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Research Article

OECD Water Governance Principles on the local scale: Using mixed method in local water resources management review

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ABSTRACT- The main purpose of this study is to examine how the OECD water governance principles fit with actual water governance at the local scale. First, this paper will focus on using the OECD index as a benchmark for progress in implementing water governance relevant to the selected catchment area. Second, it specifically advances the OECD agenda to describe the experience of local water governance in Iran. Based on the main research objective, this study is considered an exploratory strategy. As it involves conducting a survey and qualitative study to gain deeper insight in to the research objective. Local elites come together and discuss how the lack of appropriate scale, lack of data and information sharing, lack of financing, mistrust and corruption cause water management problems over time. We expect that this study will inspire further analysis of water governance at the local level. We also expect that the approaches presented in this study will serve as a resource for developing further research on local water governance and supporting local water governance in order to develop frameworks for implementing the OECD principles at the local level.

INTRODUCTION

Despite the centrality of water resources to the realization of sustainable development goals, water resources in the world, are under increasing pressure from national to local levels, eventually leading to, achieving sustainable development by 2030 will be a challenge (FAO, 2020). The water crisis is not specific to one region. More than 43 countries in the world are facing this crisis. Being located in the arid and semi-arid region of central Asia, Iran is no exception to this rule and is currently facing a serious water crisis and economic and social changes will worsen the situation (Khatibi and Arjumand, 2019). This is while, it is widely acknowledged that the current water crisis is mainly a crisis of governance rather than a physical lack of water (Tatar et al., 2022). It means that the government's approach to water management significantly affects water resources (Michel, 2017).

To strengthen water resource management in areas facing restrictions, water governance, has been introduced as the key to solving water problems in a sustainable manner, which guarantees the achievement of sustainable development goals (FAO, 2020). It encompasses the range of political, institutional, administrative rules, practices and processes through which decisions are made and implemented (OECD 2015).

Evidence show that most developing countries have developed new water laws and policies, pursuing good water governance. Iran as a pioneer of sustainable water management as well had also developed promising policies for the good water governance, and partly making use of its principles. However, there is discrepancy between appearance and reality. Iran like many developing countries has hampered in operationalization water governance principles perhaps since existing ambiguity in both the concept and the approach of good water governance. In order to bridge this gap in the design and implementation, there is a need to identify, assess, and address the state of water governance (Mohajeri, 2020; Jiménez et al., 2020).

Moreover, identifying challenges, in the current situation also is the first step toward establishing water good governance (Romano & Akhmoch, 2019). Nevertheless, existing research has often focus on the principles and indicators of governance, and in the best case, some international organizations such as the World Bank or the Economic and Development Cooperation Organization have published guidelines, but there is little operational example at the local level. Bridging this research gap this study aims to examine challenges facing water Governance at the local scale. We put the guiding principles of the OECD on the forward and conduct the study in the Harsin catchment, located in the west of Iran. Harsin once the ancient water governance in the Iran, is now experiencing a dramatic situation on the water governance, reflected by agricultural losses, drying springhead, declining groundwater resources, and

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deteriorating water quality. Since the late 1950s and early 1960s, population growth and urbanization have led to water management challenges in the region, as more users have claimed sovereignty over shared water resources. On the other hand, it is assumed that a large part of the challenges in the region are not due to the quantity of water resources, but rather to the governance system.

Is water governance really responsible for the recent challenges in the basin? Is agricultural water management in the study area on the right track? It is debatable to what extent water management in the study area is close to a good water governance system. What is the current status of good governance indicators for agricultural surface waters in the study area? How do local elites describe the challenges facing water governance in the region? In an attempt to answer these questions, in the first step, an attempt was made to explain the real state of water governance in the current conditions of the region. Undoubtedly, it is not possible to examine all aspects of water governance in a specific study. Because the structure of water governance is changing over time. At the same time, the attitudes of stakeholders towards this structure are constantly changing. In fact, this study seeks to find the reality of water governance in the region based on the perceptions of stakeholders. Accordingly, this study can serve as an operational example for implementing good water governance in other local catchments.

Samples of good water governance experiences in the world

The world in 2050 will be significantly different from what it is today. Water governance will also need to adapt to these changes (Neto et al., 2018). While there are no suitable and usable local indicators of good water governance, some general indicators are available for countries' water governance. These are of limited value for local water governance. It is argued that independent and objective case studies of good local water governance would be very useful. Because learning what contextual and regional factors contributed to their success could allow others to significantly improve their current governance practices and processes for management water resources.

