



Assessing Water Governance Gaps with a Four-Layer Governance Model and OECD Principles

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Abstract

In this study, water governance in four layers including the contextual layer, institutional layer, relational layer, and performance layer was evaluated using the 12 principles of the Organization of Economic Cooperation in East Azerbaijan Province of Iran. This manuscript has used descriptive cross-sectional research to analyze of water governance gaps. Data were collected using the method of interviewing 36 key experts and farmers and studying documents, including 26 laws, 20 bylaws, 4 canons, and other documents published in the country's water sector. The results of the study showed that there are large gaps in the implementation of laws, policies, and guidelines, especially the achievement of macro goals and accountability and trust in the region. These gaps are mainly in line with Principles 7, 9, and Principle 2. Important obstacles to the implementation of laws and policies are as follows: the short period of management of individuals, low financial and administrative capacity of government departments, monopolization of policy-making by authorities, and as a result lack of role and participation of local stakeholders in the policy-making process, lack of legitimacy of policies at the local level, contradictory laws and contradictory actions of the government and the legislature at various times have led to a loss of trust in the legislature and the government. Therefore, some problems at the local level are tied to problems at the national level, and these problems can be generalized to other provinces, it is necessary to study and evaluate water governance at the national level.

Keywords: East Azerbaijan province, Four-layer governance model, IRAN, OECD Principles, Water governance gaps.

1. Introduction

Research by scientists in the field of water shows that the water crisis is not only due to natural constraints on water supply or lack of funding and appropriate technologies but also due to deep failures in the institutional and economic aspects of water in the interdisciplinary literature economic, social, political, managerial and business. In this study, the study area water problems, are examined from the perspective of local governance. The study area, despite having the largest number of dams built and controlling surface water, is facing stress and water shortages. According to Mahdavi et al. (2019), there are 27 alluvial aquifers in the study area, none of which have a sustainable use of

groundwater resources. Even though two large water transfer projects have been implemented from the Zarrinehroud and Aras basins, the water shortage is still noticeable. Since many water problems are often rooted in the system of governance, the question is whether the region's water problems are related to governance gaps.

Over the past decade, various approaches to the sustainable management of limited water resources and how to meet its challenges have been proposed (Hedelin, 2007; Ostrom, 2009; Pahl-Wostl et al., 2010; Bakker and Morinville 2013; Grafton et al. 2013; Heikkila, 2017; Bolognesi et al., 2018). These approaches can be categorized as follows; Of course, these approaches are not independent of each other

and are considered complementary in some way.

1) Systemic approach: This approach dynamically links all aspects of the water system, including environmental, social, economic, technical, political, legal, and cultural elements (Kotir et al., 2016). Manifestations of this approach include the concepts of sustainability - which emphasizes the balance between development and the environment and the avoidance of inefficient, and unfair use of resources (Ison et al., 2007) - and its application to water resources is under the name of IWRM - which emphasizes the coordinated development and management of water, land, and related resources to maximize economic and social well-being equitably without compromising the sustainability of vital ecosystems (Biswas, 2004; Savenije et al., 2008; Zare et al., 2019; Nagata et al., 2021).

2) The approach focuses on actors' interaction and social learning and capacity building in actors (Pahl-Wostl et al., 2008; Braden et al., 2009; Benhangi et al., 2020; Bullock et al., 2022): In this approach, the clear discourse and participation in planning and decision-making related to water systems have been considered (Tidwell et al., 2008; Mirnezami et al., 2018).

3) Institutional approach: This approach considers adopting compatible laws and policies and creating organizations to implement them (Saleth and Dinar, 2005; Wiesner, 2017; Mirnezami et al., 2020; Rahimi et al., 2023).

Because each country has its own legal systems, governance, institutional arrangements, and stakeholder dynamics, a comprehensive work plan for water governance cannot be prescribed. As Woodhouse and Muller (2017) conclude in a recent study, water governance is highly dependent on the institutional context; therefore, governance evaluation should be designed with specific objectives. Assessing water governance has different purposes such as determining the dimensions and characteristics of governance, comparing water governance between countries, strategic planning, identifying risk areas, identifying strengths and weaknesses of governance, and methods of repairing weaknesses. The study of

extensive global experiences in assessing water governance in different countries shows that all of them have somehow relied on their narrative, framework, or conceptual model.

In general, there are two general approaches to evaluating the governance structure. The first approach is to use criteria and indicators that by evaluating those indicators are used to understand the quality of the governance structure. The second approach is to identify the components of the governance structure with a diagnostic approach and analyze them to evaluate the governance structure. A clear example of the first approach is the 12 governance principles of the OECD, which uses these principles as criteria for analyzing the governance structure (OECD, 2015). The OECD has also recently developed 36 water governance indicators, complete with a checklist containing 100 questions about water governance and an action plan. The indicators are descriptive in different scales (city, basin, national, or other) and can be used for different water management functions and the variables required to estimate these 36 indicators have been proposed by the indicator provider (OECD, 2018). Diagnostic approaches include the Institutional Analysis and Development Framework (IAD), the Management Transfer Framework, the frameworks provided by the UNDP Governance Center, and the Dutch Water Governance Center (WGC).

The Institutional Analysis and Development (IAD) Framework was developed by Elinor Ostrom in collaboration with researchers from around the world interested in understanding how individuals behave in collective action. This framework has been used in many research studies on water governance (Cave and Plummer, 2013; Whaley and Weatherhead, 2014; Brisbois et al., 2019). An important point about IAD is its evolution towards the study of environmental issues from the perspective of a socio-environmental system that eventually led to the SES framework (Ostrom, 2009; Ostrom, 2011; Heikkila and Andersson, 2018; Bolognesi et al., 2018).

The Management Transfer Framework (MTF) was presented by Pahl-Wostl, 2010) as a cognitive and interdisciplinary conceptual framework supporting the analysis of water

systems management processes and multi-level governance systems that focus on the processes and sequences of different actions and their effects. In MTF, the major conceptual pillars of adaptive management, social learning, and institutional analysis have been used (Pahl-Wostl et al., 2010). This framework has been used in many research studies on water governance (Knieper et al., 2010; Pahl-Wostl, 2017). The UNDP Governance Center in Oslo and UNDP Water Governance Facility Center in Stockholm UNDP-SIWI and the Water Integrity Network Center in Berlin presented the three main components of water governance assessment, including (a) actors and institutions, (b) governance principles and (c) governance performance.

