

Water Conflict Crisis in Iran's Agriculture: A New Intervention for Agricultural Extension System

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Abstract: Education is increasingly seen as one means to reduce and overcome the effect of water conflict. In this regard, agricultural extension as a kind of informal education can be a key element to reduce conflicts among its clients. The purpose of this paper was to investigate agricultural extension responsibility toward water conflict management. A descriptive method using two surveys was fulfilled as a research method. The study was conducted in Doroodzan dam irrigation network zone in Fars Province, Iran. Multistage stratified random sampling was used to collect data from 294 farmers as a first population and all of regional water experts who worked in Doroodzan dam irrigation network formed the second population of this study (75 experts). The research tool included two questionnaires for farmers and experts. Findings of this study revealed that agricultural extension as mediator variable can control and reduce water conflict by influence on context conditions which affect it. Also, findings showed extension has not the power needed to change the structural area of water management in Iran. Before agricultural extension could have a significant effect on water conflict management, it needs to revise its purposes, approaches, methods and specially tasks. Finally, according to the findings, a model was designed to determine the role and position of agricultural extension as a means of intervention in water conflict management.

Key words: Agricultural water conflict, Water management, Extension, Iran.

1. Introduction

Education is increasingly seen as one means to reduce and overcome the effect of conflict. It can prevent emergencies from occurring and can bring a sense of normalcy and stability into an otherwise chaotic situation (UNESCO¹, 2002). Agricultural extension as a kind of informal education can be a key element to reduce conflicts among its clients.

In recent years, one of the processes has been taken consideration in agricultural extension, accompanied by theories such as social learning and networks, is conflict management. Conflicts among stakeholders can accrue in terms of specific circumstances such as different rural socio-economic structures, regulations and legislative frameworks related to agricultural extension organizations, discriminations in access to production resources and facilities as well as being diverse of attitudes, aspirations, preferences, and beliefs in different stakeholders. Conflict management is the best strategy for such conditions; therefore, integration negotiation is the substantial instrument and use of natural resources (Abadi&Hayati, 2010). Today, agricultural water conflict becomes one of the main challenges in agricultural water management, especially in areas that are exposed to water scarcity. Certainly, identification of the role of agricultural extension as an innovator can help to improve water conflict management in agricultural sector.

The link between sustainable agricultural development and conflict among different stakeholders has not received due attention and analysis. Environmental scarcity is the backbone of this conflict. Scarcity of natural resources such as land, water and forest can arise from depletion or degradation, increased demand or unequal distribution (Barli et al., 2006; Ahmadvand&Karami, 2007). Agricultural extension as an institution of agricultural development has long been involved in

¹United Nations Educational, Scientific and Cultural Organization

promoting agricultural growth, equality (Karami, 1986) and more recently sustainability (Roling & Van den Fliert, 1994; Karami, 1995). Therefore, environmental scarcity and the attempt to achieve sustainability have faced agricultural extension with unprecedented challenges (Ahmadvand & Karami, 2007).

