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EFFECTIVENESS OF INDICATORS FOR SUSTAINABLE WATER USE IN AGRICULTURE

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SUMMARY – Water scarcity is a prominent issue about water sustainability in many countries, in particular in the Mediterranean Region. Given the fact that agriculture has a dominant share among the water user sectors and water scarcity is a threat to water sustainability, it is expected that sustainable use of water resources in the agricultural sector is crucial for dealing with the water scarcity problem. Accordingly, water use in agriculture is the topic under discussion. Being among the tools for assessing sustainability, indicators can foster actions that can contribute to implementing sustainability. As with all the indicators, the effectiveness of the indicators for water use in agriculture is desirable. By effectiveness it is understood that through monitoring and evaluation, indicators can have an effect on the behaviour of stakeholders, who develop, manage and use water resources, in order to engage them in collective action for sustainable water use. The results of a field study in Harran Plain, a region in the southeast Turkey, demonstrate that lack of stakeholder participation during the development of indicators for water use in agriculture is among the reasons for the resulting ineffectiveness of the indicators. It is also observed that lack of participation of stakeholders during the development of indicators has implications about the resulting outcomes, which indicate the lack of an integrated approach for managing water resources and a resulting collective action problem of unsustainable water use in the field study region. It is concluded that integrated approaches to water management, which adopt participation as a core principle and reflect on the economic, social, institutional and ecological dimensions of sustainability, can bring about not only effective indicators of sustainable water use, but also long-term achievements.

Key words: sustainable water use, indicators, stakeholder participation, collective action.

INTRODUCTION

Water scarcity is a prominent issue about water sustainability in many countries, in particular in the Mediterranean Region. Scarcity of water is related to availability and use - or consumption -. On the one hand, the availability is limited since total water supply available for human use cannot be increased substantially given the economic, ecological and social constraints on the development of non-conventional water resources. On the other hand, water consumption continuously increases due to several reasons, mainly including warmer climate and population rise.

There is a need to ponder on how to deal with water scarcity and ensure water sustainability through the integration of economic, social, ecological and institutional dimensions of sustainability. Integrated approaches, which consider these four dimensions, integrate the perspectives of related disciplines and respect the interests of all stakeholders, are essential. However this is not a simple issue given the existence of several factors, which put water resource under pressure. These factors mainly include population rise, increased economic activity, improved living standards, social inequity, lack of pollution control measures and management of water resources through sectoral approaches and top-down institutions (Gleick, 1995; Gardner-Outlaw and Engelman, 1997; GWP-TAC, 2000). Furthermore, the dominant approach to the management of water resources has been supply-oriented, meaning that increasing the water supplies is the priority issue, whereas the need for managing the corresponding demand is neglected.

Within this context, integrated water resources management (IWRM) is relevant. IWRM is defined as follows:

> "*a process, which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social*

welfare in an equitable manner without compromising the sustainability of vital ecosystems" (GWP-TAC, 2000:22).

It is emphasized in the definition of IWRM that success in ecological, economic and social dimensions, depends on coordination of development and management activities, which constitutes the institutional dimension. Indeed the causes of the problems about water resources are attributed to "inefficient governance" and "increased competition for the finite resource" (GWP-TAC, 2000: 9). The inefficiency of governance can be due to disintegrated and uncoordinated approaches for water management, which rely on sectoral approaches and top-down institutions (Jaspers, 2003). Such institutions might not create a common understanding about the need for ensuring sustainability and neglect, or exclude, the knowledge and perspectives of stakeholders, who are not represented or involved in the existing institutions. The increased competition can be considered as the result of the allocation of available water resources to users, or user sectors, each of which claim their own right to use water.

It is important to ensure the participation of stakeholders in efforts towards water sustainability, whatever the scale and the issue. In the general context of water policy implementation and water resources management, stakeholder participation is stated among the key requirements for success (Seppala, 2002; Mostert, 2003). IWRM also takes participation as an approach to be adopted for water management. It is suggested that all the relevant stakeholders should be a part of the decision making process, so as to create the balance of top-down and bottom-up institutions and to ensure that all the stakeholders are aware of the water sustainability as their common issue at stake (GWP-TAC, 2000; Dungumaro and Madulu, 2003; Jasper, 2003). These premises require that the stakeholders have the capacity to participate and represent their interests, which calls for the need to build capacity for participation.

Justifying the emphasis put on participation, there are various benefits expected from stakeholder participation in the management of resources. Firstly, participation enables an understanding of the impacts of the individuals' actions on the current state of the resource that they use (Marshall, 1999). These impacts can be costs and benefits of resource use decisions both at the individual and collective level (Johnson, 1997). Through participation, the stakeholders can realise these costs and benefits, and having information about the impacts of their actions on the resource that they use, they are more likely to arrange their actions for the interest of the collective.

