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Evaluation of attitudes of stakeholders for irrigation water management: A case study of Harran Plain, Turkey

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Abstract: There is an increasing demand on water resources. Agricultural irrigations consume water at most among the other sectors at globally. The upper Euphrates-Tigris basin enclosing the whole area of Southeastern Anatolian Project (GAP) is a multi-sectorial and integrated regional development project, mainly based on water and soil resources. Harran plain is located within the GAP where agricultural irrigation is managed by water user associations (WUA) that have structural problems. It is aimed to determine the views and perceptions of the stakeholders' to irrigation water management and operation. The basic material of this study comes from four groups whose are farmers, the chairman and the manager of WUAs and State Hydraulic Works (DSI) staffs that can be called as stakeholders. 470 questionnaires were conducted by face to face interviewed. Likert attitude scale is used. 61.65% of stakeholders have negative opinion about adequacy and consistency of investment and management decisions of WUAs. The rate of having a positive opinion about given enough information to the water users are 22.37%, while technical support about water usage is 20.71% by WUAs. It is expressed by 52.73% that maintenance of irrigation systems mainly done by WUAs. 24.81% of stakeholders want management should be carried out by the chairman at WUAs. This study is a first of its kind for the Harran plain and the GAP region. The results will be guideline for decision-makers in water management policies in Turkey and also similar socio-cultural countries.

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1. Introduction

Water is non-substituent and limited natural resources essential for life. There is an increasing demand on water resources in terms of quality and quantity due to rapid population growth, urbanization, industrialization and irrigation. Regardless of development levels, agriculture and agro-based policies have priority in all countries and agriculture occupies important place in the economy of countries. Water for food and life, a comprehensive assessment of water management in agriculture is necessary (Viala, 2008). Agricultural sector is around 8% of gross domestic product (GDP) in Turkey (Aydogdu et al., 2014a). Agricultural irrigations consume water at most among the other sectors at globally.

Increasing economic pressures on water resources are causing countries to (re)consider various mechanisms to improve water use efficiency. This is especially true for irrigation agriculture, a major consumer of water (Johansson et al., 2002). As Storm et al. (2011) said, for the implementation of an effective water management, knowledge about farmers' demand for water is crucial to assess reactions to water policy, to establish a cost-benefit analysis of water supply investments or to determine the optimal water allocation between different users. Potential changes in global and regional agricultural water demand for irrigation were investigated within a new socio-economic scenario by Fisher at al., 2007 based on climate change impacts on irrigation water requirements. Fujihara et al., (2008) indicated that if the irrigated area is expanded in the future under the expectation of current flow, water scarcity will occur due to the combination of decreased inflow and increased water demand. Thus, in the Seyhan River Basin, water use and management will play more important roles than climate change in controlling future water resource conditions. Hence, agricultural water management has more importance for sustainability of water resources as compared to the other sectors.

Southeastern Anatolian Project (GAP: Guneydogu Anadolu Projesi, in Turkish) is an integrated socioeconomic development project to efficiently utilize the great water potential of Euphrates and Tigris Rivers in southeast Turkey (Unver, 1997; Balat, 2003). Covering roughly 10% of total area of Turkey and with the estimated cost of

US$ 32 billion, GAP is the largest investment for regional development in the history of Turkey and fourth largest irrigation project in the world (Miyata and Fujii, 2007; Yurekli, 2015). GAP is focused on efficiently utilizing natural resources, mainly based on water and soil resources, to increase the income level and life standards of region's people, to eliminate regional disparities and to contribute to economic development and social stability. Within the GAP's scope, there are 22 dams, 19 hydroelectric power plants and irrigation of 1,822 million hectares (ha) of agricultural land. The total investment cost is 32 billion USD (GAP, 2012). Agriculture and irrigation are expected to have an accelerating effect for development of the GAP region. Harran Plain is located in Şanlıurfa, the field of the study; semi-arid with high temperature, average precipitation amount is between 300-365 mms and annual evaporation is 1,848 mms (DMİ, 2011). Agricultural irrigation in Harran Plains within the scope of GAP began in 1994 and today, reached to approximately 150,000 ha (Anonymous, 2013).