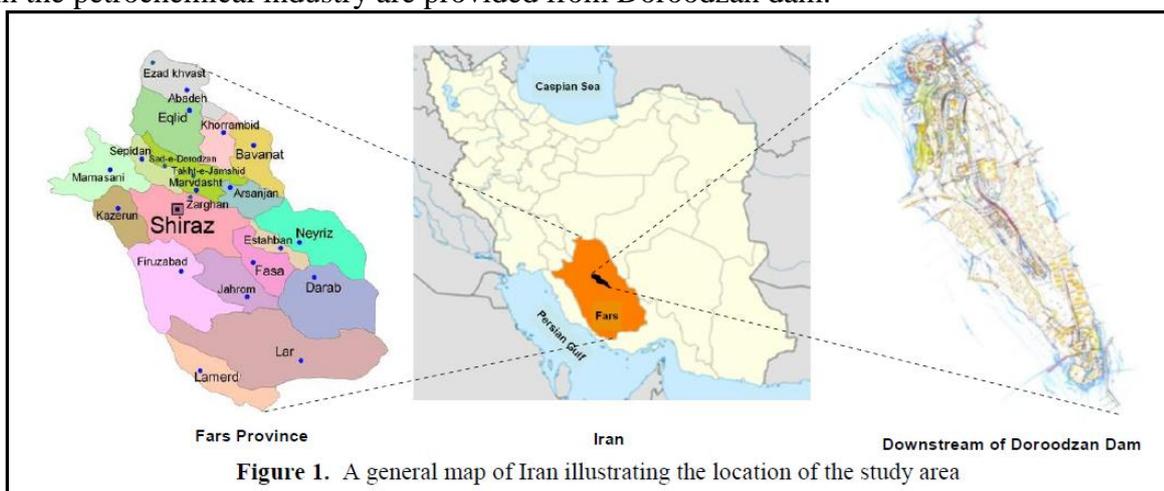
The puzzle of water conflict in the agricultural sector has many pieces. One of the most important piece and maybe the most important step in this regard is education. Education can present and introduce environmental and conservation values to make efficient changes into water beneficiaries' beliefs and norms. Also, education can clear the potential of resources management of water stakeholders, increase their participation and motivate them to more interaction and cooperation particularly to establish "water user associations". But education originating from what organization and in what form and with what content should be offered? Agricultural extension is an educational system that can be responsible for a large part of this task.

In this context, the question is "does the current extension system have the required capabilities to manage water conflicts? Or not?" If the answer is no, why? To be effective agricultural extension with regard to water conflict management in agriculture, what changes are needed? To answer these questions, the following items must be examined.

2. Materials and Methods

2.1. Study Area

The study was conducted in the downstream of Doroodzan dam, Fars province, in south-western Iran (Figure 1). Fars province is one of the largest (121,000 km²; about 7.5% of Iran's area) and most heavily populated (more than 4 million) provinces. It is one of the leading regions in agricultural production (the leading province in wheat production), although recently it has been confronted with water scarcity (Hayati & Karami, 2005). The Reservoir Doroodzan dam is one hundred kilometers far from Shiraz in the North West of it and has been constructed on the Kor River. The downstream of Doroodzan Dam consists of eight segments: Main canal, Ordibehshat canal, Hamoon canal, Left canal (in upstream), Amir segment, Fayzabad segment, Tilakan segment and Mavan segment (in downstream). These eight segments are divided in two main parts: upstream and downstream. However, the amount of agricultural lands is increasing and, with the current projects, it has shifted to 112000 hectares. Also, the needed drinking water of two towns (Shiraz and Marvdasht), as well as of large industrial enterprises near the dam, and the industrial water uses in the petrochemical industry are provided from Doroodzan dam.



2.2. Research Method

This research was conducted based on the framework of the applied approach with the methodology of a descriptive research method. Data were collected using two structured questionnaires (for farmers and experts).

2.2.1. Participants

Respondents in this study included two populations:

Farmers: A multistage stratified random sampling was used to select a sample of farmers from the area under investigation. From each region, five villages were randomly selected, which summed to a total of 40 villages. Then, from each village, proportionate to its population, 7 to 8 farmers were selected randomly. The final sample consisted of 294 farmers who used water from the irrigation network of Doroodzan dam.

Regional water experts: Number of regional water experts who worked in Doroodzan dam irrigation network was 75. All of experts were studied and finally 66 questionnaires were completed.

3. Results and Discussion

3.1. Descriptive Statistics

Summary personal and professional characteristics of the respondents (farmers and experts) have shown in [Table 1](#).

Farmers: Over 94% of farmers were men (277 people). The age of them ranged from 18 to 90 years old with a mean of 50 years. The range of educational backgrounds was from 0 to 18 years of schooling with an average of 5.7 years. The majority of farmers (29.6%) were illiterate and 28.2% had 1-5 years of education (Basic literacy). The range of family size was from 1 to 14 people with a median of 4. The agricultural work experience of farmers ranged from 1 to 75 years with a mean of 32.4 years. About 60% of farmers engaged in agriculture and hadn't a second job. Farmers had an average land size from 1 to 60 hectares, with a mean of 9.6. However, more than one-third of farmers (34.4%) had less than 5 hectares agricultural land. 84.4% of farmers were owner of lands that they work on them. Over 95% of farmers used water from Doroodzan dam irrigation network. In this regard, most of them (9%) used traditional methods for irrigation of their lands. 76.2% cultivated their farms one time in year and residual could farm two times in each year. The average of annual water supply costs that farmers pay to government was 474700 Iranian Rials (38.72 U.S. Dollars) per hectare ([Table 1](#)).