The component of actors and institutions is related to the views, capacity, power, interests, and knowledge of the stakeholders, and the component of principles includes transparency, accountability, and participation, and the component of performance includes efficiency in service delivery and effectiveness in achieving goals (Jacobson et al., 2013). The Dutch Water Governance Center (WGC) has introduced five basic water governance units, including a powerful water management organization; a water legal system; an adequate financing system; a systematic approach to planning, and stakeholder participation (Havekes et al., 2013). OCED also presented in 2011 an analytical framework for distinguishing governance gaps in institutional settings into seven categories. These categories include: policy, administrative, information, accountability, objective, budget, and capacity gaps. This analytical framework has been used in 17 OECD countries and 13 Latin American countries, as well as in Mexico, the Netherlands, Jordan, Tunisia, and Brazil (Akhmouch et al., 2013; OECD, 2011; OECD, 2014a; OECD, 2014b; OECD, 2014c; OECD, 2015).

In a study (Mirzaei et al., 2017) using the Multilevel Governance Framework (OECD) and the Delphi modified method by face-to-face interviews, they identified governance gaps in water structures called Ab-bandans in Mazandaran province of Iran. Their results showed that the main governance gaps are: lack of specific laws for Ab-bandans, lack of long-term strategic planning, insufficient

budget, lack of water user associations, lack of research on Ab-bandans, and lack of use of technology. Nabiafjadi et al. (2024) by using a normative approach and fuzzy set Qualitative Comparative Analysis of good water governance dimensions and related principles, investigated the complex factors and the configurations that influence optimal water governance in two Zayandeh-Rud and Karoon Iranian basins. Their findings reveal that none of the two basins exhibit optimal water governance. Duc et al. (2024) by using legal and institutional frameworks, Ostrom's theory, and OECD guidelines, proposed a revised water governance framework with 13 elements, along with key recommendations.

Using a combination of indicator-oriented and diagnostic methods can be the strength of an assessment that tracks indicators in each component of the governance structure. Accordingly, we are looking for a diagnostic approach that is derived from the commonalities of the definitions offered for governance.

Hofstra (2013) based on the definition given by Kooiman (2003) in the book "*Governing as governance*" of the two words '*governing*' - interactions that take place with the participation of public and private actors to solve social problems or create social opportunities, that use institutions as a context of these interactions and creation of a normative basis for all activities - and the word '*governance*' - as a set of theoretical concepts of governance - provided a three-layer diagnostic model of governance. Rocha and Viseu (2017) designed a questionnaire based on this three-layer diagnostic model of governance to assess better coping with the effects of climate change by users, water managers, decision-makers and policymakers on the BINGO project in six European research centers. The designed questionnaire consisted of 10 questions from three layers of contextual, institutional, and communication, and answers to 10 questions are comprehensively analyzed.

In this study, based on the definitions of "*governance*" provided by UNESCAP, (2009) "The way in which decisions are implemented or not implemented", UNDP, (1997) "exercise of political, economic and administrative authority to manage the affairs of a Country",

ADB Institute, (2004)" The ability of government to develop and implement public policies ", Miller and Ziegler, (2006) "How to reveal power through economic, political and social institutions one country" and finally the performance component presented within the framework of the UNDP Governance Center, the fourth layer called the function layer, has been added to the three-layer model proposed by (Hofstra, 2013) and the four-layer diagnostic model is proposed.

Given that water governance is a complex regulatory process that is constantly changing over time. *The purpose of this study* is to analyze water governance and identify its gaps on a regional scale using a simple four-layer model of water governance in the form of 12 principles of OCED as indicators to provide some information in response to the research question. We think that for the analysis of each layer, there should be indicators and criteria that we have used here the 12 known principles of the OECD for this purpose, so after identifying the placement of each principle in the relevant layer, that layer is analyzed. An interview program with stakeholders with 21 questions was set up, representing approximately four layers of governance. Then, the results of the interview were analyzed along with the study of documents including 23 laws, 19 bylaws, and 4 canons, based on the OECD framework and principles to examine the gaps in water governance in the region.

2. Materials and Methods

2.1. Condition and water problems of the area

In the 1990s, after the end of the Iran-Iraq War, which is known as the construction period in Iran, dam construction projects flourished in Iran, and this province, with its historical background and strong political representatives in parliament, gained the largest share in controlling surface waters and dam construction. According to Figure 1, the cultivation level of irrigated horticultural crops in the region has been constantly increasing. With the onset of droughts, the pressure on water resources increased, the ecological water rights of rivers were decreased, and as a result, Lake Urmia faced a drop in level, and serious

environmental crises were created for it. So that the water area of Lake Urmia decreased from 6000 square kilometers in 1997 to 1770 square kilometers in 2017.

The population, which was declining during the war, has been increasing since 1996 as agricultural land developed. Interestingly, despite the growth of the urban population in the province, the rural population is declining. This shows that the development of agricultural lands has not been successful in attracting the rural population (Figure 2). The continuation of agricultural development policies to employ the region's densely populated population eventually led to an uncontrolled abstraction of groundwater. So the groundwater reservoirs in the region in 2019 are facing a deficit of 1 billion and 216 million cubic meters. According to Figure 3, almost all aquifers in the area in September 2016 compared to September of the measurement start year have a negative balance. The most positive balance is related to the Shiramin plain equal to 1.89 million cubic meters, which is also due to the complete salinity of this aquifer and the stop of abstraction. Currently, 2.85 billion cubic meters from 3.19 billion cubic meters of renewable water is abstracted (94 %), while the abstraction of more than 60 % of renewable water is the critical limit.

2.2. Four-layer governance model

Numerous definitions of governance have been proposed by UN agencies and the international community, all of which emphasize obeying the law, sustainable development, public participation, accountability, efficiency, and effectiveness. Hofstra (2013) considers the following three layers in water governance as defined by Kooiman (2003) in "Governance as governance". Due to the simpler presentation of the concept of governance in this model and its relationship with the OECD analytical framework, in this study, this model is developed to collect the necessary data. Then we analyzed the collected materials in the 12 principles of the OECD water governance framework. The three layers of water governance explained by Hofstra (2013) are:

1. Contextual layer of problem formation: refers to the context in which water problems and issues have been created and opportunities should be created in the same context by the interaction of stakeholders to solve these problems by stakeholders.

2. Institutional layer: refers to the institutions that should be considered in the interactions between the stakeholders.

