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Water governance assessment on a local scale, case study: Azarshahr, Northwest of Iran

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Abstract

The study area, located within the Lake Urmia basin in northwest Iran, is highly fertile, but indicators of water resources show that the region is experiencing severe water stress. Approximately 10% of the aquifer volume is saline due to saltwater intrusion from Lake Urmia. The main question is why the depletion of groundwater resources in the region persists, and why the solutions implemented so far have not been effective. It appears that the underlying issues are rooted in the context of water governance. Using an analytical framework of governance as the theoretical basis, this study aims to assess the governance of the Azarshahr water resource system through deductive qualitative content analysis. The primary data were collected through semi-structured interviews with stakeholders involved in the water resource system. The coding process followed the governance analysis framework, identifying eight main categories. Within these categories and subcategories, several weaknesses and gaps were found, including the lack of long-term strategic planning, the absence of an Integrated Water Resources Management (IWRM) plan at the national level, non-compliance with rules, failure to integrate traditional water customs into new laws, fragmented responsibilities, conflicting goals, insufficient stakeholder participation in water-related processes, and low water tariffs. One strength identified in the water governance system of the area is the recognition of the human right to water. It is essential for all stakeholders to understand that if water governance remains solely under government control, many challenges will arise. Therefore, the participation of all stakeholders in water-related issues is necessary for effective water management.

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Introduction

Iran has a semi-arid climate, and most climate scenario studies predict that the country will become drier with more extreme heat (Lelieveld et al., 2016; Bucchignani et al., 2018). According to recent research by Dalin et al. (2017), Iran has ranked second globally over the past two decades in groundwater depletion, following India. Our study area is part of the Lake Urmia basin, home to one of the most valuable aquatic ecosystems and biosphere reserves under UNESCO. However, Lake Urmia has experienced significant declines in both volume and area in recent years, shrinking from about 6,000 square kilometers in 1998 to 1,771.35 square kilometers in 2018. This decline has led to severe environmental issues for the surrounding areas, such as salt dust storms, which pose respiratory health risks and create significant challenges for local agriculture (Zagharmi et al., 2015). Given the interactions between Lake Urmia and the surrounding area, investigating the challenges of water governance for sustainable development has become increasingly crucial.

Before the introduction of well-drilling technology, most of the water in the region was sourced from surface water, with the remainder provided by qanats. Fertile soil and sufficient water availability laid the foundation for agricultural development. The agricultural boom in the 1980s coincided with the introduction of well-drilling technology, and by the 1990s, the study area became an important contributor to regional food security, producing horticultural products near the city of Tabriz. However, since 1995, the area has faced repeated droughts, leading to increased groundwater extraction. This has resulted in the intrusion of saline water from Lake Urmia into the aquifer, and now approximately 10% of the aquifer's volume is saline (Mahdavi et al., 2019b). Although well drilling has been banned since 1983, illegal drilling continues. Despite efforts such as an inter-basin water transfer project for supplying drinking and industrial water and artificial recharge initiatives, groundwater extraction continues to rise, and water quality declines year after year. Figure 1 shows the average electrical conductivity of water in the study area over the past three decades.

Sustainable water management in the area has been neglected. The Relative Water Stress Index (RWSI), which measures the pressure on water resources as a proportion of total consumption of renewable natural water sources, was 1.54 in 2006 and 1.37 in 2016 for the study area. The recommended threshold for the RWSI index is below 0.4 (UNSD, 2012b). This indicates that the local water resources are highly stressed. In 2016, the per capita renewable water resources index was 476 m^3 per capita (Mahdavi et al., 2019a).

The aim of this study is to investigate the continuous decline in both the quantity and quality of local groundwater resources. This paper argues that, since the engineering-based solutions to the region's challenges have not been effective, it is necessary to address the root causes of these issues within the context of water governance. We align with the second World Water Council's statement that "the water crisis is mainly a crisis of governance" (GWP, 2000). The water crisis is not a result of water scarcity, as there is sufficient water for all people, even during temporary shortages. Instead, the root cause of the crisis is the mismanagement of water resources and public governance (OECD, 2011). Many Iranian scholars, including Madani (2014), emphasize that water scarcity in Iran stems from political, institutional, and managerial challenges that must be addressed through improved water governance.

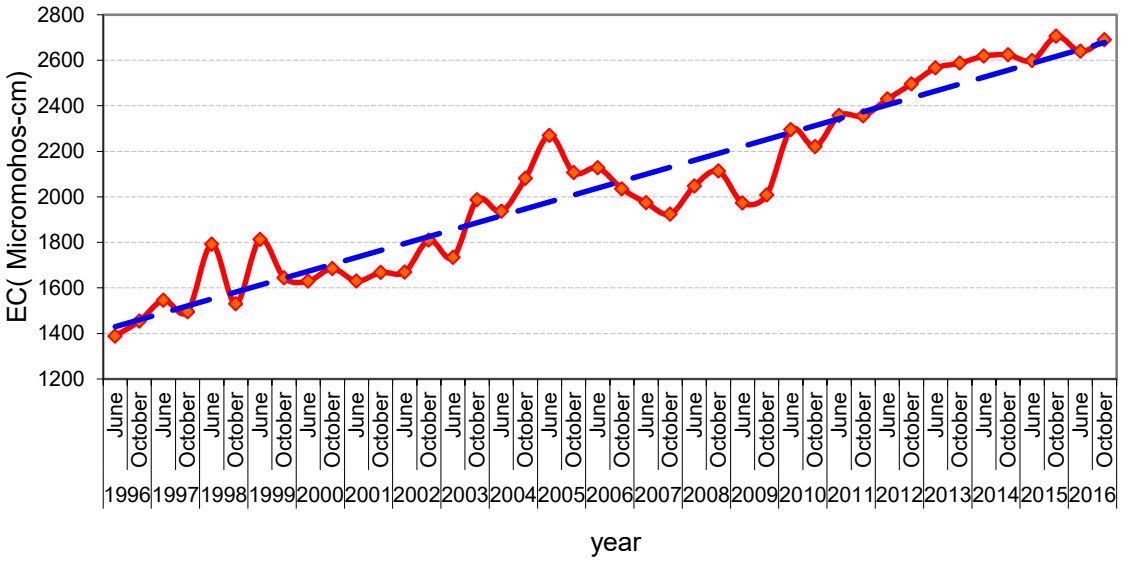

Figure 1. The average water electrical conductivity in the study area.

