Human Ecology (2020) 48:491–503
https://doi.org/10.1007/s10745-020-00168-y

# The Role of Social Capital in Water Reservoirs Governance: Evidence from Northern Iran

Arezoo Mirzaei[1] · Andrea Knierim[1] · Saeid Fealy Nahavand[2] · Masoomeh Shemshad[3]

Published online: 21 July 2020


## Abstract

Collective local governance of traditional water reservoirs (*Ab-bandans*) in Mazandaran province, Northern Iran, is gradually disappearing. Using the concept of social capital, we explore how and why components of social capital (trust, co-operation, social network cohesion, leadership roles, and conflict resolution) among various local stakeholders influence water management through semi-structured, face-to-face interviews with key local stakeholders (29 interviews). We used NVivo software to code the interview transcripts through the identification of relevant themes. Our results indicate that the most important component of social capital for local community water management is conflict resolution. Local community leaders play a crucial role in promoting and facilitating cooperation and conflict resolution among communities through negotiation and conciliation mechanisms. However, these mechanisms have proved inadequate in providing lasting resolution of conflicts between neighbouring communities over water management. Since the Iranian government has overall responsibility for water management, we recommend it engage directly in the resolution of local water conflicts to ensure lasting solutions acceptable to all local stakeholders.

**Keywords** Water management · Local leadership · Social capital · Conflict resolution · Mazandaran province · Northern Iran

## Introduction

Demand for water is increasing and the world is expected to face a 40% global water shortage by 2030 (UNESCO WWAP 2015), potentially leading to conflicts (Serageldin 2009). Iran is located in an arid and semi-arid region with average annual precipitation of 228 mm, which is 72% less than the global average of 814 mm (Karandish and Hoekstra 2017). Agriculture in Iran consumes more than 90% of available water (Karandish and Hoekstra 2017). Many Iranian experts claim that the most significant cause of the current water crisis is the failure of effective water governance (Foltz 2002), including managerial, political, and institutional failures (Madani 2014). Water governance covers "the range of political, social, economic, and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society" (Rogers and Hall 2003: 16). Water governance involves a range of actors and structures in water policy formulation and implementation (Akhmouch and Correia 2016), and includes a set of collective activities to secure the water systems viability and integrity and to achieve common goals of diverse stakeholder groups (Wiek and Larson 2012).

Mazandaran province in Northern Iran has annual average precipitation of 749.9 mm, which is high in comparison with other provinces in the country (Ministry of Energy Iran 2015). A considerable amount of the precipitation occurs during the non-growing seasons in autumn and winter and is collected in traditional water reservoirs (*Ab-bandans*) for use the following season irrigating rice fields (Azmoodeh *et al.* 2009; Mirzaei *et al.* 2017, 2019). Beginning about 3000 years ago, these were typically constructed by local farmers by digging and compressing soil to construct a wall around an excavated pond (Ejlali *et al.* 2012; Ghoddousi 1999; Rahimi Farahani *et al.* 2012). The local farmers are responsible for the maintenance of these reservoirs, although other local actors, such as community leaders and fishermen, play an important role in the water-related interactions (Mirzaei *et al.* 2017; Vosoughi and Mohammadi 2013).

✉ Arezoo Mirzaei
arezoo.mirzaei@uni-hohenheim.de

[1] Institute of Social Sciences in Agriculture, University of Hohenheim, Stuttgart, Germany

[2] Agricultural Extension and Education Institute, Tarbiat Modares University, Tehran, Iran

[3] Agricultural Extension and Education Institute, Science and Research Branch, Islamic Azad University, Tehran, Iran

Farmers upstream and downstream of the water reservoirs as well as other users of a reservoir have conflicting claims for access to water (Mirzaei *et al.* 2017), so their ability to cooperate and formulate regulations regarding access that are generally agreed and adhered to is crucial for successful governance of this common good (Rasmussen and Meinzen-Dick 1995), also referred to as social capital, defined by Ostrom and Ahn (2003:4) as "an attribute of individuals and their relationships that enhance their ability to solve collective-action problems" (Putnam 1995; Ostrom and Ahn 2003). However, there is evidence that formerly relatively collective reservoir governance within local communities is gradually disappearing and this has led farmers to seek individual and short-term benefits and on occasion to withdraw more water than is sustainable (Vosoughi and Mohammadi 2013).

We examine the governance of *Ab-bandans* through an exploration of how and why components of social capital among various local stakeholders influence water-related interactions in user communities. Although there is scientific evidence related to social issues in water management in Iran, there has been no empirical research that specifically addresses components of social capital in action. In this research we aim to 1) identify key components of social capital among local stakeholders of *Ab-bandans*; and 2) investigate how these components of social capital affect and relate to their day-to-day governance.

## Theoretical Background

The concept of governance focuses not only on state and formal institutions but also on social actors and informal institutions such as family, tribe, or local community, and engages various stakeholders from different sectors at the local, regional, national, and international levels (Bevir 2013). Water governance involves political, social, economic, and administrative dimensions at various levels to develop policies and institutions in the water sector (Rogers and Hall 2003). According to the OECD (2015: 5), water governance is "the range of political, institutional and administrative rules, practices, and processes (formal and informal) through which decisions are taken and implemented, stakeholders can articulate their interests and have their concerns considered, and decision-makers are held accountable for water management." Water governance is here defined as the capability of various social stakeholders to manage water resources in a collective manner at the local level (Solanes and Jouravlev 2006).

Putnam (1995: 664) writes of social capital as "networks, norms, and trust that enable participants to act together more effectively to pursue shared objectives," while Fukuyama (1997, cited in Adler and Kwon 2002: 20) described it as "the existence of a certain set of informal values or norms shared among members of a group that permit co-operation among them." Nahapiet and Ghoshal (1998: 243) found social capital as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit." It is a resource that individuals stand to benefit from by virtue of membership in social networks, structures, and relations (Bisung et al. 2014; Portes 1998). As social capital is a multidimensional concept (Claridge 2004), based on a review of related literature, we considered five central components of social capital: trust, co-operation, social network cohesion, leaders and their roles, and conflict resolution (Fig.1).

.

Trust refers to the extent to which people feel they can rely on relatives, neighbours, colleagues, and even strangers for support and assistance (Dudwick *et al.* 2006). Trust is "expectation or belief that one can rely on another person's actions and word and/or that the person has good intentions toward oneself" (Dirks 2000). General trust as well as trust in institutions constitutes an important aspect of social capital (Hunecke *et al.* 2017). General trust is defined as trust in people within the surrounding society, e.g., family members, friends, neighbours, and colleagues (Hunecke *et al.* 2017). This is a vital aspect of social capital that facilitates communities' governance and economic well-being (Yamagishi *et al.* 2015). Trust in institutions regulating in water-related issues requires trust in government at different levels and its agencies, community officials, politicians, and associations (Hunecke *et al.* 2017; Narayan and Cassidy 2001; Polyzou *et al.* 2011).

