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Sadeghizadeh Bafandeh, Shahrzad; Bagherzadeh, Saeed; Mianabadi, Hojjat; Ghorbani, Amineh

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Consensus-Based Fuzzy Group Decision-Making Framework for Tailoring Good Water Governance to the Context: A Case Study of Sistan, Iran

Shahrzad Sadeghizadeh Bafandeh[1]; Saeed Bagherzadeh[2]; Hojjat Mianabadi[3]; and Amineh Ghorbani[4]

Abstract: Although good water governance (GWG) is a widely accepted concept, mistaking its principles for silver bullet approaches has hindered its successful applications. This highlights the idea that one-size-fits-all thinking does not satisfy the need to navigate toward sustainable outcomes in ever-changing complex water systems. This also indicates that endeavors toward governing water systems must be tailored to the specific context that these systems are nested within. Scholars have pointed out the importance of residents' input in contextualizing water governance practices. With that being said, this paper proposes an innovative approach to tailoring principles of GWG to the context by building an analytical framework upon which survey research was conducted. The survey, it took input from three categories of residents, namely experts, authorities, and experienced locals. Analyzing the data led to a group decision-making problem that was approached using fuzzy risk-based multiple-attribute decision-making methods, including technique for order of preference by similarity to ideal solution and ordered weighted averaging, while considering the amount of consensus among mentioned groups. Furthermore, to validate the results of the decision-making problem analysis, additional interviews were conducted to get a more pragmatic picture of the situation. Sistan Delta in Iran was selected as a case study mainly due to the current undesirable situation and also the international social, political, and environmental significance of the area. This study aims to take the first step of rethinking water governance in the area. The results indicated that to operationalize good governance, the principles of collaboration, legitimacy, adaptability, and trust and engagement must be prior considerations to redefine the water governance structure in the Sistan region. **DOI:** 10.1061/(ASCE)WR.1943-5452.0001587.
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Introduction

Obtaining a clear and comprehensive picture of good water governance (GWG) requires wise clarification of each word. What is good? What is water? And what is governance? These are deceptively simple questions. However, rare are the agreed-upon answers for each.

Water has a hybrid nature (Ingram 2006; Linton and Budds 2014). It is an entity that can be material, economic, political, religious, or cultural at the same time (Krueger et al. 2016). Water systems are complex, and most of the problems that emerge in such systems are categorized as wicked (Islam and Susskind 2018, 2012; Mianabadi 2016). This is not only because it crosses multiple boundaries (Islam and Susskind 2018), scales (Gupta and Pahl-Wostl 2013; Vörösmarty et al. 2015), and disciplines (Krueger et al. 2016), but it is also subjected to various (and mostly competing) preferences and interests by numerous stakeholders (Carr et al. 2012). This creates a situation where human and natural dynamics interact with each other in a nonlinear manner with multiple feedback loops nested within (Pahl-Wostl 2007). With the pressures on water resources becoming more and more tangible and turning into global concern (see, e.g., Boretti and Rosa 2019; Mekonnen and Hoekstra 2016; Pekel et al. 2016; Vörösmarty et al. 2010), there is an increasing understanding of the need to alter the ways of dealing with water systems; i.e., the forms of governing them.

The notion of governance has gained insurmountable popularity during the last few decades. In its simplest form, it basically came from the recognition of the necessity that state and nonstate stakeholders should be coinvolved in the formulation and implementation of the policies and plans (Timmerman et al. 2008; UNECE 2009). It encompasses elaborated and nonhierarchical interaction between actors that influence or are influenced by the decisions (Streit and Borenstein 2009). Scholars have identified three groups of stakeholders to be involved in the governance processes, namely, the scientific community, the local community, and the government (Elsenhans 2001; Turton et al. 2007; Webb et al. 2018). Inspired mostly by developments in fields such as common-pool resources and institutional analysis (Anderies et al. 2004; Imperial and Yandle 2005; Ostrom 1990, 2009) and also comanagement (Armitage et al. 2010), scholars have identified various principles for setting the standards for the quality of this interaction to move toward what is called good governance. Although these principles might vary given the area of research in interest, they all somehow promote adherence to human rights and basically are subsets of this overall group:

[1]Dept. of Civil Engineering, Faculty of Engineering, Ferdowsi Univ. of Mashhad, Mashhad 9177948974, Iran. Email: sh.sadeghizadeh@mail.um.ac.ir

[2]School of Civil Engineering, Iran Univ. of Science and Technology, Tehran 16846-13114, Iran. Email: saeed_bagherzadeh@alumni.iust.ac.ir

[3]Assistant Professor, Dept. of Water Engineering and Management, Tarbiat Modares Univ., P.O. Box 14115-336, Tehran 16846-13114, Iran (corresponding author). ORCID: https://orcid.org/0000-0002-7041-4634. Email: hmianabadi@modares.ac.ir

[4]Assistant Professor, Faculty of Technology, Policy and Management, Delft Univ. of Technology, Delft 2628 BX, Netherlands. Email: A.Ghorbani@tudelft.nl

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accountability, adaptability, capability, coherency, communicativeness, effectiveness, efficiency, trust and engagement, legitimacy and voice, transparency and openness, integration, fairness, consensus-orientation, equity and inclusiveness, rule of law, sustainability, ethicality, collaboration, and representativeness (Akhmouch et al. 2018; Allan and Rieu-Clarke 2010; Azadi 2019; Dietz et al. 2003; Fukuyama 2013; Graham et al. 2003; Lautze et al. 2011; Lockwood et al. 2010; Pahl-Wostl et al. 2010; Rogers and Hall 2003; Soma et al. 2015; Turner et al. 2014; Weitz et al. 2017). Operationalizing good governance is argued to be essential for reducing vulnerabilities to climate change (Lynch 2012), navigating toward water security (Cook and Bakker 2012), and generally pursuing sustainability (UNWWDR 2015, 2020). It is widely agreed that the current status of water resources, which has also been associated with terms such as crisis or bankruptcy (Madani 2014, 2019), has its roots in governance problems instead of physical scarcity or abundance of water (Biswas and Seetharam 2008; Rogers et al. 2005; Sivakumar 2011). Therefore, the transition from weak to good governance is no longer optional but necessary.

The main focus of this paper is on the term good. The inherent complexity of water systems takes one-size-fits-all approaches completely off the table. Context-specificity in dealing with complex systems in general and water systems, in particular, has been discussed and emphasized by various scholars (Hering and Ingold 2012; Ingram 2008; Kooiman and Jentoft 2009; Ostrom 2008; Ostrom et al. 2007; Pahl-Wostl 2015, 2017; Young 2010). Despite this recognition, prevailing is the tendency toward adopting and applying generalized and universal panaceas and remedies (also referred to as silver bullets). The existing gap between promises and practices, i.e., what is written on the paper and what is being done on the ground, is usually referred to the fact that standardized prescriptions and solutions fail to acknowledge the contextual circumstances. This study hypothesizes that in order to avoid unclear, vague, and uncertain outcomes, the practice toward operationalizing GWG must be tailored to the very context of that water system. This context may include factors relating to natural dimensions, such as hydrological, climatic, landscape, biophysical, and environmental context (Loch et al. 2020), or factors pertaining to human dimensions such as values, beliefs, norms, and cultural context (Poortvliet et al. 2018). Obviously, these dimensions significantly vary area by area. Therefore, fixes that have worked well in one country (or a region) not only may not be as successful in another but may also raise the risk of unintended backfires. Ingram (2008) recommended that in order to contextualize the approaches, it is necessary to analyze the water governance system in terms of what is present and also what is absent. Therefore, it can be argued that just like tailoring needs measurement, the initial step toward fitting good governance to the context strongly requires the evaluation of the current situation by using the analytical lens of good governance principles. Scholars have suggested taking advantage of resident input for contextualizing and fitting the governance approaches to the specific and place-sensitive conditions prevailing in an area (Hegger et al. 2017; Susskind and Kim 2021).