With a sustainable development paradigm and particular attention to a limited environmental resource that forms the basis of development, especially in developing countries, the United Nations emphasizes the integrated management of water resources in order to realize the concept of sustainable development (UNDP, 2004). Therefore in order to, address the environmental, social, and economic dimensions of sustainability, integrated water resources assessment should be both comprehensive and strategic (Hacking and Guthrie, 2008). The implementation of integrated water management requires significant changes in the interactions among laws, regulations, politics, the public and private sectors, and civil society, which are located in the concept of water governance (Rogers and Hall, 2003).

Several definitions of good governance have been presented by the UN agencies and the international community, all of them emphasize legality, sustainable development, partnership, accountability, transparency, equity, coherence, responsiveness, efficiency and effectiveness, and ethical issues (Asian Development Bank, 2004; Currie et. al, 2006; Ansell and Gash, 2008; UNDP,2013; GWP,2000).

Water governance as explained by OECD (2015a) is "the range of political, institutional and administrative rules (formal and informal), 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".

Sometimes water governance is defined as good governance that combines bottom-up and top-down processes to solve water challenges while creating constructive government-community relationships (OECD, 2015a). However, bad governance leads to increased social and political risks, organizational inability, and reduced ability to deal with related problems (Rogers and Hall, 2003).

Despite the desire to improve water governance, there is no universal framework in this regard, because the structural part of the frameworks reflects the context of governance that is unique to each country. De Stefano et al., (2014) presented a comprehensive governance evaluation framework including sections of the structure, processes, and governance functions. They analyzed the status of governance in a number of Middle East and North African countries, including Jordan, Egypt, Oman, Morocco, Yemen, and Turkey by using content analysis of legal documents and policies and interviews with experts. They concluded that in the case study results, a comparison of documentary

evidence and expert perception sometimes indicated a lack of relevance, indicating that there was a gap in implementation or there are informal rules that affect the results in practice.

Mirzaei et al. (2017) investigated the governance gap of Ab-bandans (water storage structures) in Mazandaran Province – North Iran, using interviews with experts. They used the Multilevel Governance Framework (OECD, 2011) and the modified Delphi technique. They concluded that the lack of a specific law for Ab-bands, lack of long-term and strategic planning, low awareness of "Ab-bandans" at the national level, insufficient funding, lack of water user associations, lack of research in practice, and lack of use of technologies are the major gaps in the governance of Ab-bandans. Unfortunately, as far as the authors are aware, there are no significant water governance studies in IRAN, especially in the Urmia Lake basin. Nevertheless, there is a great emphasis on improving water governance as the key component of water problems.

This research employed a deductive qualitative content analysis method to assess the state of water governance. To apply this method, a water governance framework was established, drawing on the following references as a conceptual basis: 1) *Assessing Water Governance* (UNDP, 2013); 2) the framework presented by De Stefano et al. (2017); 3) the Multilevel Governance Framework (OECD, 2011); 4) the *Human Right to Water* (WHO, 2010); and 5) OTT (2014). Using these references, a framework for analyzing water governance at the local scale was developed. Main categories and subcategories related to good water governance practices were identified based on this framework. Assessing governance can aid policymakers in prioritizing various strategies to strengthen water governance.

Theoretical background

Governance and water governance theory

Although technology has been well advanced in the water sector, the challenges, such as providing adequate water and sanitation services for all, effective control of extreme rainfall, and protecting aquatic ecosystems from contamination by harmful substances are persisting. Technology advances do not seem to be the main issue; clues are likely to be found in governance issues. Water problems seem to have been controlled by engineers over time, but the main source of water - the natural ecosystem - has almost been forgotten over time. As issues become more complex, the views of the various disciplines specialist and the improvement of the responsibilities of a wide range of stakeholders and the public are needed on these issues (Philip et al., 2011).

In recent years, the international water community has focused on governance as the most important challenge to improve water management and service provision. Most developing countries have developed new water laws and policies but in implementation, they are faced with many significant challenges. Many of the adopted water policies contain similar features and goals, such as decentralization, an increased role for the private sector, basin-wide management planning, better coordination of decision making (both horizontal and vertical), and multi-stakeholder participation, but there are still problems that prevent the formation and proper functioning of governance structures. The research over the past two decades on improving water security in developing countries has highlighted the issue of good water governance as a key to the success of water security. But until now, there is no coherent definition of water governance or good water governance (UNDP, 2013; Araral and Wang, 2013; OECD, 2011; Biswas and Tortajda, 2010; Briscoe, 2009; Cunha, 2008; Kashyap, 2004; GWP, 2000; Conzelmann 2003).

The most commonly used definition of water governance is a **"**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 and Hall 2003).

The governance system determines who controls, when, and how water is distributed, as well as who has the right to

access water and related services, and the benefits derived from them (Allan, 2002).

When conducting assessments of water governance, it is helpful to consider the four fundamental dimensions (UNDP, 2013):

1. **Social dimension**: This focuses on equitable access to and use of water resources. It includes issues such as the fair distribution of water resources and services among different social and economic groups and their impact on society.
2. **Economic dimension**: This highlights efficiency in water allocation and use.
3. **Political dimension**: This emphasizes providing stakeholders with equal rights and opportunities to participate in decision-making processes.
4. **Environmental dimension**: This stresses the sustainable use of water and related ecosystem services.