3. Communication layer: refers to the normative bases for performing activities.

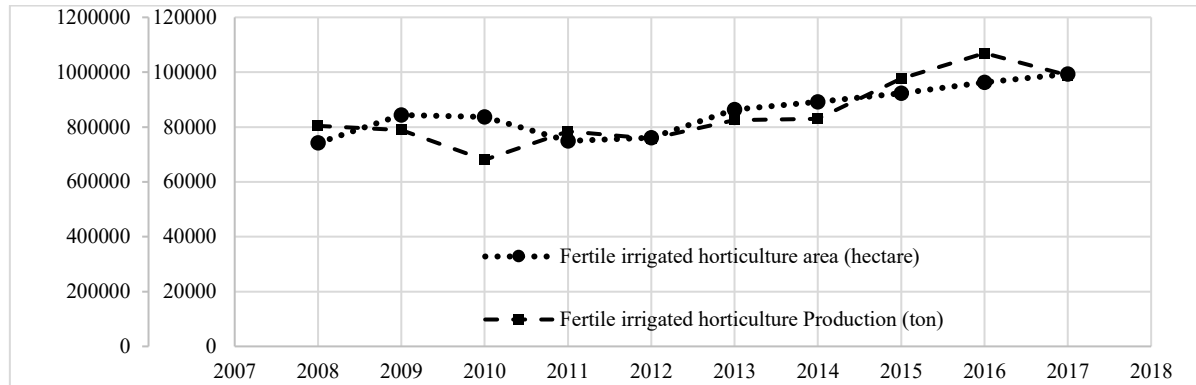


Fig. 1. Fertile and non-fertile irrigated horticulture area and production

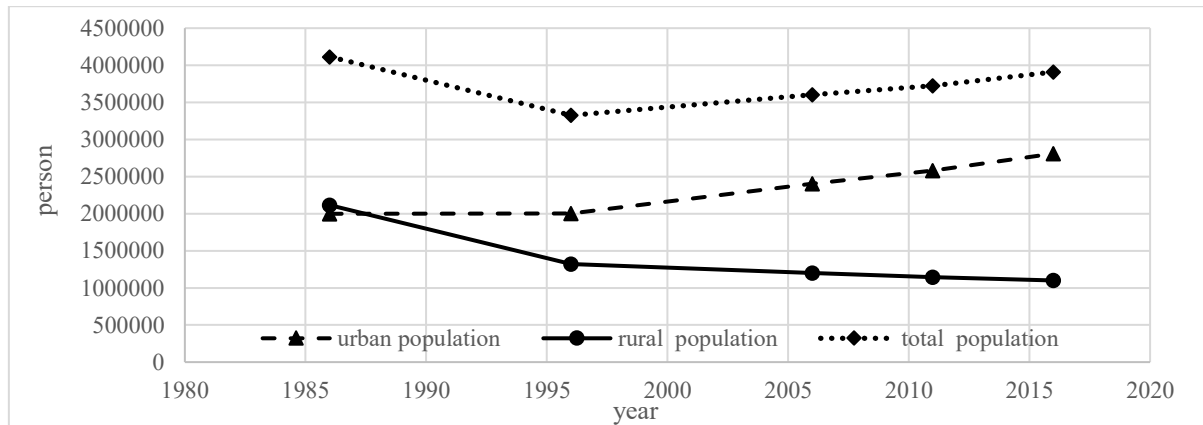


Fig. 2. Urban, rural and total population

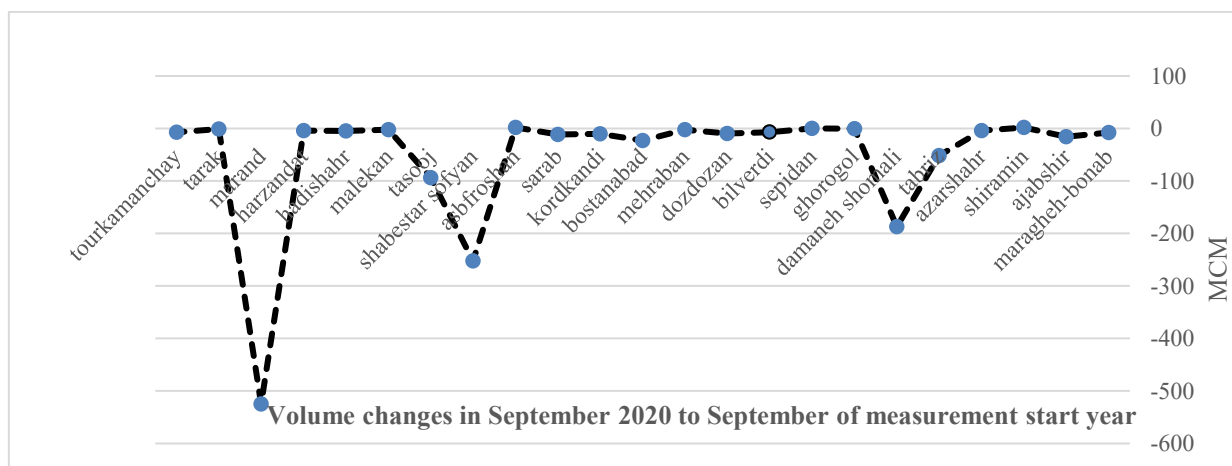


Fig. 3. Volume change of aquifers in September 2020 compared to September of measurement start year

At the contextual layer, the stakeholder's awareness of the nature of the problems requires their knowledge of the water system. Stakeholders' skills and experiences, enabling the environment (policy and legislative reform and regulation), and human resource

development can help stakeholders solve problems. Stakeholders play an important role in the success of water planning and management, so increasing the capacity of stakeholders will lead to the success of water programs and policies.

Stakeholder's capacity is related to their knowledge of water resources systems and their access to accurate and transparent information. Because of the power of governmental actors, their knowledge of water issues is of particular importance.

Institutions at the institutional layer can include policies, guidelines, regulations, and formal and informal rules. Providing water services is one of the basic needs of society, and requires public and private organizations the effectiveness of any organization depends on the laws governing it and the observance of those laws by the stakeholders, as well as the financial stability of these institutions; therefore, an effective and sustainable institutional framework for water governance must be provided.

At the communicational layer, norms are formed based on participation, trust, cooperation, communication, ethics, and culture, and form the basis of social capital. Norms are a tool for shaping patterns of good behavior in society, and society benefits from them in coordinating social interaction. Some norms come from religion, law, or government, and many important norms come from habits and traditions. In water governance, norms such as participation, trust, cooperation, responsibility, communication, ethics, and culture can help solve water problems. The relationship between the main actors and the activity space should facilitate the voluntary entry of other actors to learn and develop capacity, and the governance model should promote an integrated and long-term communication strategy, engage all stakeholders regularly, and present important water planning issues to water users. The degree of acceptance of decisions is increased through understanding social systems, traditions, institutions, and actors, and using a variety of effective forms of governance. In addition to creating factors such as confidence-building, empathy and dialogue, participation in decision-making, and empowerment of the local community and their participation, the use of consensus building and prioritization of consensus-based decisions on actions will be effective in implementation.

This study, according to the definitions provided for governance by UNDP, (1997);

ADB Institute, (2004); Miller and Ziegler, (2006); UNESCAP, (2009) and UNDP, (2013) by presenting a graphical representation of governance according to Figure 4 a fourth layer called the "performance layer" has been added to the Hofstra model to evaluate the efficiency and effectiveness of institutions presenting all water affairs, achieving goals, and implementing governance decisions in action (authority). In Iran, due to the main gap of "authority" in water governance (Iran Water Policy Research Institute, 2015), the performance layer is of great importance.

