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Agricultural Water Conflict in the Doroodzan Dam Irrigation Network, Iran: The Opinion of Regional Water Experts

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Abstract

Agricultural water conflict describes conflicts among water stakeholders in the agricultural sector. The purpose of this study was to investigate regional water experts' opinions towards agricultural water conflicts. The research was conducted in Doroodzan dam irrigation network in Fars Province, Iran. The study was carried out by using a descriptive, correlative method. All regional water experts who worked downstream of Doroodzan dam formed the population of this study (75 experts) of whom 66 people were recruited as a sample from this population. A questionnaire was used as a tool for gathering data and its validity was confirmed by a group of professionals. A pilot study was conducted and Cronbach's alpha test was applied to determine the data collection instrument reliability. Findings revealed that, among groups involved in water conflicts, the main conflict was between farmers in downstream and upstream. Downstream farmers were the main losers in water distribution. The dominant form of water conflict was "open conflict" as well. This result shows water conflict in this area is groing more gradually. The main reasons for increasing water conflict were "drought", "water scarcity" and "the style of water management by the government". According to the experts' opinions, the best type of water management must be a combination of governmental monitoring and local management by farmers. There were no significant differences among different groups of experts in regard to agricultural water conflict.

Keywords: Agricultural Water Conflict, Regional Water Experts, Doroodzan Dam.

تضاد در بهره‌برداری از آب در شبکه آبیاری سد درودزن: دیدگاه کارشناسان امور آب منطقه

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چکیده

منظور از تضاد آب کشاورزی، درگیری‌ها و منازعات میان بهره‌برداران آب در بخش کشاورزی است. هدف این مقاله، بررسی دیدگاه‌های کارشناسان امور آب منطقه پیرامون تضاد آب کشاورزی بود. این تحقیق، در شبکه آبیاری سد درودزن در استان فارس و با استفاده از روش توصیفی، همبستگی انجام شد. جمعیت کارشناسان مشغول کار در امور آب منطقه در حوزه پایاب سد درودزن ۷۵ نفر بود که ۶۶ نفر از آنها به عنوان نمونه انتخاب شدند. ابزار پژوهش شامل پرسشنامه‌ای بود که روایی آن توسط گروهی از متخصصان تأیید گردید. پایایی ابزار جمع‌آوری داده‌ها با استفاده از یک مطالعه راهنما و آزمون آلفای کرونباخ، محاسبه شد. یافته‌ها نشان داد که در میان گروه‌های موجود در تضاد آب، مناقشه اصلی میان کشاورزان پایین دست و بالادست است. کشاورزان پایین دست، بازنده اصلی در توزیع آب بودند. نوع منازعه آب، "تضاد آشکار" بود. این نتیجه نشان می‌دهد که تضاد آب در این منطقه به تدریج رو به افزایش است. دلایل اصلی برای افزایش تضاد در بهره‌برداری از منابع آب، "خشکسالی"، "کمبود آب" و "نوع مدیریت آب توسط دولت" بودند. با توجه به نظر کارشناسان، بهترین نوع مدیریت آب باید ترکیبی از نظارت دولتی و مدیریت محلی توسط کشاورزان باشد. تفاوت معنی‌داری میان نظرات گروه‌های مختلف کارشناسان در رابطه با تضاد آب کشاورزی وجود نداشت.

کلمات کلیدی: تضاد آب کشاورزی، کارشناسان آب منطقه‌ای، سد درودزن.

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Introduction

There are five types of conflicts: conflicting cultural values, conflicts about norms, conflicts about resources and diverging interests, conflicts about power and influence and conflicts about knowledge. The case described in this study is related to conflicts over water as a kind of natural resource conflict (Leeuwis, 2004; Laats, 2005). Water, like energy, is a fundamental human need, but water is not evenly available over the surface of the Earth. Population growth, economic development and rising standards of living all increase the demand for water. In many parts of the world, the rise in demand is outstripping supply. This is having serious consequences for human wellbeing. It is also a potential source of conflict between water users, as well as between those countries and regions with water deficits and those with surplus supplies. If the world is to ensure future water supplies it will need to develop management strategies to resolve these conflicts. Achieving more sustainable use of scarce water resources is another priority (Anonymous, 2012).

"Water conflict" is a term describing a conflict between countries, states, or groups over access to water resources (Tulloch, 2009; Kameri-Mbote, 2007; Wolf *et al.,* 1999). Over the past decade, policy debates have increasingly associated water scarcity with conflict both at the international level, as conflict or even war among nations sharing water resources, and at the national or local level as conflict over access to and use of water between different users and sectors (Ravenborg, 2004). The rapid development of social economy has caused sustained pressures on the natural water resources system. That leads to many severe consequences, one of which is increasingly frequent and fierce water conflict. Worldwide, water conflict has been a universal phenomenon. According to the World Water Resources Evaluation Report of United Nations, water problems induced 1,831 great conflict events in the world in the past fifty years, among which 21 events had evolved into military conflicts (Zhang, 2004; Wenjuan *et al.,* 2009).

"Agricultural water conflict", the subject of the present study, is limited to local conflict in agricultural sector related to use fresh surface water, and the intention of water conflict in this article is a term describing conflicts among water stakeholders in agricultural sector. Agriculture is the major user of water, particularly as we struggle to increase food supplies for a growing global population. While water storage and irrigation systems do make agriculture more productive, they can also be wasteful of water. Poor management of such systems can lead to problems of evaporation, seepage, salinisation and fertilizer pollution (Anonymous, 2012). Utilizable fresh water for using in agricultural sector is very limited especially in Iran. That shortage is the cause of conflicts among stakeholders. In Iran, the greatest amount of water use (83.5 bcm or 94.25 percent) is by the agricultural sector. Of this amount, about 50 percent is exploited from surface water resources and another 50 percent from groundwater (Ardekanian, 2003; Ghazi, 2002; Balali, 2009). A large part of water is wasted. The main reason is referred to none using of advanced irrigation technologies (Beheshtinejad, 2009). One of sectors of this

mismanagement is about conflict management among water stakeholders in agricultural sector.