In France and Spain, water resource management strategies in the agricultural sector include joint water governance policies between farmers and policy makers in the public sector. In other words, these countries seek to implement integrated policies. Strategies for reducing water demand in the agricultural sector are followed in the form of a technology management strategy to reduce water losses in the agricultural sector and a water reuse strategy in the agricultural sector. Among the technical solutions provided, we can mention the reduction of water storage and transfer losses in farms, water reuse, and reduction of water losses through transpiration and evaporation (Rowbottom et al., 2022).

In China, demand management is not very successful, so the main focus has been on the strategy of increasing the efficiency of water consumption, which has been very successful in this field (Rowbottom et al., 2022). The technical solutions provided in this field include technical and engineering measures such as the use of micro-sprinklers and drip irrigation, agricultural measures such as deep plowing, the use of modified seeds and the use of polytonal, and management measures such as good governance of water resources. Based on this, in this country, each of the private sector institutions, including river basin commissions, water affairs offices and water user associations, have a set of duties in line with the good governance of water resources in the agricultural sector.

Lalika et al. (2015), presented watershed protection approaches with a good water governance approach in the Pangani river basin in Tanzania. The results showed that the preservation of coastal villages is a suitable strategy for the protection of the water basin and sustainable water flow. Also, the challenges in water resources management include inefficient organizational structures and unreliable financial management. Therefore, building the capacity of the water users association can have positive results for the protection of watersheds and good water governance. Based on this, the results of the study showed that strategies and policies to improve the flow of hydrological services should be focused on local water governance.

Frank et al. (2015), examined the extent of water resources management in the last 40 years in the Kiameni basin in southwestern Tanzania. In this study, while examining how water resource management has changed over time from centralized management to good water governance, changes in water allocation, especially regarding water rights, water management organizations, and physical infrastructure, were also discussed. The results showed that the development of water resources in Kyameni has been successful in many cases and as a result, the provision of resources for many users has been associated with the improvement of livelihood standards. Tatar et al. (2022), explained the relationship of good governance based on conflict management in agricultural water resources in Gaushan basin. For this purpose, by expressing different views about the good governance of water and its relationship with the conflict management of agricultural water resources, they presented a proposed model to explain the good governance of water from the path of conflict management in the water area of Gaushan. In this framework, representatives of interest groups from the public, private, civil, and local communities intervene in the process of conflict resolution, and the ground is provided for the establishment of good governance.

Early water rights and uses of water in the Harsin catchment

Water use around Harsin is as old as the city itself and there is records of the water management dating back to the seventh century. In the early seventh, the water governance of Harsin did not have a centralized approach, but the water governance system has gradually

grown over time and has been fully adapted to the technical, social, and norms characteristics. This governance system, which was also known as Hemistad in ancient times, was based on two basic principles: technical capacity and its attendant social organization. From the aspect of technical capacity, one of the valuable achievements, was the separation of urban and agricultural water piping, which may have appeared for the first time in the world and is still admirable even today (Hamzehee, 2012).

Harsin Sarab is the supplier of urban and agricultural water in this city. Part of the water of this big spring (Harsin Sarab) is purified and can be used by citizens. The other part of the water is divided between the gardens of the city using the water-stone clock system (Fig. 1). The age of this amazing water-stone clock is from 224 to 651 AD. The general shape of this clock is circular and the diameter of its opening is about 3.8 meters and the depth is about 66 cm. This clock is completely made of stone. The water-stone watch has a special and interesting mechanism. This watch is made up of different parts and there is a conical part in the center of this circle. Below this conical section is a regular 12-sided space, which is used as a sundial for water distribution. The use of surface water, on the other hand, was also controlled by created social, cultural, and ethical systems that worked in harmony with each other and also in harmony with the technical characteristics of water governance. These social systems that were formed in different neighborhoods were like closed communes, which marriage within the group made them more stable. These systems had also turned into a mechanism for managing water conflicts, which managed the cause of conflicts in the manner of Kadkhoda. This system has had sufficient authority in decision making (Hamzehee, 2012).

Fig. 1. Water-stone clock for water management (Harsin Sarab, Iran).

MATERIALS AND METHODS

Study area

This research was conducted in Harsin county, located in the east of Kermanshah province (Figure 2). Harsin county, known for its agricultural importance, ranks first in onion production in Kermanshah province. Harsin county has a relatively diverse climate that ranges from humid to semi-arid. Its average annual rainfall is 360 mm. This county also has extensive walnut and fruit orchards. The water supply for these orchards is also from the Harsin Sarab.