Choosing a water governance system for communities whose resources significantly impact the economy, environment, and livelihoods is crucial. Competition for water use has increased among various stakeholders, and conflicts between users are rising, with some groups being more powerful than others. A well-designed water governance system can address these challenges, leading to fair water allocation and conflict resolution. However, there is no universal blueprint for water governance that can determine the best model. Each country has its unique governance systems, stakeholder dynamics, and organizational structures, facing different problems and priorities. Therefore, it is inappropriate to propose a fixed governance model for all situations. The goal is to provide tools to identify governance challenges, priorities, and actions within the existing context.

Water governance and water management are closely linked, as an effective governance system facilitates the implementation of practical management tools (Tortajada, 2010). The water crisis is not merely a scarcity issue but a crisis of governance. Water governance encompasses a set of administrative systems, including formal institutions (laws, policies), informal institutions (traditional power relations and informal rules), and organizational structures, while water management refers to the operational activities that achieve the desired objectives. Political and institutional frameworks that promote transparency, accountability, and participation are essential components of good governance (OECD, 2011).

Water governance concerns not only hydrologists and experts but also policymakers, water users, and stakeholders who are engaged in addressing water-related issues within the social structure. According to the Global Water Partnership, water governance provides the foundation for implementing Integrated Water Resources Management (IWRM). Governance without the effective implementation of policies cannot be considered useful (GWP, 2000).

Assessment of water governance

Given the current focus on water governance and methods such as integrated water management, assessment requires a shift from absolute monitoring of hydrological data to a policy monitoring information approach. However, information gathering, evaluation, and monitoring of the system are places that have been neglected by many governments. To meet these demands, there are various methods for assessing and monitoring water governance and management. Water governance assessment is the first step that can lead to the identification of system weaknesses. As a result, more effective interventions can be made to improve performance in those areas (UNDP, 2013).

Political Ecology

Water governance calls for a multidimensional approach, while widespread social and political processes involved in water systems have been overlooked in research for decades. To address this gap, recent approaches address the complexity and relationships of water systems with culture, economics, environment, history, politics, and community institutions (Beckedorf 2012; Mosse, 2008). Indeed, only

multidisciplinary knowledge, including environmental and social sciences, politics, economics, and ethics, can properly address multifaceted environmental decisions. One of the recent approaches to water area research is political ecology, a multidisciplinary research method that seeks to address this complexity and link resources with politics and the social sciences (Krings, 2008). Political ecology proposes topics such as privatization of water supply and decentralization reforms (Krings 2008; Lieb, 2013). Understanding political ecology as a multidimensional approach is about linking politics with nature and the social sciences (Rauch 2009; Zimmer 2010b). Political ecology implies the natural resources and power relationships between different actors that are winners or losers and have a limited scope of action (Beckedorf, 2012). The main concept of political ecology can be seen as an analysis of the use of resources as the result of political, economic, and social interests and power structures (Krings, 2008; Rauch, 2009). For social conditions and structures, institutional influence is important. Beyond that, the interests of different actors are analyzed in their global, national and regional contexts (Beckedorf, 2012). The political ecology of the human relation to the environment is based on actor-centered (Zimmer 2010). A key factor in understanding actors' relationships is the analysis of power between actors. There is inequality of power between different levels and between different stakeholders (Mirumachi & Vanwyk, 2010). The power of actors lies in unequal access to opportunities and rights in natural resources (Krings, 2008). The act is possible only within the scope of action, interests, strategies, and specific power. (Rauch, 2009; Beckedorf 2012; Zimmer 2010b). A scoop action of each actor is affected by different political, economic, social and environmental and, cultural contexts. In addition, the historical and conditions of formal and informal institutions are discussed. Power means to access and control water resources as well as quality of interaction with other actors. In problem-solving strategy, multidimensional political ecology considers the relationship of power, the social system, and the economic and political context at multi-spatial levels (Rauch, 2009). Depending on the extent of the problem, the further scope of effective factors can be considered.

The analytical framework presented in this research is based on political-ecological and water governance theories, which consider access to water and the arena action of various stakeholders to be dependent on political, social, cultural, economic, and environmental conditions such as informal, and formal institutions (Figure 2a).

Specific components of water governance have been achieved based on the literature review (GWP, 2000; Teisman and Hermann, 2011; De Stefano al., (2017); Gupta, 2011; Toonen, 2011 and UNDP, 2013; WHO, 2011; Ott, 2014; OECD, 2011), and access to information during the fieldwork in study area (Figure2 b). Main categories and subcategories related to good water governance patterns, were identified from these specified components for deductive qualitative content analysis (Table1).