Iran is a water scarce country with a mean annual precipitation of 250 mm (Hayati *et al.,* 2010). In fact, Iran is one of the most water-scarce regions in the world. Due to population growth, increasing affluence and the development of irrigated farmlands there are increasing pressures on water supplies. In Iran, after political revolution in 1979, the Government decreased its control over water resources. In that situation, there was no need for anticipating or a legal mechanism for controlling water conflicts. Furthermore, in the last decade another important factor was added to this trend and increased water conflicts in agricultural sector. In fact, this factor was climate changes especially drought. With the condition of drought and water scarcity, managing water conflict is more complex. The main part of the conflict is between government and stakeholders especially in districts that are confronting with drought. In the other side, urban and industrial consumption has had a large growth in recent years and government allocates the most of saving water to them. It is one of reasons for conflict between the Government and stakeholders (Hayati and Bijani, 2011).

The main objective of this study was to examine regional water experts' opinions toward agricultural water conflicts in the Doroodzan dam irrigation network located in Fars Province, Iran. To achieve this, some specific objectives were considered for this study. They are:

- Recognizing and prioritizing elements that can cause water conflict among water stakeholders;
- Investigating the level of agricultural water conflict;
- Investigating winners and losers among water user groups;
- Identification of water experts' dominant strategy in managing water conflict; and
- Analyzing the relationships between some of the variables affecting agricultural water conflict.

Theoretical Literature Review

Since water ignores boundaries, water resources are shared by users on all levels, namely local, national, and international. Conflicts can arise between end users of water, but they can also develop at the institutional or governmental level or between up- and downstream riparian users. Tensions over water allocation can increase when water is scarce, for example, if herdsmen and sedentary farmers compete for the limited resource. But allocation among parties can be highly contested even when the resource is not severely limited, such as when different sectors hydropower production and irrigation, for instance have conflicting interests in using available resources (Houdret *et al.,* 2006). As freshwater is a vital, yet unevenly distributed natural resource, its availability often impacts the living and economic conditions of a country or region. The weakness of water resource management in some areas (Murakami, 2008), among other elements of water crises, can put severe pressures on all water users, whether corporate, government, or individual, leading to tension, and possibly aggression (Tulloch, 2009). According to Carius *et al.*, (2004), there are three major linkages between conflict and water (Table 1):

Table 1. Three Major Linkages Between Conflict and Water

Linkages Between Conflict and Water	Details
Access to Adequate Water Supplies	Conflict is most likely to occur over water when disputes involve access to water of adequate quantity and quality. Even when water supplies are not severely limited, allocation of water among different users and uses (urban residents and agriculture, for example) can be highly contested.
Water, Livelihood Loss, and Civil Conflict	Water importance in sustaining human livelihoods can indirectly link it to conflict. Water is a basic resource for agriculture, which is traditionally the largest source of livelihoods. If this livelihood is no longer available, people are often forced to search for job opportunities in the cities or turn to other, sometimes illicit, ways to make a living.
Water Management and Conflict	In most cases, it is not the lack of water that leads to conflict, but the inadequate way the resource is governed and managed. There are many reasons why water management fails, including lack of adequate water institutions, inadequate administrative capacity, lack of transparency, ambiguous jurisdictions, overlapping functions, fragmented institutional structures, and lack of necessary infrastructure.

Source: (Carius *et al.*, 2004)

Different people have different goals and interests while using the same resource. Frequently, when people pursue different interests, their goals and interests may clash, leading to a dispute or conflict. Indeed, the process of pursuing different interests has always possessed the potential for conflict, but it takes something more to create a spark that finally brings about a conflict. Hence the existence of competition or a change in the use of a resource may provide the impetus to trigger a conflict. Furthermore, there are many conditions that may trigger conflicts such as competition for scarce resources, differences in organizational status and influence, unmet expectations and needs/interests and unequal power and authority. Others include jurisdictional ambiguities, distortion in communication, misconceptions and interdep-endence of people and tasks. The main disagreements may be the result of conflicts between large-scale and small-scale irrigators, upstream and downstream users, domestic water use and other uses (agricultural, industrial, livestock and municipal). Moreover, there are conflicts between industrial and sustainable environmental management (i.e. pollution and environmental protection and ecosystem management) and agricultural and industrial uses such as power generation (Mjwahuzi, 2001; Mbonile, 2005).

Conflicts over irrigation water represent one of the most common types of water conflict. Rivalries between upstream and downstream riparian users or between users of a common irrigation system can lead to destruction of the infrastructure or violence against people. In this regard, key issues that can make water conflicts especially among farmers are (Houdret *et al.,* 2006):

- Increasing water demand and scarcity, often coupled with weak water institutions;

- Overexploitation of groundwater resources and subsequent falling water tables, rendering access difficult for some or all farmers;
- Lacking or damaged water infrastructure entailing unequal access to and use of the resource; and
- Existing rivalries and socio-economic inequalities among farmers.

There are several paths towards alleviating tensions among farmers, including the promotion of alternative livelihoods, support for updated and water-efficient equipment, and increased education about water economy and supply. But intervening in and preventing these conflicts is also linked to efficient and legitimate water management institutions (*Ibid*).

A number of claims about the conflict-inducing effects of "climate change" have surfaced in the public debate in recent years. Climate change has so many potential consequences for the physical environment that we could expect a large number of possible paths to conflict (Nordas and Gleditsch, 2007). Over the last decade, another important factor was added to this trend and has increased water conflicts in agricultural sector; this factor was climate change, especially drought. With the condition of drought and water scarcity, managing water conflict becomes more complex (Bijani and Hayati, 2011). Some factors that can impact how we respond to water conflict are gender, self-concept, expectations, situation, position (power), communication skills, life experiences and the kind and practice of conflict management (Anonymous, 2012).