The term performance refers to the ability of a plan to be effective (to achieve the desired result), be efficient (to produce output for a minimum of inputs), and follow process criteria (performing appropriate activities and steps within the defined process to achieve the desired result). Measuring the performance and progress of water governance is a necessary step in pursuing the question of whether existing governance systems meet their intended objectives. Are the reforms effective in practice? Proper implementation of a governance system requires proper monitoring and performance control. Each performance appraisal system has two parts, structure and content. Performance appraisal in the structural sector is often done in terms of efficiency and effectiveness, and in the content sector, the concepts of good governance are used (Berk, 1986).

It should be noted that there is a dependency between the layers, ie the strengths of one layer can help to overcome the weaknesses of the other layer. For example, reforms in policies and regulations can strengthen the context layer, and the presence of communication layer components can strengthen the fourth layer, namely governance performance. A four-layer model of water governance is presented in Figure 5, in which each major layer and water content are identified according to OECD principles. According to the content of each layer and their definitions and concepts of the 12 principles of the OECD, principles 4, 5, and 12 are related to the contextual layer. Principles 6 and the part of principle 7 which deals with the legal vacuum and conflict of laws are related to the institutional layer. Principles 1, 3, and 10 are

related to the communication layer, and principles 2, 9, 11, and 8, and a large part of principle 7 which deals with the non-

implementation of rules, instructions, and rules, are related to the performance layer.

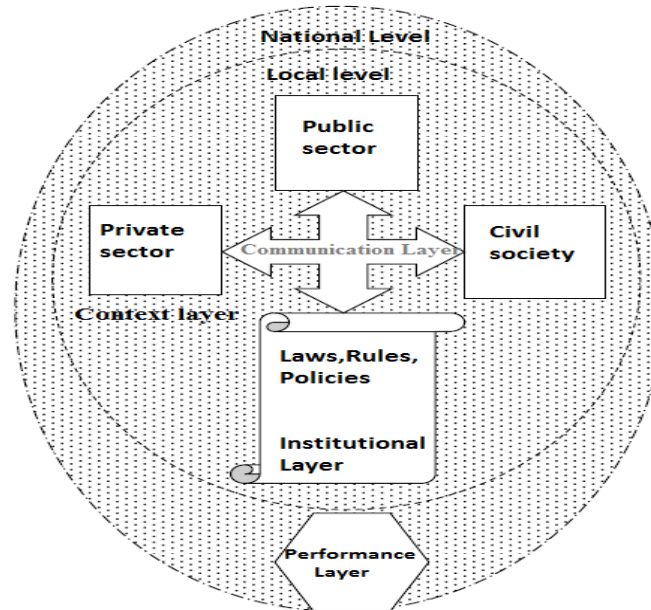


Fig. 4. A graphical representation of water governance

OCED Principles	Contextual layer	Question	OCED Principles	Institutional layer	Question
Principle 4 Principle 5 Principle 12	Knowledge and Information Experience and skills Policy reform	Q1 to Q5	Principle 7 Principle 6	Government, Private and Cooperative institutions Financing institutions Formal and Informal laws and rules	Q6 to Q10
OCED Principles Principle 1 Principle 3 Principle 10	Relational layer Communication Cooperation Participation Transparency Trust Coordination	Q11 to Q15	OCED Principles Principle 2 Principle 7 Principle 9 Principle 11 Principle 8	Performance layer Efficiency Effectiveness Human Right to Water Implement laws and policies Achieving goals Accountability	Q16 to Q21

Fig. 5. Four-layer model of water governance

2.3. OECD water governance principles

The OECD water governance principles were presented by the OECD Water Governance Initiative in June 2015. These principles include broad principles of good governance such as legitimacy, transparency, accountability, human rights, and comprehensiveness of laws and rules. These principles emphasize the notion that water governance systems must be tailored to the

challenges. The OECD Principles of Water Governance provide a framework for understanding whether water governance systems are operating efficiently or need to be adjusted if necessary. These principles can accelerate efforts to create more appropriate practices, learn from international experience, and create reform processes at all levels of government to facilitate change in place and time (Akhmouch and Correia, 2016).

These principles are interdependent and complementary. For example, the implementation of Principle 7 in the form of regulatory frameworks depends on the clear realization of the roles and responsibilities associated with their effective policy-making, implementation, and coordination (Principle 1). Also, weak institutional design (Principle 7) with ambiguous responsibilities (Principle 1) can undermine the accountability of policymakers and decision-makers responsible for enforcing laws (Principle 9) and lead to the absence of stakeholders in the decision-making process (Principle 10) or poor representation of subgroups (Principle 11). Eventually, trust in regulatory decisions will be challenged, causing several powerful groups or individuals to use their influence to usurp resources, formulate or implement policies, and create various forms of corruption.

Although local manifestations can be found for all of these principles, some of these principles are closely related to governance at the national level, such as Principle 11 (governance arrangements), Principle 12 (policy readjustments), and Principle 6 (due to budgeting and funding in Iran), as well as many parts of Principles 1, 2, 3 and 9, are covered by national scale governance. To see the 12 principles of the OECD and the ways to achieve them please refer to Akhmouch and Correia (2016).

2.4. Data collection and analysis method

This research has chosen the method of deductive qualitative content analysis to analyze the data and collected information.

Content analysis is a research method for subjective interpretation of texts that works through the process of regular classification of coded themes or patterns (Hsieh et al., 2005). To gather the necessary information according to the specified four-layer model, the structured interview questions related to each layer and the OCED principles related to them were designed according to Table 1. The references mentioned in this table have dealt with the content of the question in the discussion of governance assessment. To increase the validity of the research, the interview questions along with their guide were approved by several experts.

The number of participants in the interview program was knowledgeable and experienced persons in different sections according to Table 2. The selected sectors are all involved in some way with the issues and problems of water management and governance. Mason (2010), in a study of 560 dissertations using qualitative methods, found that a sample size of 15 to 50 participants is typically adequate. To increase the validity of the research, data were collected by two methods (Willis et al., 2007): a) interviews with stakeholders and b) study of library documents including 26 laws, 20 bylaws, 4 canons, and other published documents. Based on the data collected from the interviews with the stakeholders and the study of various documents, the anchor examples of weaknesses and strengths in each of the four main layers are identified. In the next section, using the 12 principles of the OECD framework, the collected data are analyzed according to the content analysis method.