Regional water experts: Over 86% of the experts were men (57 people). The age of them ranged from 25 to 57 years old with a mean of 36.4 years ([Table 1](#)). Therefore, most of them were middle-aged. The majority of experts had Bachelor and M. Sc. degree (81%) and "Irrigation" was a dominant academic discipline. It is notable more than 20% (22.2%) of experts were in the field of agricultural extension and education. The work experience of experts ranged 26 years with a mean of 3.11 years in Water Organization. More than 60% (63.8%) of the experts had no experience work in Water Organization and worked in other organizations that are operating in the field of water resources management. In this regard, the average work experience was about 7 years. About 69% of respondents hadn't a second job. Nearly 70% (68.6%) of them were employed on a contract basis. About 60% of respondents were native in the region of their activity. However, that more than 80% (81.3%) declared Shiraz is their residence place (center of Fars Province).

Table 1
Summary of demographic characteristics of respondents

Characteristics		N	Mean	SD
Farmers	Age (years)	294	50.2	17.4
	Formal educational background (years)	294	5.71	4.87
	Family size	294	4.08 (4)	2.50
	Agricultural work experience (years)	283	32.4	18.59
	Area of agricultural land (hectare)	289	9.6	7.9
	Annual water supply costs (10000 Rials) U.S. Dollars ^a	222	47.47 38.72	18.17 14.82

Experts	Age (years)	57	36.39	8.96
	Formal educational background (years)	64	16.97	1.95
Work experience (years)	Water Organization	66	3.11	6.46
	Other organizations	66	6.7	7.88

a: The exchange rate from U.S. Dollar to Iranian Rial: 1 to 12260

3.2. Agricultural Water Conflict and its Types

Descriptive statistics pertaining to each of items regarding agricultural water conflict are presented in (Table 2). In this study, agricultural water conflict was measured with 14 items. Items extracted from the literature review and through interviews with farmers and water experts were selected as the factors that may influence water conflict. Most item means are in the range 3 to 4 (on a scale of 0-5) for farmers and are about the median score 5 to 6 (on a scale of 1-10) for experts. Therefore it can be concluded that water conflict in the perspective of farmers and experts was about moderate.

The range of agricultural water conflict was from 0 to 70 for farmers and 14 to 140 for experts. Graph 1 shows majority of farmers (over 85%) and experts (over 90%) mentioned agricultural water conflicts between moderate to high range.