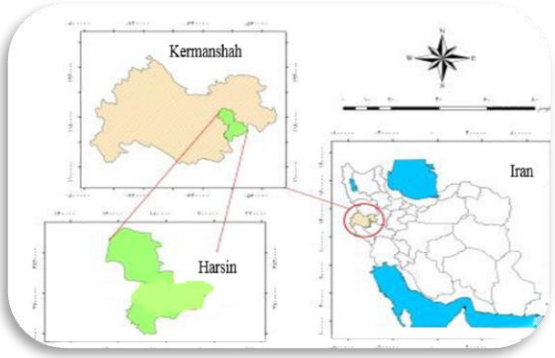

Fig. 2. Geographical locations of Harsin county.

Research design

This research is descriptive-survey and aims to explain the status of local governance of agricultural surface water resources at Harsin county. Specifically, this research seeks to answer the fundamental question of how local water governance is carried out in the study area? In order to address the weaknesses of each of the quantitative and qualitative research methods and to gain a deeper understanding of agricultural water governance in the region, a mixed paradigm (quantitative-qualitative) was used as a research strategy in a two-stage design. The mixed paradigm allows each part of the quantitative or qualitative research to play a supporting role for the other type (Craswell, 2003). Therefore, the study was designed in two stages as follows:

Step one

In the first step, the aim of the research was to assess the status of water governance indicators in the study area. Since no specific guidelines were available regarding the assessment of local water governance, the comprehensive and global OECD checklist was used. This checklist includes 12 principles and more than 100 indicators for assessing water governance. Therefore, the text of the checklist was accurately translated by the research team using the opinions of several faculty members who are experts and experienced in the field of water resources studies. Since water governance is very contextual and location-based, the opinions of water elites (WE) were used to select indicators appropriate to the study area. These individuals included water resources specialists from the regional water organization, local users, faculty members of the water engineering department at Razi University, Organization of Agriculture Jihad's experts of Harsin County and Kermanshah Province. The sampling method used was Judgmental sampling. A total of 36 participants were purposefully selected to respond to the questionnaire.

The questionnaire indicators were focused on the water governance indicators checklist and the traffic light (Table 1), suggested by OECD (2022). Using the participants' opinions, 12 principles and 56 indicators (Table 2, Table 3 and Table 4) were selected from the OECD comprehensive checklist to assess the status of local water governance in the study area. Finally, respondents were asked to choose the color corresponding to the level of implementation of the local water governance indicators in the study area. This helps to visualize the results. Table 1 shows the descriptive thresholds of the status of implementation of the OECD indicators.

Table 1. Degree of implementation

	The governance dimension is complete and relevant in all aspects, and no major concerns are noted.
	The governance dimension is in place, but the level of implementation is not complete.
	The governance dimension does not exist and there are no plans or actions taken for developing it.

The questionnaire's validity was confirmed by panel of experts, and a pilot study, involving 30 farmers, was conducted in outside the study area to evaluate the instrument. After collecting the data, it was entered into SPSS software and analyzed using descriptive statistics (mean and standard deviation).

Step two

In the next step, we aim to identify key obstacles facing the agriculture surface water governance in the study area during 2020-2022 provokes for achieving good governance, with the support of qualitative method and naturalistic paradigm. This step would clarify concepts, along with operationalizing the components of good governance and deeper understanding the results obtained from the previous step and eventually, will increase the reliability of the research. It will be the comparison between subjectivity and objectivity. In this phase, we utilized both primary and secondary sources. Primary data was gathered through semi-structured interviews on the OECD governance principles and their usefulness in practice. They were asked what the current state of water governance in the region? The duration of the interviews was between 90 and 120 minutes. The qualitative data collection process continued from the interviewees until data saturation. Data saturation is the stage where no new data is discovered in the continuation of the interviews (Given, 2016). At this stage, the sample size was sufficient after 25 interviews because no new data was discovered in the subsequent interviews. After reaching saturation, the data analysis stage was carried out in order to develop concepts, combine concepts and find relationships between concepts (Thistoll et al., 2016). For this purpose, the qualitative content analysis (QCA) method was used, because the aim of this study was to develop a framework different from the OECD framework, according to the conditions of the study area and at the local level. Also, continuous comparison with the OECD framework during the analysis helps to provide a deeper and more comprehensive analysis and also increases theoretical sensitivity (Glaser, 1967).