An examination of co-operation provides a deeper understanding of how people work with others within the community on a common project and/or how they respond collectively to a problem or crisis (Dudwick *et al.* 2006). Co-operation is an essential element for successful collective action and natural resource governance (Uphoff 1999). Local participation can be seen as a central issue for enhancing water governance and a co-operative approach in water-related processes can be beneficial both for local stakeholders and society more widely (Mirzaei *et al.* 2019).

Social network cohesion entails social connections and relations between societal units e.g., individuals, groups, and associations (Berger-Schmitt 2000). It is the vertical and horizontal interaction and connectedness among members of society and includes trust, a sense of belonging, and the willingness to participate in social activities (Chan *et al.* 2006). It can be evident in community events, e.g., weddings and funerals or other activities that promote solidarity, communication, and a sense of collectiveness and consciousness (Dudwick *et al.* 2006). Fostering social relations among various stakeholders can increase the chances of collaboration and joint action (Bodin and Crona 2009). These social interactions lead to the formation of groups and networks and consequently the development of social capital (Leahy and Anderson 2010).

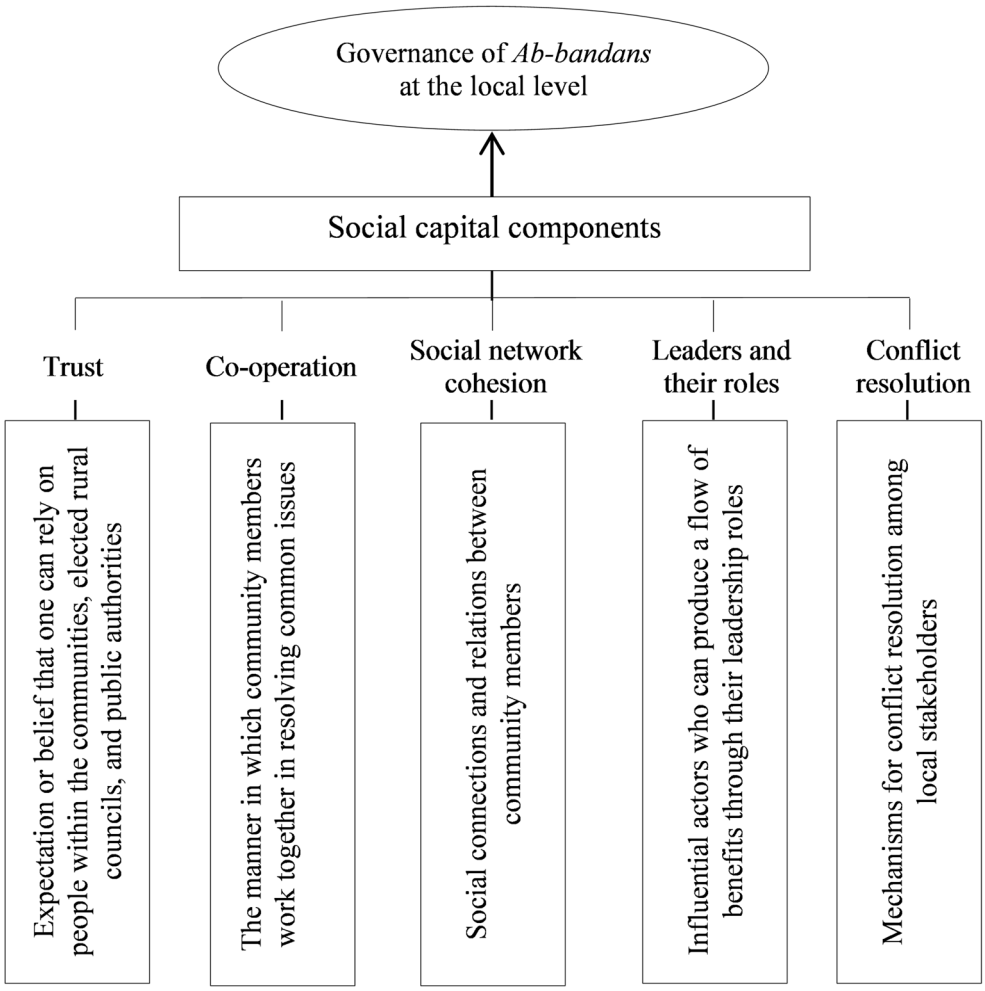


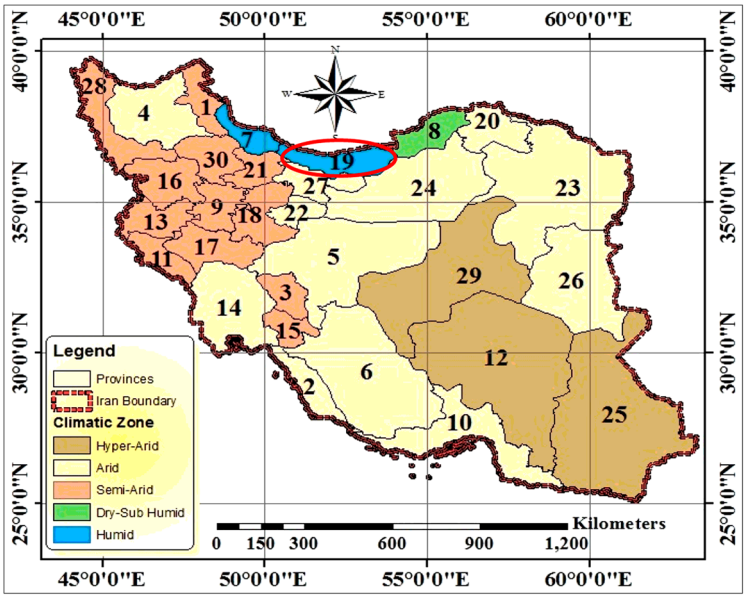

**Fig. 1** Theoretical background guiding this research

Bodin and Crona (2008) describe community leaders and influential actors as a latent stock of social capital that can produce a flow of benefits. "Leadership can be understood as social capital that collects around certain individuals –whether formally designated as leaders or not - based on the acuity of their social perceptions and the structure of their social ties" (Balkundi and Kilduff 2006: 421). Leaders can form social networks within and between communities and play the role of legitimizers (often prominent citizens with prestige) and/or effectors (professionals or technicians) in society (Gray *et al.* 2005). They can share information, provide advice and support and have a great influence on collective action (Hoppe and Reinelt 2010).

Mechanisms for conflict resolution are often held to be an essential component for common resource management, but are rarely included in empirical studies of social capital (Bodin and Crona 2008). Access to water can indirectly produce tension and conflict because it is a basic element in agriculture and rural livelihoods (Carius *et al.* 2004). In most cases, water conflict is not simply due to the lack of water, but is caused by inefficient governance (Carius *et al.* 2004). If conflicts are constantly ignored, they intensify and exacerbate the degradation of natural resources, erosion of social and human capital and ultimately, result in problems for rural livelihoods (Sanginga *et al.* 2007). Therefore, in developing countries where shared use of common resources is essential for rural livelihoods, applying strategies for building trust, conflict prevention, and long-term social-ecological resilience should be seen as prerequisites for successful natural resource management (Ratner *et al.* 2014).