Agricultural irrigation is the largest water user groups in Turkey by 72.7% (Aydogdu et al., 2015a). Irrigations were previously under the authority of the State mainly by State Hydraulic Works (DSI). Later on irrigation management and operations were transferred to water user associations since 1994 in Harran plain for sustainability of systems in order to ensure the rational use and rate of transferred reached to 96% (Aydogdu, 2015b). WUAs are operating irrigation systems under the control and supervision of DSI. The performance of the WUA with the indicators of utility, productivity, sustainability and financial efficiency was found to be positive; while the performance of adequacy was identified as poor (Uysal and Atış, 2010). It is known that, because of various reasons, irrigation management insufficiently developed in Turkey. The situation is the same in the Harran Plain as well (Aydogdu et al., 2014c). It cannot be said conducted water management to provide the expected benefits from GAP. Gorton et al. (2009) investigated the performance of water communities in the Bregalnica region in Macedonia. According to the study; key determinants identified include transparency and trust regarding management, cost recovery rates, farm size and irrigation costs. Membership satisfaction is an important determinant of payment behavior.

There are 22 WUAs with 21094 registered farmers in the Şanlıurfa-Harran Plain, within the scope of GAP project (Aydogdu et al., 2015c). However, it is obvious that, for various reasons, WUAs could not provide the expected benefits in the current situation in GAP region (Aydogdu et al., 2015d). WUA's are managed by the chairman based on elections from among the farmers and WUAs' managers are permanent staff and mostly agricultural engineers. In this regards there are four stakeholders in Harran plain irrigation; farmers, chairman and managers of WUAs, and DSI. This study was conducted to determine the views and perceptions of the stakeholders' for irrigation water management and operation. This study is a first of its kind for the Harran plain and the GAP region. The results will be guideline for decision-makers in water management policies in Turkey and countries with similar socioeconomic and hydrological conditions.

2. Materials and Methods

Wastewater, soil and plant samples were collected from the target areas and data was collected from four groups including farmers, the chairman and the manager of WUAs and DSI staffs. There are 22 WUAs and 21 094 farmers in the WUAs at Harran plain. Total 373 farmers were selected using a simple random sampling method by formula (equation 1). The chairman and managers of WUAs (total 44) were assessed under the full enumeration. DSI staff (53) members, involved in irrigation, management and operation divisions, were randomly selected. Total 470 questionnaires were filled by face to face interviews. The sample size was determined using the formula (1), (Yamane, 2001):

$$n = \frac{Nt^2pq}{d^2(N-1)+t^2pq} \quad (1)$$

Where; n is sample size, N are the farmers in the main population, which is 21094, t is the sample size (>30), Z table value with 5% error margin is 1.96 in normal distribution table, p is the possibility of farmers accepting the offered proposals is 50% so 0.50, q is the possibility of farmers not accepting the offered proposals, 1-p= 0.50, d: it was taken as 0.05 with 95% confidence interval.

Table 1. Descriptive statistics of the participants

Factor	Participants	Age (years)	Education (year)	On duty experience (year)
Farmers	373	44.6	7.0	21.4
Chairmen	22	47.7	6.1	6.5
Managers	22	38.3	14.5	8.8
DSI Staffs	53	50.5	13.3	17.2
Weighted Average		45.1	8.1	19.6

Table 2. The answers of stakeholders about investment and management decisions of WUAs

Factor	Strongly Agree	Agree	Fair	Disagree	Strongly disagree
Farmers	4%	8%	25%	30%	33%
Chairmen	0%	31%	39%	17%	13%
Managers	5%	10%	35%	35%	15%
DSI staffs	0%	5%	25%	32%	38%
Weighted Average	3.4%	8.83%	26.12%	29.85%	31.8%

Likert attitude five point scales were used in the research. The principle is that participants assign their judgment in the researched topics ranging from "strongly agree" to "strongly disagree" and focusing on these judgments.

There are two situations in the Likert scale: The wanted situation and the unwanted situation. Positive and negative situations are expressed with an equal number of statements. The judgment statements should have a single meaning and definite outcomes. While using this scale, judgment statements are given to persons in a certain order and each person is asked to select the option for each judgment statement which best reflects their agreement level.