Table 1. Interview questions about layers and sub layers

Contextual layer	Q2	Do water management and planning policies have adaptation mechanisms for drought and floods?	Huntjens t al. (2011)	Principle 2
	Q3	Are water policies focused on sustainable and integrated water management?	Mitchell (2005)	Principle 3
	Q5	Do the stakeholders involved in the water sector have knowledge and skills in integrated water system management and understand the pressures on the water system?	Stewart (2007); Neshkova and Guo (2012); Challies et al. (2017)	Principle 4
	Q4	Is there relevant, accurate, sufficient and up-to-date data or information on the water system or is it produced? Is it available or shared?	Pedregal t al. (2015)	Principle 5
	Q1	Are there clear and non-contradictory policies on water planning and management?	Bolognesi and Pflieger (2019); Bolognesi and Nahrath (2020)	Principle 9
Institutional layer	Q6	Are the roles and responsibilities of all institutions clearly defined and stable? Is there an overlap between the roles and responsibilities of institutions?	Bolognesi and Pflieger (2019); Bolognesi and Nahrath (2020)	Principle 1
	Q7	Are uniform procedures followed by institutions to prevent different positions /decisions?	Bolognesi and Pflieger (2019); Bolognesi and Nahrath (2020)	Principle 8
	Q9	Does the water sector have sufficient and reliable financial resources? Is there transparency in access to finance?	Saleth and Dinar (2005); Ostrom (2011)	Principle 6
	Q10	Are the rules and regulations accepted by the stakeholders (legitimacy)?	Lieberherr et al. (2012); Lieberherr (2016)	Principle 9
	Q8	Are there sufficient institutional tools to facilitate communication, coordination and integration of water interventions?	Saleth and Dinar (2005); Ostrom (2011)	Principle10
Relational layer	Q11	Is there relationship between water sector policies and policies of other sectors? How are the interests and conflicts between departments managed?	Jordan and Lenschow (2010); Trein and Maggetti (2020); Bolognesi and Nahrath (2020)	Principle 3
	Q14	Is transparent data and information on current and future water needs and issues of interest to the government and water users, shared?	Dawes and Helbig (2010)	Principle 5
	Q13	Are there the tools and facilities needed to establish communication channels between government and society? Is there appropriate inter-organizational collaboration between institutions?	Marchington and Vincent (2004)	Principle10
	Q12	Do all stakeholders participate in the planning and decision-making processes? Is the value of their involvement diminished by technical decision makers?	Neshkova and Guo (2012); Stewart (2007); Challies et al. (2017)	Principle10
	Q15	Is there trust between stakeholders?	Takacs and Baranyai, (2010)	Principle 11
Performance layer	Q16	Are the medium and long term goals of the water sector fulfilled?	Adam t al. (2018)	Principle 2
	Q20	Do tariffs and water prices match return on capital and costs? Are water sector revenues and costs completely transparent?	Saleth and Dinar (2005); Ostrom (2011)	Principle 6
	Q19	Is the knowledge available at universities and research centers practically applied in the water sector and in decision making?	Dawes and Helbig (2010)	Principle12 Principle 8
	Q18	Are the decisions actually being implemented? How is a violation followed?	Brynard and Stone (2004)	Principle 7
	Q17	Are water policies and strategies implemented in practice? How is a policy violation tracked?	Brynard and Stone (2004)	Principle 7
	Q21	How is it complied with the human rights of the present and future generations in the field of water in terms of quantity and quality?	Pejan (2004)	Principle 11

Table 2. List of interviewees

Sector	Organization Name	Number of interviewees
Public	Regional Water Authority of Eastern Azerbaijan	8
	Agricultural Jihad Organization of Eastern Azerbaijan	7
	Directorate General of Environment in the Eastern Azerbaijan	4
Private	Water and Wastewater Company of the Eastern Azerbaijan	3
	Directorate General of Industries and Mining in the Eastern Azerbaijan	2
Civil Society	Representatives of farmers	6
	Industries Owners	2

3. Results and Discussion

In the following, the results of governance analysis are discussed separately in each layer and 12 OECD principles in two qualitative and quantitative sections:

3.1. Qualitative analysis

Context layer of problems formation

Principle 4: According to this principle, the technical, financial, and institutional capacity and knowledge of responsible authorities and institutions should be increased in the face of the complexity of water challenges. While government agencies are unable to train their employees to accurately analyze water issues, and due to the gap between industry and academia, university graduates lack the capacity and efficiency to deal with real issues. Government agencies lack the knowledge to use integrated simulation models. Due to the wide scope of water management, various organizations are active in the water sector with a large number of employees, but their staff and their ability, especially in the use of interdisciplinary and multidisciplinary specialists, do not meet new needs and environmental changes. The attitude of government management has led people to believe that water problems should only be solved by the government. This understanding must be eroded by widespread and coherent information, and user participation in decision-making and implementation so that the issue of

water can be socialized. There are instances of legislation in which the legislature has paved the way for more water to be withdrawn from the prohibited plains. The complexity of water issues and their dynamics are not well understood in the legislative process.

Principle 5: According to this principle, the production of up-to-date, consistent, and water-related data and information is essential to strengthening the water sector; while there are many gaps in this regard. One of the important issues in this regard is the lack of a national water accounting method, which has also affected the region, in addition to this, no national and regional database is compatible with international water accounting frameworks. Applying these frameworks requires economic, social, and environmental data at the scale under study. Meanwhile, economic data in Iran are provided at the provincial level and environmental data are mainly based on the river basin and population data at the political and administrative scales. Therefore, for small-scale research, extracting the necessary data is very difficult and in the case of economic data is almost non-extractable.

In addition, water accounting requires various data in the agricultural sector, such as crop cultivation area, harvested water, and return water. The Agricultural Organization does not have accurate and up-to-date data in this regard, and the available data have either been obtained from statistical sampling methods or have been obtained by inaccurate census at intervals of several years. An interviewee from the Agricultural Organization said "Many of the statistics recorded in the villages in the water or agriculture sector are only asked and recorded by a few well-informed villagers". Of course, in recent years, the provincial agricultural organization, with the approved budget, has started to identify agricultural lands, which has not been completed yet. Upon completion of this project, it will be possible to collect some agricultural data more accurately.

Another important issue is the lack of sufficient information about the price of water delivered to different sectors of the economy. According to the legal materials, the Ministry

of Energy must at least have the set, ordered, and corrected prices. Meanwhile, the Water Economics Office of the Water Resources Management Company, which is responsible for preparing the economic price of water, faces many challenges in estimating these prices due to the lack of access to accurate data. Household water quality data and water quality delivered from water treatment plants and effluent quality from wastewater treatment plants are not available online and access to real data is not easy. One interviewee from the Water Authority said "If you want to access real water quality data, you have to spend a lot of time and effort".

Regarding the assessment of water resources, reports are prepared by consulting engineers that the method of estimating some important components of the aquifer balance, such as the return water of economic sectors and the infiltration and exchange of water between the river and the aquifer, is not scientific and reasoned. In general, data and information exchanged between organizations are not very reliable. Because organizations do not provide real data to better demonstrate their performance.

Principle 12: This principle emphasizes the regular assessment of water policy and governance to improve them. Policies are evaluated and amended by members of parliament. Unfortunately, some policies challenge sustainable development, such as the Fadak plan (granting national lands to university graduates in agriculture) and the plan of licensing of unlicensed wells, which have been pursued to short-term interests and their impact on parliamentary elections.

