



Role of Rural Organizations in Water Resources Management: A Case Study in Pistachio Producing Areas in Kerman Province, Iran

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ABSTRACT

Inappropriate water governance, which has been known as a variable to explain the water crisis in many parts of the world, needs to examine the institutional structures and required reforms. In the present study, the effectiveness and possibility of applying of five rural local organizations, as intermediate organizations for water resources protection in Anar and Rafsanjan areas, Kerman province, Iran, were investigated. These organizations are included as; village councils, Basij (non-governmental branch of Iranians military forces), agricultural production cooperatives, mosque board of trustees, and agricultural well curator. Here, in this research, we applied a survey method, and the research tool was two types of questionnaires which must be completed by farmers and organization managers. As the first step, the validity and reliability of questionnaires were determined. For first purpose, i.e., the determination of validity, the questionnaires were sent to a numbers of researchers, farmers, and organizations' managers, and their received opinions were considered. For the second purpose, i.e., the determination of reliability of the questions, the Cronbach's alpha was calculated, which was about 0.83 (in a good and acceptable level). A sample of 1099 pistachio producers was selected. To measure the effects of socio-economic factors on rural local organizations efficiency, multivariate regression and the analysis of variances (ANOVA) were also applied. The final results indicated that none of these five organizations, solely, can be considered as an intermediate organization for water protection. Therefore, a formal or informal combination of the mentioned organizations might be enough efficient to improve the water resources protection factors.

Introduction

Despite the past, when the water crisis was being attributed to drought, it is now more closely linked to water governance. In fact, the variable of inappropriate water governance today is more likely to be useful to explain the factors of water crisis in different parts of the world. Although the term water governance is applied for various cases in different disciplines, its common application involves the establishment and administration of various

institutions in the field of water to improve its usages. The main roles of these institutions are to explain the social activities, to evaluate the roles of different individuals and groups, and to determine the way they can interact with each other in this field (Fischhendler, 2008). According to Menared and Maria Salth (2011), there is a general consensus in the literature and policy centers which indicates that water crisis is necessarily linked to governance. The importance of

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the consensus can be seen in all water sectors, especially in one of its most essential subsectors, i.e., irrigation in agriculture. As the poor water governance leads to high environmental, social, and economic costs, it is necessary to consider the current governance conditions and alternatives. They have also shown that a single and worldwide governance arrangement for all regions of the world may not be achieved, and meanwhile, the success of the implementation, and oversight of a particular organization in this discipline depend mainly on the institutional conditions that govern the society. Therefore, they believe that each region, depending on the economic, social, and institutional conditions, may design its own governance and control systems for the control and protection of water resources, and/or may modify the existing institutional and governance systems. In this regard, Theesfeld (2010) also argues that understanding the groundwater governance arguments should be considered as a prerequisite for policy advice. Meanwhile, Maria Salth and Dinar (2005) emphasize that water institutions are structurally and spatially subjective, dependent, hierarchical, and nested, and are also embedded within the cultural, social, economic, and political contexts. Therefore, importantly the experiences of one region cannot be extended to other regions, and in other words, it is necessary to examine the required institutional structures and reforms for each region, separately to establish the water resources management policies.

Ahmad (2000) also argued that the characteristics of common-pool resources, low excludability and the extent of ownerships cause some problems in water resources management, and therefore, it is important to pay attention to institutional arrangements.

Considering water shortage for the pistachio cultivation in Anar and Rafsanjan areas, Kerman province, Iran, the institutional water reform is strongly needed.

Results of a study by Abdolahi -Ezzatabadi *et al.* (2014) showed that due to the lack of proper

organizational structure and temporal management knowledge of water usage has not increased water productivity. They also showed that, the application of modern irrigation systems, instead of rising water productivity, expands the cultivation area and therefore puts more pressure on water resources. Therefore, it should be noted that the establishment of the organizations structures for monitoring the groundwater recharge in these two areas are necessary to make all tools and policies useful for producing and controlling water resources. One of the methods for organizational structures reforms is to identify the forms of intermediate institutes between government and farmers, which has been investigated in current research.