This paper argues that prioritizing which principles of good governance to be tackled more seriously in an area can contribute to redefining the structure of water governance in order to navigate toward sustainable outcomes. To this end, methodologically, similar to what Ma'Mun et al. (2020) have done with Ostrom's design principles, this study builds an analytical framework based on the proposed principles for good governance. Also, it uses content analysis, desk research, and survey research to collect data. The survey research is divided into two main parts. First, 12 key decision makers were selected as the questionnaire's sample population to analyze the decision-making problem using multiple-attribute decision-making (MADM) methods. Then, 15 other influential people were interviewed. Analyzing the interviews' contents provided more in-depth and empirical insights and made it possible to back up and validate the results of the MADM.

Generally, this study will hopefully contribute to broadening the understanding of contextualization in terms of GWG, a notion which, despite gaining much intellectual interest, has been deprived of practical analysis. Methodology-wise validating the mathematical results using on-the-ground evidence is somehow a rare approach. However, it holds its value since it first provides policy-maker-friendly results, and second, it can also be found appealing by the scientific community because of the mathematical logic behind it. More particularly, it is aimed to take the first step toward defining a GWG structure tailored for the Sistan region in Iran. Contextualization of water governance practices in such a significant area of paramount national and international value can set the stage for redefining the water governance structure and transition toward GWG, whether in other parts of Iran or other countries.

Case Study

The case study, Sistan Delta, the cradle of 5,000 years of ancient civilization (Dupree 1980) and historically known as the breadbasket of western Asia (Goldsmid 1876), is located at the end of a large transboundary river basin that is shared among Iran, Afghanistan, and Pakistan (Fig. 1). Hamoun wetlands and 120-day winds are two interlinked primary characteristics of the area. Having the Hirmand/Helmand River as their main bearer of water (Penning and Beintema 2006), Hamoun wetlands are considered the source and the meaning of life in the Sistan, both from natural and socio-economic viewpoints. As one of the main and most valuable aquatic ecosystems in the region, these wetlands are registered in the Ramsar and UNESCO Biosphere Reserve Conventions (Van Beek and Meijer 2006). Recognized as a Ramsar site, Hamoun wetlands play a pivotal role in the area, including but not limited to contributions they provide to biodiversity, health, economy, cultural, and religious aspects of the Sistan inland delta (UNDP 2005; van Beek et al. 2008). In downstream Iran, 96% of the Sistan inland delta's agroecological system depends on surface water coming from Afghanistan (Thomas and Varzi 2015). Not to mention, given the transboundary characteristic of the wetlands, they are featured in national security issues and international interactions as well (Mianabadi et al. 2020).

On the other hand, the combination of strong natural 120-day-winds and Hamoun Lakes, when filled with water, provide a kind of natural air conditioning system for the area. However, the same strong winds with the drying and almost empty Hamoun lakes cause severe sand storms affecting the health of the inhabitants (van Beek et al. 2008). The Hirmand river inflow to the area has been experiencing significant fluctuations. These fluctuations have their roots in upstream's developments and water controlling policies combined with hydrological causes. It results in the drying out of the Hamoun wetlands and significantly increases the intensity and frequency of dust storms in the area (Miri et al. 2010; Rashki et al. 2013). All of which will impose additional pressure both on Hamoun wetlands—which already are in a critical situation—and on a water governance system that already struggles to function properly. The aforementioned factors have caused livelihood challenges for the residents of the Sistan region, who are mostly associated with water-dependent occupations such as agriculture, fishery, or animal husbandry. These challenges include income, food, and the physical health of inhabitants in the region (Meijer and Hajiamiri 2007). Combined with health issues, which have either resulted from degraded water quality or dust storms, these challenges force the

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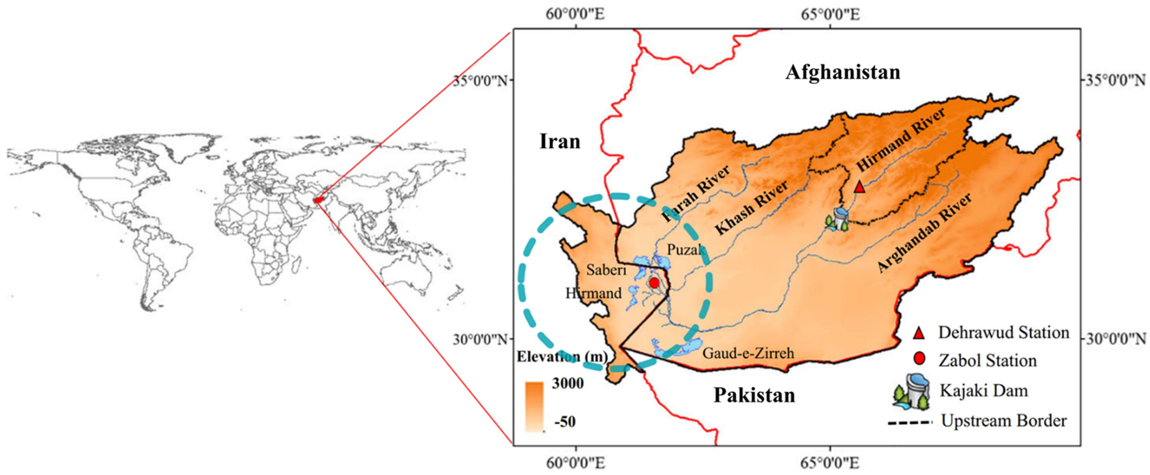

Fig. 1. Location of Sistan Delta. (Reprinted with permission from Springer Nature: Springer, *Water Resources Management*, "International environmental conflict management in transboundary river basins," A. Mianabadi, K. Davary, H. Mianabadi, and P. Karimi, © 2020.)

residents to leave their homeland. Causing any sorts of secondary problems such as emptying borderlines or putting pressure on other cities, the issue of the Sistan region has turned into an international concern. Proof of this concern can be found in numerous conflicts happening over the water resources in the area. Reversing this deteriorative trend requires, in part, studying, evaluating, and consequently rethinking water governance in the area.

Water governance in Iran in general, and Sistan in particular, falls under the command-and-control paradigm (Mirnezami et al. 2018; Mirzaei et al. 2019; Nabavi 2017). The state-centric structure of the water governance in the area leaves little space for the inclusion of diverse stakeholders, including the environment. Water-related decisions are made through unclear processes and behind closed doors (Edalat and Abdi 2017). They are usually implemented without prior social or environmental assessment reports (Michel 2017). In addition to hindering trust-building among actors, this issue is a significant impediment to transparency. Consequently, a clear and precise picture of the water system could not be drawn, resulting in diverge viewpoints and concerns by the actors. Furthermore, the current governance system adopts a passive attitude toward uncertainties. It tries to address the uncertainties after they take place rather than adopting proactive approaches (Ardakanian 2005). It is also worth noting that the critical level of social capital in the area (Iran's Social Council 2015) indicates that people struggle to accept and justify the government's water-related decisions. Furthermore, the governmental bodies that make the decisions regarding water resources act on their own, resulting in conflicts between them. Additionally, the misconception about the development has made the supply side of water resources the main theme of the interventions. The focus of these interventions is being put on the unsustainable solutions to the problems that took decades to emerge. This mismatch between the problems and the associated solutions happens at the expense of ecosystem services.

