Users' Perceptions of Water User Associations: Evidence From Three Cases in Turkey

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Abstract: This paper assesses the outcomes of the irrigation management decentralization, operation and maintenance with a focus on three regions from two provinces of Turkey. Its main goal is to identify the factors that impact irrigation users' satisfaction with the Water User Association's (WUA) performance. The motivation here is the close link between sustainability of the WUA and satisfaction of its members. The results show that despite functioning within a common legislative framework, self-governing WUAs operating in different regions have different features; even two WUAs that share the same river basin have significant differences in the way they operate and the way their decisions on governing the WUA are perceived by their members. We also verify a negative relationship between elite capture and users' satisfaction in two cases; but, interestingly, in one region, this relationship is shown to be positive. This result is attributed to the presence of irrigation groups, sub-groups within the WUA, which are financially compensated for their services to the WUA. Any policy developed towards sustainable use of common pool resources should be sensitive to local conditions, adaptive to users' needs, have a flexible institutional structure, and allow for institutional learning and change. Policy makers should design such institutions that will be able to incorporate the recommendations of those in the field, such as the water users and WUA personnel into the governance system. This is more likely to yield better resource use with less negative impact on the environment.

Key words — decentralization, irrigation, sustaining resources, Turkey, Water User Associations

JEL Classifications: C51, D02, D70, Q12, Q56

1. Introduction

Decentralization is the "transfer of planning, decision-making, or administrative authority to the state's field organizations, local administrative units, semi-autonomous and parastatal organizations, local governments or NGOs" (Rondinelli, Nellis and Cheema, 1984:9). In the case of natural resources, such as forests or water, Agrawal and Ostrom (2001:488) define decentralization as "any act by which the central government cedes rights of decision-making over resources to actors and institutions at lower levels in a politico-administrative and territorial hierarchy." This paper examines the case of Turkey where the State Hydraulic Works (*Devlet Su İşleri* - DSI) planned, built, operated and maintained all major irrigation schemes up until 1993 (Ünver and Gupta, 2003; Kudat, 1996). In line with neo-liberal measures to reduce state involvement in service provision, the agency transferred the duty of water management, fee collection, and maintenance to the locally-managed Water User Associations (WUAs).[1]

Following the description of the decentralization process in Turkey, this paper assesses the outcomes of the irrigation management decentralization by examining user satisfaction with the functioning of WUAs in two provinces. The main goal is to identify the factors that impact irrigation users' satisfaction from locally managed WUAs. Given the fact that institutional structure of the WUAs are identical throughout the country, this study hypothesizes that the conduct of WUAs in the provision of water, power relations within the community, monitoring of users to abide by the rules, and socio-economic factors would impact user satisfaction with irrigation services provided by the associations. The motivation with measuring factors affecting

[1] Along with Mexico and Colombia, Turkey decentralized large irrigation systems to local organizations (Bruns and Meinzen-Dick, 2000). WUAs have been the most frequently crafted institutions for irrigation management transfer – see, for instance, Nikku (2002) for the case of Andhra Pradesh; Khanal (2003) for that of Nepal; Gorriz et al. (1995) for Mexico, Sehring (2007) for the cases of Kyrgyzstan and Tajikistan; Veldwisch, (2007) for the case of Uzbekistan's experience. Wilder and Romero Lankao (2006) and Sehring (2007) show that the creation of WUAs was the condition upon which donors provided funding for new investments in the water sector in Mexico and Kyrgyzstan/Tajikistan, respectively.

users' satisfaction is that there is a close link between sustainability of the WUA and satisfaction of its members (Gorton, et al., 2009).

The following sections will first give an overview of the literature on decentralization and the implementation of decentralization in Turkey in relation to irrigation management followed by the application of the model and hypotheses developed through the literature review to two provinces from Turkey.

2. Decentralization of Common Pool Resources (CPR)

Decentralization reforms were, on the one hand, a reaction to the over-centralized mixed economies in the developing as well as developed countries in the post-World War II period. In developing countries the centre was the planner, financier, and service provider because it had to stimulate economic development (Bennett, 1990:10). The concentration of political and economic power, which was a product of the over-centralized state apparatus, imposed limits on personal freedom (Devine, 1988:4). This was the motivation for decentralization from a leftist perspective, which supported the need for a free self-governing society (Devine, 1988:13) in order to empower citizens in the decision-making processes. On the other hand, World Bank and other international development agencies promoted decentralization primarily as a means to improve service delivery, reduce the burden on central government budget and to demonstrate to citizens that democracy works (McCarthy, 2004:1201; Kolavalli and Brewer, 1999:249). Over-centralized states were seen as the source of efficiency shortfalls and budget deficits. The World Bank expected decentralization to "promote civic empowerment, diminish corruption, enhance efficiency and improve public service delivery" (Andrews and de Vries, 2007:426).

Irrigation systems are common pool resources because it is difficult to exclude potential users once the infrastructure is built, and the withdrawal of water by users at the head subtracts

from the tail-end users (Wade, 1987; Tang, 1992; Ostrom et al., 1994). The CPR research on water resources examines the conditions under which resource management is sustainable (see, among others, Ostrom, 1992; Tang, 1992; Lam, 1996). The factors that determine the sustainability of the resource according to this literature include the type of institution established to manage it, and the characteristics of the resource and those of the users. In the case of irrigation, relevant characteristics might include the number of irrigators; cultural and social features of the users such as ethnicity, race and tribe; the amount of irrigated land they hold, and the location of their plot within the system (Tang, 1992:12).