Institutional layer:

Principle 7: A large part of this principle emphasizes the existence of legal frameworks, while there are many cases of legal vacuum, the most important of which are:

Lack of law on land aggregation, a lack a law on water recycling in industries, and a lack of law on farmers' adherence to cultivation patterns. Despite the strong potential of local historical informal institutions and rules, which had led to the resolution of many water problems and issues by users, these informal rules have unfortunately been abandoned or

ignored in the new rules, and government management has prevailed; Existing laws are complex and sometimes contradictory, and a comprehensive water law has not been finalized, all of which has affected the region. For example, according to Article 45 (e) of the Law on Fair Water Distribution, "anyone who digs a well without complying with the law he must fill the well, and compensate the damage. Also, he is condemned to 10 - 50 lashes, and 15 days to three months of correctional imprisonment in the opinion of the ruler of Sharia". On the other hand, in the same law, the note under Article 3 allows the water organization to issue abstraction permits for unlicensed active wells. Surprisingly, the Law Ta'een Taklif on unlicensed active wells, approved in 2010, again allows unlicensed active wells that were drilled before 2006 to be licensed by the Water Authority by the conditions.

The legislature has an ambivalent behavior toward issues related to groundwater protection. On the one hand, it equips the licensed well with a water meter to measure the volume of abstracted water, and on the other hand, does not fill the identified unlicensed well for years and finally passes a law called Ta'een Taklif on unlicensed wells and by this law, the unlicensed wells were licensed. In this way, the owners of unlicensed wells abstract groundwater as much as they want during the years of illegal activity due to not installing water meters and finally get a permit. In this way, farmers are encouraged to dig unauthorized wells. The representative of the farmers says in this regard, "The owner of an unlicensed well easily abstracts as much water as he wants. Now, why should a licensed well comply? ". An interviewee from the Water Authority says: "The fact is that the installation of volumetric on licensed wells is not completely deterrent. The government should adjust its precautionary measures with the income data of the farmers, in proportion to their income, to prevent the looting of free groundwater".

Principle 6: According to this principle, sufficient financial resources should be available to the water sector and financial resources should be allocated efficiently, transparently, and promptly. While the price of

water services does not cover the costs, inevitably, a large part of the financial resources of water service companies are provided mainly from government sources. According to the Law on Targeted Subsidies, which was implemented in 2010, the price of energy carriers such as water was to gradually increase over five years and reach modified (real) prices. This work should have been implemented by 2015 and the prices should have been offered to the people in a non-subsidized and real way, which has not happened so far.

The OECD refers to penalties for persons, who pollute and damage water resources, to increase the income of water organizations to carry out their mission. In this regard, the Water Authority identifies the groundwater abstractions by smart and volumetric meters, and in case of water abstract more than the license issued, the well owner will be fined for damaging the aquifer, according to Article 45 of the Fair Water Distribution Law. The impact of this fine on illegal water abstraction control and especially its negative impact on participatory management is unknown.

The provincial environmental organization also fines polluters of water resources, but the amount of this fine is not very deterrent. There are many cases of unauthorized abstraction of groundwater by governmental and semi-governmental organizations and military centers for households and services that do not pay fees. In this regard, one of the interviewees from the Water Organization says: "Groundwater or surface water delivered to urban and rural water companies is not measured very accurately and abstracted water is more than the issued permit".

The Water Companies have not yet implemented the construction, operation, and transfer contracts, for the water transmission and treatment. In some areas, due to the strict control of the users, or the salinity of parts of the aquifer, the possibility of digging unlicensed wells is limited and farmers start to trade off the water with each other. This has provided the context for the prosperity of the water market, and the regional water organization can use this context to form a local water market.

Communication layer:

Principle 1: According to this principle, the roles and responsibilities of the stakeholders should be clearly defined and coordinated between them, and their roles and responsibilities should not overlap. While there are various signs of role overlap or non-compliance with the legal role. Such as some of the tasks assigned to the two the Jihad Agricultural Organization and the Water Organization regarding the distribution of water in irrigation networks. Members of parliament are the most powerful stakeholders at the local level. There is a lot of evidence that MPs interfere in executive affairs, especially in the appointment of managers and officials at the county level.

Said one of the interviewees "*There are many cases where the political representatives of the counties have opposed the implementation of the law on filling unlicensed wells*". Thus, not only is there no coordination between the stakeholders, but political representatives also intervene in technical and expert matters. In the construction of water structures and water transmission lines, there is a role interference between the three Jihad Agricultural Organizations (Jihad-e-Sazandegi), the Water and Wastewater Companies.

One of the interviewees from the Water Organization says about this "*Jihad-e-Sazandegi does not have the skills to build a dam as much as the water organization, so a large number of small dams have been built by Jihad in the province that has technical and operational problems*". According to Principle 1 of OECD, there should be coordination between departments and responsible authorities, but there are various signs of a lack of horizontal and vertical coordination.

A clear example of this is the lack of coordination between the four institutions of the Agricultural Organization, the University of Medical Sciences, the Standards Office, and the judiciary in controlling the quality of agricultural products, which leads to a decline in the quality of these products. Poor quality of agricultural products leads to their wastage and their sale at low prices, and eventually consumed water is wasted.

Said an interviewee from the industry sector, *"Agricultural waste is high in the province, and due to the lack of planning and control of the agricultural market, one of the two tomato or onion crops is lost every year in the province"*.

Principle 3: According to this principle, the policies of different economic sectors must be consistent and coordinated; While the policies in the sectors of employment, economy, and food security have been set without considering the principles of sustainable development and weaken the policies of the water sector for short-term benefits. An interviewee from the industry sector says in this regard, *"Gross per capita income, the share of employment, and water consumption in the agricultural sector of the province in 1393 are equal to 250 US dollars, 22%, and 88 %, respectively."*

In contrast to water consumption, the income of the agricultural sector is very low but the 22 percent share of agricultural employment is not small, and it is not possible to bring a large number of them into the industry as soon as possible." Some incorrect policies regarding the implementation of large-scale water supply projects such as Zarrinehrood and Aras to the metropolis of Tabriz have encouraged excessive use of water and migration to the city and neglected environmental requirements. The economic facilities and activities of Tabriz have intensified the migration to the center of the province so that 45% of the population of the province lives in Tabriz.

The Agricultural Jihad Organization, which is responsible for the development and supervision of agricultural affairs, is more focused on development and less on the agricultural supervision sector.

The same is true of the water organization; So that this organization is more focused on the development of water resources and infrastructure and the issue of water protection has been neglected. Since any performance of the Agricultural Jihad Organization somehow affects the water system, there needs to be more coordination between the two organizations. For example, to provide facilities for farmers, the Jihad Keshavarzi Organization introduces the owners of garden

houses and buildings related to the processing of agricultural products to the electricity affairs to give them household electricity, unaware that many of these farmers have unlicensed wells. Electricity sharing can facilitate unauthorized groundwater abstraction. However, according to the executive instructions of the Provincial Water Resources Protection Council, the electricity of farmers who have unlicensed wells must be cut off.