In Iran, agricultural water stakeholders include farmers, governmental agents, urban consumers and industrial applications. It is notable investigation of agricultural water conflict needs extensive research. Therefore, this study is dedicated only examines the perspective of water experts (as the governmental agents of water management) towards agricultural water conflict in the Doroodzan dam irrigation network. Government officials play an important role in water management and its distribution; they can control or create conflict among farmers. In this regard, some experts' characteristics that can impact on agricultural water conflict are listed below.

- *Personal (Individual) conditions:* including experts' "sex (male or female)", "age", "level of formal education", "field of study", and "place of residence".
- *Professional conditions:* including experts' "work experience", "job (having a second job or not)", "native or non-native", and "place of activity".
- *Experts' attitudes:* including experts' attitude towards "geographical and climatic conditions" and "the role of extension services".
- *Management and organizational conditions:* including experts' "satisfaction with water management by Government", "type of job position (manager or expert)", "employment status", and "style of conflict management (avoidance, oriented solution and control strategies)". A summary of the above factors is presented in Figure 1.

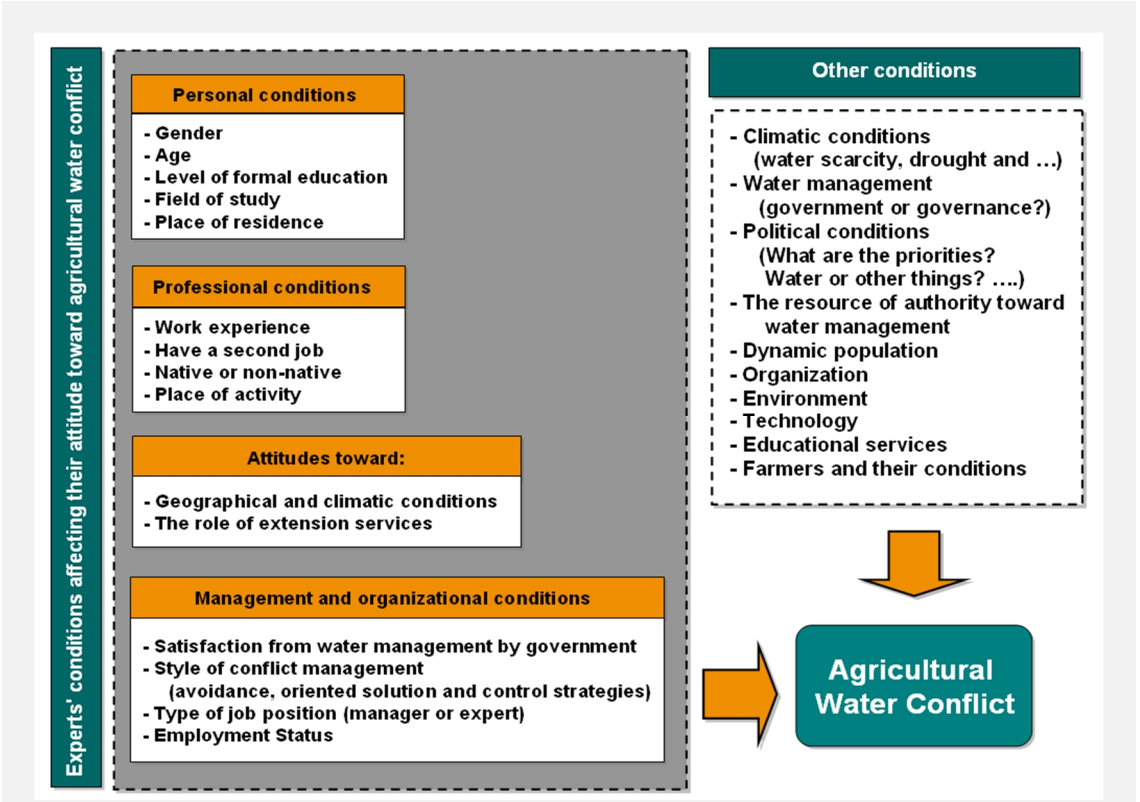

Figure 1. Experts' characteristics affecting their attitude towards agricultural water conflict as one of the factors affecting agricultural water conflict.

Materials and Methods

Study Area

The study was conducted in the Doroodzan dam irrigation network located in Fars Province, in Southwestern Iran (Fig.2). Fars is one of the 31 provinces of Iran and its centre is Shiraz. Doroodzan Reservoir dam is one hundred kilometers from Shiraz to the Northwest and has been constructed on the Kor River. The dam, with about 760 million cubic meters of water per year, provides water requirements over 70 thousand hectares of its downstream. The downstream of Doroodzan Dam consists of eight segments divided in main two parts, namely upstream and downstream: the Main Canal, Ordibehesht Canal, Hamoon Canal, Left Canal (upstream), Amir Segment, Fayzabad Segment, Tilakan Segment and Mavan Segment (downstream). However, the amount of agricultural lands is increasing and, by the end of the current projects, will rise to 112,000 hectares. Also, the necessary drinking water for two cities (Shiraz and Marvdasht), some small and large industrial enterprises near the dam and industrial water uses in the petrochemical industry are all supplied from Doroodzan dam.

Research Method

This phase was conducted within the framework of an applied approach using a descriptive, correlational and causal-comparative research methodology. A survey technique was used for gathering the required data.