Participation provides information about the gap between the institutions -or the rules- and the actions of the stakeholders (Johnson, 1997). Stakeholders can have a better understanding of the rules by obtaining information about them and they can become aware of and reduce the gap between their perception about the rules and the resulting costs and benefits of following or breaking the rules. They can also agree on and make commitments so as to act in compliance with the rules. Having information about the actions of other stakeholders would also be useful for the stakeholders to make sure that the commitments are kept by every stakeholder. In that respect, participation can be useful for making use of the experiences of stakeholders (Johnson, 1997; Marshall, 1999). Each participant can monitor his own actions as well as the actions of others, which creates an environment that binds the individuals to each other and to the outcomes of their actions. Such an environment can enhance the perception of the stakeholders that the sanctions are assessed on those who break the rules (Ostrom et al., 1994).

Participation has additional benefits in terms of enabling the decision making process to be at the same time a social learning process (Pahl-Wostl, 2002). This means that, through participation, a common understanding about the situation can be built; exchange of ideas among stakeholders, who might have diverse interests and knowledge, can be possible and the stakeholders can become more likely to act for the common goal of sustainability.

The final, and very crucial, benefit that can be expected from participation is the ownership that it raises about the resource used by the stakeholders. Participation demonstrates to the stakeholders that each of them has a stake in the state of the resource that they use and their knowledge and perspectives are important for the betterment of the resource (Johnson, 1997; Marshall, 1999). Consequently, based on the added-value of the knowledge of stakeholders, the benefits of stakeholder participation can be summarised as follows:

> "*Local knowledge is often valuable for devising rules, decision procedures and monitoring and sanctioning mechanisms that take equity as well as efficiency considerations into account, and therefore are likely to gain broad support from local citizens or resource users"* (Baland and Platteau, 1996, cited in Marshall, 1999).

In addition to the participation of stakeholders, the assessment of the progress towards or away from sustainability is a major issue for ensuring sustainability. Developed and used at different levels, sustainability indicators constitute a major tool for assessing sustainability. The emphasis put on indicators for the assessment of sustainability is attributed to the expected contribution of indicators to sustainability, which is possible through the monitoring and evaluation. Monitoring enables the quantification and communication of the information and in turn improves stakeholders' knowledge about the system. It also establishes the basis for description of the system. Through monitoring, system characteristics and dynamics of the system can be better understood by the stakeholders. If the measured values of indicators are also evaluated by taking implications into consideration, then indicators can become tools to assess the success of the actions and policies for implementing sustainability and to improve their performance.

With regard to the assessment of water sustainability, the importance of indicators should be acknowledged as well. In particular regarding the water scarcity problem, the lack of stakeholders' awareness of the water scarcity problem is mentioned as a challenge for water resources and this ignorance is attributed to the perception that water will always be abundantly available (Abu-Zeid, 1998). Therefore, developing and using indicators that address the problem of water scarcity is relevant since they enable the assessment of the state of water resources and the impacts of the actions of stakeholders.

Given the fact that the availability of water resources is limited and human population continuously rises, a competition among different user sectors is inevitable and agricultural sector might also be affected from the situation. Therefore agricultural sector can gain from developing and using indicators for water use, since it has the largest share among all water user sectors, especially in the Mediterranean region (Araus, 2004). Justifying the argument that indicators are useful for assessing water use in agriculture, in many countries indicators are developed and used within the agricultural sector, e.g., indicators for irrigation (Bos, 1997; Molden at al, 1998; Lorite at al., 2004; Kellett at al., 2005).

Within the context of water use in agriculture, the effectiveness of the indicators is desirable. In this paper, the effectiveness of an indicator is defined the degree of adoption and utilisation of the indicator by the stakeholder in taking actions that contribute to sustainable water use in agriculture. It is argued that effectiveness of indicators requires stakeholder participation during indicator development. Through a participatory approach the knowledge and perspectives of the stakeholders can be incorporated when the indicators for sustainable water use in agriculture are developed and hence the indicators can be perceived as relevant and useful and hence their effectiveness can be improved. It is acknowledged that the indicator development requires the multiple concerns and, among others, stakeholder participation is considered as a principle during the development of indicators (Hardi and Zidan, 1997; Bell and Morse, 2004; McCool and Stankey, 2004).

MATERIALS AND METHODS

With the aim of investigating the role of stakeholder participation in the effectiveness of indicators for sustainable water use, an analytical framework was developed and applied using empirical findings from a field study.

Analytical Framework

The analytical framework was developed through the incorporation of the relationship of the stakeholder participation during indicator development and effectiveness of indicators to the theory on collective action for common-pool resources (Ostrom, 1990; Ostrom et al., 1994). After a review of the theory on collective action and its application to the use of common-pool resources, it was inferred that sustainable water use requires collective action, since water for agriculture is a common-pool

resource that needs to be used collectively by all relevant stakeholders. Several relevant aspects of collective action for sustainable water use and the relationships among these aspects were examined. These aspects include the context for water use in agriculture, the stakeholders of water use in agriculture, the indicators used by the stakeholders, the institutions -or the rules- for water use in agriculture, the actions of the stakeholders in terms of following the rules, using water for agriculture, and developing and using indicators, and the outcomes of these actions.