RESULTS AND DISCUSSION

The research results were divided into two sub-sections. The first section examines the status of implementation of water governance dimensions in Harsin County as the study area (Tables 2, 3 and 4). The second section discusses the problems that hinder the successful implementation of local water governance in the region. In this section, quotes from participants are used to discuss how the OECD principles can explain the main obstacles to "good" water governance in practice.

Local baseline results on implementation of water governance indicator

Table 2 shows the status of the four subcomponents of effectiveness in governance of agricultural surface water resources in the area covered by Harsin's sarab based on the participant's opinions. These four subcomponents are; capacity building, clearly roles and responsibilities, coherence policy and appropriate scales. The capacity building with a total average of 2.02 is in a moderate state, clearly roles and responsibilities with a mean of 1.79 is in a moderate state, the coherence policy with a total average of 1.59 is in a moderate state. finally, the appropriate scales with a total average of 0.4 is in a weak state compared to the other subcomponents. In addition, the highest average is 4. This is because the questionnaire questions were designed in a four-level spectrum according OECD check list (Table 2).

Efficacy

Efficiency is another component of water governance. Efficiency means ensuring effective implementation of water governance which is possible through assessing the existence and status of four sub-components. The sub-components of financing revenues, water data, regulatory frameworks and innovative water governance. As shown in Table 3, the two sub-components; innovative water governance and financing revenues have the highest scores although their average score is relatively low and is around 2. On the other hand, the lowest ranking indicators were related to regulatory frameworks and data.

Trust and engagement

This principle seeks through appraise the existence and level of implementation of regulatory frameworks, stakeholder engagement, participation, and transparency. The top-ranked indicator according to the results was participation (1.75), and then stakeholder engagement (1.67). Variables of monitoring and evaluation (1.58), and transparency (1.53) ranked in the next places. The

overall ranking of principle in Fig.3 shows that trust and engagement ranks highest and effectiveness lowest. However, this ranking does not enough for assessment (Table 4).

Qualitative analysis the challenges facing the agricultural water governance system

The second part of the study analyzes the most important challenges of water governance in the study area. To analyze each challenge, first explanations are provided based on the experiences of the respondents, then scientific evidence related to each challenge is presented.

Table 2. Survey questions address the effectiveness

Principle	Questionnaire question	Mean	Sd	Total Mean	S	M	W
	Effectiveness						
1. Clearly roles and responsibilities	Binding and non-binding law to clarify roles and responsibility of institution(s) responsible for the agricultural water in a river basin context	1.88	1.008	1.79			
	Dedicated water policy to clarify roles and responsibility across water institution in a river basin	2.3	0.925				
	Administrative mechanisms for admitting errors and managerial mistakes of water-related authority across local stakeholders	1.32	0.806				
	Legal and regulatory frameworks, set the ground rules for agricultural water use (written laws, rules and procedures, informally established procedures and norms	1.76	0.922				
	Administrative mechanism for make related organization to responsivity about disturbed impacts of project	1.59	0.743				
2. Appropriate scales	Administrative mechanism to facilitate decision-making with regard to water resources development and management, specify the positions of various users (the way in which decisions are made and not the decisions themselves). Even including norms, traditions, practices, and customs	1.18	0.137	0.4			
	Autonomy in the local-based institution(s) responsible for the agricultural water in a river basin context (staff and budget)	0.65	0.119				
3. Coherence policy	Coherent and long-term planning in the surface water resources that is not subject to political changes	1.91	0.142	1.59			
	Allocation rules on competing users (such as agriculture and industry) across local sectors	1.62	0.120				
	Regulations to constrain undesirable behavior and to management interests, preferences, and objectives conflicts among farmers	1.47	0.148				
	Institution for fostering coherence across different users	1.38	0.134				
4. Capacity building	An adequate organizational framework with the necessary instruments and a good financing structure	2.29	0.161	2.02			
	Formal or informal administrative institutions by which authority is exercised	2.03	0.127				
	Regional technical capacity in institutions related to water management in a river basin context	1.97	0.130				
	Research capacity in local body of water governance	1.94	0.140				
	Negotiation mechanism for management conflicts over irrigation water	1.88	0.139				