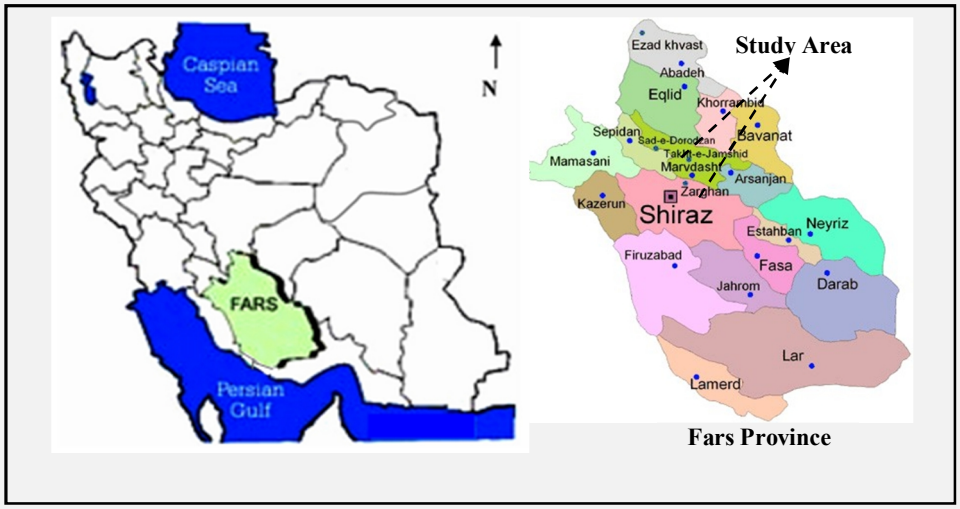

Figure 2. A general map of Iran showing the location of the Study Area.

Participants

The number of governmental regional water experts who worked in Doroodzan dam irrigation network was 75, from whom 66 people were recruited as a sample from this population.

Instrument

Data were collected during December of 2011 using a structured questionnaire. Its "face validity" was confirmed by a group of professionals in Agricultural Extension and Education Department, Shiraz University. A pilot study was conducted and Cronbach's alpha test was calculated to determinate the data collection instrument reliability. The data obtained through questionnaire, were analyzed using $SPSS_{19}$.

Results

Descriptive Statistics

The personal and professional characteristics of the respondents are shown in Table 2. Over 86 percent of the experts were men (57 persons). The age of respondents ranged from 25 to 57 years old with a mean of 36.4 years. Therefore, most of them were middle-aged. The majority of respondents held Bachelor and M.Sc. degrees (81.8 percent) and "Irrigation" was their dominant academic discipline. It is notable that more than 20 (22.2 percent) of respondents were in the field of agricultural extension and education. The work experience of experts ranged over 26 years with a mean of 3.11 years. More than 60 (63.8) percent of the experts had no experience of work in the Water Organization and worked in other organizations operating in the field of water resource management. In this regard, the average working experience was about 7 years. About 69 percent of the respondents had no second job. Nearly 70 (68.6) percent of them were employed on a contractual basis. About 60 percent of the respondents were native in the region of their activity. However, more than 80 (81.3) percent declared Shiraz is their place of residence (capital of Fars Province).

Table 2. Descriptive characteristics of the respondents.

Variable			Frequency	Percent	Valid Percent	Cumulative Percent	Mean	Standard Deviation	Median	Mode	Min	Max	Range
Gender	Female		9	13.6	13.6					Male			
	Male		57	86.4	86.4								
Age (years)	Young (20- 30)		21	31.8	35.6	35.6	36.39	8.96	34	27[a]	25	57	32
	Middle (31- 40)		19	28.8	32.2	67.8							
	Elderly (more than 40)		19	28.8	32.2	100							
	No response		7	10.6									
Education (Years)	Diploma		2	3	3.1	3.1				BSc. & MSc			
	Associate Degree		4	6.1	6.3	9.4							
	B.Sc.		27	40.9	42.2	51.6							
	M.Sc.		27	40.9	42.2	93.8							
	Ph.D.		4	6.1	6.3	100							
	No response		2	3									
Field of study	Agricultural extension and education		14	21.2	22.2	22.2				Irrigation			
	Irrigation		17	25.8	27	49.2							
	Other fields of agriculture		13	24.2	25.4	74.6							
	Civil and water engineering		16	19.8	20.6	95.2							
	Other fields		3	4.5	4.8	100							
	No response		3	4.5									
Work experience (years)	Water Organization of Fars province	0	37	56.1	63.8	63.8	3.11	6.46	0	0	0	26	26
		1-5	12	18.2	20.7	84.5							
		More than 5	9	13.6	15.5	100							
		No response	8	12.1									
	Other organizations	0	15	22.7	28.3	28.3	6.7	7.88	3	0	0	27	27
		1-5	16	24.2	30.2	58.5							
		More than 5	22	33.3	41.5	100							
		No response	13	19.7									
Second job[b]	Yes		18	27.3	31					No			
	No		40	60.6	69								
	No response		8	12.1									
Job position	Manager		38	57.6	70.4					Expert			
	Expert		16	24.2	29.6								
	No response		12	18.2									
Employment status	Contract		35	53	68.6					Contract			
	Treaty		7	10.6	13.7								
	Experimental		0	0	0								
	Definite formal		9	13.6	17.6								
	No response		15	22.7									
Native / non-native	Yes (Native)		34	51.5	58.6					Native			
	No (Non-native)		24	36.4	41.4								
	No response		8	12.1									
Location	Shiraz (Center of Fars province)		52	78.8	81.3					Shiraz			
	Other cities of Fars province		6	9.1	9.4								
	Village		6	9.1	9.4								
	No response		2	3									
Place of activity	Water organization of Fars province		9	13.6	15.8					Other water advisory organizations			
	Operation and drainage company		10	15.2	17.5								
	Other water advisory organizations		38	57.6	66.7								
	No response		9	13.6									
Experts' work	As a senior manager	Yes	9	13.6	18.8					No			
		No	39	59.1	81.3								
		No response	18	27.3									
	As a staff expert	Yes	21	31.8	43.8					No			
		No	27	59.1	46.3								
		No response	18	27.3									
	As a field expert	Yes	29	43.9	60.4					Yes			
		No	19	28.8	39.6								
		No response	18	27.3									

a: Multiple modes exist. The smallest value is shown.

b: Having other activities in addition to working on water issues

Agricultural Water Conflict and Its Types

Descriptive statistics pertaining to each of the items regarding agricultural water conflict are presented in Table 3. In this study, agricultural water conflict was measured using 14 items. Items extracted from the literature review and through interviews with farmers and water experts were selected as an important group which may influence water conflict. Most item means were around the median score 5 to 6 (on a scale of 1-10), indicating that water conflict according to the experts' opinion was relatively moderate.