Despite being promoted on a global scale, the performance of decentralized irrigation institutions, when constituted with a top-down approach, is not clear (Gorton et al., 2009, Meinzen-Dick, 2007). Agrawal (2002:45) states that similar institutional rules can have different outcomes depending on "biophysical, social, economic and cultural contexts." The biophysical factor that most affects the irrigation management in Turkey is the availability of water and whether water is delivered through gravity or necessitates pumping. In terms of social, economic and cultural contexts, the important factors are whether there is a significant inequality in resource and power distribution, whether the powerful elite can capture the WUA management and use it for their self-benefit, and whether there are appropriate mechanisms to monitor the functioning of WUAs. These factors are no doubt interrelated: power differentials can cause elite capture[2] as well as prevent appropriate monitoring[3] from taking place if measures are not in place to prevent the impact of powerful local elites.

[2] As stated by Dasgupta (2007:230), local elites, defined as those "with disproportionate access to social, political, economic power," may capture the local associations and "corrupt community-level planning and governance."
[3] Monitoring and enforcement are necessary for a better functioning of WUAs (Ostrom, 2009).

In line with the contemporary literature on CPR and based on Turkey's experience with decentralization of irrigation, this paper investigates the impact of the conduct of WUAs, power relations within the community, monitoring of users and socio-economic factors on the perception of users as to whether they are satisfied with the WUAs. Our motivation comes, first, from Agrawal (2002, p.45), who emphasizes the need for studies that concentrate on "…how aspects of user group membership, and the external social, physical, and institutional environments affect institutional durability and long-term management at the local level." Second, Saleth and Dinar (2008) point out that the need for change in organizational structure comes from individuals, who respond to economic outcomes and endogenous preferences, and not from organizations.

We assume that user's perception of WUAs is a better indicator than just looking at the budgetary performance or the amount of water distributed by the associations since these may be affected by factors that are out of the association's control. Perception-based data is not a perfect indicator of the performance of the WUAs but has been used to "synthesize different types of information (objective data, subjective observation, and expected trend)" and internalize some of the important but complicated concepts (e.g. performance, efficiency and equity) (Saleth and Dinar, 2008:306). In addition, perceptions of stakeholders can be used as a tool to identify the effectiveness of institutions (Shinakoti and Thapa, 2005). This paper will evaluate the performance of WUAs using the perceived satisfaction of water users with their associations. To start with, first, the next section provides an overview of decentralization of irrigation management in the case of Turkey, as the empirical analysis will be based on data collected from two provinces of Turkey.

3. Water User Associations in Turkey

In Turkey, State Hydraulic Works (DSI) is the state agency responsible for the construction, operation and maintenance of large-scale irrigation infrastructure (Ünver and Gupta, 2003). Historically, State Hydraulic Works operated the irrigation schemes through a top-down approach with very low levels of farmer participation. Cost-recovery rates for the irrigation projects were very low, averaging only 10 percent (Aküzüm et al., 1997:552). In many cases, maintenance was not (and could not be) performed due to a lack of funds, and the long-term sustainability of these projects depended on significant changes being made.

The director of the DSI Operation and Maintenance Department asserts that the DSI Act of 1954, which modeled DSI based on USA's Bureau of Reclamation, allowed for the transfer of management of state-owned infrastructure to local user associations. Only very small-scale irrigation systems were transferred to users, and it was not until 1993 that any significant development occurred on this front (Çevikbas, 2001:98).[4] There was a sharp increase in the number of transfers to the WUAs beginning in 1993, and by 2009, a total of 1.92 million hectares[5] had been delivered to water user associations.[6] This constitutes 90 percent of all transferred irrigation systems by DSI.

DSI maintains ownership of the resource infrastructure but the responsibility for secondary and tertiary canals is transferred to the WUAs.[7] The legal standing of the WUAs is

[4] In one of the first studies on the GAP region, Akşit and Akçay (1997) searched for the appropriate management, operation and maintenance model. Doing their fieldwork in 1993 just before irrigation started, by using a household survey, the authors propose that irrigation technology and social relations need to interact for advancing productive use of irrigation in the region.

[5] The total irrigated agricultural land is 3.13 million hectares in Turkey. The transferred irrigation schemes constitute 68 percent of all irrigated land in Turkey. Other organizations which operate irrigation schemes transferred by DSI are cooperatives, municipalities, and village authorities. The total of their share as part of transferred irrigation schemes is 10 percent.

[6] http://www.dsi.gov.tr/hizmet/tarim.htm.

[7] WUAs in Turkey were created in cases where the irrigation scheme covered more than one village (Svendsen, 2001). In other cases it was the village administration which took over the operation and management responsibility.

usually guaranteed by an enabling law, which authorizes its establishment, and the transfer agreement between the state agency and the WUA. In the case of Turkey the transfer of irrigation management to the associations progressed much faster than planned. In 1995 alone, the area transferred was three times that of the yearly plan. There was no opportunity to prepare an enabling law that would be the legal foundation for the associations. The associations were established using a patchwork of the Village Act (No. 442), the Local Government Act (No. 1580) and the Provincial Governance Act (No. 5442).