Conceptual Framework

Water Governance

The human relationship with water has been a history of use and abuse (Keskitalo and Preston 2019). First, it started with the technocratic and engineering-oriented approach with the thirst to improve the supply side through structural solutions and utilization of new water resources. With the gradual increase in understanding of the complexities of water systems, the second half of the twentieth century witnessed major changes in humans' attitudes toward water resources (Biswas 2004; Heathcote 2009). Influenced by the notion of sustainability, the introduction of integrated water resources management (IWRM) was an attempt to adopt a holistic approach to dealing with water systems (Dziegielewski 2003). Similarly, the need for transition from top-down and command-and-control approaches to more polycentric, participative, and flexible approaches brought the notion of governance into the water resources debate.

Governance is the medium within which objectives are chosen and the measures to navigate toward those objectives are selected and implemented through a collective decision-making process (Cosens and Gunderson 2018). It incorporates both the structure and the process required for steering or managing parts of societies (Rijke 2014). The trialogue model of governance indicates that the success of the governance system depends on (1) how scientific knowledge is diffused in society (science-society interface); (2) the extent to which government's decisions are scientifically informed, and how much government supports the scientific community (science-government interface); and (3) the extent to which society's needs are met, legitimacy of political processes, and the level of openness in governance to civil society's opinions (government-society interface) (Turton et al. 2007; UNECE 2009). When applied to water systems, water governance is a complex, multilevel process of interaction among social, economic, political, and institutional systems, setting the context for the development and management of water resources and provisions of water services (Rogers and Hall 2003). The overall objective of water governance is to navigate the water systems toward desirable states or to move them away from undesirable ones (Pahl-Wostl 2015).

Good Water Governance and Its Principles

There is extensive literature on definitions and interpretations of the concept of good governance (For a comprehensive and inclusive review of good governance, see Addink 2019). One of the first definitions is the one World Bank represented in 1989 as "a public service that is efficient, a judicial system that is reliable and an administration that is accountable to its public" (Van Doeveren 2011). Good governance is considered to be the opposite of bad,

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Table 1. Good water governance principles

Principle	Description	References
Accountability	As the hallmark of modern democratic governance, accountability ensures that water-related actors fulfill their roles and are held responsible for their actions (or inactions). Additionally, they are answerable to their constituency in terms of procedures and outcomes of their decisions.	Azadi (2019), Furlong et al. (2008), Lockwood et al. (2010), and Rogers and Hall (2003)
Adaptability	Being vital in dealing with uncertainties, adaptability ensures that a governance system has the flexibility to respond to changes in circumstances and needs which are specific to an area. It requires rearrangements in processes or structures and incorporation of new knowledge and learning into decision making.	Akhmouch and Clavreul (2016) and Lockwood et al. (2010)
Transparency	It ensures that water-related decisions are being made in an open and clear environment. The logic behind decisions is evident, and public access to water-related data and information is granted in a timely and proper manner.	Akamani and Wilson (2011), Allan and Rieu-Clarke (2010), Iza and Stein (2009), Lockwood et al. (2010), and Soma et al. (2015)
Effectiveness	It represents the quality of policy implementation and the extent to which the objectives and requirements are met.	Akhmouch et al. (2018), Akhmouch and Clavreul (2016), Hirsch (2006), and Hopper (2017)
Efficiency	Mobilization of resources and capacities in a proper fashion that optimizes cost-benefit balance for society as a whole.	McCall and Dunn (2012) and Pahl-wostl et al. (2010)
Trust and engagement	Essential for constructive engagement, trust indicates the extent to which actors believe the others would keep their words and that the intention behind their actions is good.	Akhmouch et al. (2018) and Akhmouch and Clavreul (2016)
Fairness	Necessary for peace and wellbeing in society, fairness depicts how impartial decisions are being made and how unbiasedly costs and benefits are distributed throughout the society.	Lockwood et al. (2010)
Rule of law	The extent to which the legal frameworks are enforced in an equitable manner and how state and nonstate stakeholders are being treated alike.	Addink (2019), Hirsch (2006), Hopper (2017), and Pahl-Wostl et al. (2010)
Consensus-orientation	To reach maximum convergence of different viewpoints and interests of various stakeholders on what is best for the society (in various time scales).	Pahl-Wostl et al. (2010) and UNESCAP (2006)
Legitimacy	The extent to which shared water-related rules are accepted and justified by the community. It can have implications on the integrity and commitment of the decision makers.	Bernstein (2004), Lockwood et al. (2010), and Turner et al. (2014)
Monitoring	Conceptually, the feedback loops within water systems must be tracked and monitored. This means the status of water resources, and also the amount of progress toward predetermined objectives must be monitored through an unbiased procedure. It is preferred to be complemented by self-regulation mechanisms.	Dietz et al. (2003), Dinshaw et al. (2014), Ostrom (1990), and Sanchez and Eds (2014)
Certainty	This principle deals with the predictability that concrete legal frameworks provide to incentivize nonstate stakeholders' engagement.	Addink (2019) and Iza and Stein (2009)
Responsiveness	Refers to how decision makers take account of the needs of citizens and uphold their rights in a timely and proper manner.	Plummer and Slaymaker (2007)
Collaboration	It is of paramount importance in governance processes. The governance system must guarantee freedom of association and expression to facilitate meaningful participation. This can result in more informed and more inclusive practices of governance. As a cornerstone in governance, it encompasses taking the interests of various stakeholders into account.	Akamani and Wilson (2011), Havekes et al. (2013), Hirsch (2006), and Pahl-wostl et al. (2010)

weak, or poor governance which is defined as an inefficient, ineffective, bureaucracy-oriented way of governance that is associated with high transaction costs and a mismatch between responses and on-the-ground needs (Akhmouch and Clavreul 2016). Clearly, good governance cannot be achieved by itself; it needs elaborative and careful planning and policy-making (Tortajada 2010). To avoid adding another jargon to policy and scientific debate, scholars have tried to come up with principles and indicators to determine what qualities the governance system must pose to be categorized as good. Reviewing literature has resulted in 14 principles for water governance to be considered good (Table 1). Given the complexities of the water systems, these principles shall not be mistaken as blueprints in isolation. However, they can be used as an analytical framework to evaluate the existing water governance systems in order to reveal their strengths and pitfalls. Accordingly, the results of the evaluation can help attaining a baseline context-specific picture of the water governance system, which will guide the transition toward good governance.

Methods and Materials

The ever-increasing complexities of emerging problems in today's world have made it irrelevant to make decisions based on the optimization of one single criterion (He and Xu 2019; Zeleny 2012). MADM methods are well-organized tools to make preference decisions over available alternatives, which are characterized by multiple attributes (Mianabadi 2016). The required data for this research are gathered through survey research, more specifically, questionnaires and semistructured interviews. The questionnaire is generated by reviewing literature and through multiple revisions using experts' opinions. It consists of 88 items with a 5-point Likert scale to allow the individuals to express their opinion about each item (see Appendix S1). The selection of the sample population is made through the snowball method. The sample population for the questionnaire consisted of 12 people, which is an acceptable number given the fact that only key decision makers in the area were considered. The sample population consisted of three groups:

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(1) water-related state authorities (mainly at the management level and including water, agricultural, and environmental sectors); (2) local people with water-related job experiences (mostly the influential individuals of the different tribes, which covered various occupations such as agriculture, fishery, and animal husbandry); and (3) water-related academic experts (university professors from water resources management groups of different local and national universities). Given their background, educational level, and working experiences, all respondents were well aware of the situation in the region (Table 2). Also, 15 semistructured interviews were conducted. The interviewees were local residents of the region and were also from the three aforementioned stakeholder groups (Table 3).

Two multiattribute decision-making methods, namely, (1) technique for order of preference by similarity to ideal solution (TOPSIS); and (2) ordered weighted averaging (OWA), were utilized to analyze the questionnaire results and rank the principles. On one hand, the TOPSIS method is simple, rational, and a widely used method. It is usually used as a complementary method (and sometimes the basis) for other decision-making methods (see, e.g., Janjua and Hassan 2020; Seyedmohammadi et al. 2018; Zyoud et al. 2016). On the other hand, regarding OWA, unlike other decision-making methods (such as AHP and ELECTRE), OWA has the flexibility to take into account and model the risk attitude of the decision makers in addition to the risks associated with external decision variables (Ahn 2008; Zarghami et al. 2008a). This factor can significantly influence the final outcome (Mianabadi et al. 2014).