## Study Area and *Ab-bandans*

This study was carried out in the province of Mazandaran, Northern Iran, which covers 24.000 km2 (1.46% of the total area of Iran) and is bordered by the Caspian Sea to the north and the Alborz Mountains to the south (Kheyroddin and Hedayatifard 2017), extending between latitude 35° 46′ and 36° 58′ north and longitude 50° 21 and 54° 8′ east (Shahbazi and Esmaeili-Sari 2009) (Fig. 2). The province is geographically divided between the coastal plains and a mountainous area with an average temperature of 25 °C in




| | | | |
|---|---|---|---|
| 1 | Ardabil | 16 | Kordestan |
| 2 | Bushehr | 17 | Lorestan |
| 3 | Charmahal | 18 | Markazi |
| 4 | East Azerbaijan | 19 | Mazandaran |
| 5 | Isfahan | 20 | North Khorasan |
| 6 | Fars | 21 | Qazvin |
| 7 | Gilan | 22 | Qom |
| 8 | Golestan | 23 | Razavi Khorasan |
| 9 | Hamedan | 24 | Semnan |
| 10 | Hormozgan | 25 | Sistan and Baluchestan |
| 11 | Ilam | 26 | South Khorasan |
| 12 | Kerman | 27 | Tehran |
| 13 | Kermanshah | 28 | West Azerbaijan |
| 14 | Kuzestan | 29 | Yazd |
| 15 | Kohgiluyeh | 30 | Zanjan |

**Fig. 2** Geographical position of the study area. Adopted from Karandish and Hoekstra (2017)

summer and 6 °C in winter (Shahbazi and Esmaeili-Sari 2009). It has high agricultural production capacity due to the humid temperate climate and rich soil (Khoshbakht and Hammer 2006). Thirty-seven percent (199,000 ha) of the land is used for the cultivation of rice, which is the staple food in Iran. *Ab-bandans* are the most important water resources for irrigating rice fields during the growing seasons (Ministry of Agriculture Iran 2016). *Ab-bandans* cover from 3 to 1000 ha (Abbasian *et al.* 2014), and there are 880 in Mazandaran with an area of around 17,000 ha and depths varying from 1.5 m to 4 m (Mazandaran Regional Water Authority 2016). They are multi-functional and play a significant role in recharging underground acquifers and wells, collecting drainage water, aquaculture, providing habitat for birds and plants, and attracting tourism (Salabi 2010) (Fig. 3).

## Methodology

We adopted a qualitative approach to investigate key social capital components affecting the governance of *Ab-bandans* among local stakeholders in the study area. Qualitative research provides findings based on understanding peoples' everyday lives and their viewpoints under different circumstances (Yin 2016), and it is suitable for research directed at understanding the motivations behind people's behaviour or actions (Rosenthal 2016).

We conducted semi-structured, face-to-face interviews from July to mid-September 2018, with a range of local key stakeholders who are directly involved in *Ab-bandans* use and management, i.e., farmers, fishermen, informal leaders (elders, *Mirab*, farmers' representatives), and official leaders (members of rural councils) who have been

**Fig. 3** A water reservoir in Mazandaran Province. Image provided by the first author

formally elected by the villagers. The wide range of stakeholders involved allowed us to produce a rich image of the views of the interviewees and thus increased the value of our findings (Shenton 2004). We selected three different *Ab-bandans*/villages on the basis of previous research conducted by the first author (Table 1). Initially, we interviewed a group of stakeholders who were already known to us (purposive sampling), and then used a snowball sampling approach to identify additional interviewees who also had experience, ability, and were willing to provide data (Rosenthal 2016). We continued sampling and interviewing until the data revealed that there were no new insights on the subject under investigation (Charmaz 2006), achieving theoretical saturation (Elo *et al.* 2014). In total 29 local stakeholders were interviewed, all male (Table 1), since men are the main stakeholders of *Ab-bandans*; we did not address women's perceptions as indirect stakeholders.

During the interviews, participants gave their oral consent and received information on their voluntary participation, protection and confidentiality of the research data. In addition, they were informed that they could withdraw from the interview at any time (Flick 2009; Forsgren *et al.* 2016). Two members of the research time (the first and fourth authors) conducted and recorded the interviews, which took an average of 60 min. We had the advantage of being familiar with the native language, so were able to communicate directly with the local stakeholders. In addition, we recorded our observations and impressions about each interview during the research (Hancock *et al.* 2009).

The interview questions were primarily open-ended, which provided opportunities for both interviewer and interviewee to have a detailed discussion of the topic under investigation (Hancock *et al.* 2009). Before final application, the interview guide questions were tested among several Ph.D. students as well as local stakeholders to identify any potentially unclear and biased questions (Rosenthal 2016). The interviews began with an opening question and continued with a range of related questions following an interview guide (Table 2). We encouraged the interviewees to provide more detailed information by asking short questions such as 'Can you explain more?', 'What do you mean?', and 'Can you give an example of your experience?'

**Table 2** Interview guide

| Opening question | Guide questions | Follow up questions |
|---|---|---|
| Could you please tell us a bit about your *Ab-bandan*? | How do you see trust among different stakeholders in your community? | To whom do you go when you need cash to solve your financial problem? How do the rural councils and public authorities work? |
| | To what extent do people collaborate with one another in the issues related to *Ab-bandan*? | How are the decisions related to *Ab-bandan* taken? How is the role and involvement of individuals in the decision-making process? Do you contribute if the government demands your financial or physical participation for *Ab-bandan*? |
| | How is your interaction with individuals in your community? | In which events do people come together? |
| | Who plays a leadership or mobilizing role regarding *Ab-bandan*? | How are the leaders selected? What are the main characteristic and role and responsibilities of leaders? |
| | Do you experience any conflicts in your community regarding *Ab-bandan*? | Who are the key actors involved in the conflicts? What are the frequency, intensity, and duration of conflicts? What are the causes of conflicts? How do you resolve these conflicts? Have these worked? |

Data from this research study included interview transcripts and field notes from observations. All the recorded interviews were transcribed verbatim and the interviewers analyzed the data. We used NVivo software (version 10) to code the transcripts through the identification of relevant themes, concepts, ideas, and relationships. As Sutton and Austin (2015) noted

**Table 1** Description of selected *Ab-bandans* and local stakeholders interviewed

| *Ab-bandan*/village name | Shorthand | Local stakeholders | | | |
|---|---|---|---|---|---|
| | | Farmers | Fishermen | Informal leaders | Official leaders |
| *Panbeh Zar Kooti* | PZK | 4 | 1 | 4 | 2 |
| *Gol Neshin* | GN | 4 | 1 | 2 | 2 |
| *Abasali Kash* | AK | 3 | 1 | 3 | 2 |
| | Total = 29 | 11 | 3 | 9 | 6 |

"this process enables the researcher to begin to understand the world from each participant's perspective." After coding the data independently, the two researchers presented and discussed any similarities and differences in their codes and reached decisions on final themes. This process resulted in the revision of the codes and helped to clarify and confirm the research findings (Sutton and Austin 2015). We highlighted the results with direct quotes from the interviewees and the researchers' interpretations of the themes and concepts.