The associations are set up by the local authorities in an irrigation zone and apply to the DSI in order to sign the transfer agreement which gives them the right to collect fees and assigns them the responsibility to distribute water and maintain the canals. Even though irrigators are in charge of the management, technical staff is hired to carry out the operation of the system (Palerm-Viqueira, 2004). The WUAs are in charge of collecting the water demand forms before the beginning of each irrigation season (usually in April) and forwarding the total demand to DSI which is responsible for allocating the amount of water from the reservoir. The most common method of water distribution is the rotation system among different tertiary canals and a distribution ranking among farmers set by technicians. The number of siphons - which are pipes used in order to divert water from irrigation canals to the fields – farmers can use to divert water from the canal to their field is determined by the size of land they irrigate. The field technician is in charge of auditing the process, of patrolling the territory for infrastructural problems and for ensuring the smooth running of the water distribution process.

According to the bylaw, the main decision-making body of a WUA is the Council. The Council, which has a four year term, is composed of the local authorities who are permanent members (such as the village headmen and the mayor) and selected representatives from each

village. The councilors elect the chair and the executive committee of the association. The general secretary of the association is responsible for the steering of the associations' daily operations and coordination. The council is responsible for the approval of work plans and the budget; determining/approving irrigation fees[8] for the coming season; and the decision to acquire machinery and employ new personnel.

Irrigation fees constitute the majority of the WUA revenues. The fees are set by each association and vary according to the crop that is cultivated (Ünver and Gupta, 2003). The associations depend on the collection of fees for survival – unlike DSI whose budget depended on transfers from the general budget. The budgetary autonomy renders the associations able to freely decide about their expenditure items. This autonomy, however, should be complemented by systematic and in-depth audits if embezzlement and corruption are to be prevented.

Given the patchy legal foundations, both WUAs and DSI articulated the need for a new law prior to 2005 (Kadirbeyoglu, 2008:110). The draft law which was circulated among different state agencies in 2004/2005 was discussed in several meetings that gathered WUA officials and state bureaucrats; however, this draft was never debated in the parliament. Instead, the WUAs were brought under the jurisdiction of the new legislation pertaining to local governance unions (Law No. 5355, *Mahalli İdare Birlikleri Kanunu*, 26 May 2005). Accordingly, the WUA councilors – except for the mayors and headmen who are the automatic members – are now elected by farmers from the villages instead of being assigned by the headmen/mayors. The duration of the chairperson's mandate has been shortened to be two years.

The WUAs were asked to modify their bylaws according to Law No. 5355. The new bylaw brought about two fundamental changes to the functioning of the WUAs. First, elections

[8] Irrigation fees refer to the price of water farmers pay to the associations.

are now held at the village level to determine the councilors (other than the headmen and mayors who are automatically assigned as councilors). Originally, the new bylaw stipulated that only those water users who are residents in a village would vote in the elections. This excluded many farmers who resided in the district centre and cultivated land in the villages. When elections were carried out, many farmers who resided outside of the village boundaries were antagonized. The residency requirement was strongly opposed by the farmers from Söke Plain WUA since in one village only 58 out of 1,200 farmers were able to vote at the elections because of the residency requirement (Kadirbeyoglu, 2008:207). This rule was in place for only one election (in 2006) and following the pressure exerted on the Ministry of the Interior by farmers who do not reside in the villages the bylaw was modified to remove the residency clause (TBMM, 2005:1049).[9]

The second major change that the new bylaw stipulated was the reduction of the chairperson's term in office. In the old system, the chair served between four to five years. Due to problems of accountability, the new bylaw reduced the term of the chair to two years so as to enhance accountability. If the chair is approved by the council at the end of two years, then he could serve three more years. Therefore, the new clause granted the council an accountability check of the chairperson's performance; however, some chairpersons and general secretaries opposed this clause by arguing that the new personnel brought in with the new chair would have only started learning the job when they will be replaced with new ones in the eventuality of a new chair being elected by the council at the end of the two years (Kadirbeyoglu, 2008:208). The pressures of the WUAs resulted in another modification in 2006: the term of the chairs was extended back to five years.

[9] Law No. 5445 *Mahallî İdare Birlikleri Kanununda Değişiklik Yapılması Hakkında Kanun* – Law on Changes to the Local Authority Unions Law (legislated on 29.12.2005; published in the official gazette on 04.01.2006).

Hence, legally the structure that was set up for the transfer of irrigation management generated many complaints; yet attempts to rectify the problems have not been effective. In terms of water use and the biophysical characteristics of the resource, there is significant variation among the associations. In general almost all irrigation infrastructure until recently was built using open canals with gravity induced flows. This leads to significant evaporation and loss of water.

Another biophysical feature of the resource is its abundance in some settings and scarcity in others. Şanlıurfa has abundant water for the time being since it receives it from the largest dam of Turkey: Atatürk Dam. The water allocated to the fields of Harran Plain will diminish over the years when subsequent irrigation projects will be completed along the Mardin Main Canal to the east. Despite abundance of water in the main canal in Şanlıurfa, as the water flows to the south of Şanlıurfa Canal, fields towards the end of the canal system receive much less water because of the excessive water intake by upstream associations. Nevertheless, there is abundant water in comparison to Aydın which receives water from Menderes River and is not served by a dam. This leads to very low availability of water, especially during drought years.