Table 2. Decision makers' professional features

Group	Average working experience (years)	Self-reflected level of water knowledge	Number
State authorities	15.2	High (3) Medium (2)	5
Experienced locals	21	High (2) Medium (1)	3
Academic experts	19.25	High (3) Medium (1)	4

Table 3. Details of interviewees

Region	Number	Groups
Zabol	5	State authorities: 3
Zahak	2	Experienced locals: 6
Nimrouz	4	Academic experts: 6
Hirmand	2	
Hamoun	2	
Total	15	15

Based on what Herrera and Herrera-Viedma (2000) recommended, linguistic terms were replaced with fuzzy sets represented by the triangular membership function (Table 4). To initiate the analysis, the fuzzy sets of linguistic variables were defuzzied. Using the averaging method, defuzzied values (Z^*) for fuzzy sets can be estimated by:

$$\mathrm{For}(\mathrm{a,b,c}) \rightarrow Z^* = \frac{a+b+c}{3} \tag{1}$$

Technique for Order of Preference by Similarity to Ideal Solution

Initially proposed by Hwang and Yoon (1981), TOPSIS is a method for solving MADM problems (Hwang and Yoon 1981; Afshar et al. 2011). According to this method, an alternative (A_i) is evaluated based on its distance from both ideal and antiideal options. The preferred option must be the closest to the ideal one and also the farthest from the antiideal option (Kumar and Agrawal 2009). TOPSIS is only applicable when the values and weights of the options are certain numerical values (Hwang and Yoon 1981). The analysis can be illustrated throughout seven steps (Hwang and Yoon 1981):

1. Aggregation of decision makers' responses for each principle:

$$\bar{x}_\omega = \frac{\sum \omega_i x_i}{\sum \omega_i} \tag{2}$$

within which, ω_i = each item's weight; and x_i = defuzzied response of each decision maker to each item.

2. Generation of the decision matrix.
3. Normalization of the decision matrix:

$$r_{ij} = \frac{x_{ij}}{\sum_{k=1}^{m} x_{ij}} \tag{3}$$

within which, x_{ij} = value of each component of the decision matrix; and m = number of options.

4. Generation of a weighted matrix:

$$V = N_D \times W_{n\times n} \tag{4}$$

5. Then, the ideal and antiideal options are generated by Eqs. (5) and (6), respectively:

$$A^+ = \{(\max V_{ij}|j \in J), (\min V_{ij}|j \in J')|i = 1,2,\ldots,m\} = \{V_1^+, V_2^+, \ldots, V_n^+\} \tag{5}$$

$$A^- = \{(\min V_{ij}|j \in J), (\max V_{ij}|j \in J')|i = 1,2,\ldots,m\} = \{V_1^-, V_2^-, \ldots, V_n^-\} \tag{6}$$

within which:

$$J = \{j = 1,2,\ldots,n|j \in Benefit\}$$

Table 4. Fuzzy numerical values and diffused values for five linguistic quantifiers

Titles	Linguistic quantifiers	Scoring scale	Fuzzy numerical values	Defuzzied values
S_0	Very low (VL)	1	(0,0,0.25)	0.083
S_1	Low (L)	2	(0,0.25,0.5)	0.25
S_2	Medium (M)	3	(0.25,0.5,0.75)	0.5
S_3	High (H)	4	(0.5,0.75,1)	0.75
S_4	Very high (VH)	5	(0.75,1,1)	0.917

Source: Data from Herrera and Herrera-Viedma (2000).

Table 5. Family of linguistic quantifiers and their relevant values of α and θ

Linguistic quantifiers	Optimistic coefficient (α)	Optimism degree (θ)	Optimistic condition
At least one	$\alpha \to 0$	0.999	Very optimistic
At least a few	0.1	0.909	Optimistic
A few	0.5	0.667	Fairly optimistic
Half	1	0.500	Neutral
Most	2	0.333	Fairly pessimistic
Almost all	10	0.091	Pessimistic
All	$\alpha \to \infty$	0.001	Very pessimistic

Sources: Data from Malczewski (2006); Zarghami et al. (2008b).

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$$J' = \{j = 1, 2, \ldots, n | j \in Cost\}$$

6. The distance from ideal and antiideal options is calculated by Eqs. (7) and (8), respectively:

$$d_i^+ = \sqrt{\left(\sum_{i=1}^{n} (V_{ij} - V_j^+)^2\right)}, \quad i = 1, \ldots, n \tag{7}$$

$$d_i^- = \sqrt{\left(\sum_{i=1}^{n} (V_{ij} - V_j^-)^2\right)}, \quad i = 1, \ldots, n \tag{8}$$

7. The similarity to the ideal option is determined using Eq. (9); each option with higher cl (closest to 1) is superior, as:

$$cl_i^- = \frac{d_i^-}{d_i^- + d_i^+}, \quad i = 1, \ldots, n \tag{9}$$

Ordered Weighted Averaging Operator

Originally introduced by Yager (1988), OWA is a soft aggregation operator (Hojat Mianabadi et al. 2011) that assigns a goodness measure for each option that is calculated as follows (Yager 1988):

$$F_w(x_1, x_2, \ldots, x_n) = \sum_{i=1}^{n} w_i \cdot b_i, \quad x \in I^n \tag{10}$$

where the inputs of the OWA operator $(x_1, x_2, \ldots, x_n)$ should be ranked in descending order. Accordingly, b_i is the ith largest component of the ordered set. Simply put, b_1 is the largest and the b_n is the smallest element of the set $(x_1, x_2, \ldots, x_n)$. The coefficients w_i denotes the order weights in a way that $\sum_{i=1}^{n} w_i = 1, w \in [0, 1]^n$. Also, n is the number of attributes in the MADM problem.

An important characteristic of the OWA operator is that it considers the risk attitude of each decision maker as an influential factor in the final solution. The OWA method can be illustrated in four sequential steps:

1. Normalization of decision matrix:

$$r_{ij} = \frac{x_{ij}}{\sum_{k=1}^{m} x_{ij}} \tag{11}$$

2. The order weighting vector can be determined by Eqs. (12) and (13), as (Yager 1993, 1996):

$$w_i = Q\left(\frac{i}{n}\right) - Q\left(\frac{i-1}{n}\right), \quad i = 1, \ldots, n \tag{12}$$

$$Q(r) = r^\alpha, \quad \alpha > 0 \tag{13}$$

where $Q(i/n)$ = linguistic quantifier for ith attribute; n = total number of attributes; and α = coefficient of optimism, denoting the risk attitude of each decision maker toward different alternatives. The values for α and the relevant linguistic quantifiers are derived from Malczewski (2006) and are given in Table 5.

3. Next, values of the normalized decision matrix will be arranged in descending order.
4. Finally, using Eq. (10), aggregated value for each option (here, the good governance principles) is calculated and then ranked.

Group Consensus Measure

To measure the level of consensus achieved within the process of group decision making, the similarity among the decision makers' opinions has to be obtained (Cabrerizo et al. 2017). The degree to which opinions of the decision makers converge around a decision is measured by the group consensus measure. It is an index to evaluate the agreement between the preference of DMs and the group decision (Mianabadi et al. 2011). It depends on various factors such as the decision environment, importance of the issue at stake, and number of decision makers. Group consensus is built when decision makers have reached an overall agreement on an alternative (Ness and Hoffman 1998). Using the results of TOPSIS and OWA, the group consensus would be determined throughout five steps (Lai and Hwang 1994; Mianabadi and Afshar2008):

1. The distance of each decision maker's opinion from the group's overall opinion would be calculated by:

$$S_q(C_i) = |P^q(x_i) - P^g(x_i)| \tag{14}$$

where $P^q(x_i)$ = value of alternative x_i from the opinion of the qth decision maker; and $P^g(x_i)$ = value of alternative x_i from the opinion of the group as a whole.