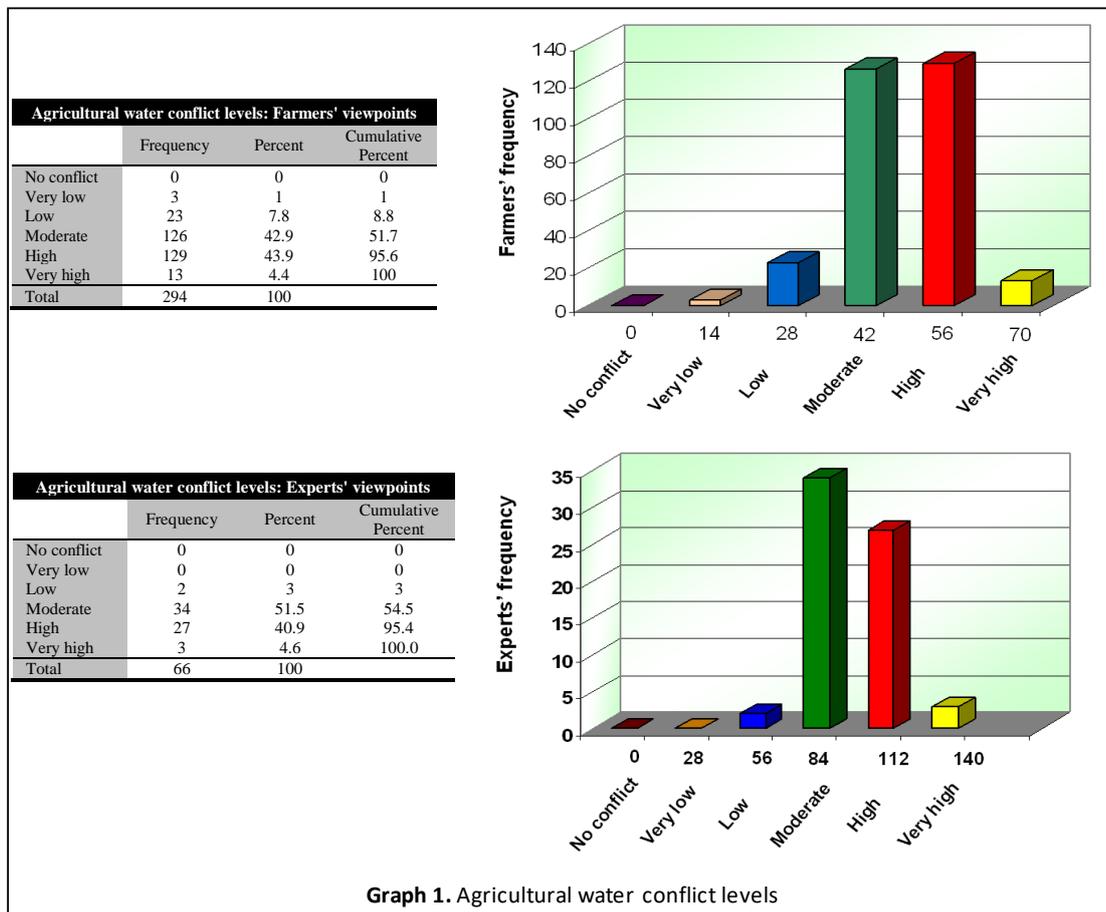
Table 2
The amount of agricultural water conflict

Experts' opinion ^b			Agricultural water conflict: Statements	Farmers' opinion ^a		
Rank	SD	Mean		Mean	SD	Rank
9	2.85	5.80	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.	4.19	0.90	1
1	1.62	8.29	Drought in recent years is the main factor aggravating the contradiction among water stakeholders.	4.18	1.06	2
2	2.49	7.55	Water conflicts in downstream of Doroodzan dam is more than it's upstream.	4.10	1.26	3
10	2.47	5.58	Injustice in the distribution of water is usual in the management of water distribution in Doroodzan dam downstream.	3.88	1.27	4
3	2.25	7.29	Water conflict between farmers and the government is a usual phenomenon for many years and this conflict is going more gradually.	3.48	1.21	5
5	2.43	6.26	Bribe to governmental agents to achieve more water is a usual manner in various forms.	3.35	1.49	6
			- I'm sure that a fraud happens in lottery time of water distribution (for farmers).	3.14	1.77	7
11	2.78	5.58	- I think, sometimes a fraud happens in lottery time of water distribution (for experts).			
8	2.17	5.92	There is conflict for the use of water always in Doroodzan dam irrigation network and it is a norm.	3.11	1.37	8
			- As for the design of irrigation canals, its construction format isn't suitable and my farm has not been received needed water (for farmers).	2.96	1.64	9
7	2.52	6.21	- Farmers think about the design of irrigation canals, its construction format isn't suitable and their farms have not received needed water (for experts).			
			- Several times I have quarrelled with other farmers to use of water (for farmers).	2.28	1.64	10
13	2.88	5.32	- Several times, I have witnessed conflicts between my colleagues and farmers for the use of water (for experts)			
			- If more water is required, we manipulate the water canals or water supply valves with other farmers' collaboration (for farmers).	2.18	1.72	11
4	2.61	6.33	- Farmers with other farmers' collaboration, manipulate the water canals, or water supply valves (for experts).			
12	2.36	5.42	Fulmination of other farmers and governmental regional experts is usual to use of water.	2.14	1.35	12
			- Sometimes, I have to extract my needed water using motor pump from main canals (for farmers).	1.78	1.74	13
6	3.42	6.23	- Sometimes, farmers extract their needed water using motor pump from main canals (for experts).			
			- I have been reprimanded several times, because I have had some conflicts with water distribution agents (for farmers).	1.33	1.55	14
14	2.52	3.08	- I have been reprimanded several times, because I have had some			

conflicts with farmers about the use of water (for experts).