This feature of the abundance and scarcity of water in different settings impact the satisfaction of users as will be outlined in the following section on the evaluation of survey results. However, given scarcity of water, it is possible to see the advantages of a decentralized irrigation management system through the example of Aydın and Söke WUAs. 2007 was a year of drought for the Menderes river basin. The scarcity was such that the second round of water for crops was unavailable. Different parties involved in the process, such as DSI, the governor, WUAs and directors of the Provincial Directorate of Agriculture gathered in March and determined the process of water distribution that will be followed in order to make sure water

will be available to irrigate cotton for the second and third rounds.[10] They resorted to fee per irrigation, which was objected at first but was gradually accepted. This pricing mechanism reduced the number of irrigation for a single crop from 6 to 2 times on average.[11]

Contributions of the paper

- The WUAs in Turkey were created under a common legal framework and support program, and thus a shared external environment. Hence, first, we concentrate on internal factors, such as socio-economic characteristics, structure and conduct of the WUA (Gorton, 2009), and investigate their importance in explaining the performance of WUAs, drawing on data from two regions in Turkey. It is expected that these factors influence the probability of successful self-management and provide the basis for testing hypotheses.
- Second, we apply appropriate econometric techniques to model farmers' satisfaction with WUAs, and test hypotheses based on (i) governance, conduct, structure of WUA such as power, elite capture, corruption, (ii) impact of characteristics of resource on success of WUA, such as scarcity and salience, and (iii) impact of socio-economic user characteristics such as age, education, farm size on success of WUA.

4. Methods

This paper draws on fieldwork carried out in Şanlıurfa in Southeastern Turkey, Aydın in Western Turkey, and Ankara, the capital city, in the summer of 2009. We conducted in depth interviews with WUA personnel and chairmen, experts and academics, DSI employees, and farmers. Following the examination of the literature and interviews, we designed a survey and conducted it in September 2009 in the Şanlıurfa and Aydın provinces to capture the satisfaction of irrigators

[10] Interview with C. Koç, Director of Operation and Maintenance Department in Aydın Office of DSI, 16.07.2009.
[11] Interview with the chairman of Aydın Plain WUA, 17.07. 2009.

with the WUA performance. Differing satisfaction levels have been reported by scholars studying the WUAs in Turkey (see, Baran, 1996; Güvercin and Boz, 2003 for results from the Düziçi district in Turkey and Kumbaroğlu, 2004). Based on the survey with 400 water users from the two provinces and qualitative interviews with different stakeholders, this paper evaluates the performance of the WUAs and the factors that impact the sustainability of the institutions and the resource. WUAs sampled in this study cover an area of almost 43,000 ha in Aydın and 82,000 ha in Şanlıurfa. The number of users belonging to WUAs in these regions is approximately 5,900 in Aydın and 11,100 in Şanlıurfa.

5. Econometric Analysis, Model, and Results

5.1. Variables

Gorton et al. (2009) provide a thorough analysis of the literature where performance of WUAs is measured using three criteria: formation/membership rates, technical impact, and cost recovery. These criteria and related performance measurements are criticized for relying heavily on expert opinions or irrigation agency data and not paying attention to members' perceptions (Gorton et al., 2009; Araral, 2005a). Another difficulty in interpreting the results of the studies in the literature is due to sampling across different countries and market environments, which are the motivation of Gorton et al. (2009) to concentrate on WUAs in a specific region in Macedonia where WUAs operate under a common legal framework during the same time period—which is also the case in this research.

Regarding applied research on WUAs, studies that benefit from farmers'/users' opinions and evaluate conditions of WUAs from users' perspectives are rather limited. Naik and Kalro (2000) use a stakeholders' approach to measure impacts of irrigation management transfer in India. Using household surveys, for the case of Nepal, Shivakoti and Thapa (2005) analyze

institutional involvement in the farming system adjustment process by emphasizing interactions between household participation, institutional effectiveness, and socioeconomic variables. How farmers devise, monitor and enforce mechanisms to deal with collective action problems while managing water resources is the question tackled by Vandersypen et al. (2006). Using a questionnaire survey, the authors conclude that farmers behave selfishly and this results in negative implications both for themselves and their neighbors. To identify factors influencing farmers' attitudes towards water management, Vandersypen et al. (2008) also use a survey and look at farmers' interest in water management and how they are motivated towards collective action in Mali. McKay and Keremane (2006) use face-to-face interviews with farmers and officials from irrigation department and WUAs to derive farmers' perceptions on rules-in-use while managing water resources in India. For the cases of Uzbekistan, Tajikistan and the Kyrgyz Republic, to asses WUA performance through users' perspectives, Gunchinmaa and Yakubov (2009) look at whether a well-defined and enabling institutional environment leads to better WUA performance, where performance is measured by using adequacy, timeliness, and equity as critical factors.

While setting-up the model that will be used in the regression analyses, we concentrate on the following themes that are hypothesized to influence a users' satisfaction with the WUA performance:

a) WUA Structure and Conduct: Adequacy and timeliness of water delivery define whether water is delivered reliably at the requested amount and at the requested time. These two variables are indicators of good irrigation service (Facon, 2000; Gunchinmaa and Yakubov, 2009). The existing literature shows that irrigation is most valued when water scarcity is at moderate levels; relatedly, farmers put greater emphasis on a functioning irrigation system when there is water scarcity (Gorton et al., 2009). The users that are located in the regions we sample from have

either ample water available from the dam reservoir (Şanlıurfa) or face significant amount of water shortages because of scant water in the river stream during the summer months (Aydın and Söke).

Dietz et al. (2003) state that monitoring of resources and their use by humans will lead to effective governance of commons. Monitoring of the system by management also faces challenges stemming from incorrectly specified incentive structures (Meinzen-Dick, 2007). Monitoring of the irrigation system by WUA personnel makes the water distribution more effective as they can detect problems on the spot or prevent users from misusing the system. Monitoring of the irrigation system and the WUA management by auditors are hypothesized to impact user satisfaction.