It is suggested that the actions of the individuals take place in three different levels, namely the operational, collective-choice and constitutional-choice level (Kiser and Ostrom, 1982 cited in Ostrom et al., 1994) Corresponding rules are devised and used for each level and for the interactions between the levels (Ostrom, 1990; Ostrom et al., 1994). The rules at the constitutional-choice level are about the governance and they indirectly affect the operational level actions since they define the way that the collective-choice rules are made and changed. Similarly collective-choice rules also affect the operational level actions indirectly. They are the rules about how the operational rules are made and by whom the operational rules can be made and changed. Collective-choice rules mainly include the rules about policy making and management. Finally the operational rules include the rules that affect the daily actions of the individuals about appropriation, provision, monitoring and enforcement. Given the scope of the research, the focus of the analysis of the empirical data is on the collective-choice and operational rules and the corresponding actions of the individuals. The constitutional-choice rules are discussed to the extent that there are findings about the rules and actions at this level.

With regard to the position of indicators for sustainable water use in the framework, it is acknowledged that indicators can contribute to collective action, since they have the potential to influence the behaviour of the stakeholders in a way to engage in collective action. Such behaviour of stakeholders is associated with the adoption and utilisation of indicators by the stakeholders and indicators are considered effective to the extent that they fulfil this potential by affecting the behaviour of stakeholders, and in turn their actions. Based on the assumption that stakeholder participation during indicator development is among the reasons for the effectiveness of indicators, stakeholders and indicators were examined thoroughly in terms of their interactions and their relationship to collective action for sustainable water use.

Field Study

The field study was carried out through individual interviews with the representatives of the stakeholders and through the review of written documents, which are extracted from different sources of information.

Harran Plain was chosen in order to carry out the interviews with the stakeholders from regional and local level. Harran Plain is a region in Şanlıurfa province, located in the south-eastern part of Turkey and included in the GAP (Southeastern Anatolia Project). GAP is a regional development programme, aiming at, among others, increasing agricultural production, employment and income in the South-Eastern Anatolia Region of Turkey (Ünver, 1997). The region has a semi-arid climate with very low precipitation levels. Within the content of the GAP, investments have been made for water development and as a result irrigated agriculture is practiced for 10 years in the region. Before that time, rain-fed agriculture was practiced.

Currently, water for agriculture is abundant due to the water transferred from the Euphrates River through Şanlıurfa Tunnels and main irrigation canals. However the area of the irrigated land gradually increases through the completion of canals that carry water to the regions other than Harran Plain. This means that the same amount of water will be shared by higher number of users, which implies a potential for water scarcity when the water is used excessively. There are studies, which address the problem of excessive water use in the region, having also adverse effects on the soil quality and water table levels (Kendirli et al, 2005). Therefore the field study was fruitful in terms of eliciting the perception of stakeholders about water scarcity and indicators for water use in agriculture as tools to prevent the potential impacts of irrigated agriculture.

The specific circumstances, under which the indicators for water use in agriculture are developed and used, were also investigated for Turkey in general, and for the field study region, in particular. It is

expected that the use of indicators in terms of monitoring and evaluation, can be made on the basis of different water user sectors. However the development of indicators cover several related processes about water, i.e., planning, investment, management, etc., which are usually done for all sectors through several overlapping laws and regulations. Making the system more complicated, the responsibility and authority regarding different uses of water are distributed among different stakeholder organisations. Therefore it is meaningful to have an understanding of the national setting for water use without a narrow focus on agricultural water use. Stakeholders of water use in agriculture include the governmental organisations, environmental non-governmental organisations and water user organisations. The activities of each stakeholder and the distribution of responsibility and authority among the stakeholders at different levels and were explored.

The two major stakeholders at regional level are State Hydraulics Office (DSI) and Water User Organisations (WUOs). DSI is the governmental organisation responsible for the planning, development and administration of water resources at national level. It has a general directorate and 26 regional directorates (DSI-RD), which function at regional level. Two officers of DSI-RD, which is responsible for Harran Plain, were interviewed. WUOs are the legal entities formed by the representative of farmers. They are responsible for the appropriation, i.e., distribution of water to the farmers and provision, i.e., operation, maintenance and repair of the irrigation facilities. Since the WUOs are active in all Turkey, with a total number of around 780, only the situation in Harran Plain is investigated and five out of the eleven WUOs were contacted in the region. In addition to the scheduled interviews, conversations were made with farmers and the relevant observations and impressions from these conversations are incorporated.

Given the fact that the aim of interviews was to elicit the perception and the knowledge of the stakeholders, it was found appropriate to conduct semi-structured interviews. Most of the questions were prepared as open-ended questions so as to enable the interviewees to talk freely on the issue addressed by the questions. While most of the questions are the same for all the interviewees, one or two questions were included or excluded for several interviewees, according to the major tasks and specialisation fields of the interviewees.

Analysis of Findings

The findings from the field study were utilised as empirical data for the application of the framework. For this purpose, the context, rules, actions and outcomes, which are related to water use in agriculture, were identified and analysed. Firstly, the examination of the context for water use in agriculture was made, which includes description of water for agriculture as a common-pool resource, the producers, providers and the appropriators of water for agriculture, and the social and cultural conditions of the region.