## Results

### Leaders and Leadership Roles

The results from all three villages indicate that the official leaders of *Ab-bandans* play a key role in decision-making and planning related to water management. There are between three to five leaders in each community (five in villages with more than 1500 inhabitants) who are formally elected by the villagers for a period of four years. They comprise a constitutionally mandated[1] rural council (*Shura*) and are legal representatives of the government in the villages. All activities related to local water management have to have the approval and are under the supervision of the rural councils, including, e.g., requests for funds from the regional government for the rehabilitation of *Ab-bandans*, plans to lease to qualified persons for aquaculture, the dredging of canals, and improvement of farm roads, The rural councils also play a role resolving minor conflicts among farmers.

Elders and farmers' representatives are informal leaders in the villages who enjoy influence and are socially respected in rural society. Together with the rural councils, they mediate disagreements among farmers and pass judgments on claims the farmers present. Their decisions are respected and enforced. At the beginning of each growing season, two or more individuals are selected by farmers as "water masters" (*Mirab*) who, under the supervision of the rural councils, are responsible for storage of water in the reservoirs during the rainy seasons, for maintenance of the reservoirs, and the distribution of water among farmers during the growing seasons so that rice fields are irrigated in turn. This is particularly important during dry years. At the end of the growing season, they receive a portion of the farmers' crop in payment (6 kg rice per hectare), but sometimes these fees are paid in cash.

Influential, experienced, reliable, and well-known farmers, usually from different family groups, represent the interests of the local farmers, working with the rural councils to legitimize decisions about *Ab-bandans* and the resolution of conflicts.

Our interviewees' responses indicate that the rural councils as official leaders play a more important role in legitimization and implementation of water-related decisions than the informal leaders due to their legal authority (Table 3).

### Conflict Resolution

Our results show that there are endemic conflicts among local stakeholders in the study communities (Table 4). One interviewee from PZK explained that: "The conflicts between farmers are ordinary and inevitable. For example, a farmer may cultivate a common border between his farm and the adjacent one to produce more crops which leads to protest from the neighbouring farmer," and an interviewee from GN also stated that: "Conflicts among farmers are exacerbated with water scarcity. Last night a farmer wanted to steal water. He secretly attempted to alter the flow of water into his farm." The interviewees noted that in rural areas, norms are more effective than legal rules; therefore, the majority of the disagreements and claims among farmers are usually resolved through the intervention of rural councils and informal leaders.

The use of *Ab-bandans* for fish breeding also creates conflict between the fishermen and farmers. One fisherman remarked that: "My fish are dying. When they come to the margins of the reservoirs, they get stuck there because the water level is too low. Therefore, they cannot return to the

**Table 3** Sub-categories identified in the component of leaders and their roles

| Category | Sub-category | Description |
|---|---|---|
| Leaders and their roles | The role of rural councils with regard to *Ab-bandans* | • Decision-making and implementation of water-related decisions<br>• Attracting farmers' participation<br>• Resolving minor everyday conflicts among farmers |
| | Influence of elders | • Mediation in solving minor conflicts among farmers |
| | The role of *Mirab* | • Storing water during rainy seasons in the water reservoirs<br>• Maintenance of the water reservoirs<br>• Distribution of water among farmers during the growing seasons |
| | Co-operation of farmers' representatives in water management | • Legitimize decisions<br>• Resolution of conflicts among farmers |

[1] According to the Iranian Constitution (Article 100), "for the timely promotion of social, economic, development, health, cultural, educational, and welfare programs, the administration of each village must be carried out under the supervision of a rural council."

**Table 4** Sub-categories identified in the component of conflict resolution

| Category | Sub-category | Description |
|---|---|---|
| Conflict resolution | Resolving conflicts within the communities:<br>- among farmers<br>- among fishermen and farmers<br>- among leaders | • Mediation of the rural councils and informal leaders by local meetings, negotiations, and conciliation<br>• Negotiation and conciliation among leaders |
| | Resolving conflicts between different communities | • No local mechanism |
| | Resolving conflicts between communities and government | • Remaining unresolved over many years |

reservoirs." Although the revenues from the lease of *Ab-bandans* are used for their maintenance and protection and the development of the local area, when there is a shortage of water conflicts arise, as farmers need larger allocations of water for their fields. The rural councils try to manage this conflict in a friendly way by meeting with and negotiating between the two sides. However, the fishermen sometimes sue the public authorities in order to find a solution to the problem.

There are opposing views and disagreements not only among the members of the rural councils, but also among the councils and farmers' representatives. Although these conflicts are usually resolved through negotiation and conciliation, grudges remain on both sides.

As well as conflicts within the local communities, there are conflicts between different communities and these are more intense. The interviews in GN showed that there is a serious conflict between farmers in this community and the upstream village. The winter runoff passes through the upstream village before entering and being stored in GN's *Ab-bandan*. However, residents of the upstream village have diverted the water away from GN's reservoir. One interviewee from GN explained that: "This conflict goes back to a long-standing grudge among our grandfathers which has been passed on to their children and grandchildren and has continued until now."

Farmers from AK traditionally obtained part of their required water from a common *Ab-bandan* located in the adjacent village. However, the farmers in the adjacent village prevent the AK farmers using the water. "The water war among us started many years ago. They (people in the adjacent village) are mostly young and say that this water belongs to them, and that they would prefer to use it for fish breeding. But since ancient of days, we have been using this water for agriculture" (Interviewee from AK). These conflicts sometimes lead to mass violence, and local meetings, negotiations, and conciliation are only short-term, temporary mechanisms to solve these problems. The interviewees stated that there is no local mechanism to resolve disputes between different communities and so they are referred to the public authorities, e.g., government agencies related to water management, courts, and police; but many of these disputes still remain unresolved over many years.

The government has not only failed to resolve the conflicts between different local communities, but is itself occasionally party to conflicts over water. The current conflict between the farmers from PZK and the regional government stems from the latter's claims that according to the water law, all water resources belong to the government and therefore they are the main decision-makers for administration, authorization, and control of the water reservoirs. One interviewee from PZK pointed out that: "Our *Ab-bandan* is near the main road, it is a good place for leisure and recreation activities, and would be an attraction for tourists. Therefore, the government claims ownership and wants to decide independently in regard to the different projects in our *Ab-bandan*. However, this *Ab-bandan* has been in our village for hundreds of years and our grandfathers built it, therefore, we are the real owners. It is our asset and we want to make this decision independently." Villagers are afraid of losing the resources that they have been using for agricultural purposes over generations, which would amount to loss of their livelihoods. Another interviewee from PZK noted that: "In one of the villages in Mazandaran, the government undertook the administration of the *Ab-bandan* and claimed ownership. Gradually they changed the use of *Ab-bandan* and built a residential complex there." This dispute has been in court for many years and as long it remains unresolved, farmers are not allowed to use the water for other functions except irrigation.

