Ukrainian Journal of Ecology

Ukrainian Journal of Ecology, 2018, 8(3), 315-321

ORIGINAL ARTICLE

A Conceptual model to explain and identify Rafsanjan Plain water governance: A grounded theory study

Z. Goudarzi[1], M. Chizari[1], H. Sadighi[1], A. Bagheri[2]

Agricultural Extension and Education Collogue of Agriculture, Tarbiat Modares University, Tehran, Iran
Water Resources College of Agriculture, Tarbiat Modares University, Tehran, Iran. E-mail: mchizari@modares.ac.ir
Received: 07.08.2018. Accepted: 27.08.2018

Water governance explores how water management policies and management practices are built. It requires processes that encourage people to participate in the design, planning, management, and implementation of water management activities and empower communities to change. To shift from the current groundwater management paradigm, a comprehensive focus on groundwater governance is required optimal utilization of aquifers and beyond in the catchment area requires management that, given the qualitative characteristics of groundwater reservoirs, can exploit them in terms of the development or application of operating restrictions before creating undesirable conditions, or critical determination and preventing irreparable damage. This report attempts to illustrate the relationship between the uncontrolled exploitation of aquifers and its consequences. In this regard, Rafsanjan plain has been selected as a case study of one of the critical forbidden plains of the country. A grounded theory study by using deep interviews was conducted with surviving farmers (n=51), governmental sector experts (n=21), and Private sector experts (n=10) in Kerman province (Rafsanjan's plain), Iran. Data were analyzed using constant comparison in open, axial, and selective coding stages. And developed a conceptual model through the grounded theory study to explain the relationships between the main categories extracted.
Keywords: Rafsanjan plain; groundwater governance; grounded theory study

Introduction

The major part of the world's water resources is groundwater. In the desert regions of Iran, these resources are very important. Iran with a mean rainfall of 250 mm, has a dry and semi-arid climate (Rafsanjan Water Resource Studies, 2007), meanwhile, the average reported annual rainfall in Kerman Province is about 110 mm. Thus, in desert regions and dry and semi-arid climates, life is completely dependent on groundwater resources (Fahmi, 2004; Soleimani & Mortazavi, 2007). One can say that proper management of groundwater in such areas can guarantee sustainable development (De Janvry & Sadoulet, 2005; Alley & Leake, 2004). Groundwater, as a common source, incorporates complexities and uncertainties due to the hydrogeological nature as well as operational, social, economic, and legal systems associated with it. In this regard, the management of groundwater is the art of changing attitudes, behavior, choices and social and economic systems (TTIWP, 2015).

Population growth is an important factor that negatively affects water quality. This factor is one of the most important factors of overpressure on water resources in arid areas (FAO, 2004).

The first consequence of population growth followed by mismanagement of resources is quality degradation of agricultural products as well as the loss of resources' quality and quantity (FAO, 2004; Giridhari & Thapa, 2004). Following the resources loss of quality, job opportunities deprive which itself, leads to poverty such that development cannot be maintained (Lefroy et al., 2000; Key, et al., 2000)

Many studies revealed that many problems do not primarily relate to resources, but to the failure of governance systems. The failure of resource governance has multiplied, affecting both developing and industrialized countries in many ways. In many developing countries, corruption and the lack of civilization, as well as the inefficient existing governance structure poses problems for any kind of development. Such cases, not only do not provide appropriate resource management, but also fail to meet the essential human needs of a large part of the population (Ostrom, 2005). Regarding governance, it is important to consider a high degree of interrelationship, dependence, and the nature of the government's reciprocal reinforcement. Groundwater governance should also be seen in close proximity to international and national policies, even regarding food and energy security (Varady et al., 2013).

Accordingly, in order to achieve the long-term sustainability of groundwater governance (and water management in general), each country should organize its water resources governance within its financial system, technology, and its organizational

and strategic capacity in using international resources. This demand needs a significant ingenuity at the level of government through the most appropriate conditions in particular fields (Wijnen, 2012).