Note: S= Strong, M= Moderate and W= Weak

Table 3. Survey questions address the efficacy

Principle	Questionnaire question	Efficacy	Mean	Sd	Total Mean	S	M	W
1. Water related data and information	Existing regional agricultural water statistics service information cover a wide range of subjects including meteorological data, irrigated crop calendars, and other water information		1071	.938	1.50			
	Existing data on qualitative and quantitative state of water resources publicly available		1.53	.788				
	Existing local policy force responsible organization to share detailed database on the water- and agriculture-related projects publicly available		1.24	.923				
	Creating a database to provide the most accurate information on costs related to water collection, water quality parameters, and issuing legal permits for water exploitation		1.26	.898				
	Existing data on risk management publicly available		1.18	.626				
	Existing water information system coordinated across responsible authorities at the local scale		1.68	.945				
	Existing water information system represent the status of agricultural water resources in the region (reports, maps, and diagrams) publicly available		1.94	1.153				
2. Water finance	Existing institution for allocate financial resources for recurrent costs or to agricultural water projects at the local scale		1.62	0.853	1.48			
	Basin budget for the recurrent costs or to deal with the water quality problem		1.35	0.774				
	Mechanism for providing sufficient revenues for protective water resource projects (including taxes, tariffs, and transfers) at basin level		1.59	0.821				
	Mechanism for specify revenues raised from water resource projects (such as dedicated levies on water user) for investment at basin level, including water resources infrastructure		1.26	0.751				
	Existing investment plans and programs at basin level		1.59	0.701				
3. Regulatory frameworks	Institutions set the ground rules in the distribution and use of surface water		1.91	0.933	1.61			
	High-level political support to facilitate coordination between relevant local authorities		1.85	0.821				
	Water information system foster experience-sharing among local user		1.65	0.849				
	financial support from the central authority		1.38	0.817				
	Institutional arrangements for monitoring water-related rules		1.29	0.871				
4. Innovative water governance	Regulatory mechanisms for promoting adaption innovative practices		2.56	0.927	1.75			
	Adaptation of government officials to innovative changes		1.35	0.734				
	Mechanism for accelerating the adoption of innovative water technologies		1.65	0.812				

Note: S= Strong, M= Moderate and W= Weak

The total average of indicators shows that the highest scores were assigned to trust and engagement (Fig. 3).

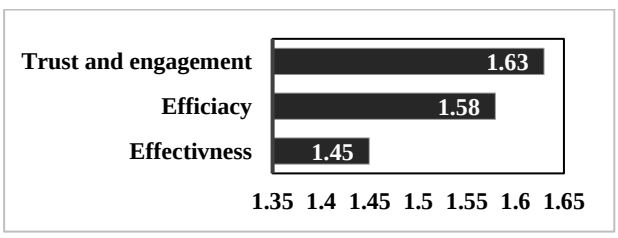

Fig. 3. Difference between average of local indicators of water governance.

Harsin is known as an agricultural city. During the Sasanian era, the method of water distribution was the use of Sarab streams and a water network system that directed water into the villages. This basin was prone to irrigated agriculture due to frequent droughts and low rainfall. Therefore, the water rulers in Harsin in ancient times created extensive water infrastructure to provide irrigation for farms and gardens. Including large canals around the water source and smaller canals to direct water into the farms and gardens (Hamzehee, 2012).

The most important streams of Harsin, from north to south, are: Baraftau, Marina, Khanaq, Miyawar, Bakhe zangan. the main stream of water is called river. As better techniques developed, Harsin's local residents were built other type of irrigation infrastructure such as water mills. They were enacted regulation, which established rights to water and customary water rules in traditional irrigation system. When new infrastructures were built, and old infrastructure has been destroyed new rights were established and new different rules from the rules proposed by local residents were made by government.

The main challenge for the local authorities, and relevant institutions is how to establish water management laws and institutions, since the formal water governance laws tend to ignore the customary laws. Concurrently, local community ignore formal laws and use their customary laws to manage their water resources. As mentioned, the water distribution system on the banks of the Kamish river is still based on the landlord- peasant period. The majority of rural farmers in Harsin have strong allegiance to customary law and institutions, which was also known as Hamistad (Hamzehee, 2012), in ancient times, was based on two basic principles: technical capacity and socio- cultural capacity.