Also, another research of Abdolahi-Ezzatabadi *et al.* (2015) showed that the non-governmental organizations can play an important role in the conservation of water resources. However, if the necessary precautions are not imposed, these organizations will experience the presence of greedy and melancholy individuals, which leads to the opposite result. In other words, because the associations of water users established inaccurately, their members would be the people who have done the most to deplete water resources so far. Therefore, these organizations not only discourage us for conservation of water resources, but also lead to further destruction of these resources (Abdolahi-Ezzatabadi *et al.* (2015)). Care must therefore, be taken for establishment of such non-governmental organizations. More attention must be paid for those organizations in the smaller societies such as the villages. Results of the study by Hashemi *et al.* (2020a) indicated that, growers who had more pessimistic perceptions of the groundwater resources in Rafsanjan were more likely to increase groundwater extraction; however, these growers were also more likely to seek external employment (income diversification). The final path models suggest attitudes toward groundwater conservation were the most important determinants of pumping behavior,

while perceptions of the state of the groundwater were the most important determinants of income diversification. Whether Iranian policies to increase awareness of falling water tables could succeed in securing water conservation would depend on the 'balance' of these two forces, an increase in pumping with increased pessimism or a potential decrease in pumping through income diversification. Results of the study by Hashemi et al. (2020b) showed that, while showing heterogeneous views, the majority of pistachio growers 'perceptions and subjective norms on the livelihood, Stressor, and Response components strongly favor the human element (short-term pistachio production) over the water element (groundwater conservation for future use). Furthermore, the study showed that knowledge of pistachio growers about the groundwater system is an additional factor that influences their decisions to increase groundwater use. In the present research, the main goal was to investigate the role of the different rural NGOs in improving the communication between the government and farmers for the conservation of water resources.

Research Methodology

This research has been relied on a survey method where the research tool was two kinds of questionnaires which must be completed by the farmers and organization managers. Before the questionnaires were sent to the applicants, they were validated, and their reliability had been checked. For these initial purposes, we sent the questionnaires to a number of the researchers, farmers, and organizations' managers and received their opinions to confirm the validity, where the reliability of research questions was confirmed by the Cronbach's alpha. The calculated results showed that the found alpha was 0.83 which is in an accepted range. All active local rural associations were identified in the region. For our research's goal, five broad and effective

organizations of village councils were chosen. These included; Basij (non-governmental branch of Iranians military forces), agricultural production cooperative, mosque board of trustees and agricultural well curator. For the next step, all villages in research areas were recognized and labeled. Amongst the villages, there were only 24 ones in which all five organizations were active. And then, the potentials of five rural NGOs to contact government and farmers were determined in the chosen villages by the research questionnaires. And the farmers and NGOs' managers were also interviewed. The period of the research was during 2016 to 2019 farming years. In the first questionnaire, all main characteristics of the organization, including the number of members, decision making, physical facilities, organization's knowledge, ability, and willingness to conserve water resources were asked and analyzed. The second questionnaire was completed by the invited farmers to the organizations. A total of 1099 farmers were interviewed. The arrival times to the meeting for each farmer participant and also their appearance were considered as an assessment factor for NGOs' ability for deep and influenced communication between two sides, i.e., the farmers and the government.

Multivariate regression and analysis of variance (ANOVA) statistics were then applied to compute and compare these indices for different organizations. The participants' satisfaction of the organizations functioning water resources protection were also considered during the study by a five-point Likert-type spectrum. Data analysis was done using SPSS 22 Software.

Results

Table 1 shows the number of villages with the organizations active. These organizations are; Basij, agricultural production cooperative, mosque board of trustees, and agricultural well curator.

Table 1. Activity level of the organizations under study

The name of the organization	Number of villages in Anar where the organization is active	Number of villages in Rafsanjan where the organization is active
Village council	21	145
Basij	7	50
agricultural production cooperative	7	17
mosque board of trustees	21	145
agricultural well curator	21	145

Source: research results

As Table 1 shows, village council, mosque board of trustees, and agricultural well curator are active in all the villages, while Basij is active just in 33% and 34% of the villages in Anar and Rafsanjan areas, respectively. It also shows that, the agricultural production cooperative organizations were well established in 33% and 12% of the villages in Anar and Rafsanjan, respectively, which is the lowest presence compared to the others. The total number of

the villages with active agricultural production cooperatives in two areas was 24, which were considered for the study sample. Table 1 also describes that, Basij, and agricultural production cooperatives had less priority than the others in terms of distribution in the rural areas.

In Table 2, the variables affecting water resource management in the five organizations were compared.