Principle 10: This principle emphasizes the promotion of informed and consequential participation of stakeholders in the design and implementation of water policy. The dominant top-down approach is the most important barrier to the involvement of stakeholders in policy design and the pre-decision planning process. In this approach, the relationship between the government and other stakeholders is such that it prevents the voluntary participation of NGOs in times of crisis to facilitate activities, enhance learning, and develop capacity.

Before 1963, local people were actively involved in the water sector under rural aid organizations. After the establishment of the Ministry of Water and Electricity in 1963, normative changes took place in the society and the presence of local people was reduced. The formation of surface and groundwater cooperatives as an alternative to rural aid organizations has not been effective in practice due to lack of funding and legal barriers, and lack of cooperation from the local community. To transfer the management and maintenance of irrigation and drainage networks to farmers, companies operating irrigation and drainage networks have been established; But in practice, farmers have no role in these companies, and, these companies operate like government service contractors.

Performance layer:

Principle 2: According to this principle, water management should have appropriate scales in the form of an integrated governance system based on the watershed. One of the biggest gaps in this regard is water governance in the form of administrative boundaries that do not coincide with the watershed boundary, and sometimes a watershed is cut by several provincial boundaries.

Also in line with this principle, planning should be appropriate to the long-term scale and strategic goals, while decision-makers are more interested in short-term development measures that have immediate economic impacts. Regional short-term development plans have led to unintended environmental problems whose long-term costs are significantly higher than their short-term benefits. A clear example of these plans is water transfer projects from Zarrinehroud and Aras catchments and low priority of demand management. Economic insecurity and high inflation rates have led to uncooperative attitudes and behaviors in water management, meaning that both users and decision-makers are interested in increasing short-term benefits.

Regional governmental organizations lack the knowledge to use integrated simulation models. Even the laws in water do not address the relationship between surface and groundwater resources, as well as the relationship between soil resources and water resources about the principles of sustainable use. Investment and growth of the agricultural sector have been done without considering the dynamic relations of the agricultural sector with the sectors of water, environment, and ecosystem. In this regard, the laws related to the transfer of national lands for agricultural development are noteworthy. All laws in this field before 2006, by ignoring the source of water supply in this regard, facilitated the conversion of these national lands into agriculture.

Principle 7: A large part of this principle emphasizes the implementation of legal and regulatory frameworks. Although there is legal material in the Fifth Development Plan for the production of good agricultural products, agricultural products are seldom tested and the quality of agricultural products is not tracked. In some cases, farmers use raw sewage or factory effluent for irrigation. Because treatment plants are designed for municipal wastewater, due to the unauthorized connection of rainwater and surface water to the sewerage networks, during heavy rains the inflow to the treatment plants increases, and a large part of the wastewater is diverted directly

to the rivers which are eventually used in agriculture.

The final sediment in the wastewater treatment plant lagoons is sold to farmers as fertilizer by water and wastewater companies. In general, there are good rules in the water sector, but the necessary sensitivity is not taken by the representatives and the monitoring department to the non-implementation of them, and there are no good solutions and mechanisms for their implementation. Instead of an action plan based on rules and regulations, there are cases where work is done according to the preferences of local water managers, such as not filling unlicensed wells due to pressure from political representatives and issuing permits to abstract water from the river contrary to the rules.

Principle 8: Based on this principle, the application of new and scientific methods of governance such as increasing social learning, lessons from failure experiences, and increasing efficiency is emphasized. Using practical learning and social learning will lead to fewer mistakes in the trial and error process and lower costs. In this way, blind trial and error will turn into knowledge-gaining trial and error, and eventually, process rationality will increase and decision-making error will decrease.

While in the area, lessons are not learned from the failed experiences of using water supply hardware methods, and instead of embracing the software approaches such as reducing demand and reducing water losses, failed methods are still a priority. Agricultural development continues despite lower irrigation efficiency, lower share in employment, and lower net income. Losses of treated water in urban water networks are high. Said an interviewee with the Water and Wastewater Company: *"Some cities' water supply networks are very old and need to be rebuilt to reduce water losses, but due to limited financial resources, the modernization of water networks is slow"*.

The fact is that the problem of modernization of water networks is not only related to the lack of financial resources.

The point is that although the two regional water companies and the Water and

wastewater Company are independent, both companies are affiliated with the Ministry of Energy and therefore help each other to cover up each weakness. Because the modernization of water networks is very costly. In some cases, the water and wastewater Company, in order not to reveal the water losses of the municipal water network, coordinates with the water organization so that raw water delivered is reported less. Managers of water and wastewater companies like to develop water and wastewater networks to satisfy political officials.

Local evidence suggests that some senior executives of the Water Authority work with the Water and Wastewater Company after their retirement as advisors to the CEO. This is to advance the affairs of the Water and Wastewater Company in connection with the water organization, but inwardly, it can be a kind of spread of administrative corruption. According to the decree of Urmia Lake Rehabilitation Headquarters, an 8% reduction of water consumption in the agricultural sector should be achieved every year and 40% over 5 years. Despite the development of modern irrigation, in practice, there is no significant reduction in water consumption.

An interviewee from the agricultural sector says about this: *"The problem is that after the implementation of the modern network, we have no control over the development of agricultural lands, and there is no control over the abstraction of groundwater from unlicensed wells. It is also not possible to implement a modern irrigation for owners of unlicensed wells."* In general, unlicensed water abstraction and excessive water consumption, and water losses in the area, are not sufficiently blamed by elites and stakeholders.

Principle 9: This principle seeks to create integrity and transparency in the set of institutions and governance systems, in a way that causes accountability and trust in decision-making and implementation. While there are various signs of a lack of accountability in governance and achieving goals. One of the obvious signs of non-accountability is the non-standardization of agricultural products, especially in the discussion of exports, which must also have the standard of the reference

country. In recent years, legal provisions have been adopted in this regard however, what is happening in the agricultural sector is the non-implementation and not mandatory of these standards and the use of low-quality pesticides and non-compliance with the Pre Harvest Interval period to earn more profit by farmers.

The same is true of standards in the water sector. Many national water standards have been developed to improve the activities of the water sector, but are unfortunately not used due to lack of oversight and are not mandatory. There are many cases of non-accountability regarding the failure to achieve the plan and goals. For example, 5-year development plans, which are comprehensive and macro-plans that cover all economic, political, social, and cultural issues, there are many cases where not only the goals of the current 5-year plan have not been achieved, but even the goals of the previous 5-year plan have not been achieved.