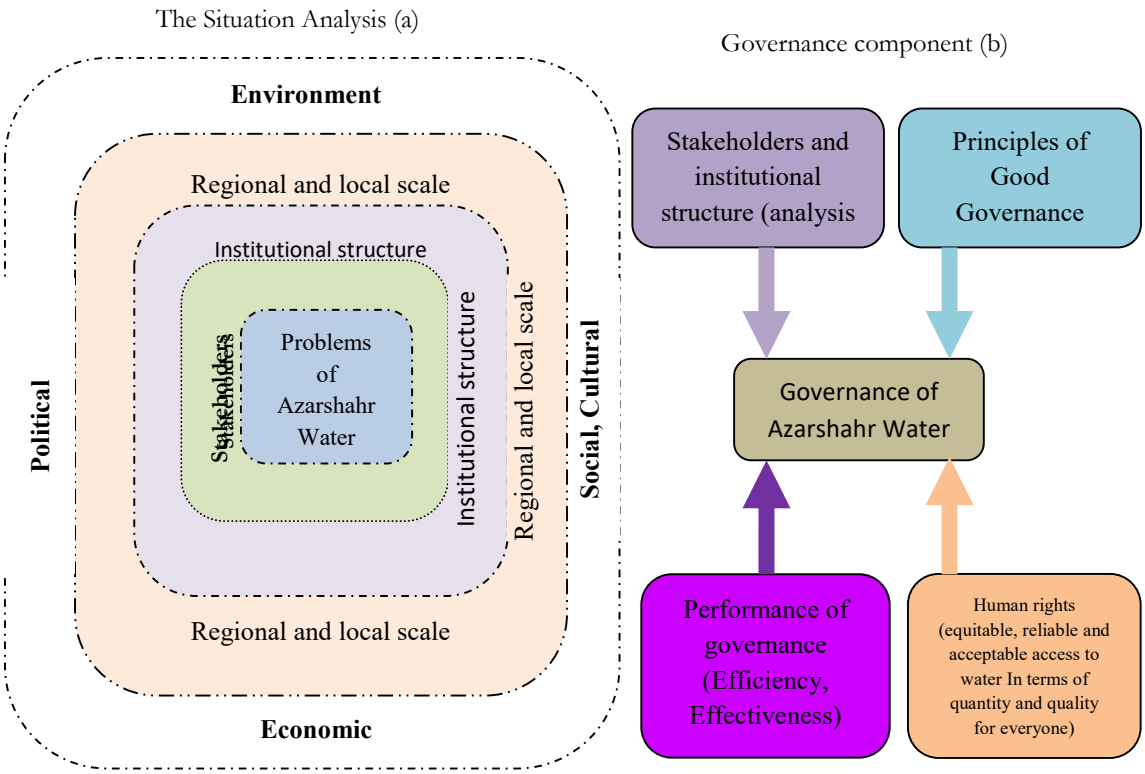

Figure 2: Analytical framework of governance

Table 1. Main categories and subcategories defined from analytical framework of governance

Main categories	subcategories
1. Stakeholder	1.1 Willingness to change
	1.2 Capacity to change
2. Institutions	2.1 Water policies (formulated, established, implemented)
	2.2 Water laws and rules and institutions
	2.3 Solutions towards human right and justice to water
	2.4 IWRM
3. Transparency	3.1 Availability of reliable information
	3.2 Accessibility to reliable information
	3.3 Public decision expansion
4. Accountability	4.1 Clarification of stakeholder roles and responsibilities
	4.2 Internal and external supervision of tasks
	4.3 Social accountability
5. Participation	5.1 Civil society participation in law and practice
	5.2 Legal basis for affected stakeholder to participate
6. Human Right to Water	6.1 In terms of quantity of water for drinking (50 and 100 liters per person per day - WHO,2010)
	6.2 In terms of water quality for drinking (safe water)
	6.3 Acceptable (culture, gender, lifecycles, privacy)
	6.4 Accessible (If the water is piped into the house, the access is favorable- WHO,2010)
	6.5 Affordable (socio-economic value)
7.Efficiency	7.1 Effective maintenance of infrastructure
	7.2 Water distribution losses (non-revenue water)
	7.3 Coverage of services with the participation of the private and public sector
	7.4 Billing and collecting sales income and water services and pricing and water tariffs
8.Effectiveness	8.1 No corruption
	8.2 Practice according to the law
	8.3 Objective of national water policy is achieved
	8.4 Sustainable conservation of resources
	8.5 Coordination with other parts of the water performance
	8.6 strategic planning

Case Study

The Azarshahr study area, as a catchment of the Lake Urmia basin, in the northwest of Iran, is highly fertile (Figure2). Integrated assessment of the water resource in the study area by adopting the System of Environmental and Economic Accounts for Water (SEEA-WATER) and calculating over thirty indicators of water, economic and social aspects in 2006 and 2016, indicated that the study area is highly stressed in terms of water quantity and quality. Also, the area suffers severely from unsustainability and dis-equilibrium between water resources and consumption (Mahdavi et al., 2019a).

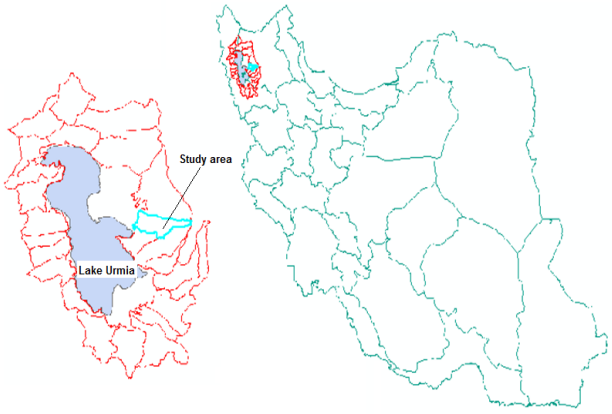

Figure 2: Location of study area

Methodology

Content analysis is a research method for subjective interpretation of texts, which acts through the regular categorization process of coded themes or patterns (Hsieh et al., 2005). Content analysis is the controlled, methodological, and experimental analysis of texts in their own context, which step by step approaches the formation of a theoretical model (flick et al., 2004; Mayring, 2014).To do so, this study adopts deductive qualitative content analysis. Table 2, shows the coding used in the research, to analyze the content of the interviews. The coding process of the interviews was carried out by two coders to ensure the validity of the coding. If the two coders came up with different interpretations of the same coding, they would reach a consensus. Two analysts also assessed the extent of sub-categories coverage by the discovered codes. The analysis was both qualitative and quantitative. So, given the extent of coverage of each subcategory by codes, scores between 1 (non-existent) and 4 (existent, active, effective) were assigned to each sub-category (Table 4). If there were differences in the scoring of the subcategories by the analysts, it would be finalized, by the formal resolution process and consensus.

Data collection and analysis

Since the attitudes, perspectives, beliefs, and behaviors of stakeholders must be considered to achieve the goals of this research, a qualitative data collection method was employed. The snowball sampling method, a goal-directed sampling technique, was used to identify stakeholders (Speziale et al., 2011). While various local stakeholders, such as farmers, farmers' representatives, and local officials, all play equally important roles in water governance, most of the findings in this research are derived from public water governance. The participants in the interviews are described in Table 3. Due to the limited scope of the study area and the point at which data saturation was reached, the sample size is considered sufficient. Mason (2010), in a study of 560 dissertations using qualitative methods, found that a sample size of 15 to 50 participants is typically adequate.