Table 2. Comparison of the mean of variables representing ability of studied organizations in water resources management

Variable name	village council	Basij	agricultural production cooperative	mosque board of trustees	agricultural well curator	Significance level of F statistic
Average number of farmers who responded positively to the invitation and participated in the interview	10.65	8.05	6.55	17.39	11.23	0.000
Total orchards owned by participating farmers in each interview session (ha)	52.77	34.52	33.34	48.40	45.94	0.705
Farmers' orchard per capita responded to organization invitation (ha)	4.79	4.03	5.20	2.46	5.14	0.53
The levels of familiarity of the members of the board of organization with the state agricultural departments (1 to 5)	3.00	2.12	3.47	2.57	3.25	0.000
Suitable place for gathering farmers (%)	91.00	94.00	76.00	100.00	50.00	0.000
Having audiovisual equipments (%)	35.00	78.00	18.00	33.00	12.00	0.000
Willingness to participate in water resources conservation plan (%)	100.00	100.00	88.00	100.00	87.00	0.107
Number of people nominated by the head of organization for water conservation	7.86	5.41	5.82	1.44	2.50	0.000
Active presence of the head of organization in interview sessions (%)	61.00	79.00	78.00	41.00	81.00	.030

Source: research results

Table 2 explains that, the average number of farmers responded positively to the invitation and participated in the interview was significantly different among the five organizations. As a result, the ranking of the organizations based on their success to contact the participants is; the mosque board of trustees, the curator of agricultural wells, the

village council, Basij, and agricultural production cooperatives. Table 2 also shows the total number and per capita of orchards owned by present farmers at the meeting. As it is shown, there is no significant difference between the five organizations for these two variables. In other words, the composition of the participants in the five meetings did not differ

significantly in terms of ownership of the pistachio orchard. But table 2 indicates that amongst the five organizations understudied, there is a significant difference between the levels of members' familiarity of the board of an organization with the state agricultural departments. In details, the directors of agricultural cooperative and agricultural well curators are most familiar with state related agricultural departments, and the village councils and mosque board of trustees, and Basij are in next positions, respectively. Meanwhile it was shown that, all mosque board of trustees have a suitable place for gathering and more than 90% of villages' councils, and Basij are well-positioned in this regard. Agricultural cooperatives are in third place, and agricultural well curators are not in a suitable position. Basij is well-positioned in terms of having audio-visual equipment compared to others.

Village councils, Basij, and mosque board of trustees have declared their willingness to cooperate with the government to protect water resources, while

88% of agricultural cooperatives and 87% of agricultural well curators have done so. However, the F statistic indicates that there is no significant difference between five understudied organizations. As another result, it can be found a significant difference for the number of people nominated by the head of organization for water conservation versus five groups. In more accurate manner, the village councils' officials had the highest priority followed by Basij, agricultural cooperatives, mosque board of trustees, and agricultural well curators, respectively. About 80% of the directors of agricultural cooperatives, Basij, and agricultural well curators were attending and chairing the interview and meeting, they had personally managed the farmers' invitation, while the village council's and mosque board of trustees' directors have shown less willingness to do so.

Table 3 lists the factors which affect the mean of the number of farmers participated in the interviews.

Table 3. Regression of the factors affecting the average number of farmers attending the interview

Variable name	Estimated coefficient	Statistical value t	Significance level t
Constant	-11.96	-3.31	0.001
Age of head of organization (year)	0.22	4.71	0.000
Level of agricultural knowledge of board members (1 to 5)	1.68	2.07	0.041
Suitable place for gathering farmers (yes = 1, no = 0)	3.50	2.29	0.024
Having audiovisual equipments(yes = 1, no = 0)	2.27	1.80	0.075
Village population	0.001	3.97	0.000
R ²		0.39	
adj R ²		0.35	
F		10.91	
sigF		0.000	

Source: research results

As Table 3 shows, one of the factors which affects the number of contributors in the meeting is the age of the invitee; The higher the director's age, the broader participants. In a similar manner, higher level of agricultural knowledge of the directors' board has positively affected on the number of farmers in the

interviews. Besides, the organizations equipped by suitable gathering place and visual aids have shown a more exceptional ability to attract audiences.

In Table 4, the leading groundwater degradation causes from the farmers' viewpoints are presented.

