.

REFERENCES

- Akhmouch, A. & Clavreul, D. (2016). *Flood Governance: A Shared Responsibility*. OECD, Paris, France.
- Akhmouch, A., Clavreul, D. & Glas, P. (2018). Introducing the OECD principles on water governance. *Water International* 43(1), 5–12.
- Álvarez Cobelas, M., Catalán, J. & García de Jalón, D., (2006). Impactos sobre los ecosistemas acuáticos continentales. In: *Evaluación preliminar de los impactos en España por efecto del cambio climático*. Moreno, J. M. (ed.). Ministerio de Medio Ambiente y Universidad de Castilla-La Mancha, Madrid, Spain, pp. 113–146.
- Baccaro, K., Degorgue, M., Lucca, M., Picone, L., Zamuner, E. & Andreoli, Y. (2006). Calidad del agua para consumo humano y riego en muestras del cinturón hortícola de Mar del Plata. *Revista de Investigaciones Agropecuarias* 35(3), 95–110.
- Barbosa Ribeiro, N. & Formiga Johnsson, R. M. (2018). Discussions on water governance: patterns and common paths. *Ambiente & Sociedade* 21, 1–20.
- Batchelor, C. (2007). *Water Governance Literature Assessment*. International Institute for Environment and Development (IIED), London, UK.
- Bedmar, F., Gianelli, V., Angelini, H. & Viglianchino, L. (2015). Riesgo de contaminación del agua subterránea con plaguicidas en la cuenca del arroyo El Cardalito, Argentina. *Revista de Investigaciones Agropecuarias* 41(1), 70–82.
- Belderrain, M., Lacaze, M. V. & Atucha, A. (2015). La organización del trabajo en la frutihorticultura de General Pueyrredon: análisis de su sostenibilidad jurídica. In: *IX Jornadas Interdisciplinarias de Estudios Agrarios y Agroindustriales*, 3–6 November, Buenos Aires.
- Bueno, M. d. P. (2013). La incorporación de la gobernanza a la agenda latinoamericana. *Comentario Internacional. Revista del Centro Andino de Estudios Internacionales* 13, 175–188.
- Calderon, G. (2019). *Gestión Integrada de Recursos Hídricos en el Ordenamiento Territorial como aporte al Desarrollo Sostenible del periurbano. El área serrana del partido de General Pueyrredon, Provincia de Buenos Aires. Spatial Planning and Sustainable Development PhD Thesis*, National University of Cuyo, Mendoza, Argentina.
- Camkin, J. & Neto, S. (2016). Roles, rights, and responsibilities in water governance: reframing the water governance debate. *World Affairs* 179(3), 82–112.
- Daga, D. Y., Zulaica, L., Ferraro, R. & Vazquez, P. (2017). Expansión e intensificación hortícola en el partido de General Pueyrredon, Argentina: Sustentabilidad ecológica e impactos ambientales. *Revista Geografía em Questão* 10(2), 102–117.
- De Gerónimo, E., Aparicio, V. C., Bárbaro, S., Portocarrero, R., Jaime, S. & Costa, J. L. (2014). Presence of pesticides in surface water from four sub-basins in Argentina. *Chemosphere* 107, 423–431.
- De Stefano, L., Svendsen, M., Giordano, M., Steel, B. S., Brown, B. & Wolf, A. T. (2014). Water governance benchmarking: concepts and approach framework as applied to Middle East and North Africa countries. *Water Policy* 16(6), 1121–1139.
- Dourojeanni, A. & Jouravlev, A. (2001). *Crisis de gobernabilidad en la gestión del agua: desafíos que enfrenta la implementación de las recomendaciones contenidas en el capítulo 18 del Programa 21*. CEPAL, Santiago de Chile, Chile.
- Echeverría, J. (2015). *Agua y Ecosistemas*. Corporación Andina de Fomento (CAF)-Banco de Desarrollo de América Latina, Caracas, Venezuela.
- Elias, G. (2018). Marco para una Gobernanza del Agua: hacia una cooperación en cuencas transfronterizas. *Brazilian Journal of International Relations* 7(1), 84–112.
- Frimpong, J., Adamtey, R., Pedersen, A. B., Wahaga, E., Jensen, A., Obuobie, E. & Ampomah, B. (2021). A review of the design and implementation of Ghana's National Water Policy (2007). *Water Policy* 23(5), 1170–1188.
- Garrick, D. E. & De Stefano, L. (2016). Adaptive capacity in federal rivers: coordination challenges and institutional responses. *Current Opinion in Environmental Sustainability* 21, 78–85.
- Global Water Partnership (GWP) (2000). *Integrated Water Resources Management, Technical Advisory Committee, Background Paper No.4*. GWP, Stockholm, Sweden.