Secondly, the rules about water use were identified and discussed. Utilising the empirical data, the rules at constitutional-choice, collective-choice and operational levels were identified. Given limited empirical data, a thorough analysis of the constitutional-choice rules could not be made and these rules were mentioned in order to give a general idea about the background for the collective-choice and operational rules.

Thirdly, the outcomes of water use in agriculture were identified at the system level and the actions of the stakeholders, which might lead to these outcomes, were investigated. The analysis of outcomes is focused on the collective-choice and operational levels with the purpose of tracing how the interactions of the context, rules and actions might lead to the outcomes. From the analysis of context and the rules, several implications have been made. The resulting set of implications is classified under two groups; the implications of the context and the constitutional-choice rules and the implications of the collective-choice and the operational rules, most of which are related to the monitoring and enforcement of rules for allocation of water.

RESULTS

The interactions among the context and the rules were investigated with the purpose of revealing how these interactions might lead to the actions and outcomes of water use in agriculture in the field

study region. For this purpose, firstly, the outcomes observed at the regional level were identified. According to all interviewees from DSI-RD and the WUOs, there is "excessive water use" in the region, which results in the following outcomes:

- rise in water table
- degradation of soil quality; mainly in the form of salinisation and becoming barren
- high quantity of water that goes to discharge

The above outcomes are negative externalities of water withdrawals by water users. These externalities are experienced by all the water users in the region and they imply that the individuals do not act for the achievement of common welfare or reflect on the ecological impacts of their individual interest. Hence it can be stated that there is a collective action problem in the form of unsustainable water use. There is no evidence that DSI or the WUOs experience problems about the irrigation facilities. This situation might mean that the focus of the WUOs and DSI are more on the irrigation facilities. Therefore it can be inferred that the actions of the stakeholders do not lead to provision problems, but rather appropriation problems in the form of the outcomes above.

It is argued that excessive water use can be a result of the context in the region, as well as the lack of monitoring and enforcement of the rules. The factors, which might lead to above outcomes, are identified and explained below.

Context and Constitutional-choice Rules

Water as a new resource

Water for irrigation is available since ten years. Before that time, there was no irrigated agriculture and almost no water at all. Hence, irrigation water is new for the farmers. Therefore it can be expected that the farmers are not experienced in using water for agriculture. Another expectation is the lack of awareness about the limited water availability and the need for using water efficiently. This might cause a distorted perception. Since water continuously flows in the canals, the farmers might have a perception that water is not abundant. Similarly the farmers, inexperienced in irrigation, might think that using more water brings about higher yield. Unlike the farmers, all the WUOs state that the water resources are not abundant and they try to enforce the farmers to use water efficiently. Hence, it can be expected that the farmers' awareness of water availability and use might be a critical factor on their actions and resulting outcomes.

Governmental support for cotton production

The national agricultural policy, which supports cotton production, might also have an impact on the actions of the farmers. The governmental support on cotton production might induce the farmers to cultivate cotton with the expectation that they can sell what they raise and guarantee their income. Currently, the share of cotton is about 80-90% of the whole cultivated land in the region. This proportion had been foreseen as 25% in the GAP Master Plan (Ünver, 1997). The impact of this high proportion is a water demand much higher than expected, since cotton consumes more water than many other crops. The support of cotton production has an impact on the type of the crop cultivated by the farmers. The individual interests of farmers about increasing their income and the outweighing short-term benefits can be the factors that lead to this choice of crop, which in turn affects substantially the quantity of water used by the farmers.

Size and composition of the WUOs

There is no rule about the limit to the number of farmers to be included in a WUO. This situation results in the fact that the WUOs are not homogeneous in terms of their size and the area of land that they manage. Having a high number of members can make it difficult to build continuous relationships and trust among the farmers. Furthermore, the existence of leasehold farmers increases the diversity of the members of the WUOs. The resulting heterogeneous and unstable composition of the WUO can lead to short-term relationships among the farmers and lack of a shared interest for a common future with other farmers in the WUO. It is also mentioned that the leasehold farmers might give less consideration to the externalities of water use in agriculture and take only the short-term benefits into

account. Combined with the size of the WUOs, the existence of leasehold farmers can also lead to problems about monitoring the actions of farmers in terms of water use and enforcing the rules for allocation and provision. The farmers who withdraw water from the same canal even might not know each other.

Organisation of the Water User Organisations

The WUOs find their institutional capacity low in terms of the outputs of their activities. They attribute it again to the lack of a WUO law, as well as the lack of awareness among farmers, lack of coordination among higher level organisations, limited financial and administrative resource and lack of qualified staff. Furthermore, within the organisational structure of the WUOs, the secretary general is the only person who has to deal with the administrative, operational and legal issues. This situation makes secretary general the central person in the WUOs and in turn creates dependency on the side of other personnel as well as the member farmers of the WUO.

Monitoring and Enforcement of Collective-choice and Operational Rules

Monitoring and Enforcement by DSI

Monitoring of water use for agriculture at the regional level is carried by DSI-RD through monitoring the quantity of water allocated to each WUO and the water use per hectare for the region. However most of the WUOs indicate that there is no comparison of among the WUOs with respect to each other or to the regional level.