Table 2: Definitions of main and subcategories, coding and anchor examples

Main categories	**subcategories**	Definition	anchor examples (poignant quotes)	Code
Stakeholder	Willingness to change	Stakeholders understand the change of system status and tend to make changes to improve the system status. Understanding behaviors, interests, programs, and influence of stakeholders in decision-making processes.	"We must embrace change we should not be proud of our 50 years of uniform management."	S1
	Capacity to change	Improve stakeholder knowledge, experience, and confidence in the use of ecosystem-based water management approaches. Sense of collective ownership, interactive and participatory learning.	"Everyone talks about water restrictions. But in practice, there has been no change in the attitude of the government and the people." "Launching the Azerbaijan Water Diplomacy Room, to produce knowledge and frame water governance issues and partnerships."	S2
Institutions	Water policies (formulated, established, implemented)	Is there a gap between policy and stakeholder behavior and real outcomes?	"There is no law obliging the farmer to follow the pattern of cultivation"; "There is no law obliging the industrial or manufacturing unit to recycle wastewater."; "There is a lack of transparency of laws and the need for enforcement guidelines"; "Different interpretations of a law by several government agencies."; "It is not clear how long public institutions will have the opportunity to enforce laws, if they do not comply with the laws, what will be the punishment?"; "Attitudes must change to enforce the rules"; " In the new rules have not addressed to the maintenance of the local rules and customs."	I1
	Water laws and rules and institutions	Improving the functioning of institutions. Formal and informal institutions shape the ability of actors to act on their motivations. The simplicity and transparency of the rules.		I2
	Solutions towards human right and justice to water	How many institutions are there to address human rights and equitable water distribution?		I3
	IWRM	Do institutions have an integrated management orientation to water resources?		I4
Transparency	Availability of reliable information	Is there reliable data and information?	"The issue of water quality is political and security, it is not publicly available. Anyone who wants to know how water quality, should spend more time and effort trying to access it."; "Sometimes the reported data is manipulated contrary to the facts."; "Because data is poor, therefore, the information produced is also poor and cannot easily be transformed into decision-making knowledge."	T1
	Accessibility to reliable information	Whether there is access to reliable information and data?		T2
	Public decision expansion	Are all the stakeholders or their representatives involved in water sector decisions?		T3

Table 2: Definitions of main and subcategories, coding and anchor examples

Main categories	**subcategories**	Definition	anchor examples (poignant quotes)	Code
Accountability	Clarification of stakeholder roles and responsibilities	Is the role and responsibility of stakeholders involved in the water sector well defined?	"All three water, environment, and agriculture organizations have responsibilities in preventing the use of raw sewage in agriculture, but none of them perform their duties."; "Internal and external oversight of government agencies has not been effective in their effective functioning."	A1
	Internal and external supervision of tasks	Are internal and external oversight bodies properly monitoring staff performance?		A2
	Social accountability	What actions are being taken by the people, the media, and civil society to hold governments and decision-makers accountable?		A3
Participation	Civil society participation in law and practice	Are civil society involved in legislation and actions?	"The Water Authority's Public Partnership Office has designed a model where all cooperatives and representatives of various government agencies will enter into a village under an agreement to provide greater overlap."; " Despite the enormous legal provisions on participation, farmers do not participate in legislation and enforcement measures and the expectation is that all water supply and transmission investments should be made by the government."	P1
	Legal basis for stakeholders to participate	Are the issues of participation important in laws, regulations and policies?		P2
Human Right to Water	In terms of quantity and quality of drinking water	50 and 100 liters per person per day is Sufficient -WHO,2010 ;(safe water as WHO standards)	"All urban areas and more than 90% of villages have access to sanitary tap water inside residential homes. 10% of villages have access to sanitary water at a central point at a distance of less than 1 km from the place of residence and permanently." "The price of water in rural areas is very low (less than 1% of household income) or free and in urban areas less than 3% of household income."	H1
	Acceptable (culture, gender, lifecycles, privacy); Accessible	If the water is piped into the house, the access is favorable- WHO,2010		H3
	Affordable (socio-economic value)	(Socioeconomic value, less than 3% of household income; WHO,2010)		H5
Efficiency	Effective maintenance of infrastructure	Financing for efficient maintenance of infrastructure	"The depreciation of the water infrastructure is greater because of insufficient funding."; "There is a large volume of water losses in the transmission, distribution and consumption networks."; "The conditions for private sector investment in water infrastructure have not been met."; "The defective structure of the	E1
	Water distribution losses (non-revenue water)	Financing to prevent water losses in the water distribution network.		E2
	Coverage of services with the participation of the private and public sector	How much does the private sector, along with the public sector, contribute to the coverage of water services?		E3

Table 2: Definitions of main and subcategories, coding and anchor examples

Main categories	**subcategories**	Definition	anchor examples (poignant quotes)	Code
	Billing and collecting sales income and water services and pricing and water tariffs	Is the revenue from sales and water services well collected? Is the pricing and tariff of water proportional to the cost?	water economy does not give the consumer a message of saving water."	E4
Effectiveness	Investigate the existence of corruption	Use the power and ability of government or government agencies to achieve individual or group financial benefits.; Widespread and systematic corruption	"There are many cases of illegal activity in the water sector, such as failure to prevent the drilling of unauthorized wells and not filling of unauthorized wells and not release of the riparian zone and bed river ..."; "There are signs of corruption in the water sector that are hidden and sometimes obvious…."; " More than 91% of water consumption in the agricultural sector is by traditional irrigation network and irrigation system, so the biggest factor contributing to water resources conservation is agricultural employment pattern reform."; "Most political representatives (city representatives, governors) for various political reasons (preventing public dissatisfaction and attending public ceremonies) are blocking the legal duty in the water sector."; " There is no long-term strategic plan in the water sector."	EE1
	Check that the measures comply with existing laws	Whether they're breaking the law or breaking the norm?		EE2
	The objective of national water policy is achieved	How much the goals of national water policies have been met?		EE3
	Sustainable conservation of resources	Encourage the protection and restoration of water sources, and promote water use optimization. Require the implementation of systems for wastewater treatment before reuse or disposal.		EE4
	Coordination with other parts of the water performance	Know the big picture; Create well-defined roles, Foster great communication.		EE5
	strategic planning	Set priorities, focus energy and resources, strengthen operations, ensure that employees and other stakeholders are working toward common goals, establish agreement around intended outcomes/results, and assess and adjust the organizations.		EE6