Farmers	Total score of water conflict:	N: 294	Min: 12	Max: 63	Mean: 42.07	SD: 9.38
	Range from 0 to 70: Mean: 42.07⇒(Moderate to high)					
	a: Responses weighted 0 to 5: from none (0), very low (1), low (2), moderate (3), high (4) and very high (5).					
Experts	Total score of water conflict:	N: 66	Min: 40	Max: 122	Mean: 84.85	SD: 15.06
	Range from 14 to 140: Mean: 84.85 ⇒(Moderate to high)					
	b: Responses weighted 1 to 10: from very low (1) to very high (10).					

There are four types of water conflict: “No conflict”, “Surface conflict”, “Latent conflict” and “Open conflict” (TEARFUND, 2003). To determine the dominant contrast, for each of the types of these conflicts 5 to 6 items were provided. Table 3 shows the details of four kinds of water conflict. According to this table dominant water conflict in Doroodzan dam irrigation network from farmers’ viewpoint was “latent conflict”. However, experts believed the dominant water conflict is “open conflict”. These findings shows agricultural water conflict in this area is going more gradually from experts' opinion (Graph 1).



Graph 1. Agricultural water conflict levels

Table 3
The amount and type of water conflict

Experts' opinion				Type of water conflict		Farmers' opinion			
SD	Mean	Range	Items ^a			Items ^b	Range	Mean	SD
5.78	27.56	5 to 50	5	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	0 to 25	14.17	3.85

6.77	23.98	5 to 50	5	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	0 to 25	13.94	3.37
6.62	28.33	5 to 50	5	Latent conflict	This is conflict below the surface. It might need to be brought out into the open before it can be effectively addressed.	6	0 to 30	18.50	4.84
8.62	30.44	6 to 60	6	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	0 to 30	13.17	5.37
The dominant conflict:				The dominant conflict:					
Open conflict				Latent conflict					
a: Experts: Measuring is done based on the spectrum from very low (1) to very high (10).									
b: Farmers: Measuring is done based on the spectrum from never (0), very low (1) to very high (5).									

3.3. Need to Change

- Structural features of water management

At present, the main institution for water resources management is based in the Ministry of Energy, and its main components are as follows:

- Deputy Minister for Water Affairs (Iran Water Resources Management Organization),
- Regional water companies,
- Water and Wastewater Engineering Company (nationwide), and Provincial Water and Wastewater companies, also in important cities (30 companies). Furthermore, about 124 consulting firms and 216 construction companies support the above sections (Ardekanian, 2003). Therefore, the government is the owner and controller of water resources. However, the government couldn't organize water beneficiaries in agricultural sector efficiently (Bijani&Hayati, 2011).

Since water management is infra the Ministry of Energy and moreover, agricultural extension works under the supervision of the Ministry of Agricultural Jihad; therefore, it seems that water issues are not related to it and it cannot intervenes in water management effectively. In fact, policies, strategies, objectives and programs of water management are out of agricultural extension control. Thus, it is evident that it cannot play an active role in water conflict management. However, agricultural extension in terms of administrative structure is not manifest in water resources management directly but in the other hand with the importance of water in agriculture is associated with it. Therefore, based on its mission is forced to intervene in water affairs. However, this intervention is limited and cannot be found in the policy area. It seems that at the present, despite the structural constraints and macro policies, control and reduce water conflicts should be a mission for agricultural extension. In fact, agricultural extension can help in water conflict management by influencing on context conditions (Figure 2).

The question in current situation is “how and what agricultural extension helps to reduce and control water conflict?” According to the findings of this study, some recommendations will be presented in the following chapter.