## Social Network Cohesion

Although some communal interactions and relationships in the villages have decreased in the past years, weddings, funerals, and religious ceremonies are still held in a collective or inclusive manner. Many interviewees reported that villagers support each other in difficult circumstances such as sickness and death. For example, if someone loses one of their family members, all the villagers go to their house as a group to offer their condolences and they try to pay the funeral expenses jointly. Most communication and visiting between villagers within and between communities occur as the group events (Table 5).

However, many of these social interactions are affected by conflicts over water management. For example, shared religious values can be used as an effective idiom of relationships

**Table 5** Sub-categories identified in the component of social network cohesion

| Category | Sub-category | Description |
|---|---|---|
| Social network cohesion | Social interactions and relationships | • Participation in group events such as weddings, funerals, and religious ceremonies and performing them in a collective manner<br>• Consideration of the religious values |

and solidarity within and between local communities. But religious solidarity can be eroded in conflicts over water management. In the study villages, the residents gather in mosques and religious places and practice related customs and practices collectively during Ramadan (month of fasting) and Muharram (the first month of the Islamic calendar). However, one interviewee from PZK explained that: "This year during Ramadan, some people did not come to the mosque because they had some problems with the rural councils regarding water-related issues." Another interviewee from AK also suffers from the mounting divisions between communities; he said: "Every year during the Muharram, our neighboring village used to come to our village to perform the associated rituals. But this year, they didn't come and our annual religious ceremonies were cancelled due to the contradictions in association with Ab-bandan."

## Cooperation

The results from all three villages indicated that the issues related to *Ab-bandans,* e.g., dredging, repair, and maintenance are traditionally conducted with the cooperation of farmers in the form of financial contributions, provision of necessary equipment and machinery, and manual labour (Table 6). For example, the rural councils invite farmers to participate in cleaning canals as a labour force and while all farmers may not be available, the work will be conducted by those who are. Farmers who are absent must participate in other related activities upon request of the rural councils.

As noted above, decision-making in all villages is officially the responsibility of the rural councils. However, important decisions, such as the lease of *Ab-bandans*, are made collectively with the participation of stakeholders. For example, when the rural councils auction water reservoirs for aquaculture, they invite villagers to a meeting in the mosque to select a qualified buyer from among various candidates (this person can be local or from another village). All interested stakeholders can attend this meeting and the decisions are taken based on majority voting. Finally, all the villagers are informed of the final decision, which is either broadcast through a megaphone in the villages or reported on social media. In practice, collective decision-making is complicated by ongoing conflicts and disagreements, and requires a great deal of time and energy. This leads to delays in reaching and subsequently decisions. One interviewee from PZK reported that: "The public meetings are not efficient because there are too many comments which cause conflicts among different groups. Those people (usually farmers' representative) who are against the rural councils give comments based on their personal hostility. This leads to a delay in decision- making, longer meetings or even cancellation of meetings."

Many interviewees stated that they are willing to actively participate in projects for solving water problems in co-operation with government agencies involved in water management, for example, with money or labour in canal lining and rehabilitation of *Ab-bandans*. According to interviewees, with the regular implementation of appropriate and necessary projects, it would be possible to prevent water loss, store more water, and use the water reservoirs for other functions.

**Table 6** Sub-categories identified in the component of co-operation

| Category | Sub-category | Description |
|---|---|---|
| Co-operation | Farmers' co-operation in dredging and maintenance of *Ab-bandans* | • Collection of money, providing equipment and machinery needed, and manual labour |
| | Making decisions related to *Ab-bandans* | • Performing meetings with the participation of stakeholders |
| | Farmers' willingness to co-operate with government agencies for solving water problems | • Financial and physical co-operation for canal lining and rehabilitation of *Ab-bandans* |

## Trust

Our results indicate that in case of financial difficulties, interviewees first ask their family and relatives and then friends and neighbours for assistance. However, interviewees noted that the trust network among people has collapsed over the years due to increasing economic difficulties, the deterioration of relationships, and previous negative experiences. One interviewee from PZK stated that: "Trust among people existed before our houses were fenced off." Although general trust in case of financial difficulties within the communities is relatively high, the trust of the local stakeholders in rural councils has decreased dramatically (Table 7).

According to interviewee responses, although the members of rural councils are elected locally they are distrusted and villagers are pessimistic with regard to their financial competence. The rural councils do not provide regular feedback and

**Table 7** Sub-categories identified in the component of trust

| Category | Sub-category | Description |
|---|---|---|
| Trust | Trust among local stakeholders in case of financial needs | • Relying firstly on family and relatives, then friends and neighbors |
| | The rural councils accountability | • Lack of reporting regularly |
| | | • Low transparency in the reports |
| | Transparency in the process of the rural councils' election | • Low accuracy in determining competencies |
| | | • Election of the rural councils based on family relationships |
| | The government performance at the regional level | • Dissatisfaction with the government's promises |
| | The trust of local stakeholders in the parliament's representatives | • Dissatisfaction with the promises of parliament's representatives for solving water problems |

financial statements on how, e.g., the revenues from the lease of *Ab-bandans* are spent, or if they do, their reports do not have the required transparency. According to one interviewee from PZK "The rural council does not spend all the money on the village, they keep some of it and present false invoices." The interviewees argued that farmers do not make an effort to request and receive regular reports: "People are just talking about the rural council but they do not demand a direct explanation about what they do with the money" (interviewee from GN). The farmers avoid making requests for regular and accurate reporting for various reasons, e.g., because of family ties or they are too busy with everyday tasks and problems and do not have the time. Nevertheless, the rural councils are legally obliged to report to the public.

Relevant government bodies determine the eligibility of candidates for election to the rural councils, but little rigor is exercised in determining competencies and a lot of the criteria are ignored. Additionally, family relationships play a more important role than merit for the election of local rural councils. Villagers tend to vote for their own relatives and as a result larger tribes may be overrepresented. One interviewee from GN said that: "People want to send their relatives to the rural council so that they can use their family connections for more support." The candidates gather votes among local poor and low-income groups by donating money or food.