With the help of this scale, if a group's attitude towards a situation is wanted to be analyzed, all factors that affect the situation should be included within the scale's borders and at least one or two judgment statements for each factor should be used. At the end of the research, numerical distribution of the agreement level for individuals that create the group to each judgment statement is specified and the numerical value of the agreement options is multiplied with the option coefficient to calculate a numerical average based on the final value obtained. This average values are taken as the choice value of the group and it is compared with the calculated choice value to determine the effect of the judgment on the attitude. Confidence level is accepted as 85% in general.

3. Results and discussion

Inappropriate irrigation management and practices can reduce access to irrigation water and deterioration of water quality (Yesilnacar and Yenigun, 2011). Table 1 the descriptive statistics of the participant is given in table 1. Agricultural irrigations have structural problems. It is a must to operate and manage water resources effectively and efficiently. Irrigation water operations were previously under the authority of the State. Increasing ownership and efficiency of irrigation systems by users is one of the basic expectations. However, it is obvious that, for various reasons, it could not provide the expected benefits in the current situation. In order to define the problems, predetermined questions were asked to the stake holders. The collective answers of stakeholders to the question of investment and management decisions of WUAs are adequate and consistent are located in the table 2.

Accordingly, the rate of having a positive opinion about WUAs' investment and management decisions are 12.23%, as oppose to this one 61.65% of stakeholders have negative opinion about adequacy and consistency. These results indicate that there is problems mainly arise from insufficient staff, less education level of chairman and board members at WUAs. As a result of these, decisions are not satisfy the needs and expectations and caused to significant amount of waste of water to drainage canals. This may not cause to problems at upstream parts, but certainly create problems to downstream parts of the Harran plain. Mainly furrow irrigation is carried out and very limited night irrigation is done at the field. Furrow lengths are longer. This results to salinity problems at some areas and water shortages at peak irrigation seasons.

Table 3. The answers of stakeholders about given enough information by WUA officials

Factor	Strongly Agree	Agree	Fair	Disagree	Strongly disagree
Farmers	6%	17%	25%	25%	27%
Chairmen	0%	31%	39%	17%	13%
Managers	20%	20%	45%	15%	0%
DSI staffs	0%	7%	15%	40%	38%
Weighted Average	5.7%	16.67%	25.46%	25.85%	26.32%

Table 4. The answers of stakeholders to providing technical support by officials

Factor	Yes (%)	No (%)	Not much demand from farmers (%)
Farmers	17	83	0
Chairmen	26	17	57
Managers	15	15	70
DSI staffs	47	8	45
Weighted Average	20.71	68.27	11.02

Imambakır WUA has an area of 7 464 ha of land which affected by over irrigation under high groundwater level and to come across with salinity problems and significant losses of yields (Aydogdu et al., 2014d). It was calculated according to the effect of salinity and found that 1 840 625 kg of cotton yield loss has been occurred due to salinity and the resulting income loss was 935 711 USD in 2009 in the Akçakale district in GAP-Harran plain (Aydogdu et al., 2014b). This situation negatively affects the viewpoints of stakeholders. WUAs collect crop pattern information from farmers in order to define the water needs and give to DSI for irrigation water demand in each year. However, these demands are far from reflecting the field that is not exactly realistic, because of no appraisal of the land. Therefore water demands given to DSI were based on assumptions.

Sustainable irrigation water management should simultaneously achieve two objectives: sustaining irrigated agriculture for food security and preserving the associated natural environment. A stable relationship should be maintained between these two objectives now and in the future, while potential conflicts between these objectives should be mitigated through appropriate irrigation practices (Cai et al., 2003). The collective answers of stakeholders to the question of do you think that WUA officials are given enough information to the water users are presented in table 3.

Accordingly, the rate of having a positive opinion about given enough information to the water users are 22.37%, as oppose to this one 52.17% of stakeholders have negative opinion about the question which indicate that insufficient information is given to farmers about water related issues in the field. In fact there is insufficient and inadequate information system in the field. The education levels of famers are less as compared to the education level of the other sectors. The suitable information and extension activities are must in order to get better water management in the field. The collective answers of stakeholders to the question of providing technical support to the farmers on issues such as proper irrigation time, water amount and water needs of the product in the field is given in table 4.