2. Using weighting vectors given in Eqs. (12) and (13), the cumulative mean for disagreement on each alternative and disagreement on all of the alternatives as a whole is determined by:

$$CM(C_i) = \Phi_Q(S_1(C_i), \ldots, S_m(C_i)) = \sum_{j=1}^{m} w_j \cdot S_j(C_i) \tag{15}$$

$$CM(C) = \Phi_Q(CM(C_i), \ldots, CM(C_n)) = \sum_{i=1}^{n} w_j \cdot CM(C_i) \tag{16}$$

3. Group consensus for each decision is calculated by:

$$GC(C_i) = 1 - \left| \frac{CM(C_i) - S(C_i)^{pis}}{S(C_i)^{pis} - S(C_i)^{Nis}} \right| \tag{17}$$

within which, $S(C_i)^{pis}$ and $S(C_i)^{Nis}$ = lowest and the highest disagreement with the group's opinion, respectively.

4. Maximum and minimum disagreement on all of the alternatives as a whole would be determined using:

$$GSCL(C) = \Phi_Q(S(C_1)^{pis}, \ldots, S(C_n)^{pis}) = \sum_{i=1}^{n} w_i \cdot S(C_i)^{pis} \tag{18}$$

$$GWCL(C) = \Phi_Q(S(C_1)^{Nis}, \ldots, S(C_n)^{Nis}) = \sum_{i=1}^{n} w_i \cdot S(C_i)^{Nis} \tag{19}$$

5. Finally, group consensus on all decisions is measured by:

$$GC = 1 - \frac{GSCL(C) - CM(C)}{GSCL(C) - GWCL(C)} \tag{20}$$

the closer the GC is to 1, the more consensus exists among the decision makers.

Results

This section presents the results of applying the OWA and TOPSIS methods to the data collected through questionnaires. A decision matrix in an MADM problem consists of four main parts, namely: (1) alternatives, (2) attributes, (3) weights, and (4) measures of performance of alternatives with respect to the attributes. Accordingly, the task is to choose the most preferred alternative or rank the set of alternatives. After defuzzification of the linguistic parameters in the questionnaire, the decision matrix is generated (Table 6). Subsequently, using Eq. (3), the normalized decision matrix would be determined (Table 6, lower row in each principle).

TOPSIS

Equal weights have been assigned to each decision maker. Therefore, according to Eq. (4), the weighted normalized decision matrix and the normalized decision matrix would be the same since $W_{n\times n} = 1$ (Table 6). Then, based on Eqs. (5) and (6), the ideal and antiideal options are determined, and the results are presented in Table 7.

Next, using Eqs. (7) and (8), the closeness to the ideal option and distance from the antiideal option are calculated, respectively. The higher the *cl* gets, the more *priority* the option holds. According to the results that have been illustrated in Table 8 and Fig. 2, the considerations in prioritizing good governance principles are proposed to be in this order: 1- collaboration, 2- legitimacy, 3- adaptability, 4- responsiveness, 5- trust and engagement, 6- consensus-orientation, 7- efficiency, 8- accountability, 9- monitoring, 10- effectivity, 11- certainty, 12- transparency, 13- fairness, and 14- rule of law. The results of the TOPSIS method suggest that the collaboration principle holds the highest priority for the Sistan region and, accordingly, seems to be of key importance in navigating

Table 6. Decision matrix

Groups	Academic experts				State authorities					Experienced locals		
DMs	DM^1	DM^2	DM^3	DM^4	DM^5	DM^6	DM^7	DM^8	DM^9	DM^{10}	DM^{11}	DM^{12}
Collaboration	0.803	0.886	0.879	0.833	0.856	0.765	0.720	0.841	0.871	0.795	0.886	0.614
	0.076	0.079	0.147	0.070	0.076	0.068	0.069	0.077	0.071	0.089	0.116	0.072
Adaptability	0.854	0.813	0.552	0.875	0.823	0.708	0.708	0.875	0.854	0.688	0.719	0.469
	0.081	0.072	0.092	0.074	0.073	0.063	0.068	0.080	0.069	0.077	0.094	0.055
Responsiveness	0.683	0.700	0.500	0.850	0.783	0.783	0.700	0.700	0.883	0.550	0.633	0.700
	0.064	0.062	0.084	0.072	0.069	0.069	0.067	0.064	0.072	0.061	0.083	0.082
Transparency	0.528	0.722	0.361	0.843	0.759	0.861	0.611	0.713	0.824	0.417	0.472	0.657
	0.050	0.064	0.060	0.071	0.067	0.076	0.059	0.065	0.067	0.047	0.062	0.077
Effectiveness	0.733	0.883	0.350	0.733	0.917	0.850	0.767	0.767	0.917	0.583	0.500	0.650
	0.069	0.078	0.059	0.062	0.081	0.075	0.073	0.070	0.075	0.065	0.065	0.076
Efficiency	0.583	0.845	0.464	0.762	0.750	0.845	0.869	0.833	0.917	0.524	0.524	0.786
	0.055	0.075	0.078	0.064	0.066	0.075	0.083	0.076	0.075	0.059	0.069	0.092
Trust and engagement	0.917	0.861	0.375	0.917	0.806	0.917	0.806	0.792	0.861	0.667	0.625	0.542
	0.086	0.076	0.063	0.077	0.071	0.081	0.077	0.072	0.070	0.074	0.082	0.063
Accountability	0.781	0.760	0.406	0.917	0.833	0.833	0.823	0.719	0.917	0.615	0.573	0.625
	0.074	0.067	0.068	0.077	0.074	0.074	0.079	0.066	0.075	0.069	0.075	0.073
Consensus -orientation	0.917	0.917	0.313	0.792	0.792	0.792	0.833	0.771	0.875	0.583	0.646	0.729
	0.086	0.081	0.052	0.067	0.070	0.070	0.080	0.070	0.071	0.065	0.085	0.085
Legitimacy	0.861	0.806	0.500	0.750	0.861	0.861	0.861	0.722	0.917	0.583	0.778	0.583
	0.081	0.071	0.084	0.063	0.076	0.076	0.082	0.066	0.075	0.065	0.102	0.068
Monitoring	0.788	0.811	0.341	0.841	0.780	0.750	0.811	0.803	0.856	0.788	0.341	0.735
	0.074	0.072	0.057	0.071	0.069	0.066	0.078	0.073	0.070	0.088	0.045	0.086
Rule of law	0.625	0.750	0.313	0.917	0.750	0.750	0.583	0.771	0.875	0.625	0.313	0.563
	0.059	0.066	0.052	0.077	0.066	0.066	0.056	0.070	0.071	0.070	0.041	0.066
Fairness	0.700	0.783	0.250	0.883	0.767	0.750	0.600	0.800	0.817	0.700	0.250	0.550
	0.066	0.069	0.042	0.075	0.068	0.066	0.057	0.073	0.066	0.078	0.033	0.064
Certainty	0.833	0.750	0.375	0.917	0.833	0.833	0.750	0.833	0.917	0.833	0.375	0.375
	0.079	0.066	0.063	0.077	0.074	0.074	0.072	0.076	0.075	0.093	0.049	0.044

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Table 7. Ideal and antiideal options for the TOPSIS method

Options	DM^1	DM^2	DM^3	DM^4	DM^5	DM^6	DM^7	DM^8	DM^9	DM^{10}	DM^{11}	DM^{12}
A^+	0.086	0.081	0.147	0.077	0.081	0.081	0.083	0.080	0.075	0.093	0.116	0.092
A^-	0.050	0.062	0.042	0.062	0.066	0.063	0.056	0.064	0.066	0.047	0.033	0.044

the water system toward desired states. Undoubtedly, this is not to suggest a reductionist approach toward reaching GWG in the area but to prioritize the GWG principles in the region.