- Gonzalez Aubone, F., (2020). El nudo gordiano de la gobernanza del agua en la Argentina. In *Desequilibrios ambientales: acerca de problemáticas diversas que amenazan calidad de vida y salud humana*. Sabatier, M. A. (ed.). Universidad Nacional de Rosario, Rosario, Argentina, pp. 67–115.
- Hill, C., Furlong, K., Bakker, K. & Cohen, A. (2008). Harmonization versus subsidiarity in water governance: a review of water governance and legislation in the Canadian Provinces and Territories. *Canadian Water Resources Journal* 33(4), 315–332.
- Instituto Nacional de Estadísticas y Censos (INDEC) (2023). *Censo Nacional de Población, Hogares y Viviendas 2022. Resultados provisionales*. Available at: https://www.censo.gov.ar/index.php/datos_provisionales/ (Accessed February 13, 2023).
- Intergovernmental Panel on Climate Change (IPCC) (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. IPCC, Geneva, Switzerland.
- Jiménez, A., Saikia, P., Giné, R., Avello, P., Leten, J., Liss Lymer, B., Schneider, K. & Ward, R. (2020). Unpacking water governance: a framework for practitioners. *Water* 12(3), 827.
- Keller, N. & Hartmann, T. (2020). OECD water governance principles on the local scale – an exploration in Dutch water management. *International Journal of River Basin Management* 18(4), 439–444.
- Langhans, S. D., Reichert, P. & Schuwirth, N. (2014). The method matters: a guide for indicators aggregation in ecological assessments. *Ecological Indicators* 45, 494–507.
- Lautze, J., de Silva, S., Giordano, M. & Sanford, L. (2011). Putting the cart before the horse: water governance and IWRM. *Natural Resources Forum* 35(1), 1–8.
- Lima, M. L., Romanelli, A., Calderon, G. & Massone, H. E. (2019). Multi-criteria decision model for assessing groundwater pollution risk in the urban-rural interface of Mar del Plata City (Argentina). *Environmental monitoring and assessment* 191(6), 1–21.
- Martín Velasco, M. J., Calderon, G., Lima, M. L. & Massone, H. E. (2022). Gestión del agua en el área periurbana oeste de la ciudad de Mar del Plata, partido de General Pueyrredon. Un aporte mediante el empleo de la técnica árbol de problemas. In: *VI Jornadas Nacionales de Investigación en Geografía Argentina y XII Jornadas de Investigación y Extensión del Centro de Investigaciones Geográficas*, 4–6 October, Tandil.
- Massone, H. E. & Grondona, S. (2018). Agua, saneamiento y drenaje. In: *Segundo Informe de Mar del Plata Entre Todos. Monitoreo ciudadano, para saber qué ciudad queremos, necesitamos saber qué ciudad tenemos*. Red Mar del Plata Entre Todos, Mar del Plata Entre Todos, Buenos Aires, Argentina.
- Muriithi, K., Jimenez, M., Jannin, N., Sajid, N., Singh, S. & Sharma, S. (2015). *Quantifying Governance: An Indicator-Based Approach*. London School of Economics, London, UK.
- OECD (2018). *Implementing the OECD Principles on Water Governance: Indicator Framework and Evolving Practices*. OECD Publishing, Paris, France.
- OECD (2019). *Water Governance in Argentina, OECD Studies on Water*. OECD Publishing, Paris, France.
- Organization for Economic Cooperation and Development (OECD) (2015). *OECD Principles on Water Governance*. OECD Publishing, Paris, France.
- Organization of Latin American and Caribbean Supreme Audit Institutions (OLACEFS) (2015). *Fundamentos Conceptuales sobre la Gobernanza*. Available at: <https://www.olacefs.com/wp-content/uploads/2016/03/16.pdf> (Accessed June 10, 2022).
- Pagani, A., (2012). Oro azul. Gobernanza y recurso acuífero en Latinoamérica. In: *Anuario del Instituto de Relaciones Internacionales (IRI)*. Bueno, M. d. P. (ed.). Universidad Nacional de La Plata, La Plata, Argentina.
- Pahl-Wostl, C. (2017). An evolutionary perspective on water governance: from understanding to transformation. *Water Resources Management* 31(10), 2917–2932.
- Pahl-Wostl, C., Mostert, E. & Tàbara, D. (2008). The growing importance of social learning in water resources management and sustainability science. *Ecology and Society* 13(1), 24.
- Rogers, P., (2006). Water governance, water security and water sustainability. In: *Water Crisis: Myth or Reality?* Rogers, P., Ramón Llamas, M. & Martínez-Cortina, L. (eds). Taylor & Francis, London, UK, pp. 3–35.
- Rogers, P. & Hall, A. W. (2003). *Effective Water Governance*. GWP, Stockholm, Sweden.
- Sagua, M. C., Mikkelsen, C., Tomás, M. & Calderon, G. (2014). Los instrumentos de planificación y gestión para el Ordenamiento Territorial en el Corredor Mar del Plata-Tandil. In: *Anales X Biental del Coloquio de Transformaciones Territoriales*, 5–7 November, Córdoba.
- Saleth, R. M. & Dinar, A. (2005). Water institutional reforms: theory and practice. *Water Policy* 7, 1–19.