Table 3: Participants in the interview

stakeholder group	agricultural managers and experts	Industrial users	domestic users	water managers and experts	Environmental Managers and experts	Services users	farmers	Water researchers
Number interviewees	10	5	5	10	5	5	30	2
% interviewees of total in the stakeholder group	70%	50%	40%	80%	70%	40%	40%	70%

The main data were collected through semi-structured interviews with stakeholders involved in the water resource system of the study area. Interviews were conducted in the spring of 2020. To enhance the validity of the results, the interview protocol was carefully implemented. The qualitative content analysis method was used to analyze the interviews, employing the deductive categorization approach (Mayring, 2014). In addition to the interviews, part of the information was obtained through the analysis of written documents. The unit of analysis was the entire set of interviews or observational protocols, with meaning units consisting of words, sentences, and paragraphs. The coding process followed the analytical framework of governance outlined in previous sections. Using this framework, initial codes were designed and adjusted during the analysis to better align with the data. The governance status was then assessed based on these codes. To ensure content validity, the interview questions were reviewed and validated by experts, and the coding process was also evaluated by them. To enhance the reliability of the results, triangulation methods were employed, including interviews with different stakeholder groups and the use of multiple information sources, such as documents, historical reviews, and peer reviews (Willis et al., 2007).

Results and discussion

More than 500 anchor samples of main categories and subcategories are defined from the text of the interviews, based on their interpretation the findings are discussed in sections 5.1 to 5.8 and summarized in Table 4.

Stakeholders' categories

A water management and development program succeed only when key stakeholders have an incentive to make that program work. When key stakeholders feel threatened by water development and management programs, they have an incentive to undermine these initiatives. Understanding how various societal stakeholders—such as bureaucrats, industrialists, farmers, political incumbents, religious authorities, opposition groups, and others—have different incentives regarding the success or failure of water management and development programs is crucial for effective planning. Stakeholders' capabilities and constraints are diverse, including institutional limitations on power, poor resource availability, or an inability to collaborate effectively. Groups often create systems that maintain their privileges. Stakeholders are generally supportive of changes to socio-economic and political systems that do not threaten their interests. Powerful stakeholders tend to reward their supporters first. Some stakeholders are faced with incentives that create conflicts between their private interests and the public good. These incentives may perpetuate a situation that appears unreasonable or even detrimental to the broader community (UNDP, 2012).

Some examples mentioned in this category are described in the following:

"It is clear that there is the shortage of water…."; "water management should be changed …"; "Territorial crisis is not just behind the Ministry of Energy and the Environment. This issue spreads to the entire community and is linked to bad economic conditions leading to urban insurrections and eventually social

collapse… "; "Governance should be improved across all territorial management areas based on the status of water resources. Coordinated and integrated water management should be created. Water should be allocated to areas of high economic value…"; "The only way to get out of the current situation is to consult with the people and engage them seriously in policy and management of the territorial and to respond positively to their rightful requests"; and "The country's policy on food self-sufficiency needs to be changed and self-sufficiency in strategic products is replaced…" and so on.

The results of our analysis showed that the stakeholders have no doubt that the current state of management is unsustainable. But what matters is: Why this belief has not led to change? Looking carefully at the current situation, it is clear that most of the stakeholders are benefiting from the current situation in the short run. When the most powerful stakeholders do not want to change, low- power and low-income stakeholders (farmers who are major consumers of water) will not do anything. In the current situation, government employees have a better ability to reward their supporters. On the other hand, their interests will be threatened in a process of change. Farmers are using water without restriction and they are benefiting from very low water tariffs.

The stakeholders' ability to change is related to their knowledge. While the water resource system is a socio-ecological system, it is expected to use interdisciplinary and multidisciplinary expertise in public administration. One of the interviewees in this regard said: "In the past, community communications were simple, but communication is now complex and therefore, the use of social experts in water issues is necessary". This is while most office personnel are engineers.

Lack of technical and technological capacities is another issue. Despite the importance of protecting groundwater, not all wells are yet equipped with water metering instruments. It is arguable that the politicians' mental models, don't acknowledge technical issues offered by specialists. One of the participants in this regard said: "In the country, the political sector does not have the capacity and despite the fact that it affects economic issues and other sectors, it does not allow full transparency on many issues"; and "Political representatives have interfered in water decision-making and planning with the aim of gaining political power and regional interests and Water has become a political tool in the region".

We confirm the finding of (OECD, 2015b), that intervening in powerful and influential groups in water issues is an important challenge in water governance. We found out that there is a tendency to change the behavior of stakeholders and capacity for change in stakeholders, but it is not active.

Institution's categories

The search for technical solutions to ensure access to water with appropriate quality and quantity across time and space has shaped water policies (Akhmouch & Correia, 2016). The first step in reforming water policy is a "comprehensive mapping of institutions" to determine who is responsible for decision-making and at what level of governance (OECD, 2011).

Good policies have been taken in the water sector in recent years such as:
"Recently, a law has been passed and budgeting-planning organization is obligated, before allocating funds to the projects, to take environmental considerations from the department of environment. However, many dams have been constructed without respecting the concerns of the department of the environment"; and "with regard to the Ministry of Energy's Water Allocation Commission recently the environmental needs are the second priority after drinking needs. While in the previous years, the environmental needs were the last priority"; However, change in the water management scale from the Lake Urmia basin to the provincial political area and the pressure of water scarcity has limited the policies effectiveness.