The last variable to be included in the model in this category is whether users believe the WUA takes their views into account while setting the irrigation fee. The hypothesized relationship is that the more they take farmers' views into account, the more the farmers are satisfied.

b) Rule enforcement: In most irrigation systems water is delivered through a rotation system and there is an order with which the farmers are allowed to use water. If farmers violate the rotation system or take water even though it is not their turn, we can define this as illegal water intake. This type of action usually brings forth penalties, but whether these penalties are imposed or not is a different question. At the same time, Dietz et al. (2003) emphasize that for having effective monitoring and enforcement policies, sufficient resources should be available. When resources and their use by humans are monitored, this will lead to effective governance of resources (Dietz et al., 2003). In this category, the paper focuses on three variables: presence of illegal water intake, equity in enforcement of rules with respect to illegal water intake, and presence of bribery or corruption in the WUA.

c) Power distribution and elite capture[12]: While formulating the hypothesis for the presence of elite capture in the studied regions, we were also motivated by the remark made in Pérez-Cirera and Lovett (2006, p.342): "…there are few empirical analyses that deal with power related issues but also allow for statistical inference." With the formation of institutions, it is difficult to exclude some members or groups from taking advantage of the common resources, influence actions of the management, or change the behavior of other users (Agrawal, 2003, Pérez-Cirera and Lovett, 2006). Such behavior will lead to elite capture where these individuals or groups will alter the planning and governance procedures (Dasgupta, 2007) and appropriate the lion's share of the benefits (Sethi and Somanathan, 2006). As the end result, the irrigation system may not perform as planned (Bardhan and Dayton-Johnson, 2002) or the powerful users may even help the local organization to grow to fulfill their personal objectives (Ray and Bijarnia, 2007). Still, a differentiation can be made between elite capture and elite control where the latter term describes a case where corruption is not present although some members of the institution have elite power (Dasgupta, 2007). The variable that this paper examines in relation to user satisfaction is whether big farmers or farmers close to political power are favored by WUA management. The hypothesis is that the more there is favoritism, the less farmers will be satisfied.

d) Socio-economic characteristics/Economic inequality: The economic heterogeneity among users can be defined based on differences such as wealth, income, plot size, exit options, being

[12] Power will be conceptualized in its Weberian form and will refer to the ability of persons, groups and institutions to obtain compliance through a variety of means (Duara, 1988:4). There are forms of power that are produced and reproduced as a result of certain institutional forms (Reed, 1997:40). In Şanlıurfa, the institutional form from which power emanates is the traditional tribal structure (the *aşirets*), and power differentials stem from the feudal/familial structures. In Aydın, power differentials come from resource ownership and administrative positions. The creation of WUAs has the potential to strengthen some of these forms of power while reducing the hold of others, but it also potentially creates new centers of power based on the position of individuals in the associations. Miyata and Fujii (2007) analyze the impacts of irrigation in GAP region on users' welfare by concentrating on changes in assets and income. Using the results of a household survey conducted, the authors derive that, in irrigated villages, 58 percent of users are satisfied with the water user association. Those who are not satisfied point out to unequal distribution of water, bribery, and bad management as the reasons. It is concluded that success rate in implementation of management system varies from village to village and unequal or unjust water distribution can be attributed to power asymmetries in the region.

located at the head-end or tail-end (Bardhan and Dayton-Johnson, 2002; Vandersypen et al., 2006). This paper examines whether factors such as the position of the plot (head or tail end), the size of irrigated plot, proportion of income from agriculture, age of household head, schooling, experience and training in irrigated agriculture have an impact on satisfaction of farmers.

5.2. The Cases

We analyze two provinces in Turkey: Aydın and Şanlıurfa. Within the first province, we examine the cases of Aydın and Söke plain WUAs which share the same water source, the Menderes River. Aydın Plain is higher up in the river flow and Söke Plain is where Menderes River meets the Aegean Sea. We do not pool Aydın and Söke plains because landownership structures and the irrigation infrastructure show significant difference. In our sample, the characteristics of the plain's users in Söke and Aydın can be summarized as follows: The farmer on average is 46 years old in Aydın and 47 years old in Söke, has 6.4 years of schooling in Aydın and 6.7 years in Söke, with 78 percent of income in Aydın and 80 percent in Söke coming from agriculture. The water user has on average 24 years of experience in irrigated farming in Aydın and 26 years of experience in Söke, but only 17 percent of them in Aydın and 38 percent in Söke have received training on irrigation. The area with irrigated farming has an average size of 6.4 ha in Aydın but 16.8 ha in Söke. Regarding the location of plots, 23 percent in Aydın are within medium distance and far away from main canal whereas the corresponding value is 52 percent in Söke.

The second province is Şanlıurfa and we examine the case of the Harran Plain. Farmers sampled in Harran on average are 36 years old, have 5.8 years of schooling and obtain 91 percent of their income from agriculture. Since water delivery started in 1993 in this region, the experience in irrigated farming on average is 16 years with only 25 percent of users having

training on irrigation. Users in the region operate on average on 13 ha of land with 36 percent of plots within medium distance and far away from main canal.

Table 1 of descriptive statistics of our variables shows that 54 percent of users in Aydın, 38 percent of users in Söke and 54 percent of users in Şanlıurfa region are satisfied with the WUA performance. In another recent study done in Şanlıurfa, Harris (2005) finds that 42 percent of farmers sampled state that they are not satisfied with the WUA management. The remainder of this paper reports the findings from our statistical and econometric analysis of the empirical data derived through the survey with water users in the west and southeast of Turkey.