Agricultural water conflict was measured from the 14 items in Table 3. The range of this variable was from 14 to 140. Figure 3 shows that 92.4 (51.5 + 40.9) percent of experts noted agricultural water conflicts in a moderate to high range.

Table 3. Expert opinions on the level of agricultural water conflict.

Agricultural Water Conflict: Statements[a]	Mean	Standard Deviation
Drought in recent years is the main factor aggravating the contradiction between water stakeholders.	8.29	1.62
Water conflicts in downstream of Doroodzan dam is more than it's upstream.	7.55	2.49
Water conflict between farmers and government has been a normal phenomenon for many years and this conflict is continuing more gradually.	7.29	2.25
Farmers with other farmers interaction, manipulate the irrigation canals or water supply valves to access more water.	6.33	2.61
Bribes to governmental agents in order to achieve more water represent a usual operation in various forms.	6.26	2.43
Sometimes, farmers extract their needed water with using motor pumps from main canals.	6.23	3.42
Farmers believe design and construction of irrigation canals are not suitable so that their farms have not received needed water.	6.21	2.52
There is conflict toward use of water always in Doroodzan dam irrigation network and it is a usual norm.	5.92	2.17
Doroodzan dam is near Shiraz and Marvdasht cities and that makes up the bulk of the dam's stored water was allocated to urban consumers.	5.80	2.85
Injustice in the distribution of water is usual in the management of water distribution in Doroodzan dam downstream.	5.58	2.47
I think, sometimes a fraud happens at the time of water distribution by lottery.	5.58	2.78
Fulmination of other farmers and governmental regional experts is usual to the use of water.	5.42	2.36
Several times, I have witnessed to conflicts between my colleagues with farmers over use of water.	5.32	2.88
I have been reprimanded several times, because I have been had some conflicts with farmers to use of water.	3.08	2.52
Total score of water conflict: N: 66 Minimum: 40 Maximum: 122 Mean: 84.85 Std.deviation: 15.06		
Range from 14 to 140: Mean: 84.85 $\Rightarrow$ **(Moderate to high)**		
a: Responses weighted 1 to 10: from very low (1) to very high (10).		

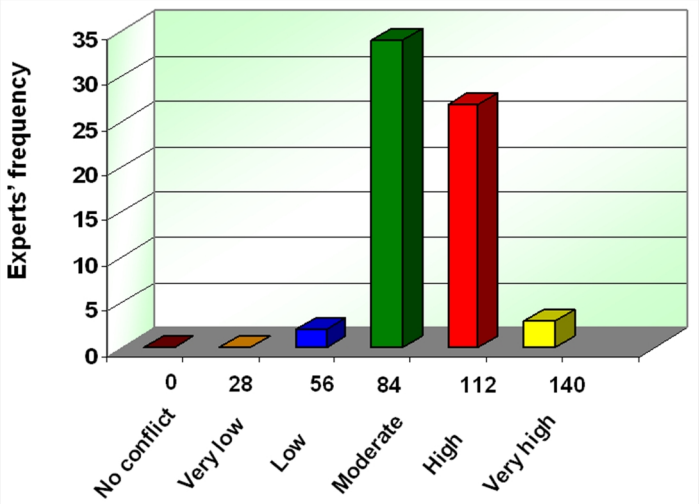

Figure 3. Expert opinions of agricultural water conflict levels.

Agricultural Water Conflict Levels

	Frequency	Percent	Cumulative Percent
No conflict	0	0	0
Very low	0	0	0
Low	2	3	3
Moderate	34	51.5	54.5
High	27	40.9	95.4
Very high	3	4.6	100.0
Total	66	100	

There are four types of water conflict: "No conflict", "Surface conflict", "Latent conflict" and "Open conflict" (TEARFUND, 2003). Table 4 shows the details of four kinds of water conflict. According to Table 4 on the expert opinions, the dominant water conflict in the Doroodzan dam irrigation network is "open conflict". This result shows water conflict in this area is going more gradually.

Causes of Agricultural Water Conflict

Based on the information in Table 5, ranks were allocated to variables in respect of the most important causes of water conflict in the agricultural sector. "Drought" was in the first ranked and "water scarcity" held the second rank. Actually, drought and water scarcity have a close relationship together and allocation of these two cases is the same starter in the first and second priorities goes back to the same reason. The third, fourth, fifth, sixth and seventh priorities are associated with water management.

After political revolution in 1979, the Government decreased its control over water resources. In that situation, there was no need for anticipating or a legal mechanism for controlling

Table 4. Types of water conflict.

Type of Water Conflict		Items[a]	Range	Total Scores (Sum)	Minimum	Maximum	Mode	Median	Mean	Standard Deviation	Priority
No conflict	Any peaceful community is likely to face conflict sometimes, although communities in this category are good at resolving conflict before it develops.	5	5 to 50	1819	11	41	29	28	27.56	5.78	3
Surface conflict	This has shallow or no roots. It may be due to misunderstanding of goals, which can be addressed by improved communication and the conscious effort of opposing groups to understand each other's needs and opinions.	5	5 to 50	1583	10	46	24	23	23.98	6.77	4
Latent conflict	This is conflict below the surface. It might need to be brought out into the open before it can be effectively addressed.	5	5 to 50	1870	13	42	33	29	28.33	6.62	2
Open conflict	This conflict is very visible and has deep roots, sometimes over several generations. Both the causes and the effects need to be addressed.	6	6 to 60	2009	8	48	33	32	30.44	8.62	1
The dominant conflict: **Open conflict**											

a: Measuring is done based on the spectrum from very low (1) to very high (10).

water conflicts. Furthermore, during the last decade, another important factor was added to this trend and the increase in water conflicts in the agricultural sector. In fact, this factor was climate change, especially drought. With the condition of drought and water scarcity, managing water conflict becomes more complex. The main seat of conflict is between the Government and other stakeholders, especially in those districts that are confronted with drought. On the other side, urban and industrial consumption has had a large growth in recent years and Government allocates most of the water saving to them. It is one of reasons for emerging conflict between the Government and other stakeholders (Bijani and Hayati, 2011).