Accordingly, the rate of having a positive opinion about given technical support to the water users are 20.71%, as oppose to this one 68.27% of stakeholders have negative opinion and 11.02% expressed that there is not much demand from the farmers on these issues. This result is meaningful. The stakeholders, excluding farmers, were indicating that farmers are not aware on these issues. On the other hand, the farmers who said no this question, 37% declared that they have enough information and experience while it is difficult to reach to the officials by 18%, and the disinterested public officials and/or inadequate public servants of 45%. Technical support is one of the tools to ensure the sustainability of irrigation systems, and may have positive effects on water savings and the drainage problems (Yenigun and Aydogdu, 2010). A clear understanding of all the components of the water balance is essential to analyze possible measures of water savings in irrigated agriculture. However, most components of the water balance are not easily measurable either in terms of the required time interval or the complexity of the processes (Droogers et al., 2000).

The collective answers of stakeholders to the question of maintenance of irrigation systems in your area are made by who in the field is given in table 5. Accordingly, it is expressed by 52.73% that maintenance of irrigation systems mainly done by WUAs. The operation and maintenance problems of irrigation systems were observed in the study area during the field visits.

Table 5. The answers of stakeholders about maintenance of irrigation systems

Factors by	Public	WUA	Farmer	WUA+Farmer	Not made
Farmers	6%	49%	7%	28%	10%
Chairmen	9%	78%	0%	9%	4%
Managers	5%	90%	0%	5%	0%
DSI staffs	45%	53%	0%	2%	0%
Weighted Average	10.49%	52.73%	5.56%	23.1%	8.12%

Table 6. The answers of stakeholders to the question of who should manage the WUAs

Factors	WUA's Chairman	DSI	WUA's Manager	Governorate	Private Company
Farmers	25%	43%	7%	7%	18%
Chairmen	78%	13%	0%	0%	9%
Managers	25%	35%	15%	0%	25%
DSI staffs	15%	38%	2%	2%	43%
Weighted Average	24.81%	40.66%	6.48%	5.78%	20.73%

The system is intended to provide continuity by making the priority and urgent interventions. In fact it is under the responsibility of WUAs because of transfer protocol of irrigation systems between DSI and WUAs. DSI also gives support on this matter, too. Maintenance of irrigation systems requires staff, machinery and financial power too. WUAs are inadequate on these subjects and frequently get helps from DSI. Legal changes should be made in order to achieve sustainable WUAs immediately (Çakmak et al., 2004). The collective answers of stakeholders to the question of who should manage the WUAs are given in table 6. This question also gives in a sense an outlook of stake holders to irrigation management.

The stakeholders, excluding chairmen, do not want to WUAs' managed by the chairman. This result is meaningful. The reasons that leads to this result is mainly based on elected chairmen were inadequate about management of such a big and complex irrigation systems, given service quality is insufficient, unavailability of resources in an efficient manner and doubts about equal and fair management. In fact, WUAs, so chairmen manage high costly important public investments. This management should not be viewed only as water management, as well as soil and natural resources are managed. Thus, the chairman should have a level of education beyond the minimum eligibility requirements. They should also be subjected to a certain training program that would allow them to do this duty after selecting in an efficient and effective manner.

DSI has more confidence with experienced and sufficient technical personnel and machinery in these matters, come to the forefront as a public authority among the others. The most striking result here is the high rate request of water management is done by private companies. These results are highly significant.

4. Conclusion

Trainings should be given to the chairmen and managers of WUAs about water management, organizations, operations and the legal regulations in order to increase efficiency of the systems. Efficient irrigation management should be aimed by preserving the soil together with providing water savings for more revenue per unit area in the field. The study area consists of mainly open channel irrigation and night irrigation is not done so much by farmers. This results to flow of water to drainage channels that is waste of savings which results to less irrigation areas with unexpected irrigation modules. Ground water level is rising in areas where existing of drainage problems and salinity problems are emerging because of evaporation due to the hot climate conditions. Awareness of farmers should be established in order to make an efficient irrigation in the field by giving training in the use of water and modern irrigation techniques. Training should be given in the Union and in the field by experienced staffs before the irrigation season. The language, materials and contents of this training should be in a manner that would be acceptable and understandable by the farmers. If a suitable combination of crop pattern and irrigation methods can be supported through training programs for farmers, agricultural water use efficiency, productivity and effectiveness can be increased significantly in the field.

Competing Interests:

Authors declare that they have no competing interests.

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