5.3. Results of the Econometric Analysis

We use the following model to derive the determinants of users' satisfaction with the WUA performance and present the results in Table 2.

$$\begin{aligned} Satisfaction_{k,i} &= \beta_{k,1} Adequacy_{ki} + \beta_{k,2} Timeliness_{ki} + \beta_{k,3} MonSys_{ki} \\ &+ \beta_{k,4} MonMan_{ki} + \beta_{k,5} WaterFee_{ki} + \beta_{k,6} IllegWat_{ki} + \beta_{k,7} Enforce_{ki} \\ &+ \beta_{k,8} BribCorrupt_{ki} + \beta_{k,9} Power_{ki} + \beta_{k,10} Plot1_{ki} + \beta_{k,11} Plot2_{ki} + \beta_{k,12} Area_{ki} \\ &+ \beta_{k,13} Income_{ki} + \beta_{2,14} Age_{ki} + \beta_{k,15} Schooling_{ki} + \beta_{k,16} Experience_{ki} \\ &+ \beta_{k,17} Training_{ki} + \varepsilon_{ki}, \end{aligned} \tag{1}$$

where with k=1 we have the Aydın, with k=2 the Söke, and with k=3 the Şanlıurfa region.

The Probit regressions run and the marginal effects calculated reveal the following results:

TABLE 1. DESCRIPTIVE STATISTICS

Variable	Description	Aydın				Söke				Şanlıurfa			
		Mean	St. Dev.	Min	Max	Mean	St. Dev.	Min	Max	Mean	St. Dev.	Min	Max
Dependent variable													
Satisfaction (users' perception of satisfaction of users in the region)	1 = satisfied, 0 = not	0.537	0.502	0	1	0.383	0.489	0	1	0.537	0.500	0	1
Independent variables (based on users' perception)													
WUA Structure and conduct													
Adequacy (water received in sufficient amount)	1 = satisfied, 0 = not	0.073	0.262	0	1	0.149	0.358	0	1	0.852	0.356	0	1
Timeliness (water received at requested time)	1 = satisfied, 0 = not	0.146	0.356	0	1	0.106	0.310	0	1	0.530	0.501	0	1
Monitoring of irrigation system (by WUA personnel)	1 = monitored, 0 = not	0.646	0.481	0	1	0.723	0.450	0	1	0.423	0.496	0	1
Monitoring of management	1 = monitored, 0 = not	0.537	0.502	0	1	0.574	0.497	0	1	0.369	0.484	0	1
WUA pays attention to users' views while setting water fee	1 = yes, 0 = no	0.268	0.446	0	1	0.255	0.438	0	1	0.430	0.497	0	1
Monitoring and enforcement													
Presence of illegal water intake	1 = yes, 0 = no	0.098	0.299	0	1	0.319	0.469	0	1	0.128	0.335	0	1
Equity in enforcement of rules/punishment wrt illegal water intake	1 = yes, 0 = no	0.951	0.217	0	1	0.883	0.323	0	1	0.792	0.407	0	1
Presence of bribery and corruption in WUA	1 = yes, 0 = no	0.159	0.367	0	1	0.330	0.473	0	1	0.456	0.500	0	1
Power distribution/Elite capture													
Big farmers or farmers close to political power are favored by	1 = yes, 0 = no	0.646	0.481	0	1	0.809	0.396	0	1	0.604	0.491	0	1
WUA management													
Socio-economic characteristics/Economic inequality													
Position of plot (medium distance to and far away from main canal)	1 = yes, 0 = no	0.232	0.425	0	1	0.521	0.502	0	1	0.362	0.482	0	1
Area with irrigated farming	In decares	64.232	64.334	3	390	167.729	191.006	9	1025	133.040	177.843	3	1100
Proportion of income from agriculture	In %	77.666	27.899	10	100	80.404	27.593	10	100	90.973	19.099	20	100
Age of household head	In years	45.683	13.995	19	77	47.255	12.015	24	82	36.020	12.501	18	68
Schooling	Years of schooling	6.427	2.440	3	13	6.713	2.742	0	13	5.832	2.081	0	13
Experience in irrigated farming	In years	23.732	13.196	2	52	25.553	11.110	3	50	15.617	5.674	4	30
Training attained on irrigation	1 = yes, 0 = no	0.171	0.379	0	1	0.383	0.489	0	1	0.248	0.433	0	1
Number of observations		82				94				149			