-The need to change the extension methods and approaches

At present, agricultural extension approaches and methods are not suitable for use in water conflict management. In this context, accurate identification of target groups and selecting appropriate utilization of as priorities are very important.

Agricultural extension in Iran such as many developing countries is mainly focused on common extension approach (Karbasioun&Chizari, 2005; Heidary et al., 2006; Allahyari, 2008). Extension

objectives toward water sustainability could range from the effective transfer of technology to the building up of strong rural water user associations, which can exert influence over future research and policy agendas and also take and enforce collective decisions over water resources management (Cho & Boland, 2004).

- The need to change into purposes of agricultural extension

What are the purposes of current agricultural extension? Is there conflict management with regard to natural resources such as water in proposes of agricultural extension?

Agriculture of Iran is facing serious environmental degradation problems particularly in water resources (Rezaei-Moghaddam&Karami, 2006; Allahyari, 2008) and extension has a key role in improving it (Van den Ban, 1999; Heidary et al., 2006; Allahyari, 2008), yet current extension system in Iran does not have sufficient competency for the achievement of water conflict management and it needs to shift toward new approaches with new objectives. It indicates that having multi-objectives is imperative for successful extension systems in this regard (Allahyari, 2008).

Agricultural extension used different approaches that vary according to the extent that they emphasized production rather than people. Furthermore, historical evidence shows that most of the time, agricultural extension concern was promoting production. Then, it used top-down approaches such as forcing, legalistic and smoothing to conflict management. We believe that if agricultural extension wants to protect its vital role in agricultural development and natural resource management, it should concern people and use participatory or bottom-up approaches such as compromising and problem-solving approaches to manage conflict in achieving sustainable development. According to the previous discussions, modification of agricultural extension efforts is needed in considering the issue of social and environmental problems such as sustainable agriculture and natural resource management (Rezaei-Moghaddam et al., 2005; Ahmadvand&Karami, 2007).

- The need to make changes in duties and intervention method of agricultural extension

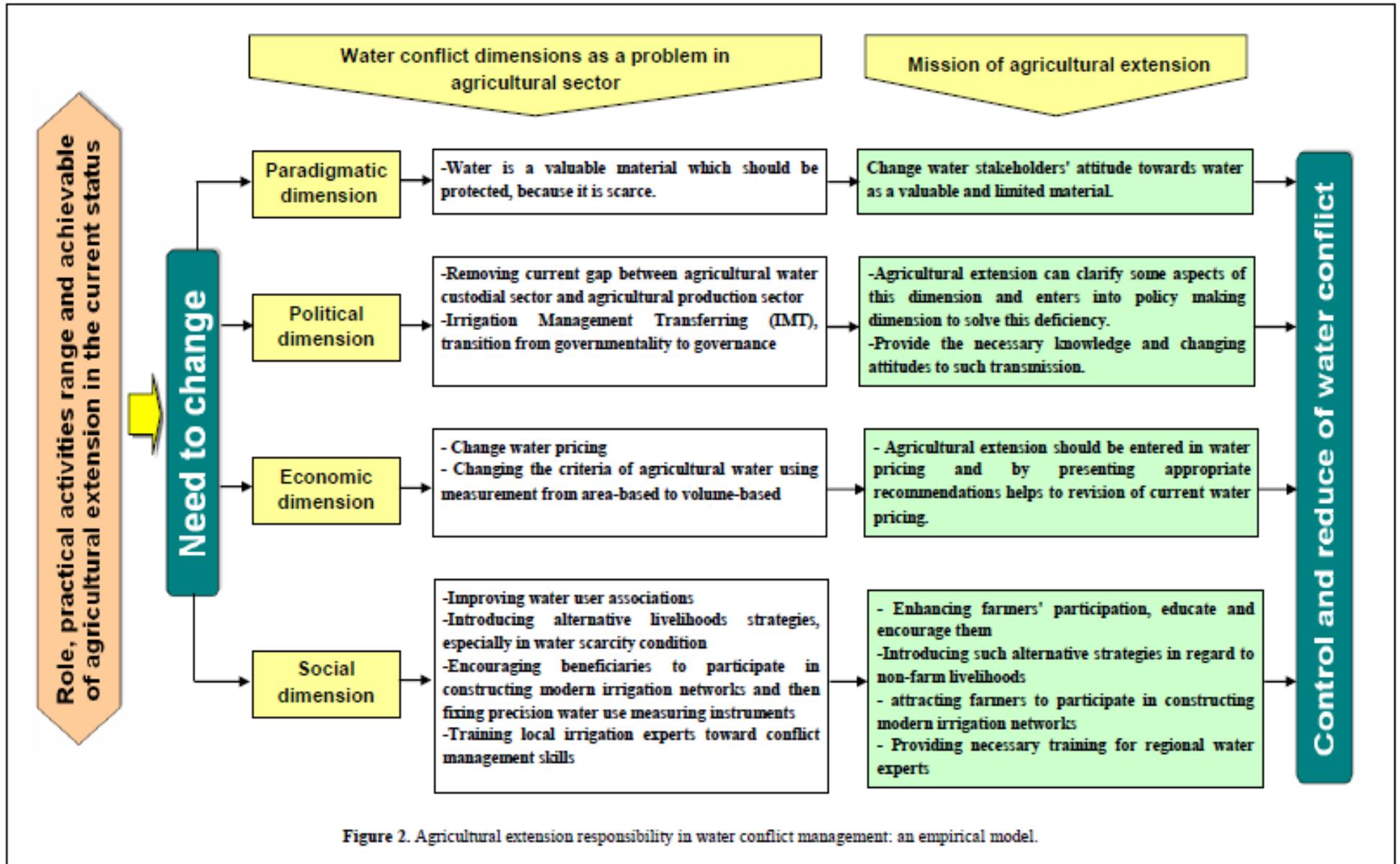
In current situation, agricultural extension cannot be able to make impact on the control and reduction of water conflicts. To achieve this change revising the duties and intervention strategy of extension are needed. One of the most important steps in this regard is focusing on establishment, implementation guidance and training “water user associations”; agricultural extension can play an effective role in this regard.