The Main Partners Involved in Water Conflict

Table 6 shows the various groups involved in water conflicts. The first priority is the conflict between downstream and upstream farmers. Experts believed in areas closer to the dam (upstream), farmers have more access to water and therefore, there is less conflict among them. In contrast, in downstream areas, there is less water for distribution among farmers; their reason is the

weakness of water management toward water distribution among farmers. The second priority is related to the conflicts between downstream farmers and the Government. It is notable that, in Iran, water resource management is undertaken by the Government. In recent years, the governmental Water Organization tried to produce an applied strategy for a balanced distribution of water between the downstream and upstream areas of Doroodzan dam with the participation of farmers. Also, the Government made some canals for better distribution of water in the upstream and downstream regions. However, there still is no regular and careful monitoring of water distribution. Other priorities are outlined in Table 6.

Table 5. The most important causes of water conflict in the agricultural sector.

Causes of Water Conflict in the Agricultural Sector	Mode	Median	Mean	Standard Deviation	Priority[b]
Drought	1	1	2.74	2.80	1
Water scarcity	1	2	3.21	2.74	2
Lake of local management of water resources by farmers	4	4	4.58	2.59	3
Type of water management quality by Governmental Water Organization	2[a]	4	4.71	2.71	4
Lack of cooperation and interaction among farmers	5	5	4.77	2.46	5
Weakening or disappearance of "water user associations"	4[a]	5	5.15	2.53	6
Lack of unity among farmers	3[a]	5	5.29	2.60	7
Farmers' selfishness	2[a]	6	5.73	3.45	8
Increased water users, especially those who were not water propertied in the past	2[a]	5.5	5.76	3.19	9
Type of climate	7	7	6.15	3.18	10
Impossibility of drilling wells	10[a]	8	7.42	3.01	11

a: Multiple modes exist. The smallest value is shown.

a: Prioritization is done based on the average (mean) score from 1 to 11 (1 is the first rank and 11 is the last).

Table 6. The main parties involved in conflict over use of water in the agricultural sector.

The Main Partners Involved in Water Conflict	Mode	Median	Mean	Standard Deviation	Priority[a]
Farmers, downstream and upstream	1	2	2.83	1.96	1
Farmers with Government	1	3	3.09	1.88	2
Farmers together	1	3	3.24	2.17	3
Landowners (farmers) with farmers without land	2	4	4.08	2.02	4
Large farmers (lords) with small farmers	3	5	4.64	2.02	5
Farmers with urban consumers	5	5	4.80	1.89	6
Farmers with industrial applications	6	6	5.44	1.75	7
Modern farmers with traditional farmers	8	6	5.64	1.90	8

a: Prioritization is done based on the average (mean) score from 1 to 8 (1 is the first rank and 8 is the last).

Table 7 shows different conditions involved among groups' use of water with the application of Game Theory. Viewing all options shows that upstream farmers are "winners" and downstream farmers are "losers"; Government against upstream farmers is a "loser" and against downstream farmers is a "winner". Also, agriculture is considered a "loser" compared with urban and industrial applications.

One of the most important tasks of government in Iran in countering water scarcity is building dams to control and save flowing water. However, although that is a good action that has a lot of benefits, the Government is unable to resolve water conflicts. The most important reason for these conflicts, according to Game Theory is a serious reality. Actually, in the stakeholders' imagination, the Government is the owner the water resources and they are just consumers. In this way, they often are losers and Government is the winner. While such a belief exists, water conflict will increase and increase in agricultural sector.

Style of Conflict and Water Management

When we talk about conflict management, one question should be addressed: What modes do people use to respond to conflict? All people can benefit, both personally and professionally, from learning conflict management skills. Typically, we respond to conflict by using one of five modes: Competing, Avoiding, Accommodating, Compromising and Collaborating. Each of these modes can be characterized by two scales: assertiveness and cooperation. None of these modes is wrong to use, but there are right and wrong times to use each of them. The following sections describe the five modes. This information may help each team member to characterize her/his model for conflict management (Anonymous, 2011).

In this study, based on observations from the opinions of some experts, three conflict strategies were proposed. They are "avoidance strategy", "oriented solution strategy" and "control strategy".

Table 8 shows description of experts' opinion toward their style conflict management. It is noted that "oriented solution strategy" was the predominant strategy. The second priority was control strategy and third was avoidance strategy.

Table 7. The main groups who engage in conflict over using water: Game Theory use.[b]

		Mode	Median	Mean	Standard Deviation	Dominant Position
Upstream farmers	Upstream farmers	1	1	1.09	0.53	Win - Win
Upstream farmers	Downstream farmers	2	2	1.98	0.22	Win - Lose
Upstream farmers	Government	2	2	1.92	0.82	Win - Lose
Downstream farmers	Government	3	3	3.21	0.82	Lose - Win
Agriculture	Urban consumers	3	3	2.88	0.80	Lose - Win
Agriculture	Industrial applications	3	3	2.89	0.83	Lose - Win

b: Coding from 1 to 4 (1= Win - Win, 2= Win - Lose, 3= Lose - Win & 4= Lose - Lose)

Table 9 describes the respondents' viewpoints towards the following question: "which group has more competencies for managing of agricultural water resources?" About half of the respondents (48.8 percent) believed that farmers and rural people have priority for this administration; 30.6 percent believed a combination of Government and farmers can work better. The second part of Table 9 shows that most of the experts had no information about the existence of formal and non-formal associations in the field of agricultural water management formed by farmers and rural people in the Doroodzan dam irrigation network. This fact that "the majority of experts have a little information about existence of formal and/or non-formal water use associations" shows poor water management by farmers' groups and the water management priority of the Government.

Another parameter in the water resource management is experts' satisfaction from governmental water management. In this research this variable was measured by 7 items (Table 10). This measurement was a kind of assessment by regional experts' services of themselves. In other words, this investigation of expert satisfaction is a kind of self evaluation. Findings revealed that the experts' level of satisfaction with water management was "moderate". This finding shows that there is still a great distance from the ideal water management. Also, this finding is consistent with the experts' opinion in Tables 5, 6 and 9.