Many rules are not followed. Said an interviewee from the water sector "The deadline for enforcing the law is not clear, and it is not clear how that institution will be punished if the law is not obeyed". There is ambiguity and a lack of transparency in stating the facts and problems of water governance. For example, all government officials in their media interviews speak in such a way that it seems that there is no problem in the relevant department or that the existing problems have been imposed on them by other departments. Therefore, in the meetings, different sections accuse each other.

This promotes negative thinking in the dialogue between government agencies and makes it difficult to trust and reach collective agreements. Although oversight bodies can play an important role in accountability, internal and external oversight mainly tracks how budgets and financial resources are spent and does not hold organizations accountable for failing to perform defined tasks. Even in the financial sector, supervision is not very effective. Said an interviewee of Water and Wastewater Company *"If the audited organization does not cooperate with regulators to detect corruption, it is very difficult for regulators to detect corruption"*.

Principle 11: This principle refers to equality and justice and the empowerment of relations between different areas (urban and rural) and between different users. While in the region, the biggest obstacle to changing the current situation is the greater benefit of the current generation from the current situation with the loss of the rights of future generations. The rural farming community has the largest share of water consumption in the agricultural sector, while the income of the rural sector is very low due to the low prices of agricultural products to maintain food security. Therefore, to implement modern irrigation projects, rural sector empowerment programs are needed to increase their income. In the field of household water, with the merger of urban and rural water and wastewater companies in 2019, it is expected that the unfair distribution of household water and effluent treatment services will gradually decrease in the rural sector.

One of the important issues regarding equality and justice is the development of illegal abstractions of surface water upstream of rivers, which has caused the loss of water rights of downstream villages from surface water. Unfortunately, there is no supervision on this illegal abstraction of surface water by government officials. Development of agriculture upstream of rivers has reached a

point that has led to conflict between villagers and nomads in the summer areas.

3-2- Quantitative analysis

The coding process is based on the four-layer model of governance and the 12 principles of water governance of OECD. Based on the coverage of the governance layers and the 12 principles of water governance of OECD by the discovered codes, a quantitative assessment is presented according to Figure 6. Figure 6 shows the number of anchor examples of governance gaps in each governance layer and its connection with the OECD principles of water governance. However, the authors do not quite agree with this presentation because the width and depth of the gaps are not the same in different principles and layers, it should be noted, that a gap in one layer may be equivalent in importance and cost to several gaps in another layer and we do not claim to have identified all the anchor examples of governance gaps. But if we are satisfied with the collected data, it can be seen that the three principles 7, 9, and 2 have the most anchor examples of weakness and gap, respectively. Among the four layers of governance, the function layer has the most weaknesses and gaps.

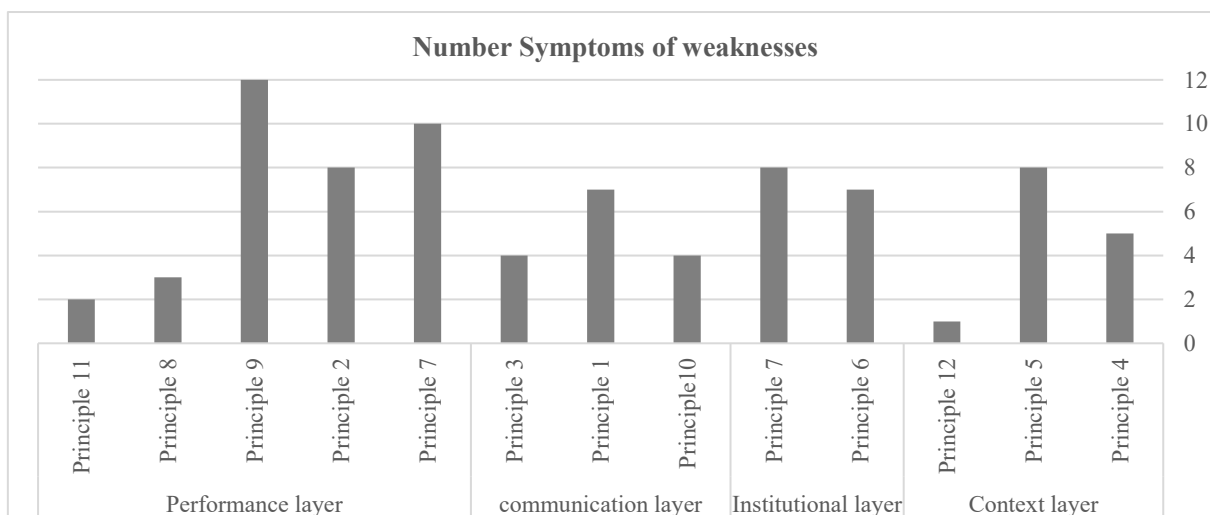


Fig. 6. The number of governance gaps in the 12 OECD governance principles of the four governance layers

4. Conclusion

In recent decades, new insights have emerged that many water-related problems are governance problems; therefore, assessing

water governance gaps and prioritizing how to move forward to close some of them, and identifying sufficient tools to achieve these goals can be beneficial to the area. This

manuscript focuses on the various sources of water governance gaps. From a practical point of view, filling these gaps is not a small task. We have concluded that there are major gaps in the implementation of laws, policies, and guidelines, and in particular access to macro goals, accountability and trust. These gaps are mainly related to the governance principles of 7, 9, and 2 of the OECD.

This result is consistent with similar research on a national scale, especially a study published by the Iran Water Policy Research Institute, which focuses on law enforcement and governance authority. According to the authors, the problem in the agricultural sector of the province is more complex than other sectors, so we do not know exactly who, when, where, to what extent, and from what source, abstract agricultural water.

Important obstacles to law and policy implementation include political instability and short-term management, the low administrative capacity of departments, policy conquest by political authorities, lack of role and participation of local stakeholders in the policy-making process, lack of understanding of policies at the local level due to the lack of information and training of local stakeholders (low of legitimacy), as well as the existence of contradictory laws and contradictory actions of the government at different times regarding unlicensed wells, which has led to a loss of trust to the legislator and the government. However, providing financial incentives to increase irrigation efficiency has led to limited support from farmers for these policies in the area.

Therefore, we emphasize the special role of regulatory bodies, which are known in the governing literature as the miso-institutional layer. We think that miso-institutions create a fundamental connection between the macro-level at which the rules for the formation of water activities are determined and the micro-level at which these rules are exploited and enforced. The OECD Principles on water governance can play a role in strengthening miso- institutions by targeting inconsistencies between institutional arrangements, incentives, and resources mobilized in water policies.

Strengthening the miso- institutional layer can help fill a part of the gaps. We think that

the OECD principles can not only be an effective audit tool and data collection tool to strengthen water governance, but we must seek to prepare the context for the implementation of these principles and link them to stakeholders for social learning. This assessment and awareness of the state of the area's water governance systems can strengthen the capacity of stakeholders to deal with current water crises in the area.

5. Disclosure Statement

No potential conflict of interest was reported by the authors.

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