Table 4. Survey questions address the trust and engagement

Principle	Questionnaire question	Mean	Sd	Total Mean	S	M	W
	Trust and engagement						
1. Corruption and Trust	Existing formal administrative mechanisms to tracking corruption in the local water resource management (manipulation information, providing false information, information rents, etc.)	1.44	0.786	1.53			
	Existing mechanisms, norms, and standards to detect corruption in	1.56	0.896				
	General binding rules for sharing information regarding the decision-making operations to its people	1.56	0.960				
	Mechanisms for reviewing the performance of water service providers (such as reporting expenditures related to local water resources)	1.41	0.821				
	Mechanisms and requirements for community to conduct the audit	1.53	0.961				
	Existing formal laws or procedure for providing an overview of the water resource projects financial performance	1.71	1.115				
2. Stakeholder engagement	Existing formal laws or procedure for facilitating stakeholders (including government agencies, private sector, and local	1.53	0.825	1.67			
	Formal administrative mechanisms for contributing actors (including government agencies, private sector, and local community) role and responsibility (such as irrigation department)	1.79	1.008				
	Local government policies concerns, stakeholders' engagement in the water resource management at the basin scale	1.79	0.845				
	Existing informal rules (norms or even practice), for involving stakeholders in decision making such as equitable distribution of surface water among the different users in a river basin	2.06	0.919				
	Existing informal administrative mechanisms to engagement the stakeholders in common agricultural water resource (such as multi-stakeholder meetings or group discussion for farmers to address their challenges related to common water resource)	1.59	0.892				
3. Management of interactions	Local policy to justify common interests as a driver for stakeholder participation	2	0.985	1.67			
	Local interactive process for present non-discriminatory participation in decision-making	1.71	0.938				
	Holding workshops, webinars, or meeting to communication of governors and farmers	1.41	0.657				
	Existence and functioning of a dedicated institutions protecting vulnerable groups	1.79	0.770				
	Foster consensus among competing organizations	1.47	0.787				
4. Regular monitoring and evaluation	Water service monitoring frameworks (for example the local monitoring system measures the quality) of drinking water source that households use	1.82	0.797	1.58			
	Conflict mitigation and resolution mechanisms	1.82	0.904				
	General binding rules for sewage discharge to the springhead water	1.47	0.825				
	Mechanisms of auditing the revenues of surface water resources	1.38	0.888				
	Existing key performance indicators (such as—service type, safety, quantity, accessibility, equity, and affordability)	1.44	0.860				

Note: S= Strong, M= Moderate and W= Weak

Technologies such as aqueduct (kariz) have been created for the first time in the western regions of Iran. The characteristics of the aqueduct were such that it helped to recharge the underground water. Other water supply methods were developed since this region has more rainfall than other desert regions of Iran. One of the valuable achievements of the Sassanids in the field of technology, which is still admirable even today, was the combination of urban and agricultural water piping, which may have appeared for the first time in the world. The technical capacities including aqueducts, water mills, and local water distribution mechanisms, including lottery or shooting, guarantee the effectiveness of the governance system and especially at the local situation.

The customary water distribution system was also accurate and acceptable. In addition, they had created social, cultural, and ethical systems that worked in harmony with each other and also in harmony with the technical characteristics of water governance. These local institutions that were formed in different neighborhoods were like closed communes, which marriage within the group made them more stable. These systems had also turned into a mechanism for managing water conflicts.

Problems of fit between governance and community setting

The results show that one of the most outstanding challenges on the local scale is that water related decisions does not fit with social context and community setting. The expansion of urbanization in the 1960's and 1970's, has triggered unbridled construction activities leading to serious damage on the old irrigation infrastructures. In some cases, even the modern houses were superimposed on the ancient networks. High water demand increases, water is needed to generate electricity in factories near the city, this calls for reallocation water resources from agricultural sector to the industry.

Efficacy

The lack of sharing data and information

Based on quotes, one of the most important deficiencies in Harsin's water governance system is the issue of data and information related to water and how to share this data. Respondents reported a lack of publicly and/or freely data sharing nor used in decision making. Particularly, concerning the reports on the quality of water and sewage source since the insufficient supply of adequate quality water to all peoples.

"The sharing of data that takes place is often incomplete or often not publicly and/or freely available nor used in decision-making. Data on the infrastructures including dam project or refine water, which may influence water users is accessible only for regional water authority experts through their formal organizational account. You can find out with a simple search that the reports on the quality of water and sewage sources are not timely. Even no coherent databank exists. They do not use experiential information".