Local stakeholders also protested about the regional government because past broken promises to undertake particular projects, such as canal lining and rehabilitation projects of the water reservoirs have engendered distrust. One interviewee from AK emphasized that: "The government officials are thinking of their own pockets rather than farmers. We have reservoirs in this area that are filled with water in winter and the extra water flows into the sea and is wasted. But the government does not make any arrangements for storing this extra water." If dredging and rehabilitation were be carried out, more water could be stored during the rainy season and other resources such as a dam or well would not be necessary to irrigate the rice fields. Another interviewee from AK also argued that: "Water canals are constructed with soil. If the government conducts the project of canal lining, water will not be wasted, and then there will be enough water for both irrigation and fish breeding. In my opinion, there is no water shortage; we ourselves are the cause of it." The members of the rural councils are also dissatisfied with the government's promises as well as the long-term administrative procedures.

Interviewees expressed distrust of the parliamentary representatives from the region, explaining that they gather votes in the region through advertisements and promises to solve problems, such as rehabilitation of the reservoirs and resolution of disputes among communities, but once they are elected they don't fulfill these promises. One interviewee from GN argued that: "The representatives, despite their promises, do not make an effort to resolve disputes among us and the upstream village. They are too afraid of losing the votes of upstream people for the next round because they have a larger population than us".

## Discussion

This study provides a detailed picture of the role of social capital components in the governance of *Ab-bandans* by local key stakeholders, i.e., farmers, fishermen, informal leaders, and rural councils. We considered five central social capital components: trust, cooperation, social network cohesion, leaders and leadership roles, and conflict resolution.

We found that elders, farmers' representatives, "water masters" (*Mirab*), and especially rural councils are the key individuals and leaders in promoting and facilitating collective action in the utilization and management of *Ab-bandans* through co-operation and conflict resolution. They can decrease the water-related problems through mediation and negotiation within the community and manage local conflicts through customary laws and norms derived from ethical, social, and religious values. Our results also indicate that the rural councils play a more important role in the management of *Ab-bandans* than the informal leaders due to their legal authority. In contrast, Bodin and Crona (2008) found that

traditionally elected leaders have a central and powerful position in the village and are firmly engaged in village social networks in comparison with formally elected leaders with official authority. Dahal and Bhatta (2008) demonstrated that such leaders solve problems in the interest of both sides through assessment of the causes of conflicts, engagement in arguments, exchange of information, and identification of the common points. They play a significant role in convincing people to take collective action and making rule-breakers aware of their mistakes. Local leadership can "mobilize energies, generate trust, give vision, and support the collective finding of a clear direction in a multiparty process" (Pahl-Wostl *et al.* 2007: 8).

Local conflicts can be resolved by local leaders through mediation, negotiation, and conciliation, but these local mechanisms are not effective in preventing conflicts and violence over water usage between neighbouring communities, indicating the need for an institutionally more comprehensive approach. Increasingly, disputes and lack of appropriate solutions lead to the reduction of social interactions and relationships that negatively affect the utilization and maintenance of *Ab-bandans*.

It is interesting to note that many interviewees argued that intervention and facilitation by public authorities is necessary to solve conflicts between neighbouring communities. However, government agencies responsible for water management have not only failed to provide appropriate mechanisms for resolving conflicts, but they are also exacerbating conflicts due to their preference for top-down decision-making and planning regarding *Ab-bandans*. As water is a public commodity in Iran and the government has overall responsibility for its management (Bijani and Hayati 2011). Neutral intervention by public authorities through facilitation and strengthening of the culture of dialogue and negotiation could be a mechanism for conflict resolution in the management of *Ab-bandans* (Mirzaei *et al.* 2019). Tyler (1999) concluded that government policies in conflict management enable local stakeholders to act successfully in assessing their needs, negotiating and discussing with other users, evaluating the technical quality of resources, and reaching consensus-based solutions.

According to our results, villagers are keen to retain their local values and customs. However, many ceremonies and group events have been impacted by conflicts over water utilization, reducing opportunities for participatory action and communication within and between the communities to solve common problems related to their *Ab-bandans*. Relationships in social networks can improve collaborative governance through the generation and diffusion of environmental knowledge, mobilization and allocation of key resources for effective governance, and dispute resolution. It is important to note that social ties within local communities foster trust, mutual assistance, and ultimately the social relationships and cohesion that are essential for consensus building and conflict resolution in the governance of natural resources. Social ties between local communities play a critical role in access to any external resources and encouragement of collective action (Bodin and Crona 2009).

Co-operation of farmers in water-related management and maintenance activities takes place in the form of the collection of money, providing equipment and machinery, and manual labour. Water reservoirs-related decisions are also made collectively with the participation of stakeholders. Although the co-operation of each farmer in decision-making is useful for collective management and leads to more legitimate decisions, in practice, most farmers participate in the decision-making process through their representatives rather than being directly involved. However, often collective discussions do not reach a definitive conclusion due to ongoing disagreements among the local stakeholders. This leads to the failure of decision-making and planning for the water reservoirs in a cooperative manner.

We found that local stakeholders are eager to collaborate with government agencies responsible for water management, which provides an opportunity for these agencies to engage with them in developing management plans for *Ab-bandans*. This engagement could have a significant impact on their sense of belonging and willingness to participate in the management of *Ab-bandans.*

Although locally general trust is relatively high, farmers' trust in the rural councils has been reduced due to the lack of accountability and transparency, both of which are necessary if collective action problems related to water reservoirs are to be solved. Furthermore, trust in the governmental and political representatives has been damaged over the years due to their failure to keep promises. It is important to note that the local trust in the government and its agents can increase the motivation of stakeholders to provide solutions for overcoming water problems. Mirzaei *et al.* (2019) describe how farmers can trust the government and its agents when they see that their needs regarding the usage and maintenance of *Ab-bandans* are the main focus of government administration of water management.

## Conclusion

Our focus in this research was not to address the quantitative and qualitative reduction of water in Iran, or the impacts of sudden droughts, increased cultivation, and international sanctions, although we recognize that these factors are catalysts of the water crisis. However, our findings contribute to current literature regarding the role of social capital components in collective local governance of *Ab-bandans* among local stakeholders. Certainly, neglecting social capital components leads to the failure of collective action in the management of water

reservoirs, although this does not mean that social capital alone will be sufficient for successful governance of *Ab-bandans*.

We demonstrate that the importance of social capital components can differ in different contexts. For example, while many events are held jointly within and between the communities, which indicates a high level of social relationships, the use of mediation, negotiation, and conciliation mechanisms by leaders to resolve conflicts between different communities provides only temporary solutions. Effective mechanisms for conflict resolution are the most important aspect of social capital. According to our results, social relationships and cohesion continue to be reduced due to conflicts in water management. Furthermore, conflicts and disagreements lead to the failure of collective interaction among local stakeholders in water related decision-making and planning. Therefore, a better understanding of how social capital components influence stakeholders' participation in the collaborative governance of water reservoirs is vital to help policymakers to design programmes for water usage and management. As the entity with overall responsibility for water management in Iran, the government should establish effective strategies of water governance facilitate the empowerment and integration of local stakeholders so that they are better able to solve their water-related problems independently. This would enable local communities to be more resilient in the face of collective action problems.