Furthermore, each year, WUOs submit three documents to DSI, namely, monitoring and evaluation report, inspection report and water distribution plan, all of which have the same structure for all WUOs, meaning that they are not tailored according to specific conditions of the WUOs. Inspection report and water distribution plan are used for declaring respectively the provision and distribution activities. Monitoring and evaluation report is used in order to monitor and evaluate all activities of the WUOs. Since none of the abovementioned outcomes are related to provision problems, the use of inspection report is not analysed, whereas the issues about monitoring and evaluation report and water distribution plan are discussed in detail.

Monitoring and evaluation report is a very comprehensive document conveying many types of data to DSI. It can be expected that the data in this document are evaluated by DSI and the performance of the WUOs are assessed in terms of their past vs. present outputs or against other WUOs. With regards to the uses of the monitoring and evaluation report, most of the WUOs indicate that they could not make use of it in terms of a contribution to their success. All the WUOs indicate that they receive no regular or formal feedback from DSI about the monitoring and evaluation report. This situation can imply that the monitoring and evaluation reports, which the WUOs send in the previous years, are not regularly evaluated by DSI. It is mentioned by all the interviewees from WUOs and DSI that DSI informally evaluates the performance of the WUOs, e.g., by talking about the outputs of the monitoring and evaluation reports during their meetings. However there is no evidence about a regular performance evaluation of the WUOs.

Absence of feedback from DSI implies a lack of common understanding about the uses of the monitoring and evaluation report as well as inspection report and water distribution plan. It is also a communication problem between the DSI and WUOs due to the one-way flow of information from WUOs to DSI. Some WUOs mention that they expect DSI to evaluate their performance. It can be expected that WUOs require a performance evaluation from DSI, since they share the water from the same canal and each of them would like the others to perform well. However the WUOs complain about their legal and organisational incompetence, which constitutes a barrier for them to take such actions.

With regards to the water distribution plan, it is used for planning the allocation of water to the WUOs. It is mentioned that the demanded value on the water distribution plan are negotiated and it can be decreased by DSI. However, during the irrigation season, water is continuously available and the weekly demands of WUOs are met. Hence, even if DSI monitors the quantity of water allocated to

each WUO, the WUOs do not make their allocation rules according to the quantity of water allocated to them.

Monitoring and Enforcement by the WUOs

As observed from the operational rules, most of the decisions made by the WUOs are based on two variables, namely, the area of the land irrigated and the type of the crop cultivated on the land. A water related variable is not used by the WUOs when they make decisions, nor they monitor the quantity of water used. Distribution of water to farmers and contribution of farmers to provision are made based on area of the land and the crop type.

WUOs plan the distribution of water based on the area of the land to be irrigated and the type of the crop cultivated on the land. The amount of water to be distributed increases with increasing area of land and is also dependent on the type of the crop. According to the distribution plan, the water is allocated to each farmer for a predefined number of days. Thus the WUOs do not monitor the quantity of water withdrawn by each farmer; instead they rely on the duration of irrigation. Only one of the interviewed WUOs is an exception to this case. This WUO was founded in 2004. It is planned by the WUO that water is withdrawn through valves instead of siphons and irrigation is made with piped irrigation network and a closed system instead of open canals. It is stated that existence of valves also enables the metering of the quantity of water taken by each farmer. Currently, some of the fields have been equipped with the valves and it is mentioned that they will monitor the water use through the valves. It is also mentioned that this method decreases the amount of water that goes to discharge.

With regards to the method for the determination of the irrigation fee to be paid by each farmer, most WUOs use the area of the irrigated land and the type of the crop cultivated as the two criteria. This implies that the irrigation fee is independent of the quantity of water actually used by the farmers. Indeed, most of the WUOs indicate that there is no metering of the water withdrawn by each farmer; instead the farmers take the water from the tertiary canals through the siphons, which withdraw the water from the canal. It can be expected that collecting the irrigation fee based on quantity is not adopted by the WUOs since its justification would more difficult, given that they do not monitor it.

Finally, all the WUOs indicate that they are responsible for monitoring the level of water table in their region, but most of the do not make it. It is also mentioned by some of the WUOs that currently DSI monitors the level of water tables, but there is an impression that WUOs are not successful in terms of communicating these values with the farmers and convincing the farmers not to use excessive water.

When the monitoring and enforcement actions of WUOs are considered as a whole, three factors, which might have an effect on the actions of the farmers, in terms of monitoring their own water use, are identified as follows:

- determining the irrigation fee and water distribution according to crop type and irrigated area
- using the irrigation duration as the unit of water distribution
- not monitoring the quantity allocated to each farmer

Monitoring by the Farmers

Following from the rules, which are based on the above three factors, it can be inferred that the farmers do not have an incentive to monitor how much water they use or what the impacts of their water use are. In that respect, the interactions between three variables, namely the type of the crop, quantity of water and duration of irrigation, and two main issues that result from these interactions are relevant about the actions of the farmers and the abovementioned outcomes.