OWA

The risk attitude of the decision makers can be manifested in a weight vector. Using Eqs. (12) and (13), the weight vector is determined and presented in Table 9. Based on Table 5, five different values were assigned to α. The final values of each option, subjected to different values of α, along with their rankings are presented in Table 10.

As shown in Table 10 and Fig. 2, by applying the OWA method and with optimistic, Fairly Optimistic, and Neutral risk attitudes, the principles of collaboration, legitimacy, and adaptability ranked first to third. While, in the Fairly Pessimistic risk attitude ranking, the principles of collaboration, trust and engagement, and legitimacy were the top three priories, respectively. And finally, in the pessimistic risk attitude ranking, principles of collaboration, accountability, and legitimacy gained the highest values among other principles. An overall aggregation of principles' values subjected to different risk attitudes shows that the principles of collaboration, legitimacy, adaptability, trust and engagement, consensus-orientation, and accountability were the most repeated ones among the top six ranks.

GCM

For measuring group consensus, four different groups were taken into account: (1) the degree of consensus between academics and locals; (2) the degree of consensus between academics and authorities; (3) the degree of consensus between locals and authorities; and (4) the degree of consensus among three groups collectively. For the sake of brevity, only the final results are illustrated in Fig. 3.

In a Glance

Final rankings of the principles using OWA and TOPSIS methods are given in Fig. 2. As it is illustrated, the principle of *collaboration* ranked first using TOPSIS and OWA with various risk attitudes. Thus, it is recommended that this principle would be considered the first priority in redefining the water governance structure in the Sistan region. Regarding TOPSIS and OWA methods with three different risk attitudes, namely optimistic, Fairly Optimistic, and Neutral, principles of *legitimacy* and *adaptability* ranked second and third, respectively. Using OWA with three risk attitudes of Fairly Optimistic, Neutral, and pessimistic, the principle of *trust and engagement* ranked fourth. The principle of *consensus-orientation* ranked fifth using OWA with risk attitudes of Fairly Optimistic and Neutral and ranked sixth using TOPSIS and OWA with Fairly Pessimistic risk attitude. Besides, the top three priorities of each decision maker group are given in Fig. 4.

Table 8. Numerical values and rank of options (principles) using the TOPSIS method

Principles	di^+	di^-	cl^-	Rank
Collaboration	0.032	0.149	0.822	1
Adaptability	0.077	0.095	0.552	3
Responsiveness	0.089	0.080	0.475	4
Transparency	0.125	0.051	0.288	12
Effectiveness	0.110	0.064	0.369	10
Efficiency	0.099	0.079	0.446	7
Trust and engagement	0.098	0.082	0.454	5
Accountability	0.098	0.074	0.430	8
Consensus -orientation	0.106	0.085	0.446	6
Legitimacy	0.078	0.098	0.556	2
Monitoring	0.118	0.072	0.379	9
Rule of law	0.135	0.040	0.230	14
Fairness	0.144	0.045	0.237	13
Certainty	0.120	0.068	0.361	11

Discussion

The results of applying the OWA and TOPSIS methods to the questionnaire data propose that the principle of *collaboration* is the highest-ranked priority, while *legitimacy* and *adaptability, trust and engagement, and consensus-orientation* are in the top five ranked priorities ordered differently among the two methods and different ranking systems. In what follows, the insights gained using semistructured interviews with locals, authorities, and academics are presented to back up the analysis and get in-depth information on the situation. The main purpose of this section is to validate the mathematical insights gained from questionnaire data using empirical evidence gathered through the interviews. Relying merely on mathematical evaluations may fall into the trap of reductionism; therefore, we tried to adopt a broader vision by taking advantage of real-world evidence to support the results of the analysis.

Lack of collaboration is considered one of the main causes of water-related problems in Iran (Ardakanian 2005; Madani 2014); this issue was also confirmed through our analysis of the questionnaire data. It is established that collaboration needs to be explicitly considered in various phases of water-related policy-making from design to implementation (Watson 2007). Either direct or indirect—through bridging institutions—collaboration can provide a more inclusive view of the situation, and by reducing transaction costs, it can accelerate the implementation process (Watson 2007). Regarding the Sistan region, most of the water-related decisions are being designed and approved outside the region without the involvement of local stakeholders. One of the locals stated, "*The managers that make decisions for the Sistan and Hamouns cannot even locate the Hamouns! They possess no knowledge about the region, and that's why we have so many management problems.*" As mentioned earlier, collaboration among three groups of stakeholders is required to facilitate the navigation of water systems toward desired states. However, the role of government is much more prevalent in the Sistan region, and the other two groups are being neglected. Another local informant posited that "*Water management in the region is extremely governmental and hierarchical, so, public participation has faded away. There used to be an 'Irrigator' who used to take the leading role and contribute to the planning and decision-making for water resources, but now everything is legislative-oriented.*" A university expert criticized the government for the

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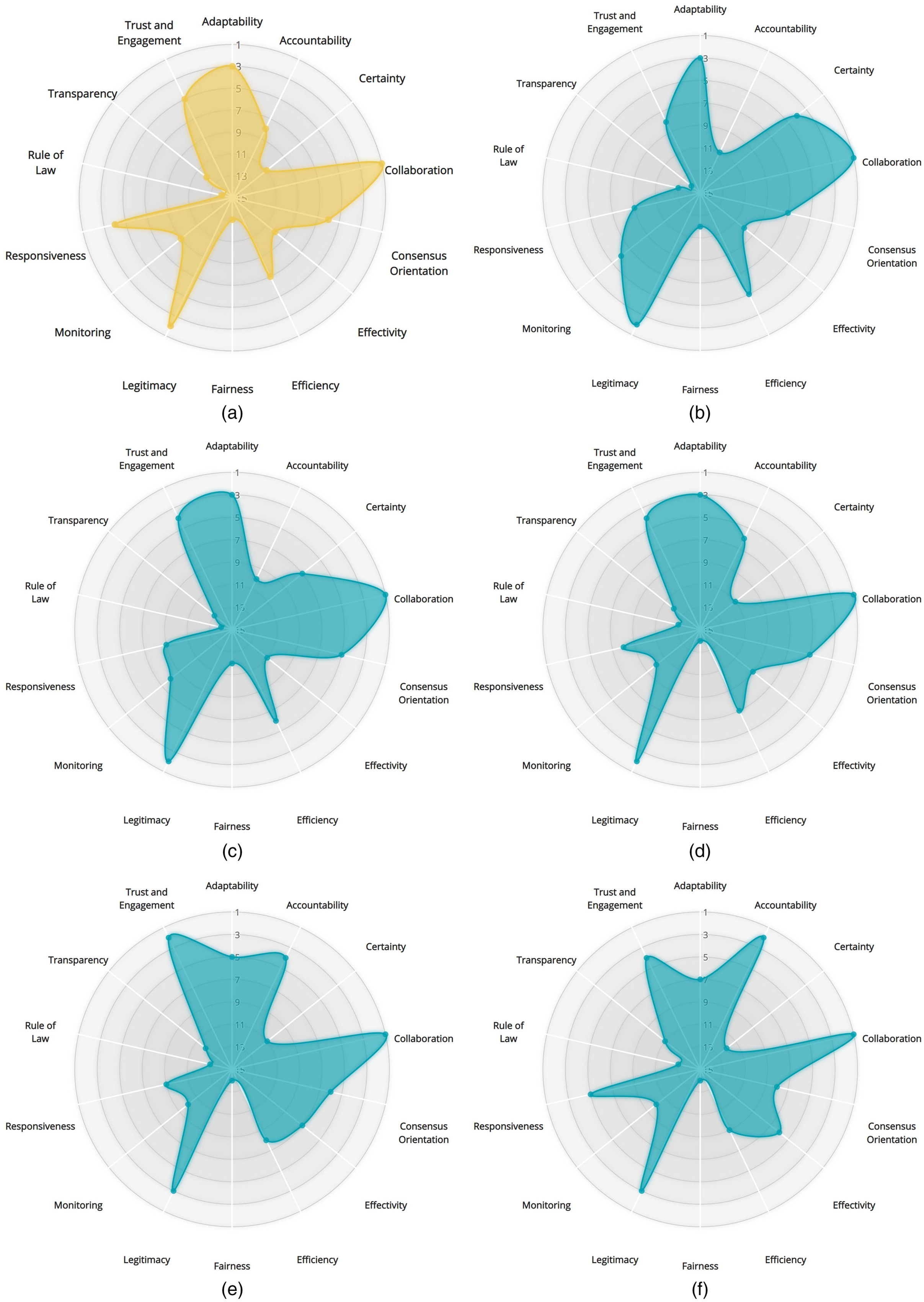