Financing

Irrational budget allocation to finance the region's water resources

In the current fiscal environment of tight budgets, hard facilities allocate the lion's share of financial resources. Yet unfinished infrastructures are increasing at the local because of the financial deficit. The local authorities, which drawing their funds from central governments are faced with numerous limitations since the allocation of public finance across the water sector (until recently) does not consider rational.

"Most government water authorities allocate the bulk of their budget to large, long-term investments such as dam construction or wastewater treatment. Their implementation involves several phases and takes about twenty years. While investment preference may be given to lower-cost solutions such as protecting aquifers, covering water supply costs by pricing water to farmers, maintaining facilities, and treating wastewater".

A water expert from Harsin County explains the financial challenges facing good water governance, including inequality in allocation of funds and then transparency of allocated funds:

"The three water consuming sectors; drinking water, agriculture and industry face difficulties in receiving budgets. Since Harsin County faces socio-political problems resulting from poor urban development planning, decision-makers prioritize drinking water supply over agricultural water needs. This inequality in allocation of water resources has caused farmers to face irrigation problems, losses in production, reduced harvests and conflicts. There is no mechanism to ensure how the budgets allocated to water resources in Harsin County are used appropriately and effectively".

Finally, are political considerations in the budget allocation process:

"Many financing decisions are taken in the life time of governments. You know I talk about what? Responsible authorities and their policies. These political considerations seem to block the entry of new financial resources, and caused to water management only provided and funded by the state from national budgets. It is important that financing gap be filled to achieve integrated approach in water resource management".

Trust and engagement

Statements about the distrust and then increasing corruption in water governance also abound in the quotations.

Trust

Most applied statements that conceptualize distrust share the idea that from the indigenous point of view, government official has not enough competences and the goodwill to successfully governance water in this region.

"Code of Ethics? Regional water authorities have code of ethics in word, while there is no guaranteed formula for their successful implementation. It has resulted in mistrusted".

"The political decisions and promises of the government officials in their provincial trips to calm the protesting farmers were never realized. Of course, locals do not trust them because of their unfulfilled promises and the ambiguity in decision making".

By strengthening local integrity systems, sub-national governments can thus capitalize on the opportunity to build trust between citizens and governments.

Corruption

Some water elites in interviews pointed to corruption as a factor in water governance in the region. Two main forms of corruption found were bribery related to political capture of water projects, and discrimination in the water assignment and irrigation patterns in favor of power.

"Pollution is not stopped because factories that pollute river water evade control punishment by bribing officials, then our drinking water has poor-quality".

"The water issue in whole of the region has become a political and social issue and we see the role of power prominently in the allocations. With the coming of the new government, politicians who want to unveil their management achievements in the election campaign, capture large-scale water projects rather than small and long-term projects, I mean, elections and politics exacerbate the water crisis in the region".

"A type of water-oriented bureaucracy and specific political considerations have ruled over the country's water sector and its management. Experience has shown that politicians, mainly with electoral goals, do not listen to expert opinions much, and ambitious plans steal the hearts of managers sooner than difficult ones. When an eight-year-old government become the custodian of a multi-million-year-old region (Harsin), it means that within a few time, decisions for the next generations will be make. The current state-centric approach is that the government take over the water resources".

DISCUSSION

This study tries to explore how water governance is interpreted on a local scale and which principles do work through a local level and why others do not. Specifically, ancient Harsin was one of the first civilizations to systematically manage infrastructure for accessing water resources. Although there has been a long history of water governance in Harsin it now has difficulty in solving current water crisis. The challenges are clustered around three mains dimensions: effectiveness, efficacy, and trust with engagement. Effectiveness is related to the water management underwent changes in early 1990 (dates back to the paradigm of industrial modernity), which is labeled as the hydraulic mission paradigm (Yazdanpanah et al., 2013). Following urbanization and challenges in the way in which decisions are made in regard water resource management, fast-paced development initiated with unsustainable linear water management pattern.

Harsin has experienced changes in water resource management over time. During the transition process, its technical and socio-ecological systems have also changed. In the face of these changes, modern infrastructure for water resource exploitation has been developed. Today, laws and permits for the use of water resources are issued by state organizations. While many aspects of customary and traditional laws for the use of water resources have been ignored in the new management. Thus, we witness a mismatch between the traditions of the community and the new water governance.