Regarding the water law, one of the main problems is the plurality of rules.

Good action in recent years has been the preparation of a comprehensive water law that has not yet been finalized. There are a lot of problems with the current rules. In this regard, participants mentioned the following:

"Article 28 of equitable water distribution law, which prohibits the water use outside the scope specified in the license and outside the specified use type, prevents the optimal use of water";

"Note 3 of the equitable water distribution law about licensing to unauthorized wells under certain conditions, has caused the abuse of this Note and the expansion of unauthorized wells";

"With the introduction of wells technology, the previous norms broke down and the new rules did not provide the necessary means to control the water withdrawal from the well."

In the past 20 years, adopted laws in the water sector have been contrary to the demands of the water sector such as: "free water supply to the traditional irrigation networks in 1985; the law of licensing to unauthorized wells in 2006; free supervision of licensed wells ";

"There is no law in land use planning (legal gap) that forces the farmers to comply with the advised cultivation patterns, only the pattern of cultivation is recommend to farmers";

"There is no law to force industrial or production units to recycle wastewater", "Water law does not create the necessary capacity for pricing water economic values"; "There are no legal deadlines in water laws and this affects the water laws"; "There are many cases of illegal activity in the water sector, including drilling of unauthorized wells and do not filling unauthorized wells and not release of the riparian zone and river bed areas".

As Barbosa et al. (2016) have argued, the lack of authority and no commitment by government representatives is an important cause of failure to follow the laws.

There are some disadvantages regarding fair solutions in water laws. Participants mentioned the following:

"The rules permit to drilling and exploitation of the wells is not fair (adding a new user to existing users list is not easy and there are difficult conditions) while in some countries the sharing of groundwater is proportional to the level of land ownership"; "When we change the status of water rights by constructing a dam on the river and will release more water to downstream, we must have laws to mandate downstream consumers spending a fee for watershed management and preventing water pollution in the upstream".

Although measures to integrate water resources management have been taken under programs such as: "the integrated management of Lake Urmia", "the Urmia Lake revival office" in practice, there is less success. One of the participants in this regard said: "There is a structural problem for integrated water management, because the water supply is the responsibility of the water organization, while the main water consumer is the agricultural organization, so for better water management, the two organizations should be combined to control water consumption".

One of the most significant legal gaps in this regard is "the lack of a law on the land aggregation" also the balanced development of all sectors has been neglected and agriculture has been over-developed to increase employment. Even in the water research sector, there is no integrated and focused research. In general, an active institutional structure is dominant in the area but is not effective.

Transparency categories

There is no guarantee of the quality of the data collected and there is a great deal of discrepancy in data. Due to these weaknesses, the resulting information is too weak to support decision-making knowledge. An example of this is the contradictory information about the hydraulic connection of Lake Urmia with the surrounding aquifers. Information exchanged between different departments and organizations sometimes is not trusted. Significant quantitative and qualitative data are collected in the drinking water network, but sometimes measured data is

manipulated and even it is not accessible publicly. No information is exchanged between the water supplier and customers. Stakeholder feedback is not organized. The views of stakeholders are not concerned and analyzed, thus do not lead to general decision- making.

Accountability categories

The major weakness of accountability is the role and responsibility overlapping among the stakeholders. One of the most prominent examples of responsibility overlap is the monitoring of water pollution by three organizations (including the health organization, the department of environment, and the water authority). Responsibility overlapping causes in practice none of the three organizations to properly monitor water quality. Another example of responsibility overlapping is the construction of the dam by the water organization and agricultural organization.

Although external oversight of all government departments is carried out by representatives of the judiciary, the legislature, and the executive powers, this monitoring is not effective. The same is also true for internal monitoring, which causes forgetting and/or repeating mistakes. One participant said: "Some small dams in the province were constructed without a thorough study of all the factors, and it has not been operated and no one is responsible ". Most of the performance reports do not cover the failures.

Participation categories

Although the water organization has succeeded in setting up water users' cooperatives in the modern irrigation networks and has provided good interaction models with stakeholders, in the traditional irrigation networks, there are no water users' cooperatives. While in the 60s the traditional irrigation networks had their own traditional cooperatives which used to form as people's awareness increased in the form of social and economic systems. Unfortunately, these regimes were undermined by land reform and never found a suitable alternative.

There are legal barriers in the drinking water sector to private sector participation in the construction and operation of drinking water infrastructures. In most soil and water projects, the share of farmers' financial participation should be 15% according to the law, but farmers are not interested in participation and they expect these projects to be done entirely by the government.

Human Right to Water categories

Drinking water as healthy, safe, accessible, acceptable, and affordable in the form of piped water to residential houses is available in all urban areas and 90% of rural areas. some villages have access to sanitary water at a central point at less than 1 km from the place of residence and permanently. There is no arbitrary disconnection of water and water services. Water tariff in rural areas is very low or free (less than 1% of household income) and in urban areas less than 3% of household income. After the revolution of 1978, the government of Iran has done very well in establishing health facilities in rural areas.

Efficiency categories

The maintenance of water infrastructures has serious problems. The depreciation of the water infrastructures is high, because not sufficient funds are available for maintenance. Return capital of water infrastructures is low and usually returning capital is costing elsewhere. Development has taken place regardless of the carrying capacity of Lake Urmia Basin. Therefore, due to the condition of Lake Urmia, some of the water infrastructures have been abandoned. Water and wastewater companies do not have enough funds to develop and/or maintain the networks to prevent water losses, so a large volume of water is lost in transmission, distribution, and consumption. Non-revenue water is very high.