Table 8. Expert's conflict management style.

Conflict Management Styles (Strategies)	Items[b]	**Range**	Total Scores (Sum)	Minimum	Maximum	Mode	Median	Mean	Standard Deviation	Priority
Avoidance strategy	4	4 to 40	1267	4	35	14[a]	19.5	19.20	6.36	3
Oriented solution strategy	4	4 to 40	1846	4	40	30	28	27.97	6.19	1
Control strategy	4	4 to 40	1406	4	38	20	21	21.30	7.81	2
The dominant conflict management: **Oriented solution strategy**										

a: Multiple modes exist. The smallest value is shown.

b: Measuring is done based on the spectrum from very low (1) to very high (10).

Table 9. Respondents' preference for water resource management and their awareness of the existence of formal associations and non-formal use of water resources.

Variable			Frequency	Valid Percent	Mode
Having the competence for water management	Government		13	21.0	Farmers and rural peoples
	Farmers and rural peoples		30	48.4	
	A combination of government and farmers		19	30.6	
Experts' awareness of the existence of formal and/or non-formal water use associations	Formal associations	Yes	31	48.4	Yes
		No	9	14.1	
		Lack of awareness	24	37.5	
	Non-formal associations	Yes	22	35.5	Lack of awareness
		No	7	11.3	
		Lack of awareness	33	53.2	

Table 10. Determining the level of experts' satisfaction with water resource management: a self evaluation.

Statements[a]	Mean	Standard Deviation
Easy access to water experts	6.12	2.55
Behaviour and guidance of water operators in confrontation with farmers	6.08	2.47
Attracting cooperation and participation of stakeholders in water management projects	5.98	2.49
Transparency and clarity of Governmental Water Organization regulations	5.64	2.65
Equal and fair interaction with all audiences	5.56	2.65
Seriousness in providing services	5.45	2.37
Provide appropriate, applied and on time training activities in the field	4.98	2.60
Total score of satisfaction: N: 66 Minimum: 10 Maximum: 70 Mean: 39.82 Std.deviation: 14.81		
Range from 7 to 70: Mean: 39.82 ⟹ **(Moderate)**		

a: Responses weighted 1 to 10: from very low (1) to very high (10).

Relationship between Agricultural Water Conflict and Selected Variables

Table 11 shows the correlation of agricultural water conflict with some of independent variables. A Pearson correlation test was used to investigate the relationship between agricultural water conflict and selected variables. The findings revealed a significant relationship between the level of water conflict with the experts' attitude toward geographical and climatic conditions ($r= 0.468$ and $p= 0.000$). This finding indicates that, in the study area, water conflicts are closely related to climatic conditions. This is consistent with the findings in Table 5. In fact, in recent years with drought and water scarcity, water conflict has greatly increased. We can also see an inverse significant relationship with the experts' attitude toward extension services and water conflict ($r= 0.323$ and $p= 0.008$). This finding shows a positive attitude towards agricultural extension services can decrease the level of agricultural water conflict among water users. It is believed that appropriate education can reduce water conflict and change it to suitable cooperation among stakeholders.

There was no significant relationship between agricultural water conflict with experts' age, work experience and satisfaction from water management.

Agricultural Water Conflict: Comparing Different Experts' Groups

Table 12 reveals there was no significant difference between male and female, manger and expert, native and not-native groups regarding their attitude to agricultural water conflict. The experts could be categorized into four academic groups, including "agricultural extension and education and rural development", "water engineering and irrigation", "agriculture" and "other disciplines". Kruskal-Wallis test results showed there are no differences between them in relation to their attitude towards water conflict. The same result was obtained on respondents' levels of education and work situation (Table 13).

The results in Table 12 and 13 indicate that there are no significant differences between different groups of experts in regard to water conflict in the agricultural sector in the Doroodzan dam irrigation network. In other words, in this regard their opinions are fairly similar.

Table 11. Pearson correlations between agricultural water conflict and some independent variables.

Variables	r	P (Sig)
Age	- 0.241	0.066
Work experience (Years)	- 0.229	0.103
Satisfaction from water management	- 0.242	0.051
Experts' attitude toward geographical and climatic conditions	0.468**	0.000
Experts' attitude toward extension services	- 0.323**	0.008

*: Correlation is significant at the 0.05 level (2-tailed).

**: Correlation is significant at the 0.01 level (2-tailed).

Table 12. Mann-Whitney Tests (comparison of means between expert groups from the water conflict perspective).

		N	Mean Rank[a]	Sum of Ranks	Mann-Whitney U	Sig. (2-tailed)
Gender	Female	9	38.44	346.00	212.00	0.405
	Male	57	32.72	1865.00		
Job Position	Manager	16	29.97	1139.00	210.00	0.075
	Expert	54	21.63	346.00		
Native / Non-native	Native	34	29.09	989.00	394.00	0.825
	Not native	24	30.08	30.08		

Table 13. Kruskal-Wallis Test (comparison of means between expert groups from the water conflict perspective).

		N	Mean Rank[a]	Chi-Square	Sig. (2-tailed)
Formal Educational Background	Diploma and Associate Degree	6	29.42	7.407	0.060
	B.A. and B.Sc.	27	31.56		
	M.A. and M.Sc.	27	30.52		
	Ph.D.	4	56.88		
The Field of Study	Agricultural extension and education, Rural development	14	39.75	4.765	0.190
	Water engineering and Irrigation	35	31.77		
	Agriculture	11	25.64		
	Other fields	3	21.83		
Employment Status	Contract	35	27.74	1.562	0.458
	Agreement	7	22.86		
	Definite formal	9	21.67		

Discussion

Agricultural water conflicts in Iran show there are different goals among stakeholders, especially between farmers and the Government. Since regional water experts as government officials, are responsible for water management, it is important to assess their views about water conflicts. According to the findings, there is no a general difference between different expert opinions towards agricultural water conflict. In fact, the experts' individual characteristics could not alone affect on water conflict and the experts' opinions towards agricultural water conflict were generally similar. They were unanimous about water conflict in agricultural sector and had a shared understanding in this area. Their personal and professional characteristics did not make significant differences among their opinions toward water conflicts.