Firstly, despite the fact that WUOs assume 24 hours of irrigation per day, it is mentioned that some of the farmers do not apply “night-irrigation”; they irrigate the land during the day and let the water go to the discharge during evening and night. Hence, insufficiency of night irrigation is the main reason of the high quantity of water that goes to discharge. It is also indicated that quantity of discharged water should be as low as possible, and zero in the ideal, however, it is not possible with open canals and siphons. It can be expected that because the distribution of water is on the basis of time, duration of irrigation is critical for the farmers and they should adopt night irrigation. Indeed, it is mentioned that

night irrigation has several advantages. Firstly, if it is applied as complementary to day-light irrigation, the duration that the water is withdrawn from the canal can be extended to 24 hours/day and irrigation can be finished earlier. Furthermore it is likely that the water allocated to the WUO is used more efficiently, since the amount of water that goes to discharge reduces significantly. Secondly, if it is applied either as a substitute (or complementary) to day-light irrigation, the water loss due to evaporation is decreased since the crop consumes the water, not (only) during the warmer hours of the day, but cooler hours of the evening and night. Thirdly, the consumption of water by most of the crops is easier when the crop is irrigated during evening or night. But still the WUOs cannot effectively implement night irrigation, implying that the farmers might not have enough *motivation* to apply it.

Secondly, the quantity of water that they use is not a priority of farmers when they irrigate the land. The WUOs takes into account the type of the crop, since each crop needs different amount of water. However, the farmers do not monitor the quantity of water that they use; instead the relation between the type of the crop and the amount of water that the crop needs is reflected by a heuristic adopted by the farmers. It is mentioned that the farmers base their actions about water use according to the “total number of times” that they irrigate the crop. It is stated by a farmer that in the previous years, the farmers used to irrigate the cotton ten times; now they irrigate six or seven times.

Even if they do not monitor their own water use, it could be expected that the farmers could have an interest in the water use at WUO level and follow the outcomes of the monitoring activities carried out by the WUO. However it is mentioned that the farmers do not have a concern about these monitoring activities. Consequently, it is observed from the actions of farmers that using the irrigation duration as the unit of water distribution and planning it according to crop type and irrigated areas are not reflected on the side of the farmers’ actions. This situation has several implications about the WUOs and farmers. These issues imply that the rules used by the WUOs do not relate the quantity of water, needed by the crops, to the duration of irrigation. Therefore the farmers might not adopt the night-irrigation and monitor the quantity of water at the farm or local level. Several secretary generals explain the reasons for the lack of monitoring by the farmers and the farmers’ awareness of the impact of their actions on the abovementioned outcomes using a common proverb. This implies that, since most of the outcomes are observed with a time lag after their actions, the farmers might not be considering what the outcomes will be. It can be expected that lack of knowledge, experience and awareness of water for agriculture, and the outweighing short-term benefits, such as earning income, can lead to these actions.

DISCUSSION

Remember that the condition for the indicators to be effective is that they are adopted and utilised by the stakeholders in taking actions that contribute to sustainable water use in agriculture. Hence the actions of DSI-RD, WUOs and farmers, in terms of monitoring and evaluating the indicators, are of utmost importance in evaluating the effectiveness of the indicators. Analyses of findings address the following actions of DSI-RD, WUOs and farmers:

- Neither DSI-RD nor WUOs monitor the quantity of water withdrawals by the farmers.
- Farmers monitor neither the quantity of water that they use nor the impacts of irrigation on soil quality and water table level.
- WUOs do not monitor the realisation of their water distribution plan in terms of the allocation of the quantity of water according to it.
- WUOs monitor many indicators, use them to prepare the monitoring and evaluation report and submit it to DSI annually, but they receive no regular feedback about it and most of the WUOs make little use of the monitoring and evaluation report in their success.
- WUOs do not have an ownership of indicators that they monitor for the monitoring and evaluation report; several WUOs perceive monitoring and evaluation report as irrelevant to their activities and having no contribution to their performance.
- DSI monitors indicators about water use by WUOs, but the performance of the WUOs is not evaluated explicitly and little communication occurs between DSI and WUOs about the outcome of the evaluation.

Above findings suggest that the indicators are either not monitored at all, or monitored with a lack of evaluation of their value, implying the lack of utilisation of indicators by the stakeholders. Furthermore there is an impression that the adoption of the indicators by the stakeholders is very low, which is reflected by the lack of ownership about indicators and motivation to monitor and evaluate the indicators. All these findings are considered as strong evidences for the existence of ineffective indicators and it is concluded that the indicators for water use in agriculture are ineffective in the field study region.

In order to verify whether there was lack of stakeholder participation during indicator development, the functioning of WUOs and the method, with which the indicators for water use in agriculture had been developed, are discussed. The role of the WUOs in creating a participatory context is considered important, since the WUOs act like a bridge between DSI and the farmers. It is acknowledged that, by carrying out the operation and maintenance of the irrigation facilities and by distributing the water on their own, WUOs constitute a useful collective-choice entity for the participation of farmers in the management of the irrigation system. However, participation of WUOs remains at operational level. There is no evidence from the empirical data that WUOs have participated during the design of many constitutional-choice rules that in turn affect their decisions at both collective-choice and operational level. For instance, with regards to the monitoring and evaluation of the activities of the WUOs, there are several collective-choice actions, in which the WUOs could be involved. Among others, contributing to the design of monitoring and evaluation report, tailoring it according to their context, communicating its content to their farmers and in turn adapting it by considering the changes in conditions would be forms of participation at collective-choice level. However there is little evidence that WUOs have been involved in such actions.