In this study, we have tried to identify the current groundwater governance in Rafsanjan and prepare the existing paradigm model. At the next step, some better governance strategy is proposed for the study area.

Methods

Study area

Rafsanjan is located in Kerman Province in Iran (Figure 1). The three plains of Rafsanjan, Nouq, and Anar are located in the same area of the Center for Water Basis Studies classification named Rafsanjan study area. Average annual rainfall is low and no permanent rivers exist in Rafsanjan study area, so the water supply is groundwater. According to the latest data from the Rafsanjan plain, there are 1495 wells in operation, that annually discharge about 718 million cubic meters of water from the alluvial aquifer of this plain. Also, the number of Qanats reach 161, with a discharge rate of 25 million cubic meters per year. Rafsanjan is the first plain in Iran that has reported land subsidence due to groundwater drawdown (Kerman Regional Water Company, 2017). This area has been declared "forbidden" since 1975 (ad number 3254/94035/4001/250 dated 05/02/1975), due to over-extraction (Rafsanjan Water Resource Studies, 2007). The ban period has extended ever since because over-extraction has continued without compensation.

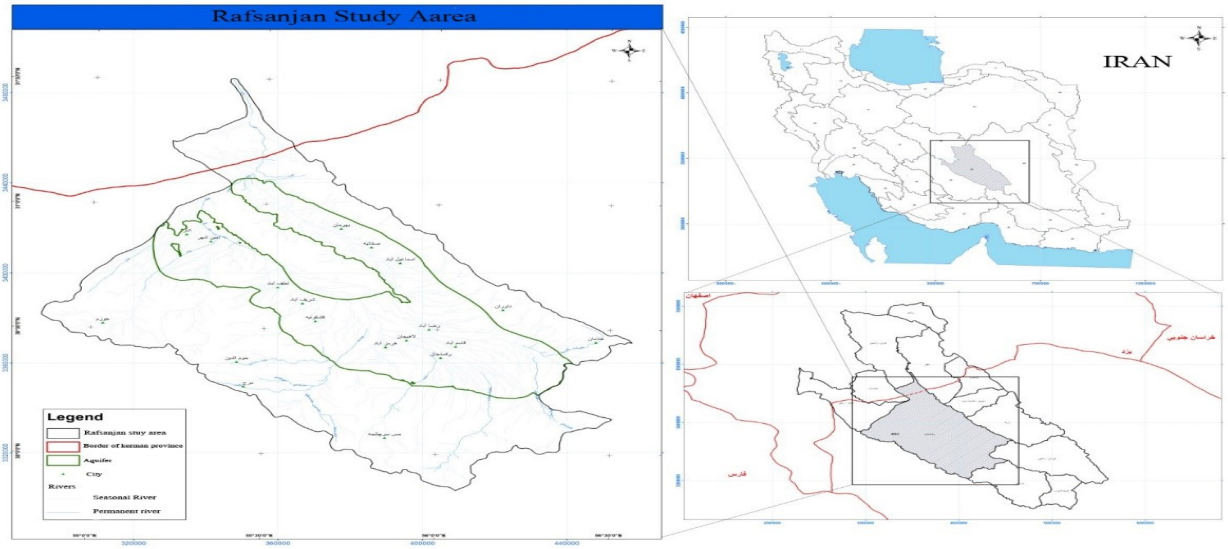

Figure 1. Rafsanjan study area.

The present study

Grounded theory study allows researchers to explore a phenomenon from a new perspective and thus, derive the conceptual and theoretical basis of the behavioral processes from the collected data (Corbin & Strauss, 1990).

Study participants and data collection

Our sampling was based on the Grounded Theory approach and proceeded in two steps (Corbin & Strauss, 1990). First, we implemented a purposeful sampling to provide maximum diversity in participant selection. We seek individuals that owned wells for pistachio garden irrigation and had faced intimate experience of groundwater crisis.