Table 4. Comparison of farmers' viewpoints in interviews of different organizations on the main causes of water resource degradation

Variable name	The mean of the total sample studied	village councils	Basij	agricultural cooperatives	the mosque board of trustees	agricultural well curators	Significance level of F statistic
Government's over-licensing of aquifers (%)	27	39	30	38	16	23	0.000
Government due to lack of control of water extraction from permitted wells (%)	36	32	33	16	49	30	0.000
Unpermitted wells (%)	14	12	16	23	12	13	0.050
People due to non-compliance with law and legal harvest (%)	17	22	17	15	16	9	0.020
Government due to injustice in licensing of wells (%)	7	6	13	9	3	9	0.000
Drought (%)	26	19	26	14	27	42	0.000
The blame is the farmer himself (0 to 5)	1.48	1.75	1.61	1.76	1.26	1.29	0.000

Source: research results

According to Table 4, the most crucial culprit for the degradation of groundwater resources is the government's failure to control extraction from permitted wells, and the second destructive factor is the government's over-licensing of aquifers. More importantly, the consequent drought is positioned as third in this key ranking. The next critical cause for the degradation of groundwater resources are the lack

of compliance with legal permits, the presence of illegal wells, and the government's failure to issue injustice licenses for wells, respectively. And finally, the average farmer's viewpoints suggest that the farmers' fault regarding to this disaster is too little.

In Table 5, the farmers' expectation from the government for reduction the effects of water resources degradation are presented`.

Table 5. Comparison of farmers' views on the expectation of the government to reduce the effects of degradation of water resources

Variable name (Unit of all variables is percent)	The mean of the total sample studied	village councils	Basij	agricultural cooperatives	the mosque board of trustees	agricultural well curators	Significance level of F statistic
Harvesting control of permitted wells	19	20	22	22	16	15	0.280
Sealing unpermitted wells	24	19	46	49	29	48	0.000
Observing justice in licensed wells	16	15	19	18	7	28	0.000
Facilitating well relocation, digging gallery, well fracturing, water transfer between two wells, and land ownership transfer.	10	10	11	20	5	10	0.000
Giving loan for intubation of waterway, pool	13	12	14	15	7	21	0.002

Table 5. Continued.

and wells costs							
Giving loan for operating a pressurized irrigation system	19	22	19	21	15	19	0.260
Giving loan for the implementation of the low-pressure subsurface irrigation system	17	19	25	28	2	23	0.000
Making dam and watershed	8	6	7	8	8	7	0.900
Giving loan for water desalination	4	5	7	8	0.3	6	0.001
Inter-basin water transmission	39	38	44	45	34	36	0.170

Source: research results

The results of Table 5 show that the farmers' highly expectation from the government in water resources issue is the inter-basin transmission. There was no significant difference between the farmers participating in five organizations, while the second demand is sealing the unpermitted wells. As it can be seen, there is a significant difference between the organizations understudied. Besides, the harvesting control of permitted wells, and the facilities helping operate a pressurized irrigation system are next. Regarding to the later expectations, there is no significant difference between the organizations understudied.

The fourth priority for farmers is to give loans for the implementation of the low-pressure subsurface

irrigation system. The next priorities are to ensure justice in licensed wells, and to give loans from the government for intubation of waterway, pool and wells costs. The next priority is the facilitating well relocation, digging galleries, well fracturing, water transfer between two wells, and land ownership transfer. Making the dam and watershed is in the eighth priority of the farmers' expectations from the government. And finally, the last demand of the farmers from the government is to give loans for water desalination to improve water resources in the region.

In Table 6, the farmers' attitudes on the organizations' efficiency in water resources conservation at different meetings are compared.

Table 6. Comparison of farmers' Attitudes at different organizations meeting on the efficiency of organizations in water resources conservation.

Variable name(Unit of all variables is percent)	The mean of the total sample studied	village councils	Basij	agricultural cooperatives	the mosque board of trustees	agricultural well curators	Significance level of F statistic
Agree on nongovernmental organizations to protect water resources	91	91	92	94	90	91	0.740
Agree on village council to protect water resources	37	50	32	26	33	38	0.000
Agree on Basij to protect water resources	15	11	34	7	14	10	0.000
Agree on agricultural cooperatives to protect water resources	21	13	19	32	22	24	0.001
Agree on the mosque board of trustees to protect water resources	13	8	12	6	20	8	0.000
Agree on agricultural well curators to protect water resources	33	19	30	37	35	47	0.000

Source: research results

According to Table 6, more than 90% of the farmer participants in the interviews have assessed the NGOs as useful for protecting water resources. Overall, none of five organizations has been able to attract more than 50% of respondents. In other words, none of the five organizations alone can represent the entire population understudy for water conservation. More precisely, the village council is more popular, and the agricultural well curator is in the second position. The agricultural cooperatives, Basij, and mosque board of trustees are next positions. The results also indicate that the farmers at each organization's meetings generally consider that the organization is top priority but would not consider that is sufficient to conserve water resources per se.