TABLE 2. USERS' SATISFACTION WITH THE WUA PERFORMANCE
PROBIT REGRESSIONS-MARGINAL EFFECTS

Variable	Description	Aydın			Söke			Şanlıurfa		
		Coeff.	p-value		Coeff.	p-value		Coeff.	p-value	
Independent variables (based on users' perception)										
WUA Structure and conduct										
Adequacy (water received in sufficient amount)	1 = satisfied, 0 = not	-0.3427	0.237		0.4054	0.094	*	-0.0332	0.711	
Timeliness (water received at requested time)	1 = monitored, 0 = not	0.1059	0.602		0.0002	0.999		0.1280	0.090	*
Monitoring of irrigation system (by WUA personnel)	1 = monitored, 0 = not	-0.0338	0.823		0.4177	0.000	***	0.2376	0.033	**
Monitoring of management	1 = yes, 0 = no	0.3431	0.015	**	0.0240	0.820		-0.0537	0.668	
WUA pays attention to users' views while setting water fee	1= yes, 0 = no	-0.0737	0.572		-0.0016	0.988		0.2014	0.003	***
Monitoring and enforcement										
Presence of illegal water intake	1 = yes, 0 = no	-0.0312	0.861		-0.1553	0.131		0.0670	0.531	
Equity in enforcement of rules/punishment wrt illegal water intake	1= yes, 0 = no	-0.0145	0.950		0.1909	0.267		0.0353	0.699	
Presence of bribery and corruption in WUA	1= yes, 0 = no	-0.0788	0.572		-0.2503	0.010	**	-0.1180	0.112	
Power distribution/Elite capture										
Big farmers or farmers close to political power are favored by WUA management	1 = yes, 0 = no	-0.2223	0.046	**	0.3429	0.019	**	-0.2232	0.003	***
Socio-economic characteristics/Economic inequality										
Position of plot (medium distance to and far away from main canal)	1 = yes, 0 = no	-0.0361	0.763		-0.0425	0.647		0.0381	0.619	
Area with irrigated farming	In decares	-0.0010	0.327		0.0001	0.669		0.0005	0.023	**
Proportion of income from agriculture	In %	-0.0012	0.592		0.0002	0.895		0.0006	0.741	
Age of household head	In years	0.0046	0.384		0.0022	0.628		0.0069	0.016	**
Schooling	Years of schooling	0.0022	0.935		-0.0044	0.825		0.0115	0.485	
Experience in irrigated farming	In years	-0.0099	0.027	**	0.0049	0.322		-0.0115	0.095	*
Training attained on irrigation	1 = yes, 0 = no	0.1180	0.381		-0.0512	0.580		-0.3635	0.000	***
	Number of observations	82			94			149		
	LR Chi-2(17)	22.52			36.26			75.05		
	Prob > Chi2	0.1272			0.0027			0.0000		
	Pseudo R2	0.1989			0.2898			0.3648		
	Log LL	-45.36			-44.43			-65.35		

***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively

a) WUA Structure and conduct:

In Aydın Plain, only 7 percent of users state that they received water in sufficient amount whereas 15 percent received it at the requested time. The respective numbers are 15 percent and 11 percent in Söke. Considering limited availability of water in this region, these results are as expected. In Aydın, neither the coefficient estimates for adequacy nor timeliness are statistically significant; hence these factors do not impact user satisfaction. In Söke, the coefficient of the variable adequacy is significant and positive, implying that water users who receive more adequate water are more satisfied with the WUA performance in Söke. It is interesting to observe that there are twice as many Söke farmers who claim that they receive water adequately in comparison to Aydın; yet, only farmers from Söke associate their satisfaction with the WUA with water adequacy. The difference between these two WUAs who receive their water from the same river can be the infrastructure: Aydın Plain irrigation infrastructure is more recent and is made of concrete canals. It became fully operational in 1998 and the management was transferred to WUA during that year. The Söke irrigation system was constructed in 1981 and is composed of canals dug into the earth. DSI operated the system until its transfer to the WUA. Hence, we can argue that the older infrastructure of the Söke Plain makes users more sensitive to receiving adequate amount of water.

In Şanlıurfa region, with ample water available from the Atatürk Dam, 85 percent of users receive water in sufficient amount and 53 percent receive it at requested time. Users in Şanlıurfa worry about the timeliness of water delivery, as indicated by the positive and statistically significant coefficient of this variable, rather than adequacy of water delivery. The more users receive water on time, the more satisfied they are. This is understandable based on the very dry summers; so, users who receive water in requested time reflect this on their level of satisfaction with the WUA performance.

Regarding monitoring, in Aydın, a significantly large portion of users state that both the irrigation system (65 percent) and the management (54 percent) are properly monitored. The respective values are 72 percent and 57 percent in Söke. In Aydın, the coefficient estimate for monitoring of management is statistically significant with a positive sign which shows that when users see that management's actions are monitored, this contributes positively to their satisfaction with the WUA performance. In contrast to Aydın, farmers from Söke, who claim that the irrigation system is monitored by WUA personnel, are more satisfied with its performance. Compared with Aydın and Söke, we observe that 42 percent of irrigators from Şanlıurfa claim the irrigation system is monitored whereas only 37 percent claim that the management of the association is monitored. As seen in the statistically significant coefficient estimate in Table 2, when users observe that the irrigation system is monitored, this has a positive effect on their satisfaction in Şanlıurfa.

Only 27 percent of users in Aydın and 26 percent of users in Söke are of the opinion that the WUA considers their views while setting the water fee and this variable is insignificant for both Söke and Aydın. Users in Şanlıurfa claim that they have more say in setting the water fee: 43 percent of users believe that the WUA pays attention to their views and this variable has a significant and positive coefficient, indicating that users' satisfaction with the association performance increases when the management pays attention to their views while setting the water fee.

b) Rule enforcement:

When asked about the presence of illegal water intake, 10 percent of users in Aydın and 32 percent of users in Söke region point to the presence of illegal activity, but, a significantly large number of users with 95 percent in Aydın and 88 percent in Söke also state that rules are strictly enforced and illegal users are punished. In Şanlıurfa 23 percent of water users believe that there is

illegal water intake and 80 percent claim that there is equity in the enforcement of rules with respect to illegal water intake. Another factor that impacts rule enforcement is whether there is bribery and corruption in the WUA. Sixteen percent of users in Aydın and 33 percent in Söke think that there is bribery and corruption within their WUAs whereas this percentage is 46 in Şanlıurfa. Nearly half of the sample from this southeastern province believe that there is bribery and corruption in the WUA. However, none of these three rule enforcement variables are significant for the case of Şanlıurfa. Hence, rule enforcement variables do not impact user satisfaction in this province. This is also true for Aydın water users. However, in Söke, users who think that bribery and corruption are present, are less satisfied with the WUA performance. The fact that nearly half of the sample claim there is bribery and corruption in Şanlıurfa yet the finding that this factor has no impact on users' satisfaction with the WUA can be an indication that users are accustomed to this type of functioning and as long as they receive their water on time, they are satisfied.