The main key in this regard is launching of stakeholders participation for water management. Actually, it is necessary to make them feel that they are the owners of water resources and thus are responsible for the preservation and optimum use of water. Creation and empowerment of collaboration sense in the format of cooperation groups such as “water user associations” is a suitable approach to that direction. That requires a change of attitude concerning governmental cooperation. It should be that of a cohort and supervisor not of an owner of water resources or controller and manager. Changing of the perception that stakeholders are owners of water instead of just users is a very important role that the government must opt for. This important event isn't impossible if all stakeholders participate in water management (Bijani&Hayati, 2011).

In this way, agricultural extension has an important role as a facilitator. This can be achieved by providing appropriate training for farmers and water experts and attract their motivation, as well. Identify potentials, strengths and weaknesses, opportunities and threats, is considered as one of the tasks of agricultural extension in this direction.

A third party is required for the management of conflicts. Agricultural extension as the third party can be entered and have an important role in facilitating the negotiation process. The attendance of change agents is essential in participatory processes as well as their participation as facilitators or mediators to resolve conflicts, particularly in water conflicts among farmers (Abadi&Hayati, 2010).

The findings of this study showed there is an open water conflict in agricultural sector whose solution requires deeper investigation and high physical energy. Therefore, it is necessary that change agents have special abilities. For this purpose, due to challenges arising from conflicts among local groups which can hinder the success of many collaborative programs in agriculture, it is important to change agents who act as mediators.



4. Conclusions and Recommendations

At the present, improvements in water resources management are being sought and implemented as part of the course of socioeconomic changes in agricultural sector of Iran. Studies indicate that the present system is entering a new stage, with widespread economic and environmental consequences arising from its progression over the past 70 years. The current condition has revealed the necessity for adopting coherent, farsighted, and comprehensive plans and actions. In this regard, water conflict is considered as one of the major challenges in agricultural water management which could be investigated according to several dimensions. Findings of this study revealed that agricultural extension as mediator variable can control and reduce water conflict by influence on context conditions which effect on it. Also, findings showed extension has not the power needed to change the structural area of water management in Iran. Before agricultural extension could have a significant effect on water conflict management, it needs to revise its purposes, approaches, methods and especially tasks.