**Acknowledgments** We would like to acknowledge the cooperation, support, and hospitality of the local participants during the data collection. In addition, we would like to give special thanks to Ms. Julia Rietze for her proofreading assistance.

**Funding Information** This paper is part of a Ph.D. study that was conducted by the first author at the University of Hohenheim, Germany with the support of a scholarship from the Food Security Center at Hohenheim University, which is part of the DAAD (German Academic Exchange Service) programme "Exceed," and receives financial support from DAAD and the German Federal Ministry for Economic Co-operation and Development (BMZ). We also received financial support through a fiat panis Ph.D. Grant from the Foundation fiat panis.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare no conflict of interest.

## References

Abbasian, H., Ashayeri, A., Hosseinmarzeh, S., Meigooni, G.H., (2014). Residues of diazinon in Ab-bandans supplied by Babolroud, Talar and Siaroud Rivers, Iran. Journal of Ecology and the Natural Environment, 6 (4): 153-158.

Adler, P.S., Kwon, S.W., (2002). Social capital: Prospects for a new concept. The Academy of Management Review, 27 (1): 17-40.

Akhmouch, A., Correia, F., (2016). The 12 OECD principles on water governance - When science meets policy. Utilities Policy, 43: 14-20.

Azmoodeh, A., Tahbandi, H., Zarei, M., Habib-Nejad Roshan, M., (2009). Appraisal the role of Ab-bandans as a strategy to deal with drought in Northern Iran. Paper presented at the first international conference on the water crisis, 10th-12th March 2009, Zabol, Iran.

Balkundi, P., Kilduff, M., (2006). The ties that lead: A social network approach to leadership. The Leadership Quarterly, 17 (4): 419–439.

Berger-Schmitt, R., (2000). Social cohesion as an aspect of the quality of societies: Concept and measurement. EuReporting Working paper No. 14. Centre for Survey Research and Methodology (ZUMA), Social Indicators Department, Mannheim. Retrieved 10th January 2019 from: https://www.gesis.org/fileadmin/upload/dienstleistung/daten/soz_indikatoren/eusi/paper14.pdf.

Bevir, M., (2013). A theory of governance. Berkeley: University of California Press.

Bijani, M., Hayati, D., (2011). Water conflict in agricultural system in Iran: A human ecological analysis. Journal of Ecology and Environmental Sciences, 2 (2): 27-40.

Bisung, E., Elliott, S.J., Schuster-Wallace, C.J., Karanja, D.M., Bernard, A., (2014). Social capital, collective action and access to water in rural Kenya. Social Science and Medicine, 119: 147-154.

Bodin, Ö., Crona, B.I., (2008). Management of natural resources at the community level: Exploring the role of social capital and leadership in a rural fishing community. World Development, 36 (12): 2763–2779.

Bodin, Ö., Crona, B.I., (2009). The role of social networks in natural resource governance: What relational patterns make a difference? Global Environmental Change, 19 (3): 366-374.

Carius, A., Dabelko, G.D., Wolf A.T., (2004). Water, Conflict, and co-operation. Policy Brief. The United Nations and Environmental Security ECSP Report, 10: 60-66. Retrieved 14th January 2019 from: https://www.wilsoncenter.org/sites/default/files/ecspr10_unf-caribelko.pdf.

Chan, J., To, H.P., Chan, E., (2006). Reconsidering social cohesion: Developing a definition and analytical framework for empirical research. Social Indicators Research, 75 (2): 273- 302.

Charmaz, K., (2006). Constructing grounded theory: A practical guide through qualitative analysis. London: Sage.

Claridge, T., (2004), Social capital and natural resource management: An important role for social capital? Brisbane, Australia: University of Queensland.

Dahal, D.V., Bhatta, C.D., (2008). The relevance of local conflict resolution mechanisms for systemic conflict transformation in Nepal. Berghof Foundation. Retrieved 19th December 2018 from: https://www.berghof-foundation.org/fileadmin/redaktion/Publications/Other_Resources/NEP_Local_Conflict_Resolution_Mechanisms.pdf.

Dirks, K.T., (2000). Trust in leadership and team performance: Evidence from NCAA basketball. Journal of Applied Psychology, 85 (6): 1004-1012.

Dudwick, N., Kuehnast, K., Jones, V. N., Woolcock, M., (2006). Analyzing social capital in context: A guide to using qualitative methods and data. Washington, DC: The World Bank.

Ejlali, F., Asgari, A., Darzi-Naftchali, A., (2012). Influence of water resources on yield and yield components of rice in paddy fields. Technical Journal of Engineering and Applied Sciences, 2 (7): 199-205.

Elo, S., Kääriäinen, M., Kanste, O., Pölkki, T., Utriainen, K., Kyngäs, H., (2014). Qualitative content analysis: A focus on trustworthiness. SAGE Open, 1-10. Retrieved 20th April 2018 from: http://journals.sagepub.com/doi/abs/10.1177/2158244014522633

Flick, U., (2009). An introduction to qualitative research. (4nd ed.). London: Sage.

Foltz, R., (2002). Iran's water crisis: Cultural, political, and ethical dimensions. Journal of Agricultural and Environmental Ethics, 15 (4): 357–380.

Forsgren, E., Skott, C., Hartelius, L., Saldert, C., (2016). Communicative barriers and resources in nursing homes from the enrolled nurses' perspective: A qualitative interview study. International Journal of Nursing Studies, 54: 112-121.

Ghoddousi, J., (1999). Traditions in water harvesting: Lessons from Iran. In N. Talebbeydokhti, A. Telvari, and S. A. Heydarian (Eds.). Proceedings of the regional workshop on traditional water harvesting systems (p. 291). 1-5 May, Ministry of Jihad-e- Sazandegi, Dept. of Watershed Management, Tehran, Iran.

Gray, I., Williams, R., Phillips, E., (2005). Rural community and leadership in the management of natural resources: Tensions between theory and policy. Journal of Environmental Policy and Planning, 7 (2): 125-139.

Hancock, B., Ockleford, E., Windridge, K., (2009). An introduction to qualitative research. The NIHR RDS for the East Midlands/ The NIHR RDS for Yorkshire and the Humber. Retrieved 20th April 2018 from: https://www.rds-yh.nihr.ac.uk/wp-content/uploads/2013/05/5_Introduction-to-qualitative-research-2009.pdf.

Hoppe, B., Reinelt, C., 2010. Social network analysis and the evaluation of leadership networks. The Leadership Quarterly, 21 (4): 600-619.

Hunecke, C., Engler, A., Jara-Rojas, R., Poortvliet, P.M., (2017). Understanding the role of social capital in adoption decisions: An application to irrigation technology. Agricultural Systems, 153: 221–231.

Karandish, F., Hoekstra, A.Y., (2017). Informing national food and water security policy through water footprint assessment: The Case of Iran. Water, 9, 831: 1-25.