- Solanes, M. (2015). *Gobernanza y franjas para la sostenibilidad del agua en América del Sur*. CAF-Banco de Desarrollo de América Latina, Caracas, Venezuela.
- Tropp, H. (2007). *Water governance: trends and needs for new capacity development*. *Water Policy* 9(S2), 19–30.
- Ukpai, S. N. (2022). *Water policy reform in the Nigeria water governance system: assessment of water resources management based on OECD Principles on Water Governance*. *Water Policy* 24(10), 1704–1722.
- UNESCO & UN-Water (2020). *United Nations World Water Development Report 2020: Water and Climate Change*. UNESCO, Paris, France.
- UNESCO-World Water Assessment Programme [WWAP] (2005). *Water for People, Water for Life: The United Nations World Water Development Report, Executive Summary*. UNESCO, Paris, France.
- United Nations Development Programme (UNDP) (2004). *Water Governance for Poverty Reduction. Key Issues and the UNDP Response to Millennium Development Goals*. UNDP, New York, USA.
- Urriza, M. N., Manzanal, M. N., Acuña, A. & Subota, L. (2016). Gobernabilidad y gobernanza: revisión conceptual y su vinculación con el ámbito organizacional. In *32° Congreso Nacional de ADENAG*, 26–27 May, Luján.
- VanNijnatten, D. (2020). *The potential for adaptive water governance on the US–Mexico border: application of the OECD’s water governance indicators to the Rio Grande/Bravo basin*. *Water Policy* 22(6), 1047–1066.
- VanNijnatten, D. & Johns, C. (2020). *Assessing the proximity to the desired end state in complex water systems: comparing the great lakes and Rio Grande transboundary basins*. *Environmental Science and Policy* 114, 194–203.
- World Bank (2016). *High and Dry: Climate Change, Water, and the Economy*. World Bank, Washington, DC, USA.

First received 5 September 2022; accepted in revised form 24 April 2023. Available online 1 July 2023