The methods that had been used for the development of indicators monitored by DSI and WUOs have direct implications about the participation of stakeholders during indicator development. At this point, a differentiation can be made with the formal and informal indicators, which imply the indicators used for monitoring and enforcement of formal and informal rules. The formal indicators mainly include those monitored for the monitoring and evaluation report. These indicators had been imposed by DSI with a unique format to be used by all the WUOs in Turkey. As explained above, there is no evidence that the WUOs or farmers have contributed to the design or preparation of the monitoring and evaluation report or adapted it to their specific conditions.

With regards to the informal indicators, WUOs have the initiative to choose the method of distribution of water to the farmers. Accordingly the WUOs develop and use indicators, in particular for monitoring water distribution. However, the informal indicators that are used by the WUOs do not match with the formal indicators of DSI-RD. On the one hand, DSI-RD takes weekly water demands from the WUOs and monitors the quantity of water allocated to each WUO. On the other hand, the WUOs distribute the water to farmers on the basis of irrigation durations and number of irrigation turns, which are different indicators to monitor water distribution. The choice of WUOs to use durations and number of turns as indicators is their own decision, but not a result of the participation of DSI-RD or the farmers. Furthermore, the secretary general is the only person responsible for the fulfilment of administrative and technical tasks of the WUOs. This situation might imply lack of sharing of responsibility with other members of the WUO and lack of a participatory approach for the establishment, monitoring and enforcement of collective-choice rules devised and used by the WUOs.

Consequently, the development of neither formal nor informal indicators was made using a participatory approach and lack of a common understanding, about the monitoring and enforcement of collective-choice and operational rules, is observed, implications of which are experienced in the form of mismatching formal and informal indicators. Thus, it can be concluded for the field study region that there is a lack of stakeholder participation during the development of indicators for water use in agriculture.

Having concluded that indicators for water use in agriculture are ineffective and there was lack of stakeholder participation during indicator development, it can now be discussed whether the latter is among the reasons of the former. For investigating this relationship, several factors are discussed based on the interactions among the context and the rules at different levels. Firstly, the constitutional-choice level decisions can affect the behaviour of the farmers. These decisions mainly include the governmental support for cotton production as part of the agricultural policy and the supply-oriented approach of DSI. Governmental support for cotton production is likely to effect the

decision of the farmers in terms of their crop choices. Since the cultivation of a crop, which can be sold, is rational for the farmers, assuring their income, i.e., the short-term benefits of water use can become dominant for the farmers. Therefore short-term benefits of using water without monitoring its quantity or impacts might outweigh the concern for common interests, which require monitoring and evaluation. Furthermore the supply-oriented approach of DSI, through the increase of water supply for irrigation by constructing necessary infrastructure and diversion of water from the rivers is relevant. This approach can result in a stimulus, on the side of the WUOs and farmers, that water use in agriculture and its impacts are not a priority issue, since water is continuously available and irrigation is possible throughout the year, no matter what the indicator values are. Given also the lack of awareness about irrigation methods and potential impacts of irrigated agriculture, it becomes more likely that indicators are not monitored or evaluated by the WUOs and the farmers.

Secondly, the socio-economic conditions of the region require that some farmers cultivate the land through leasing it temporarily. It is observed from the analysis of the findings that the existence of leasehold farmers both increases the diversity of the WUOs and makes it more likely that indicators are not monitored. The leasehold farmers might have different preferences than the owners, in particular about the sustainability of soil and water resources the region. Since the priority of a leasehold farmer can be to earn as much as income, without caring for the water use levels and impacts of irrigation, it can be possible that the leasehold farmers do not monitor and evaluate the indicators. Hence, the ineffectiveness of indicators can be attributed to the ownership patterns of the farms, too.

Thirdly, the perceptions of the stakeholders about water for agriculture are important. The context for water use in agriculture in the region shows that water for agriculture is a new resource for the farmers. This situation makes it more likely that the farmers are inexperienced about irrigation methods and ignorant of the availability of water for agriculture and the impacts of irrigation. Despite the fact that both DSI-RD and the WUOs are aware of the limited availability of water, all the problematic outcomes at regional level are attributed to excessive water use. However, the transfer of irrigation water from the Euphrates River conceals the potential water scarcity problem, which would be experienced in the absence of the irrigation canals. This supply-oriented and top-down approach does not enforce DSI-RD and WUOs to allocate water without causing excessive use. In the absence of such enforcement, the awareness of DSI and WUOs are not put in practice and it is not communicated to the farmers, either. Under these conditions, the farmers become critical actors for water use; they are the people closest to water and their perceptions and actions have direct effect on the quantity of water used. Thus, existence of an action like excessive water use might indicate that the farmers do not perceive water as a scarce resource. Such distorted perception of the farmers might imply lack of farmers' awareness about limited availability of water. Lack of farmers' awareness is attributed to the fact that farmers the communication of farmers with DSI-RD and WUOs about limited availability of water is not sufficient and the farmers were not trained about irrigation methods and water use, i.e., they did not participate in the design of the rules, which include the monitoring and evaluation of the currently used indicators. This means that lack participation of farmers can also be among the reasons of ineffective indicators.