The study was accomplished by performing thorough interviews with relevant individuals such to help the research team develop concepts and clarify their properties and dimensions. Semi-structured interviewing was the main tool for data collection. by using deep interviews, data was conducted with surviving farmers (n=51), governmental sector experts (n=21), and Private sector experts (n=10) in Kerman province (Rafsanjan's plain), This strategy allowed participants share their sensitive personal experiences in a comfortable atmosphere and permitted interviewers flexibility to pursue interesting lines of inquiry before moving on to the next topic (Gill et al., 2008). Interview information was collected via both digital recording and field notes. Interviews started with general open-ended questions about the motives for attempting self-immolation. Examples of opening questions for stakeholders include:

- What is the most important impact on your economic life with regard to water scarcity?
- What are the main changes that have occurred in the system of conservation and exploitation of groundwater resources due to lack of water?
- What is the most important change in how much groundwater resources have been used up to now?

Ethical considerations

All participants provided informed verbal consent to participate. Participants were made aware that the conversations would be recorded, recognized that they could request to withdraw from the study at any time, and understood that they could request the taped interviews be deleted or destroyed.

Data analysis

All interviews were transcribed verbatim from the recordings. According to the Grounded Theory approach recommended by Corbin and Strauss (1990), continuous comparative analysis regarding simultaneous data gathering and data analysis was

performed in three phases: open coding, axial coding, and selective coding. During the open coding phase, research team members used a shared coding plan and in vivo coding was conducted line by line from the transcribed interviews. In this practice, words or short phrases used by interviewees that were deemed remarkable were recorded as codes. Weekly research team sessions debated the process of the interviews and extracted codes, providing the opportunity for management of analysis and selection of future directions. Codes were integrated and refined to develop concepts, categories, and sub-categories.

Active involvement from the full research team members in data analysis led to an initial consensus about interview guidelines and the emergence of main concepts and categories after eight sets of interviews. In the next phase, axial coding was implemented to discover relationships between categories and subcategories. As needed, categories were merged or removed, reducing the number of categories. Last, the selective coding phase was conducted via saturation of the concepts, categories, and subcategories in order to define and then link categories around the core category. This allowed us to refine the resulting theoretical structure into a conceptual model (Pandit, 1996). Conceptual modeling allowed the researchers to consider understudied phenomenon systematically (Corbin & Strauss, 1990). Throughout the data analysis process, the research team asked probing and directed questions and constantly compared the accumulating structure with the evidence that was accumulating. All phases were checked and re-checked several times, following grounded theory approach recommendations.

Results

Five main categories and 27 Subcategories were extracted from our data via grounded theory, enabling the development of the conceptual model illustrated in Figure 2. Weak groundwater governance was identified as the core category based on the participants' views of the study. five main categories were Lawlessness, illegality, legal transgressions; The weakness of the regulatory system and the government's inability to manage water resources; Crisis disillusionment and Public distrust; Social capital and partnership with popular groups and the private sector; and finally Mono-product economy and the need for industrialization. Below, we describe each of our findings.

Causal condition

The causal condition is conceptualized as a set of events and situations that influence emergence or development (Corbin & Strauss, 1990), the causal conditions are the factors that create and develop the phenomenon or the axial category. These conditions are a set of categories with their characteristics, which have the greatest impact on the formation of the axial category.

In other words, the causal conditions are events that affect situations, issues, and issues that are related to the phenomenon and affect it (Salsali et al., 2007).

The community studied, indicated the causal factors leading to weak groundwater resources management include: lack of a plan for conservation of water resources from the perspective of the executive, lack of consideration and stakeholder participation, the ineffectiveness of the government in allocating water, people's yeoman and distrust.

Many experts have argued that lacking an appropriate consumption culture is the main reason for poor groundwater governance. Establishing a water consumption culture requires a serious overhaul of all consumers in this field.

The behaviors and intentions of people on water saving depend on their attitude and their awareness of water issues.

Regarding participation, experts and custodians of the Energy and Agricultural Jihad ministries, acknowledge that it was necessary to turn partnership from a purely rational belief to a heartbeat. Historical experience shows the capacity of farmers on good governance of water, so farmers should not be underestimated. Should the capacity of the private sector used to create social capital and increase public participation in the management of water resources?