Discussion

In this study, the roles of five organizations, including village councils, Basij, agricultural cooperatives, mosque board of trustees, and agricultural well curators were investigated in the conservation of water resources in Anar and Rafsanjan areas, Kerman province, Iran. Initial survey showed that, village councils, the mosque board of trustees, and the agricultural well curators are active in all local villages. However, Basij and the agricultural cooperatives are just acting in only one-third of the communities. The above-mentioned organizations in 24 villages were nominated to establish a conversation between the government and the farmers in water resources protection matter.

The results show that more than 90% of the participants positively believe that the non-governmental organizations have capacitance to help the government to protect water resources. This is consistent with the study conducted by Merdasi *et al.* (2018) in which institutional development has been found to have more importance to sustainable agricultural development. The farmers believed that, none of the five organizations understudied can be responsible alone for water conservation.

Interestingly, the majority of participants do not even believe that one organization is capable of protecting water resources per se. Meanwhile, the study of Ekhlaspour (2015) indicated that village council and agricultural cooperatives cannot be solely nominated for fascinating the farmers to participate in water resources protection matter. In the above-mentioned study it has been argued that, these organizations do not engage in any collaborative processes such that the meetings and the negotiations are not held regularly, and that substantially past bad experiences appear to hinder program implementation. Although, from the farmers' viewpoints, none of the five organizations can conserve water resources alone, but they might be prioritized based on ten criteria studied here in this study. These criteria are; distribution in all rural areas, farmers' welcome meetings, the level of family dependence of the members of the board of organization with the state agricultural departments, suitable place for gathering, social relations with the village elite, the socio-economic quality of the target farmers, popularity amongst farmers, willingness to participate in water resources conservation plan, active presence of organization's head in interview sessions, and having audio-visual equipment .

According to the criteria, the village council, the agricultural well curator, Basij, the mosque board of trustees, and agricultural cooperatives achieved the first to fourth places, respectively.

Then, socio-economic factors affecting the reinforcement of one of the criteria (i.e., farmers' welcome meetings) were examined. The results showed that, for the farmers the invitations from the organizations with older manager were more acceptable than the organizations with younger head. The agricultural knowledge of the board of directors had also positively impact on the presence of the farmers in the interview. And also, the organizations suited by a better place for gathering and had more modernized visual-aids were more welcomed by the participants and audiences.

Comparison of viewpoints on the main culprit of degradation of groundwater resources showed that the farmers presented in different organizations have different views. The contributors in the village councils, and the agricultural cooperatives blame the government for the over licensing of the aquifer, and condemn the people for failing to comply with the law on licenses issued, and over-harvesting. But the farmers attending Basij are more likely to believe that the government is unjust in issuing licenses. Moreover, the farmers who attended the mosque board of trustees' meetings, and the agricultural well curator attribute the least blame to the farmers. However, from the viewpoints of the mosque board of trustees, the most of the fault is due to the lack of governmental control over the permitted wells, but from the attendees' viewpoints to the agricultural well curator meetings the blame is mainly pointed to the drought.

What is clear is that the intellectual background and also the social conditions for each of the organizations have led to different points of view for the main culprit of degradation of water resources. The village council, and the agricultural cooperatives which find themselves closer to the state in power, are trying to hold the blame on the previous governments, especially in the beginning of the Islamic revolution in 1979. On the other hand, illegal harvesting is thrown at the farmers because of non-compliance. This view has been also spread to the farmers associated with the two organizations. However, Basij, and consequently the associated farmers, insist on the justice and therefore consider the most important problem as injustice related to the permitted licenses. Instead, the farmers attending the mosque board of trustees' meetings who have generally more religious believes, and the farmers associated with agricultural well curator who are responsible for observing wells, try to less blame people.