The findings of this study also confirmed that there was an "open water conflict" in the Doroodzan dam irrigation network. The results showed that agricultural water conflict is growing strongly. The main reasons for this increasing conflict were "drought", "water scarcity", "lack of local management of water resources by farmers" and "type of water management quality by government". Therefore, we can say at the present time, the main challenges of water conflict in the agricultural sector of Iran are related to climate change and "water management" issues. The practical and serious recommendation for regional water experts is that they focus on these factors, especially on improving water resource management in unfavorable climate conditions.

According to the expert opinion, the best strategy in this regard is to move from 'governmentality' to governance; in fact, in water resource management in Iran, the Government should make efforts to attract farmers' participation in this area. Attracting farmers' participation in water management and the Government's cooperation and support for this is an appropriate solution. In this research, the experts believed that the most important reference for water resource management is local people and farmers. On this basis, the role of the government should be only supportive and regulatory. The main responsibility of water experts is gradually transferring water management to farmers through training, increasing motivation and the participation of local communities, particularly constituting and development water use associations by farmers.

Finally, some appropriate recommendations are presented in Table 14, the application of which can help to control and decrease water conflict in Doroodzan dam irrigation network.

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Table 14. Summary of the findings and recommendations based on the findings.

Findings	Recommendations
- The findings of this research confirmed that there was an “open water conflict” in the Doroodzan dam irrigation network. The main reasons for this increasing conflict were “drought”, “water scarcity”, “lake of local management of water resources by farmers” and “Type of water management quality by government”. - The findings showed from groups involved in water conflicts that the second priority is the conflict between farmers and the Government. - The findings revealed a significant relationship between water conflict with experts' attitude toward geographical and climatic conditions.	- Organize, educate and encourage experts to apply appropriate education for farmers during drought and water scarcity by regional water experts. - In these circumstances, experts must to teach farmers to make use of suitable technologies that save and use better water in agriculture. Also they must present appropriate educations for farmers towards correct uses of water and spread the culture of economize in use of water resources. Moreover they should promote farmers to cultivate crops that are resistant to water scarcity stress. - Water resource management in Iran, should move from ‘governmentality’ to governance and the government should make efforts to attract farmers' participation in this area. - More attention to indigenous knowledge and culture in water resources management linked to using of new technologies. - Dissemination and promotion of local and indigenous technologies in water management among stakeholders. - Opportunities should be provided for all farmers, regardless of socio-economic status, to enhance their participation in water management programmes. - Making clear the governmental actions in the managing of water resources for stakeholders with inducing their participation. - Governmental experts should organize stakeholders towards changing water conflict to water cooperating. - Providing the necessary training and facilities, based on the characteristics of a group of farmers, is effective. We cannot apply one style to all areas. It is necessary to focus on attracting areas with different conditions, especially of the climatic and geographical conditions. This is more important in the downstream areas of Doroodzan dam.
- View all options with using “Game Theory” showed upstream farmers were "winners" and downstream farmers were "losers". The Government against the upstream farmers was the "loser" and with the downstream farmers was the "winner". Also, agriculture was considered the "loser" in comparison with urban and industrial uses.	- Producing an applied strategy for a balanced distribution of water between downstream and upstream of Doroodzan dam with the participation of farmers and using suitable technologies. - Accelerate the construction of water conveyance canals and careful monitoring of water distribution at the right time. - Teaching and improving interaction and cooperation instead of conflict among stakeholders. - The government's role in this regard, as custodian of water resources management, is notable. Equitable distribution of water for irrigation canals, construction and monitoring of water allocation can solve this problem. Currently, the Water Organization put it on top of their work and hopes in the coming years; this will remove prejudice in the distribution of water.
- Experts believed that the most important reference for water resource management is indigenous peoples and farmers. On this basis, the role of the Government is only supportive and regulatory. - About half of respondents believed that farmers and rural people have priority for water management. - Findings revealed that the experts' satisfaction from water management was "average".	- On this basis, the role of Government is only supportive and regulatory. In the case of Iran, what can help to remove or decrease agricultural water conflicts is shifting from governmentality to governance. This action needs some preconditions such as cultural supporting, people participation, adaptation of water technologies, and assistance of government without authority and instruction of water stakeholders. Cultural support for development in water resources management includes regenerating traditions and social institutions that have been adapted over time to different geographical conditions, especially in arid and semiarid regions. - Strengthening and changing the belief that stakeholders are owners of water resources instead they are just users. - Focusing on devolution of authority from Government to stakeholders toward water resources management. Actually the role of government must change from administrating to monitoring and cooperating. - Establishing and organizing water user associations and co-operations among farmers and monitoring their functions in productive and efficient way.

Table 14.

Findings	Recommendations
- There was an inverse significant relationship between experts' attitude towards extension services and agricultural water conflict.	- Focus on increasing the quality and quantity of applied trainings toward optimal management of water use in agriculture, can decrease conflict, and increase cooperation and participation of stakeholders.
- According to the experts' opinion to solve conflicts, the "oriented solution strategy" was the dominant strategy.	- Matching and coordinating solutions for water management with farmers is important. Best strategy in this area, is farmers' participation in water resources management. Get stakeholders' ideas and solutions will be helpful for experts. To achieve this finding, experts should encourage farmers to create and become member in local water use associations.
- The findings revealed there were no significant relationship between water conflict and many of experts' conditions. - There were no significant differences between different groups of experts in regard to agricultural water conflict.	- The results showed that the experts' characteristics could not only affect on water conflict. In addition experts' opinion also is needed to consider farmers' comments. It is also necessary that agricultural water conflicts well be studied at the broader backgrounds such as political, technical and technological, social, economic and environmental views.

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