In addition, consumption is a behavioral phenomenon and because no behavioral phenomenon is independent of the culture of a community, therefore, for the success of water use management, people's awareness and attitudes need to be improved and upgraded.

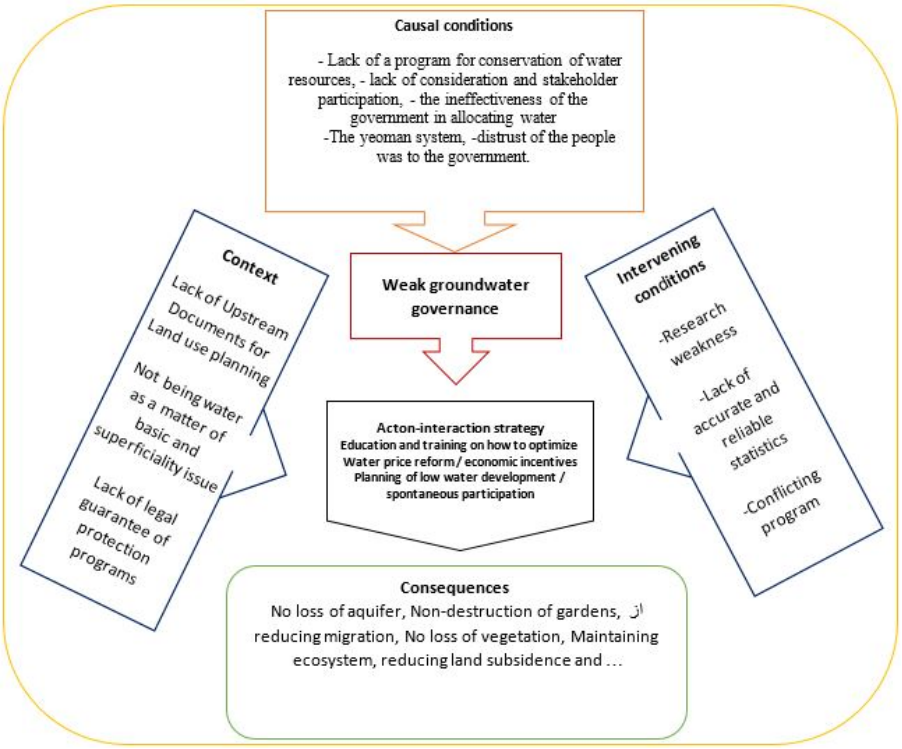

Figure 2. Conceptual model of Rafsanjan's plain weak water governance.

Context

According to the conceptual model, the context refers to a set of conditions in which a phenomenon or a problem is raised and people respond to it through the action-interaction strategy (Corbin & Strauss, 1990). A major aspect of the contextual condition for weak groundwater governance is lack of non-national well-documented rules and documents.

The Ministry of Energy, as the water counselor, has faced challenges due to the lack of a well-documented document on allocation, transfer, and use of water resources in the country level, mainly due to the lack of land-use planning and the need for complex coordination, It is time-consuming and sometimes interrupted by other devices, which can also be caused by the lack of a solid, consistent document.

The impacts of using and contaminating groundwater are often hidden and only become evident after decades or even hundreds of years (Moench, 2004, 2007; Wijnen et al., 2012).

In the context of non-observance of water as a matter of principle, one expert from the Ministry of Energy stated that:

"Improving the coherence between micro, intermediate and macro levels in water governance is a necessity, and it is necessary to design and apply appropriate mechanisms for this. The transfer of experience is lost in the state system, even between private and public sectors. It was also necessary to change the organizational culture in the government body because water management is an issue and experts as the driving engine should be able to express their opinions."

The past has shown that the lack of political will and serious determination in legislative and executive bodies has been a dominant disabling factor to achieve program goals.

The internal context represents conditions that are defined directly in the implementation process (at the operational level) within this framework. This framework itself is defined in terms of two interacting actors: the actuator responsible for policy implementation at the operational level, and the target actor who is, in fact, the target audience of the policy.