The broad spectrum of the studies addresses the transitions in water related systems and irreversible shifts from one regime to another when critical thresholds are exceeded (Afghani et al., 2022; Karimi et al., 2021; Gleick, 2018). From technical perspective, the necessity of a stepwise transition is an important issue (Maier & Londong 2016). However, the reconfiguration depends on flexibility of water system. Local Elites believe the local water governance has been not enough adaptive in the long term and has been tend to overlook the social factors shape water-society relationships. Water Elites have been argued various aspects of inappropriate sharing data. Clearly, the water governance in the Harsin is not only faced with the challenge of insufficient and unreliable data, but also with the challenge of sharing such data, that make it inefficient. High-quality, accessible, timely, and reliable disaggregated data is crucial for timely decision-making. It can also help uncover problematic situations and interventions needed to resolve the problem (Butte et al., 2022).

There is evidence that barriers to data sharing are non-technical. For example, the local water authorities have not yet fully accepted the idea of open data. Even if they can skip this roadblock, then there is debate and controversy over what data should or should not be released" (Sarfaraz et al., 2022). The introduction of good water governance, especially since 2005, has considerably improved the ability to take a more holistic approach at the water use policy. But it has not, as yet, translated into financing. Water management normally provided by the national budgets, since the water is a sort of public goods in Iranian law system. Participants raised serious concerns about the lack of financing of the water governance.

Harsin water resource governance is inadequately funded. Because the benefits of water resource management are not fully nderstood. Water governance often includes a wide range of public and private stakeholders with various conflicting interests. Trust as a cornerstone for long term and sustainable interactions in good water governance is supposed to facilitate mutual trust (Voogd et al., 2022). Nevertheless, our findings reveal that trust in the current water governance is poor, especially in the context of the unfulfilled promises and the ambiguity in decision making. Hence, we recommend paying more attention to collaborative process with locals in the future decisions as a way to making trust.

Some forms of corruption have been reported in Harsin water governance. For example, untreated sewage for agriculture, releasing the pollution from companies near the Harsin county, low water quality from Sarab and increasing migration due to mismanagement of floods as the consequences of the corruption. The origin and outspread of corruption in the water governance have

been discussed by local elites, and it was found that the corruption in the local water governance is a complex socio-economic-political phenomenon, that is related to power struggles between different political groups. Few studies have focused on the corruption in water sector of Iran, whether at the state, regional or even local levels. Considering this, it would better more research on the corruption in local water governance. Beside it, fighting corruption strategies in the water sector should be exercised.

CONCLUSION

Water resources in Harsin County face critical obstacles to local water governance. Local elites identified five challenges to water governance in the region as follows: lack of appropriate indicators to measure the status of local water governance, clarity of regional water information, financing of water management, corruption of water management organizations, and low level of public trust in government organizations (Cui et al., 2020). Discussion with the interviewees about the water challenges in this study was thought provoking. This study draws attention to the process of transition from local to government management as a fundamental factor, as it led to the shift of water management into an unsustainable linear pattern. Since then, water-related laws and regulations have gradually lost their effectiveness in terms of adapting to the traditional structure of society. In addition, water-related data collection (Nabiafjadi et al., 2021) has been severely neglected in Harsin County. Creating a database and transparency in data dissemination are also challenges. Harsin County appears to be underfunded (Cleaver et al., 2015; Cookey et al., 2016) for water governance. On the other hand, corruption in government organizations related to water governance in the region has undermined the trust and engagement of local stackholders with government organizations.

Based on the results of the study, the hybrid method is a useful tool for comprehensive insight in the representation of water governance components, although this method has been efficient in identifying weak components in the region, but it cannot analyze the communication network between components and actors. To show the relationship between components and actors, we need to design a network.

The questionnaire used in the quantitative section to measure the status of the components was derived from the global guidelines. This guideline is used at the global macro level and its questions are ambiguous at the local and small levels. Future research could be focused on localizing good water governance measurement tools according to local conditions to obtain more accurate information. Also, in future research, researchers can examine the role of good water governance in creating water security in the region. Key implications of this study include:

- Formalizing customary laws and adapting them to formal laws can help address the lack of appropriate metrics for measuring the status of water governance indicators in the region.

- Developing a key context-based policy framework that ensures that infrastructure changes are consistent with socio-technical systems in each period.

- Training farmers through workshops on raising awareness about corruption and how to report corruption in water management organizations.

- Reforming inefficient management using local water governance frameworks in the region.

- Supporting local authorities to implement local governance reforms that serve to strengthen water governance at the local level.

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DECLARATION OF COMPETING INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY

The data presented in this study are available on request from the corresponding author.

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