Fourthly, the limited capacity of the WUOs to train the farmers for monitoring, to communicate the results of the monitoring activities and to involve the farmers in the management of the WUOs can also lead to a lack of motivation on the side of the farmers to monitor and evaluate their water use behaviour. This reasoning applies to the relationship of DSI and the WUOs, too. There is little evidence that the WUOs are motivated to monitor and evaluate the indicators. This problem is associated with the lack of communication between DSI and the WUOs, especially in terms of the design of the allocation and provision rules, the evaluation of the performance of the WUOs and the feedbacks of the monitoring activities. Additionally, as mentioned above, the mismatch between the indicators monitored by DSI and the WUOs is a result of the lack of participation of the other during the development of own indicators. These communication and cooperation problems bring about lack of adoption and utilisation of the indicators. Thus, the lack of participation by DSI, WUOs and farmers to develop the indicators is a reason for ineffective indicators.

The third and fourth factors imply that lack of stakeholder participation during the development of indicators is among the reasons for ineffective indicators. It is also acknowledged that the constitutional choice level rules, e.g., governmental support on cotton production, and the context related factors, e.g., the socio-economic conditions of the region and existence of leasehold farmers,

also have an effect on the ineffectiveness of indicators. However it is expected that their impacts on the outcomes at regional level could be mitigated if the farmers would have been involved when the indicators had been developed. Through participation it could be more likely that the farmers adopt and utilise the indicators; since that would have had the opportunity to be aware of the scarcity of water resources, the impacts of their actions on the sustainability of soil and water resources, the trade-off between individual and common interest and the benefits of monitoring and evaluating the indicators.

It is concluded from the above discussion that indicators for water use in agriculture are ineffective, there is lack of stakeholder participation during the development of indicators and lack of stakeholder participation during the development of indicators for water use in agriculture is among the reasons for having ineffective indicators in the end.

Consequently, the overall situation in the region addresses a collective action problem due to excessive use of water and its adverse impacts on the soil quality and water table level. The previous barrier on agricultural production, i.e., the arid climate that causes water scarcity, has been overcome through bringing water from Euphrates River. However, excessive use of water indicates that the management of water resources, which is practiced since the construction of irrigation system ten years ago, has not adopted an integrated approach and the outcomes indicate a collective action problem of unsustainable water use. It is expected that an integrated approach would not only improve social and economic conditions by creating employment and income through increased agricultural production, but also build institutions, which enable participation of WUOs and farmers, and in turn ensure that the adverse ecological impacts of irrigated agriculture are prevented, or at least minimised.

CONCLUSIONS

From the review of literature it was observed that indicators are developed and used as tools to support the efforts towards implementing sustainability and the participation of stakeholders during indicator development is considered among the major factors that bring about effective indicators. In this paper, an attempt was made in order to explore the relationship between the lack of stakeholder participation during the development of indicators for water use in agriculture and the ineffectiveness of the indicators.

The empirical findings demonstrate that indicators for sustainable water use in agriculture are essential tools for dealing with collective action problems. When they are not monitored and evaluated by the stakeholders, the outcomes at system level are more likely to be the symptoms of a collective action problem, which is experienced as excessive water use in the field study region. Lack of stakeholder participation during the development of indicators proves to be among the reasons for the ineffectiveness of the indicators, since the stakeholders do not have an ownership about the indicators and lack a common understanding about the benefits of monitoring and evaluating them. Furthermore, the affects of the context and constitutional-choice rules are also to be acknowledged. In that respect, the socio-economic conditions in the region and decisions made regarding the national water, energy and agricultural policies affect the perceptions of the stakeholders to create a priority for short-term benefits and can result in a lack of motivation to monitor and evaluate the indicators.

The results presented in this paper demonstrate a static view. However the national context is rapidly changing due to several reasons. For instance, new institutional arrangements are foreseen at the constitutional-choice level, e.g., a water law and a WUO law (DPT, 2001). The priorities of all governmental organisations may also change according to the course of events in the EU accession process.

The limited availability of empirical evidence is a reason for making conclusions only for Harran Plain, in which the interviews were carried out with the WUOs. At the national level, a more thorough analysis could be made if there were more empirical data available. For instance, data could be collected for more than one region and the results could be compared. If more data could be collected at the national level, the effects of the constitutional-choice rules could also be discussed in more detail. At this level, two issues were analysed, namely the irrigation projects in the region, which made water available for agriculture, and the effect of governmental support on farmers' crop choice and in

turn water use decisions. However, there is not enough evidence from the field study so as to discuss all the rules and actions at this level. This situation is due to relevance of many other stakeholders, who could not be included in this study, and national policies, which affect the constitutional-choice rules and actions about energy, agricultural production, and water planning and development. Given the scope and aims of this paper, it is hoped that the presented findings and discussions constitute a comprehensive picture of the situation for water use in agriculture.

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