The delivery of water in agriculture is not volumetric. Currently, treated wastewater is not sold due to poor quality. Industrial units that use groundwater, due to low water tariffs, are not willing to invest in recycled water. The average per capita water consumption in the province is 200 liters per day, which is far

higher than that of national and global average norms.

The private sector does not invest in drinking water services. Non-revenue water is very high in the drinking water sector. The Water tariff in all sectors is very low relative to the corresponding average world water prices. Currently, the governmental value of water in the agricultural sector (Semi-modern irrigation networks), is less than 0.5 cents per cubic meter; in the service and household sector before the treatment process is less than 1 cent per cubic meter, and in the industrial sector is less than 19 cents per cubic meter. These water tariffs are much lower than the water supply costs as a result it reduces water productivity. Agriculture is traditional and the volume of water consumed per unit of production is very high, one of the participants said " We use 400 liters of water to produce each kilogram of onion which is worth 19 cents, it is clear that it is not economic, while the inherent value of water is invaluable". Major agricultural products are not exported because of poor quality and agricultural waste is high.

Effectiveness categories

There are indications of direct and indirect corruption. Some parts of corruption cannot be easily detected by the General Inspection Organization. One of the participants said, " If the corruption is not reported by the same organization in which the corruption occurred the inspection organization cannot easily detect it". Several cases of violations of law are observed; one of the participants said "Political actors, for various political reasons, impede the performance of the legal duties of the governmental agents".

Goals are achieved far from national policies. The implementation of projects takes a long time and the capital return is very low. One of the participants said, "At a given time, 2000 million $ in the water organization were invested in the construction of water structures, the annual return on this investment is not now 5 million $ to pay personnel's salaries". The research centers are not responding effectively to real-world challenges. In spite of numerous protocols among different sectors, there is little inter-sectoral coordination. The interference of political actors in water issues reduces coordination among departments. There is no long-term strategic planning for the water sector. The lack of a proper development program has resulted in another gap in effectiveness. One of the participants said: "The water organization does not have a strategic plan and a road map for the future. Usually, decisions are made passively to resolve the problems and tasks of the current time".

Table 4: Assessment of Water Governance Components

Main categories	subcategories	Non-existent	Existent, not active	Existent, active, not effective	Existent, active, effective
1 .Stakeholder	1.1 Willingness to change		✓		
	1.2 Capacity to change		✓		
2 .Institutions	2.1 Water policies (formulated, established, implemented)			✓	
	2.2 Water laws and rules and Institutions			✓	
	2.3 Solutions towards human right and Justice to water		✓		
	2.4 IWRM		✓		
3 .Transparency	3.1 Availability of reliable information		✓		
	3.2 Accessibility to reliable information		✓		
	3.3 Public Decision Expansion	✓			
4 .Accountability	4.1 Clarification of stakeholder roles & responsibilities		✓		

Table 4: Assessment of Water Governance Components

Main categories	subcategories	Non-existent	Existent, not active	Existent, active, not effective	Existent, active, effective
	4.2 Internal and external supervision of tasks			✓	
	4.3 Social accountability			✓	
5. Participation	5.1 Civil Society participation in law and practice		✓		
	5.2 Legal basis for affected stakeholder to participate		✓		
6 .Human Right to Water	6.1 In terms of quantity of water for drinking				✓
	6.2 In terms of water quality for drinking (safe water)				✓
	6.3 Acceptable (culture, gender, lifecycles, privacy)				✓
	6.4 Accessible				✓
	6.5 Affordable (socio-economic value)				✓
	6.6. The right to clean air			✓	
7.Efficiency	7.1 Effective maintenance of infrastructure			✓	
	7.2 Water distribution vs. losses (non-revenue water)			✓	
	7.3 Coverage of services with the participation of the private and public sector		✓		
	7.4 Billing and Collecting Sales Income and Water Services and Pricing and Water Tariffs			✓	
8.Effectiveness	8.1 No corruption		✓		
	8.2 Practice according to the law		✓		
	8.3 Objective of national water policy is achieved			✓	
	8.4 Sustainable conservation of resources		✓		
	8.5 Coordination with other parts of the water performance		✓		
	8.6 strategic planning	✓			

Conclusion

Although the study area experiences severe water stress, the measures implemented in previous years have not been effective. This research was conducted to identify the problems within the context of water governance. To achieve this, after providing the water governance assessment framework, the content analysis method was used to evaluate the state of water governance. The study provided a neutral platform for experts from various water-related fields to discuss water governance, its functioning, and potential improvements. This approach is a positive aspect of the water governance assessment, with the primary goal of enhancing water governance in the study area.

Based on the findings, the human right to water category emerged as one of the strengths of water governance in the area. However, the lack of long-term strategic planning was identified as the most significant weakness in the effectiveness of governance, rooted in the absence of an Integrated Water Resources Management (IWRM) plan at the national level. Water management decisions are made by multiple bodies and institutions with conflicting interests, and water

responsibilities are not consolidated under a single entity. Additionally, consumer participation in decision-making is low, despite their direct involvement in the water system through water resource exploitation.
Politicians have promoted the unsustainable development of the agricultural sector, often disregarding sustainability principles. The surface irrigation network in the area remains traditional, and under current regulations, water tariffs for these traditional networks are not applied.
The failure to enforce laws has led to unauthorized well drilling and the degradation of groundwater resources, resulting in saltwater intrusion from Lake Urmia into the aquifer. This has created a market where well owners with good-quality water trade with farmers relying on saline groundwater, perpetuating the salinity issue.
It is important to note that all water governance component categories are interdependent and can either strengthen or weaken one another. Therefore, addressing water governance gaps requires a comprehensive and integrated approach. A single solution may address multiple gaps, and conversely, a governance gap may require a combination of solutions. All stakeholders must recognize that if water governance is confined solely to the government, it will face significant challenges. For this reason, the participation of all stakeholders is essential.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability Statement

All relevant data are included in the paper or it's Supplementary Information.

Human Participants

The authors acknowledge that all interviewees have formal informed consent.

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