Fig. 2. Final Rankings of Good Water Governance Principles using TOPSIS and OWA methods (with five different risk attitudes): (a) TOPSIS; (b) OWA (optimistic); (c) OWA (fairly optimistic); (d) OWA (neutral); (e) OWA (fairly pessimistic); and (f) OWA (pessimistic).

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Table 9. Weighting vector

Risk attitudes	W^1	W^2	W^3	W^4	W^5	W^6	W^7	W^8	W^9	W^{10}	W^{11}	W^{12}
$\alpha = 0.1$	0.780	0.009	0.009	0.035	0.056	0.025	0.020	0.017	0.014	0.013	0.011	0.010
$\alpha = 0.5$	0.288	0.044	0.042	0.091	0.119	0.077	0.068	0.061	0.056	0.052	0.049	0.046
$\alpha = 1$	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
$\alpha = 2$	0.006	0.145	0.159	0.034	0.020	0.048	0.062	0.076	0.090	0.104	0.118	0.131
$\alpha = 10$	0	0.257	0.581	0	0	0	0.0001	0.0008	0.003	0.012	0.038	0.105

Table 10. Numerical values (F) and rank of options using the OWA method under different risk attitudes

	Optimistic		Fairly optimistic		Neutral		Fairly pessimistic		Pessimistic	
Principles	Value (F)	Rank	Value (F)	Rank	Value (F)	Rank	Value (F)	Rank	Value (F)	Rank
Collaboration	0.134	1	0.101	1	0.084	1	0.074	1	0.069	1
Adaptability	0.091	3	0.081	3	0.075	3	0.069	5	0.059	7
Responsiveness	0.082	9	0.075	9	0.071	8	0.067	9	0.062	5
Transparency	0.075	14	0.068	13	0.064	12	0.059	12	0.049	11
Effectiveness	0.079	10	0.074	11	0.071	9	0.067	7	0.061	6
Efficiency	0.088	5	0.078	6	0.072	7	0.067	8	0.058	9
Trust and engagement	0.084	8	0.078	4	0.075	4	0.071	2	0.064	4
Accountability	0.078	11	0.075	10	0.072	6	0.070	4	0.067	2
Consensus -orientation	0.084	7	0.078	5	0.074	5	0.068	6	0.058	8
Legitimacy	0.096	2	0.083	2	0.076	2	0.070	3	0.064	3
Monitoring	0.085	6	0.077	8	0.071	10	0.065	10	0.052	10
Rule of law	0.075	13	0.068	14	0.063	13	0.058	13	0.047	13
Fairness	0.076	12	0.069	12	0.063	14	0.057	14	0.039	14
Certainty	0.089	4	0.077	7	0.070	11	0.063	11	0.048	12

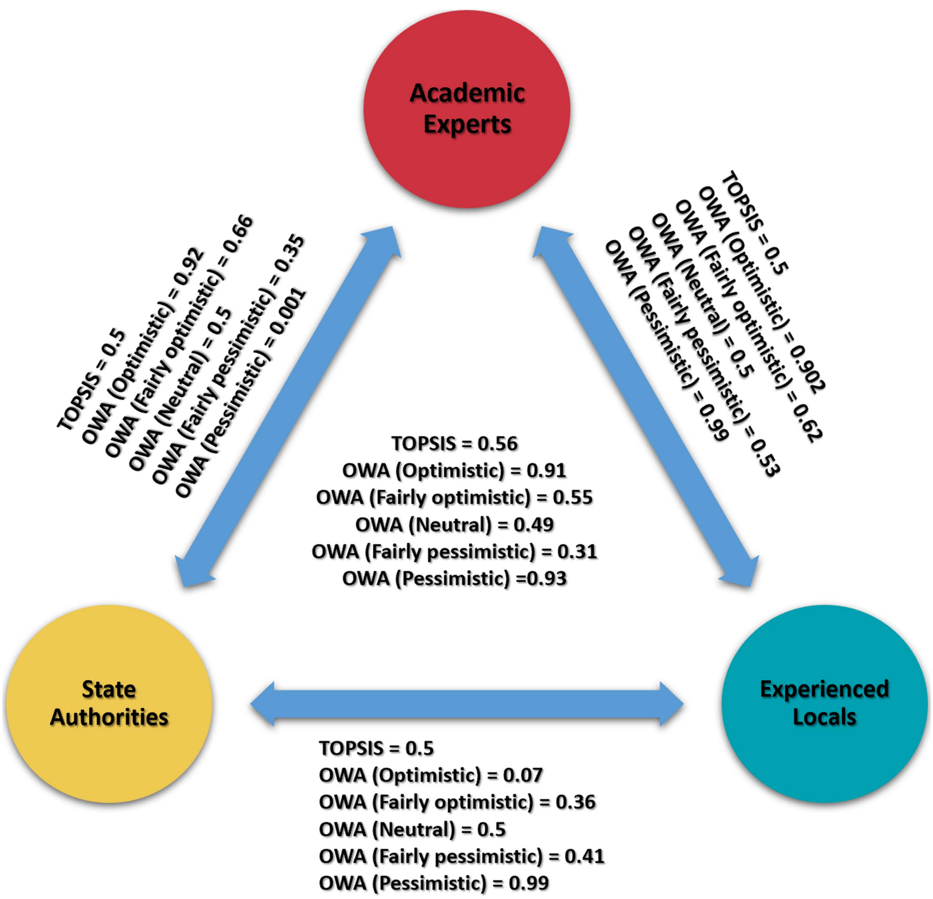

Fig. 3. Group Consensus Measures considering a pair of groups (arrows) and among three groups (center).