Several political actors play a role and can have different relationships and interactions. Different attitudes and different goals of politics may be relevant and various policy strategies can be used to implement politics. Similarly, with each responsibility, different financial, human, and intelligence resources may be available.

Although the Ministry of Energy plays a key role in the water sector and in particular, groundwater resources protection, the Ministry of Agriculture is another main actor who plays a central role in consumption. So the latter has been responsible for water management and supply. The current situation is getting worse. The ministries of Energy and Jihad-e-Agriculture sharply disagree on the issue of water resources management, as a result of their conflicting goals. This state of disagreement can ultimately lead to the loss of water resources. The contradictions lay not only in their organizational responsibilities and goals but also in their beliefs about each other. The Ministry of Energy also reciprocates the performance of Jihad-e-Agriculture against the disappointing water issue, due to the division of agriculture in the Jihad-e-Agriculture and its insistence on achieving its goals of increasing agricultural production and achieving food security regardless of water resources constraints.

The most striking legal shortcoming is the Fair Water Protection Law, in which it allows illegal good owners, whose wells were drilled before the law enforcement date, be granted exploitation license provided that two experts of the Ministry of Energy confirm that no general public losses occur. There is no exemption for cases that are placed in prohibited areas (defined in Article 4 of the same law). Naturally, the addition of such a clause in the law, regardless of the limits of its aquifers, suggests the morale of the legislature's lack of respect for the conservation of groundwater resources in favor of good owners.

In the issue of protecting groundwater resources and considering protection as a public policy, the actuators are those who are in the reach of a plain that is implementing this policy and that the actors of the audience are, in fact, exploiters of groundwater resources.

Intervening conditions

Intervening conditions either facilitate or constrain action-interaction strategies in the specific context (Corbin & Strauss, 1990). Interceptive conditions are broad and general conditions that act as facilitators or limiters of the phenomenon desired. This facilitates and accelerates the adoption of strategies, or renders them more difficult (Hastings et al., 2011). In this study, research limitations, the lack of accurate statistics, and the inconsistency of the state program as intervening conditions were raised.

Access to sources of information is an important dimension in this component. In order to implement the protection, in addition to knowing the groundwater level and its overall quality, it is necessary to know the number of withdrawals, consumption method, amounts and locations of contaminants, hydrogeological characteristics of the aquifers and availability of updated and reliable water balances.

There is almost not any such information available at present, or at least not transparent. For example, the ministry of Energy provides information on the amount of drainage from wells that are calculated from well discharge measurements multiplied by hours of good operation. According to one of the relevant authorities in the Ministry of Energy, the measurement of wells and their hours of operation are carried out by private contractors, which are carried out every few years. Obviously, the private sector being once and for all, in charge of supervision cannot meet the rational need for conservation and will leave almost enough escape routes to collect and record incorrect information. Large volumes of groundwater were lost during the prevailing of Fair Water Protection Law.

Action-interaction strategies

Action-interaction strategies are purposeful or deliberate acts which are taken to resolve a problem and which shape a phenomenon in some way (Corbin & Strauss, 1990). Of course, they are also referred to as processes (Martin & Henrry, 2012). In this study, some subcategories emerged as action-interaction strategies for going out of the current situation of the underground waters include: developing culture and training on optimal water consumption (domestic, industrial, agriculture), water price correction, water consumption management incentives, promote water-conserving technologies, planning for low-water development, self-generated participation of people in water management, compilation of water reforming processes, industry orienting rather than agriculture, and give more responsibility to local people in water resources management.

Information should be made transparent for decision making. Access to sources of information is one of the important dimensions of this component. In order to implement the protection, in addition to knowing the groundwater level and its overall quality, it is necessary to know the amount of harvest, the method of use, the amount and location of the contaminations, the hydrogeological characteristics of the aquifers and the availability of reliable and reliable balance sheets. There is barely any information available, or at least not transparent if any.

Consequences

Consequences are the outcome of an action–interaction strategies (Corbin & Strauss, 1990). They apply to all actors in the context. Findings from our research showed that there are several adverse consequences of the current groundwater governance in this region includes: No aquifer degradation, No garden destruction, reducing migration, no loss of vegetation, maintaining ecosystem, reducing land subsidence, increasing the number of authorized and unauthorized wells, reducing unemployment, preventing rising poverty, preventing plain drainage, Prevent desertification and increase regional security.