Kheyroddin, R., Hedayatifard, M. (2017). The production of exclusive spaces in coastal pre-urban areas: Causes and motivations: Middle shoreline of Caspian Sea in north of Iran. Journal of Coastal Conservation, 1-9.

Khoshbakht, K., Hammer, K., (2006). Savadkouh (Iran) - an evolutionary centre for fruit trees and shrubs. Genetic Resources and Crop Evolution, 53: 641-651.

Leahy, J.E., Anderson, D.H., (2010). "Cooperation gets it done": Social capital in natural resources management along the Kaskaskia River. Society and Natural Resources, 23 (3): 224–239.

Madani, K., (2014). Water management in Iran: what is causing the looming crisis? Journal of Environmental Studies and Sciences, 4 (4): 315-328.

Mazandaran Regional Water Authority, (2016). State statistics. Retrieved 15th November 2016 from: http://www.mzrw.ir/?l=EN.

Ministry of Agriculture Iran, (2016). A need to rehabilitate Ab-bandans in Northern Iran. Report of equipping and modernization project for rice farms, Ministry of Agriculture, Tehran, Iran.

Ministry of Energy Iran (2015). Iran water statistical yearbook. Presidency, management and planning organization, statistical center of Iran. Printing–House, Tehran.

Mirzaei, A., Knierim, A., Fealy Nahavand, S., Mahmoudi, H., (2017). Gap analysis of water governance in Northern Iran: A closer look into the water reservoirs. Environmental Science and Policy, 77: 98-106.

Mirzaei, A., Knierim, A., Fealy Nahavand, S., Shokri, Sh.A., Mahmoudi, H., (2019). Assessment of policy instruments towards improving the water reservoirs' governance in Northern Iran. Agricultural Water Management, 211: 48-58.

Nahapiet, J., Ghoshal, S., (1998). Social capital, intellectual capital, and the organizational advantage. The Academy of Management Review, 23 (2): 242-266.

Narayan, D., Cassidy, M.F., (2001). A dimensional approach to measuring social capital: Development and validation of a social capital inventory. Current Sociology, 49 (2): 59-102.

OECD, (2015). OECD principles on water governance. OECD Publishing, Paris. Retrieved 10th January 2019 from: http://www.oecd.org/cfe/regional-policy/OECD-Principles-on-Water-Governance-brochure.pdf.

Ostrom, E., Ahn, T.K., (2003). Introduction to foundations of social capital. In: Foundations of social capital, ed. E., Ostrom and T.K., Ahn. Cheltenham, U.K.: Edward Elgar.

Pahl-Wostl, C., Craps, M., Dewulf, A., Mostert, E., Tabara, D., Taillieu, T. (2007). Social learning and water resources management. Ecology and Society, 12 (2): 5.

Polyzou, E., Jones, N., Evangelinos, K.I., Halvadakis, C.P., (2011). Willingness to pay for drinking water quality improvement and the influence of social capital. The Journal of Socio-Economics, 40 (1): 74–80.

Portes, A., (1998). Social capital: Its origins and applications in modern sociology. Annual Review of Sociology, 24: 1-24.

Putnam, R.D., (1995). Tuning In, tuning out: The strange disappearance of social capital in America. Political Science and Politics, 28 (4): 664-683.

Rahimi Farahani, M., Mehrabi, E., Falahi, M., (2012). Ab-bandans and water resources management in coastal areas of Iran (case study: Gilan province). International conference on traditional knowledge for water resources management (TKWRM2012), International Center on Qanat and Historic Hydraulic Structures (ICQHS), 2-4 February 2012, Yazd, Iran.

Rasmussen, L.N., Meinzen-Dick, R., (1995). Local organization for natural resource management: Lessons from theoretical and empirical literature. EPTD Discussion Papers NO. 11. International Food Policy Research Institute (IFPRI). Retrieved 10th January 2019 from: http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/125557/filename/125588.pdf.

Ratner, B.D., Mam, K., Halpern, G., (2014). Collaborating for resilience: Conflict, collective action, and transformation on Cambodia's Tonle Sap Lake. Ecology and Society, 19 (3): 31.

Rogers, P., Hall, A.W., (2003). Effective water governance. Tec background papers no. 7. Global Water Partnership Technical Committee (TEC), Elanders Novum, Sweden.

Rosenthal, M., (2016). Qualitative research methods: Why, when, and how to conduct interviews and focus groups in pharmacy research. Currents in Pharmacy Teaching and Learning, 8: 509-516.

Salabi, M.A., (2010). Ab-bandan and its role in agricultural development in Iran, Golestan province. Journal of Jihad, 7 (104): 8.

Sanginga, P.C., Kamugisha, R.N., Martin, A.M. (2007). The dynamics of social capital and conflict management in multiple resource regimes: A case of the southwestern highlands of Uganda. Ecology and Society, 12 (1): 6.

Serageldin, I., (2009). Water wars? World Policy Journal, 26 (4): 25–31.

Shahbazi, A., Esmaeili-Sari, A., (2009). Groundwater quality assessment in North of Iran: A case study of the Mazandaran Province. World Applied Sciences Journal, 5: 92-97.

Shenton, A.K., (2004). Strategies for ensuring trustworthiness in qualitative research projects. Education for Information, 22: 63-75.

Solanes, M., Jouravlev, A., (2006). Water governance for development and sustainability. SERIE Recursos Naturals e Infraestrutura, No. 111. Santiago, Chile: United Nations (CEPAL).

Sutton, J., Austin, Z., (2015). Qualitative research: Data collection, analysis, and management. Can J Hosp Pharm, 68 (3): 226-231.

Tyler, S.T., (1999). Policy implications of natural resource conflict management. In: Cultivating peace: Conflict and collaboration in natural resource management, ed. D., Buckles. Ottawa/Washington, DC: IDRC/The World Bank.

UNESCO WWAP (United Nations World Water Assessment Programme), (2015). The United Nations World Water Development Report 2015: Water for a Sustainable World. Paris: UNESCO.

Uphoff, N., (1999). Understanding social capital: Learning from the analysis and experience of participation. In: Social Capital. A multifaceted perspective, ed. P., Dasgupta and I., Serageldin. Washington, DC: The World Bank.

Vosoughi, M., Mohammadi, A., (2013). A Study of the social-economic factors affecting the collective management of water resources in Fereidoonkenar's rural. Journal of Rural Development, 4 (2): 47-74.

Wiek, A., Larson, K.L., (2012). Water, people, and sustainability—A systems framework for analyzing and assessing water governance regimes. Water Resources Management, 26 (11): 3153–3171.

Yamagishi, T., Akutsu, S., Cho, K., Inoue, Y., Li, Y., Matsumoto, Y., (2015). Two-component model of general trust: Predicting behavioral trust from attitudinal trust. Social Cognition, 33 (5): 436-458.

Yin, R.K., (2016). Qualitative research from start to finish. (2nd ed.). New York: The Guilford Press.