c) Power distribution/Elite capture:

When asked whether big farmers or farmers close to political power are favored by WUA management, 65 percent of users in Aydın, 81 percent of users in Söke and 60 percent of users in Şanlıurfa state that there is power asymmetry in their respective WUAs. The coefficient estimates for this variable in all three WUAs are statistically significant. In Aydın and Şanlıurfa, users who are of the opinion that big farmers or farmers close to political power are favored by WUA management are less satisfied with the WUA performance. Influence of power on users' livelihoods has only been shown in a relatively few studies (Theesfeld, 2004; Pérez-Cirera and Lovett, 2006; Fritzen, 2007; Naidu, 2009), and we validate this point in our study. Interestingly, our findings show the opposite outcome for Söke: users who think that big farmers or farmers close to political power are favored by WUA management are more satisfied with the WUA

performance. This can be explained with the different organizational structure that Söke Plain WUA has in comparison to the other two WUAs under examination. The large area of the Söke Plain WUA is divided among irrigation groups which operate under the same WUA, where the members of the WUA are also the members of these groups. These groups were created during the DSI management well before the decentralization of irrigation operation and maintenance. These groups maintain the canals and perform small repairs. They receive 20 percent of the irrigation fees collected in their area in return for their services. Therefore, despite the belief among 81 percent of farmers in Söke that there is favoritism within their WUA, this is not reflected negatively in the main services of water distribution and canal maintenance that the association provides through its irrigation groups operating at a further local level than the association itself.

d) Socio-economic characteristics:

Among the socio-economic factors that may have an effect on users' satisfaction, in Aydın region only experience in irrigated farming has a statistically significant impact. Users who have more experience with irrigated agriculture are less satisfied with the WUA performance in Aydın and Şanlıurfa. The variable of experience is not significant for Söke. In Şanlıurfa users operating on larger sized plots are more satisfied with the WUA performance. This can be interpreted as the indirect impact of power relations on satisfaction. Similarly, older users are also more satisfied with the WUA performance compared with younger users in Şanlıurfa. And, lastly, users who have received training on irrigation are less satisfied with the WUA performance in Şanlıurfa. This may be due to the fact that when users get training on efficient ways of irrigating their farms but still observe the inefficient practices followed by the WUA management; this has a negative impact on their satisfaction.

6. Discussion and Concluding Remarks

This paper examined the decentralization of irrigation operation and maintenance with a focus on two provinces from Turkey and showed that despite functioning within a common legislative framework, self-governing WUAs operating in different regions have different features. The decentralization of irrigation management in Turkey began in 1993 and cost recovery rates have increased significantly since the irrigation infrastructure was devolved to user associations. However, the satisfaction of users with these associations and the sustainability of the resource use have not been examined through an econometric study. Our research aimed at filling this gap and conducted farmer surveys in Aydın and Şanlıurfa provinces.

Our results show that only half or less than half of farmers surveyed are satisfied with the operation of the WUAs. We conducted a probit analysis to see whether WUA structure and conduct, monitoring and enforcement of rules, power distribution and elite capture have an impact on user satisfaction with WUA performance. We show that even two WUAs that share the same river basin, like Aydın and Söke Plain WUAs, have significant differences in the way they operate and the way their decisions on governing the WUA are perceived by their members. In line with Agrawal (2002) and Meinzen-Dick (2007), we find that local conditions such as differences in the availability of water, region specific conditions like socio-economic characteristics and feudal structure, make it imperative for any policy developed towards sustainable use of common pool resources to be sensitive to such local conditions.

The paper also looked at the impact power inequality, another form of heterogeneity, on users' satisfaction—a rather neglected topic in the literature, mainly because of difficulty of measuring power related issues (Pérez-Cirera and Lovett, 2006). We verify the negative relationship between elite capture and users' satisfaction in two cases; but, interestingly, in Söke this relationship is shown to be positive. We attribute this result in Söke to the presence of

irrigation groups, sub-groups within the WUA, which are financially compensated for their services to the WUA and which provide the basic services of maintenance and operation on the ground.

The design of decentralized structures should take such heterogeneity and variations into consideration if they are to be viable and sustainable. These findings are not surprising as many of the existing studies in the field of resource use have already pointed out that resource management strategies and governance systems should be adaptive to users' needs, have a flexible institutional structure, and allow for "institutional learning and change," (see, among others, Dietz et al., 2003; Meinzen-Dick, 2007; Ostrom, 2009; Stern et al., 2002; Vatn, 2009).

Given the fact that resource scarcity stems from both inefficient methods and poor management (Saleth and Dinar, 2008), the success of resource use cannot be measured by pure physical performance or economic efficiency. A better measure of success is whether reflexive and adaptive institutions are set up and evolve over time (Agrawal, 2002; Vatn, 09; Jones, 2004). Therefore, as presented in this research, in absence of ideal conditions (Dietz et al, 2003), policy makers should design such institutions that will be able to incorporate the recommendations of those in the field, such as the water users and WUA personnel into the governance system. This is more likely to yield better resource use with less negative impact on the environment.

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