In a problem oriented strategy to control and reduce water conflict in the agricultural sector, the following dimensions should be considered. Also, according to the findings of this study and within range of authorities of agricultural extension, to control and reduce water conflict, some missions for agricultural extension system are presented below (Figure 2).

- Paradigmatic dimension

Although Iran is a country with water scarcity, under current conditions, water is a cheap and available material in the agricultural sector. The human relationship with water is a physical relationship now. According to human ecological perspective, water should be seen as a valuable material. We should know that water is a valuable material which should be protected, because it is scarce.

The mission of agricultural extension in this field is changing water stakeholders' attitude towards water as a valuable and limited material. According to this view, water is a source of survival.

- Political dimension

- *Removing current gap between agricultural water custodial sector and agricultural production sector:* As mentioned above, in Iran, water management is infra the Ministry of Energy and moreover, agricultural affairs are under the supervision of the Ministry of Agricultural Jihad. In this regard, the two ministries of Energy and Agricultural Jihad are not synchronized concerning water resources management and water requirements in agriculture. Agricultural production programs are not consistent with the water allocated in agricultural sector. Findings of this research showed there isn't this harmony in Korbala plain. This inconsistency is one of the main causes of water conflicts.

The role of agricultural extension in this area should be that of enlightened intervention. Agricultural extension can clarify some aspects of this dimension and enter into policy making dimension to solve this deficiency. But, it should be considered that the power of agricultural extension is not high and has no high maneuverability in this area.

- *Irrigation Management Transferring (IMT), Transition from governmentality to governance:* One of the most important issues in the political dimension is rotation and transfer of water resource management from governmentality to governance. In this way, water beneficiaries find themselves in the role of "owners" of water resources. Therefore, there will be more guarantees as to the protection of these resources.

In this regard, agricultural the mission of extension is to provide the necessary knowledge and change attitudes toward such transmission.

- Economic dimension

- *Water pricing*: At present, water is a cheap material and therefore, farmers try to use it more and more. In such circumstances, farmers have become involved in a very covetous behavior. If water acquires its actual price, it certainly leads to changes in water demand. Changes in demand can lead to changes in the utilization of water.

Therefore, we can say agricultural extension should intervene in water pricing and by presenting appropriate recommendations help to revise the current water pricing. That revision can reduce agricultural water conflicts.

- *Changing the criteria of agricultural water using measurement from area-based to volume-based*: As before mentioned in chapter seven, there is a contract between the government and farmers toward water allocation that is based on the land size (based on hectares). Therefore, the water supply cost which every farmers pay to government is based on his/her land size. Criteria of water using measurement in agriculture should be changed from area-based to volume-based.

- Social dimension

- *Improving water user associations*: Findings of this research showed social organizations have an important role to reduce water conflicts. One of such social organizations toward use of water is related to “water user associations”. Agricultural extension in this area can play an important role. Enhancing farmers' participation, training and encouraging them in this regard would be mission of agricultural extension.

- *Introducing alternative livelihoods strategies, especially in water scarcity condition*: Non-farm livelihoods can help farmers to get added income and save themselves in appropriate level of quality in life. Suitable non-farm activities decrease their dependency to agriculture and water. Agricultural extension can introduce such alternative strategies in regard to non-farm livelihoods and therefore, helps to reduce water conflicts.

- *Encouraging beneficiaries to participate in constructing modern irrigation networks and then fixing precision water use measuring instruments*: In modern irrigation networks, it is more possible to measure amount of water, accurately. It can leads to water conflict reduction. On the other hand, implementation of such networks is not possible without water stakeholders' participation. Extension has a prominent role with regard to attracting farmers to participate in constructing modern irrigation networks.

- *Training local irrigation experts toward conflict management skills*: Local water experts as staff and field water managers have the responsibility of water distribution among water stakeholders. If they acquire conflict management skills, they will able to control and reduce water conflicts. Agricultural extension can intervene by providing necessary training in this regard.

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