Some of the extracted categories represent the results of the implementation of groundwater resource management strategies, including the consequences of the abandonment of the aquifer, disappearance of gardens, decline of migration, disappearance of vegetation, loss of ecosystems, decline of land, no increase in the number authorized and unauthorized wells, reduced unemployment, preventing poverty, preventing diversion, preventing desertification, and enhancing regional security. Given the above strategies, local, national and international water should be distinguished from the water issue, as well as solutions based on the short, medium, and long-term. Management of this basin should be done with due regard to its specific social, economic and cultural characteristics, in order to increase levels of participation of people in water resources management and water use.

Discussion

The study applied Grounded Theory to explore different aspects of current groundwater governance in Rafsanjan's plain.

The results of this study emphasize the role of water resources as a limiting factor in land use planning. The addition of water resources consumption in Rafsanjan Plain is an example of the lack of attention to this factor, which has led to uneven development and waste of resources in the basin.

This affects people's lives directly. Therefore, in order to avoid the loss of water resources, sustainable development is inevitable.

Overexploitation in Rafsanjan is a complex socio-ecological problem and is the result of long-term misleading activities and behaviors of both governmental and non-governmental agents. Therefore, expecting for a panacea to change the current direction is not rational. The farmers, WAO, AO and PS as representatives of internal context have motivations, resources, and cognitions that are not supporting conservation. Farmers want more water to save their thirsty pistachio trees and they have networks for pursuing this motivation. They do not believe in honesty of governmental organizations like WAO and AO,

therefore refuse to take serious actions against overexploitation. The WAO and AO are not seriously pursuing water depletion since their resources are not supportive and they blame the farmers for water degradation. The PSs who has great influence in the decisions and actions have no serious intentions for water conservation since they are used to covering and postponing the problems by immediate and temporary fixes.

The most important lesson for the policymakers who care for water resource conservation is that, although management of water resources through infrastructural and non-infrastructural efforts can help balance the demand and supply sides, the context of conservation should also be revised in accordance with this aim. While the actors do not strongly believe in conservation, and their external context not only restricts but also enhances overexploitation, there would be no practical solution(s) to guarantee to sustain water resources in the long term.

Implications for practice and research

The results of this study and the conceptual model developed from those results offer a guide to design for water resource managers and policymakers, realizing scientifically how to find out the nature of current governance problems and how can solve it.

Conclusions

This manuscript presents a study based on Grounded Theory to explain groundwater governance in Rafsanjan plain. According to this study, continuing the current trend, the study area will be threatened in near future with a crisis of wide dimensions. Without sufficient legislation, without strong executive support, without education and awareness, without meeting the basic needs, the community will lose all its actions, utility and efficiency.

Also, due to lack of education and awareness of the people, lack of strong enforcement, inadequate regulation, etc. more water is stored unlimitedly through pumping from deep and will have adverse economic, social and environmental consequences. Rescuing the critical situation of water resources, especially the groundwater resources of the Rafsanjan Plain, today depends not only on efforts to increase the supply of water, but also to change the behavior of consumers. This will not be achieved unless the role of local communities in water management is recognized. On the other hand, in order to change the attitude of the water governance system, we need to change the attitudes of local communities towards long-term collective interests against short-term personal interests. Hence, the formation and empowerment of local communities are one of the most important steps that must be taken to get out of the critical state of water resources.

The water governance system does not provide a satisfactory condition for the development of the process of assessing the water system of the country in order to support the conservation of groundwater resources in a sustainable manner. Because the assessment shows that the water governance not only suffers from an unfavorable scope but also inherits serious weaknesses in terms of coherence.

However, it should be kept in mind that this article has focused on the issue of the current groundwater resources governance and, naturally, the results of this study for other purposes, such as urban water supply, water quality management, surface water conservation, border management. Etc. cannot be fully responsive. It should be noted that the systematic analysis of the causes and factors of many of the challenges mentioned in the results section naturally requires a separate research.