On the contrary, the religious farmers attending the mosque board of trustee's meetings, who are always disagree with administrative systems, blame

the government for failing to comply with the law. In addition, the participants in agricultural well curator meetings, like the chief responsible for water harvesting licenses, have generally attributed the main problem to drought. As above-mentioned different views show that there is a widespread disagreement among different farmers.

Different farmers' views about the main culprit of water degradation have led to different demands from the government on water issues based on their groups' interests. The most important request, however, is inter-basin water transport, which has no significant difference among the five organizations. The second one is the sealing of illegal wells, which is, although psychologically important and an incentive to do so, have a very small share of water usage in both Anar and Rafsanjan areas. And finally, the suggestion of the control of water harvesting from permitted wells and the grant of facilities to run modern irrigation systems is in third position and covers less than one fifth of farmers' believes.

According to the results of the research, the following suggestions are made:

1. Since the five NGOs including village councils, Basij, agricultural cooperatives, the mosque board of trustees and agricultural well curators cannot play intermediaries between the government and the farmers for the protection of water resources per se; a formal or informal combination of them should be established.
2. Given that there are three organizations of village councils, agricultural well curators, and the mosque board of trustees in all local villages, the employment of material and spiritual resources and also their potentials should be given priority.
3. As the results show that, the enthusiasm of the farmers to attend the meetings would be more, when an older manager or a senior member is responsible for the invitation. So, it is better that the invitations are performed by two or three senior members or influential community members.

4. As the presence of individuals with higher agricultural knowledge in the board is a relatively general demand and trust, this may be taken into account that we may have a decision-making board of the members of the combined organization.

5. And finally, because the proper venue for meetings and the presence of audio-visual facilities are welcomed by the farmers' participants in the meetings, all organizations are encouraged to provide the related facilities and equipment.

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References

- Abdolahi - Ezzatabadi M, Mohammadi - Mohammadabadi A, Mirzaie S, Abareghi GH (2015) Investigation of ethics and religion roles on protection of water resources in pistachio orchards in Anar and Rafsanjan areas. Final Report of Research Project, Pistachio Research Institute of Iran [In Persian].
- Abdolahi-Ezzatabadi M, Sedaghat R, Moazenpour-Kermani M, Hoseinifard SJ, Hokmabadi H, Basirat M, Mirzaie S, Abareghi GH, Mohammadi M (2014) The study of inputs' temporal management on productivity increasing in pistachio orchards in Anar and Rafsanjan areas. Final Report of Research Project, Pistachio Research Institute of Iran [In Persian].
- Ahmad A (2000) An institutional analysis of changes in land use pattern and water scarcity in Dak Lak province, Vietnam. Nordic Conference on Institutions, Livelihood and the Environment: Change and Response in Mainland Southeast Asia, 27-29 September, Copenhagen.
- Ekhlaspour R (2015) Collective management of water resources. Publisher, Fanoos of Kerman, 162 pages. [In Persian].
- Fischhendler I (2008) Institutional conditions for IWRM: The Israeli case. *Ground Water* 46(10), 91-102.
- Hashemi SM, Kinzig A, Abbott JK, Eakin H, Sedaghat R (2020a) Exploring farmers' perceptions about their depleting groundwater resources using path analysis: implications for groundwater overdraft and income diversification. *Hydrogeology Journal*. <https://doi.org/10.1007/s10040-020-02190-2>.
- Hashemi SM, Kinzig A, Eakin H, Sedaghat R, Abbott JK (2020b) Embedding farmers' groundwater use in the context of their livelihoods: farmers' perspectives on social-ecological stressors, causes, and solutions. *International Journal of Sustainable Development & World Ecology*: <https://doi.org/10.1080/13504509.2020.1787277>.
- Maria Salth R, Dinar A (2005) Water institutional reform: Theory and practice. *Water Policy*. 7, 1-19.
- Menared G, Maria Salth R (2011) The effectiveness of alternative water governance arrangements. In: *Towards a Green Economy*, Mike Young (editor).
- Merdasi Gh, Yazdanpanah M, Forouzani M, Baradaran (2018) Application of analytical hierarchy process (AHP) in analysis of agricultural systems: A case study of Shushtar County of Iran. *Village and Development*. 21(1), 1-23.
- Theesfeld I (2010) Institutional challenges for national groundwater governance: Policies and issues. *Ground Water*. 48(1), 131-142.