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Fig. 4. Top three priorities of main stakeholder groups, given the different methods.

situation and mentioned, "*Now everyone waits and expects the government to do the water-related stuff; however, they (the government) themselves faded the participation away by their plans and policies.*"

A significant element of the collaboration principle is cooperation among different governmental bodies (Huitema et al. 2009). Madani (2014) blamed Iran's water problems partially on fragmented governance. A local expert stated, "*The cooperation between different governmental bodies is only bureaucratic and lacks the real spirit of collaboration.*" Another local authority further admitted that "*Even different sections in a single governmental organization act on their own. For example, the Natural Resources Office and the Environmental office, which are parts of one single organization (Department of Environment), do not act coordinately.*"

According to the results of the questionnaire analysis, the legitimacy principle seems to hold the second priority in redefining water governance in the Sistan region. Values and beliefs in society are cornerstones of water systems which are categorized as complex human-natural systems [see e.g., Azizi et al. (2017)]. Most of the water-related policies and plans in the region are being designed, approved, and implemented regardless of the values, traditions, and cultural conditions in the area. This issue has degraded legitimacy significantly. A local informant asserted that "*Local experts express their objections about some of the proposed plans, but individuals who receive financial interests insist on the implementation of those plans.*" Therefore, water-related policies and plans are being designed and implemented using a top-down attitude without acknowledging the ground realities in the area. Another local believed that "*If the water transfer projects (the 46000 Ha irrigation project of the Sistan) are implemented, there would be carnage between different sections of the Sistan.*" It can be argued that the mismatch between water-related practices and ground realities has happened at the expense of the community's acceptance. Another element of legitimacy is the validation of authorities in society. A local expert acknowledged that "*Managers are not in the right places, there are people who know the problems and also the solutions, but they are not in charge and don't make decisions.*" Another local informant further explained the situation using an example, he stated that "*after the 1979 evolution they (government) dismissed the khans (heads of tribes) and the elderlies, replacing their roles with councils. A precondition of membership in the council was literacy. Therefore, the heads of the families and tribes got replaced with inexperienced but literate young people. The result was the people ignoring those young people, and eventually, the council system completely collapsed.*"

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The adaptability principle holds the third priority within the analysis. Adaptability indicates how well-prepared the governance systems are for changes and uncertainties. Unfortunately, dealing with changes and uncertainties is not being done in an adaptive manner in the Sistan region. In this regard, a local authority stated, "*We can provide multi-dimensional solutions to the problems, but we always have focused on only one issue at a time: droughts or floods. For example, we have currently focused so much on droughts that in case of floods, we will face a crisis.*" Adaptability includes the identification of the current situation in terms of limitations and possibilities and acting upon them. The adaptive capacity of the current governance system has been hindered by the negligence of the limitations that the area faces.

The results suggest that the principle of trust and engagement holds the fourth priority. This principle focuses on promoting public confidence and ensuring meaningful participation by stakeholders (Akhmouch et al. 2018). However, a lack of trust is evident within society, as one of the locals stated, "*What is the point of informing people about plans since they will be implemented anyway?*" Another local informant criticized the engagement of the scientific community as he mentioned, "*Most of the conducted research and studies are mere formalities and biased through employers' interests. Thus, they exaggerate the benefits and understate the weaknesses of the projects.*" Even local experts do not trust the managers and planners; as one of them mentioned, "*There is factionalism among government bodies that triggers conflicts, they (government) must form an expert team and share the information, then they might come up with proper solutions.*" The local community believes that the government does not hear their voice and has abandoned them, as one of them pointed out: "*The government doesn't care about the people in this area. We were born and lived here; we are old and cannot migrate. However, those who had the ability, have left the area! No one has ever heard our voices.*"

Consensus-orientation is the fifth priority in the analysis. Reaching a consensus on how to deal with the water system is of paramount importance in preventing water-related conflicts. One of the local authorities stated, "*There are meetings for considering the role of people in management practices- the governor gathers the farmers- but people's opinions don't matter in such meetings, these meetings are more like formalities and their real purpose is only to inform people about the decisions that are already taken.*" Another local informant posited that "*People's opinion must be involved in water management; otherwise, everyone would seek his/her own interests.*"

In general, the results suggest that these five principles, namely collaboration, legitimacy, adaptability, trust and engagement, and consensus-orientation, should be tackled as more effective and weighty principles in redefining the water governance structure in the Sistan region. According to Table 10 and Fig. 2, it seems that the other principles—in this order: responsiveness, efficiency, accountability, effectiveness, monitoring, certainty, transparency, fairness, and the rule of law—are next to be tackled in redefining the water governance structure in the Sistan as the first step toward GWG.

Looking from a different perspective, analyzing Fig. 4 reveals the fact that there is relatively low convergence and consensus among decision maker groups. For instance, academic experts put much of the emphasis on collaboration and adaptability principles, while state authorities paid more attention to the efficiency and effectiveness principles. Low group consensus measure between these two groups in five of six methods (Fig. 3) proves that the idea that the opinions of academic experts and state authorities in the Sistan region somehow diverge. On the other hand, regarding academics and locals, although the consensus between them is higher than the one between academics and authorities (Fig. 3), their ideas and opinions have shown some discrepancies as well (Fig. 4). They both valued the importance of the collaboration principle; however, their opinions about other priorities, such as principles of trust and engagement and accountability, are not in line, at least to some desirable extent. The lowest consensus between the pair of groups is the one between locals and authorities (Fig. 3). Although they both, surprisingly, acknowledged the significance of the legitimacy principle, regarding principles such as consensus-orientation or effectiveness, they have shown totally different levels of preference (Fig. 4). Finally, group consensus among the three groups of stakeholders collectively is only desirable as an outcome of the OWA method with optimistic and pessimistic risk attitudes. A deliberative and constructive dialogue seems to be necessary for converging the ideas and opinions of the three main groups of stakeholders regarding the water governance of the Sistan region.

Conclusion

Applied to water systems, good governance indicates the capacity of a societal system to develop water resources in a sustainable manner. Specific features, whether environmental or human dimensions, prevail in each area, making it unreasonable to adopt a prescriptive approach to water governance. Simply put, context-specific problems call for context-specific solutions. To this end, after conducting surveys, the data were analyzed using two MADM methods, namely, TOPSIS and OWA. For the results, the principles of GWG were ranked in order of preference by key decision makers in the area. The results of the MADM methods were further confirmed by the semistructured interviews. The main objective of this paper was to steer and guide the reconfiguration of the water governance structure in the Sistan region.

The results of the analysis suggested that the process of redefining water governance in the Sistan region needs to concentrate mainly on collaboration, legitimacy, and adaptability. Subsequently, the principles of trust and engagement, consensus-orientation, responsiveness, efficiency, accountability, effectivity, monitoring, certainty, transparency, fairness, and rule of law (in that order) must be taken into account.

It is important to highlight that the complexity of water resources needs to move beyond academic debate and be manifested in real-life practices of water management and governance. Despite the promising signs of acknowledging the complexities of water systems, there is still a tendency toward and sometimes even a thirst for blueprints and short-time remedies. Water governance should be tailored to the social and ecological context of each area. Clearly, what is good for Jack may not be so for John. With that being said, the prevailing context of some regions may dictate that principle of transparency must be tackled first, while another region may need to pay the most attention to the principle of the rule of law.

We argue that the process of contextualization can go beyond prioritizing the principles of GWG. Higher degrees of tailoring and fitting the governance approaches to the place would include lowering the scale of the analysis to each principle. For instance, what mechanisms for collaboration or engagement would fit the most to specific conditions in an area? How contextual characteristics such as values, norms, and beliefs in society would affect the legitimacy of the decisions? And which dimensions of adaptive capacity need to be addressed more seriously in order to enhance the adaptability of the governance system?

Finally, the primary theme of this paper was survey research. We focused on respondents' opinions on the situation. Although the

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conducted analysis was assumed sufficient given the scope of this paper, one could easily conclude that a more comprehensive picture of the situation can be obtained. The main limitation of our work might be considered as taking into account the water-related laws, regulations, and policies to analyze their standing points toward GWG. Although it would go well beyond the scope of this analysis, analyzing the institutional frameworks in place could reveal the extent to which these institutions can support or facilitate operationalizing GWG.

For the second limitation of our research, the selected case study is part of a transboundary river basin. However, we mainly focused on the Iranian side of the basin. Any decision toward water governance in such a tension-prone area should carefully consider the hydropolitical and national security implications.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Supplemental Materials

Appendix S1 is available online in the ASCE Library (www.ascelibrary.org).

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