References

Alley, W. M., & Leake, S. A. (2004). The journey from safe yield to sustainability. Groundwater, 42(1), 12-16.

Corbin, J. M., & Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. Qualitative sociology, 13(1), 3-21.

De Janvry, A., & Sadoulet, E. (2006). Progress in the modeling of rural households' behavior under market failures. In Poverty, inequality and development (pp. 155-181). Springer, Boston, MA.

Fahmi, A. (2004). The solution of Terzagi deferential equation under cyclic loading and compare with laboratory tests results. M.S. Thesis, Department of Civil Engineering, Kerman University, Kerman, Iran. (In Persian)

FAO. (2004). Carbon sequestration in dryland soils word soils resources reports 102. NRCS, Rome.

Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: interviews and focus groups. British dental journal, 204(6), 291.

Paudel, G. S., & Thapa, G. B. (2004). Impact of social, institutional and ecological factors on land management practices in mountain watersheds of Nepal. Applied geography, 24(1), 35-55.

Hastings, L. J., Barrett, L. A., Barbuto Jr, J. E., & Bell, L. C. (2011). Developing a Paradigm Model of Youth Leadership Development and Community Engagement: A Grounded Theory. Journal of Agricultural Education, 52(1), 19-29.

Kerman Regional Water Company. (2017). Report ban extended study area Rafsanjan, in Persian.

Key, N., Sadoulet, E., and De Janvry, A. (2000). Transactions costs and agricultural household supply response. American J. of Agricultural Economics, 82, 245-259.

Lefroy, R. D. B., Bechstedt, H. D., and Rais, M. (2000). Indicators for sustainable land management based on farmers surveys in Vietnam, Indonesia and Thailand agriculture. Ecosystem and Environment, 81, 137-146.

Martin, M. J., and Henry, A. (2012). Building rural communities through school-based agriculture program. Journal of agriculture education, 53(2), 110-123.

Ostrom, E., (2005). Understanding Institutional Diversity. Princeton University Press.

Pandit, N. R. (1996). The creation of theory: a recent application of the grounded theory method. Qual Rep 1996; 2(4):1-14.

Rafsanjan Water Resource Studies. (2007). Report of Rafsanjan plain study (water year 85-86), Regional Water Stock Co., Kerman. (In Persian)
Salsali, M., Fakhremohamadi, A., and Cheraghi, M. (2008). Grounded Theory Research in Medical Sciences (philosophy and principles applicable). Tehran: First edition, 96-99. (In Persian)
Soleimani, K., and Mortazavi, M. (2007). Investigation of the land subsidence and its consequences of large groundwater withdrawal in Rafsanjan, Iran. Pakistan Journal of Biological Science, 11(2), 265-269.
Moench, M. (2004) Groundwater: the challenge of monitoring and management. In: Gleick P (ed) The world's water; the Biennial report on the world's water resources 2004-05. Island Press, Washington.
Moench, M. (2007). When the well runs dry but livelihood continues: adaptive responses to groundwater depletion and strategies for mitigating the associated impacts. In: Giodarno M, Villholth K (eds) Agricultural groundwater revolution opportunities and threats to development. CABI International, Colombo.
Wijnen, M., Augeard, B., Hiller, B., Ward, C., & Huntjens, P. (2012). Managing the invisible: Understanding and improving groundwater governance.
Varady, R. G., Scott, C. A., Wilder, M., Morehouse, B., Pablos, N. P., & Garfin, G. M. (2013). Transboundary adaptive management to reduce climate-change vulnerability in the western US–Mexico border region. Environmental Science & Policy, 26, 102-112.
Think tank's water policy (2015) Preliminary assessment of Iranian water governance. Second Edition. Available in iwpri.ir/home/download?id=493

Citation: Zahra, G., Mohamad, C., Hassan, S., Ali, B. (2018). A Conceptual model to explain and identify Rafsanjan Plain water governance: A grounded theory study. Ukrainian Journal of Ecology, 8(3), 315-321.