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Chapter 10

Turkey's water allocation regime under institutional change

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ABSTRACT

Due to multiple drivers many countries are experiencing significant water-related risks, particularly to agriculture, making sustainable management of water resources critical for national development. One of the most susceptible countries to these risks is Turkey, where over-abstraction of surface and groundwater resources has occurred in agricultural regions, leading to severe environmental, social and economic impacts. In response to such risks, national water governance is currently undergoing a significant transformation through the implementation of river basin planning in the form of the EU Water Framework Directive alongside institutional innovations for water allocation. In this chapter, we therefore illustrate how this institutional change is occurring and then assess the effectiveness of this new, evolving water allocation regime in the agricultural sector in terms of its sustainability. By examining institutional change in two specific river basin case studies, Konya Closed Basin and Küçük Menderes, this chapter shows that it is not resulting in sustainable use of water resources.

Keywords: Institutional innovation, river basin planning, Turkey, water allocation

10.1 INTRODUCTION

Turkey is experiencing water-related risks, particularly in agricultural regions where over-abstraction of water resources is impacting the environment and food production (Ak *et al.*, 2019). Turkey is located in a semi-arid climate zone and faces challenges in improving water quality, increasing the amount of usable water and ensuring the sustainability of water protection and usage. The annual average annual precipitation in Turkey was 574 mm between 1981 and 2017 (Ministry of Agriculture and Forestry, 2019). Annual water consumption reached 54 billion (10^9) m^3 in 2018 (Ministry of Development, 2018). Of this water, 40.0 billion m^3 (74%) is used for irrigation, 7 billion m^3 (13%) for drinking and 7 billion m^3 (13%) for industrial water needs (ibid.). These consumption rates are unsustainable due to increasing demand. For example, the annual amount of usable water per capita in Turkey is currently around 1519 m^3 but due to population growth and climate change it is expected that by 2040, it will be approximately 1120 m^3 (Körbalta, 2019) – significantly below current levels. Agricultural sectors may also face extreme water deficits.

Figure 10.1 River Basin Districts in Turkey, including the Konya Closed Basin and Küçük Menderes Basin.

In response to such water security risks, Turkey is transforming its water allocation regime through institutional innovation. Initially adopted as part of Turkey's European Union (EU) accession process, the country is now implementing the Water Framework Directive, leading to the establishment of new institutional structures and processes for river basin management planning (Demirbilek & Benson, 2019). Pre-existing institutions – both organizational and legal – for water allocation, some dating back to the 1960s, are now being partially integrated within this emerging framework (ibid.). Under the 2014 National River Basin Strategy, the government General Directorate of Water Management (GDWM (SYGM being the Turkish acronym)) is authorized to determine sectoral water allocations in conjunction with river basin management plans (Ak *et al.*, 2019). However, 'institutional incoherence' (Benson & Lorenzoni, 2017) with other government agencies, river basin planning processes and water allocation in basins is an evident problem, raising questions concerning the effectiveness of this regime. The implications for local-scale sustainability in water-scarce agricultural areas are of particular concern.

This chapter aims at understanding the effectiveness of Turkey's emergent water allocation regime in the agricultural sector in terms of its overall sustainability. Here, we adopt a conception of sustainability that includes environmental, economic and social dimensions (Baker, 2016). Initially the chapter will provide an overview of the broad institutional framework of Turkish water management, covering the legal and policy background, water rights and access to water, plus declaration and permitting requirements. Technical-administrative aspects of the regime, including defining environmental objectives, allocation rules and monitoring and compliance, are then described. Related policy instruments are discussed regarding drought measures, economic instruments and provision of public information. Throughout the chapter, evidence from two river basins, the Konya Closed Basin[1] and Küçük Menderes[2], are used to illustrate the current performance of the allocation system.

[1]The Konya Closed Basin is one of 25 river basins in Turkey (see Figure 10.1) and is located in the central Anatolia region. The basin is often called the 'breadbasket' of Turkey due to the dominance of agricultural land use. Agriculture also provides the main income in this river basin (Ribamap, 2018). However, such activity is heavily dependent on groundwater due to its location in a semi-arid climate zone (Ribamap, 2017). As such, 90 percent of basin water abstraction is conducted by the agricultural sector (Berke *et al.*, 2014).

[2]The Küçük Menderes Basin is home to around 3.5 million people, covers the Aegean sea coast of Turkey, including the cities of Izmir and Aydin, and encompasses one of the most significant agricultural and tourism areas nationally (SYGM, 2019). Around 33 percent of the land area is classed as agriculturally productive, of which 43 percent is irrigated (Gülersoy *et al.*, 2015). The main crops produced in the basin are water-intensive potatoes, watermelons, tomatoes and fruits plus cereal crops and olives.

10.2 THE OVERARCHING INSTITUTIONAL FRAMEWORK

10.2.1 Legal and policy background

The main institutional framework for water allocation in Turkey dates back to the 1960s. Prior to this period, surface water allocations were largely determined by local and municipal authorities while groundwater was largely left to landowners' appropriation. A growing centralization of powers for water management occurred after the National Groundwater Law (1960) was enacted, consisting of provisions for protecting groundwater, usage designations and registration requirements for abstraction. The State Hydraulic Works (or DSI using the Turkish acronym), a government agency that is now part of the Ministry of Agriculture and Forestry, became the main implementing body. Article 4 of the Law states that the number, locations and depths of wells within a groundwater operation area should be determined by the DSI and licensed by them. Additionally, the Law mandates that anyone can use groundwaters on their land but must apply for a usage certificate from the DSI, meaning that the state effectively retains water ownership rights (see below)[3].

Other important legal changes related to water allocations have occurred as a result of Turkey's EU accession process. Although this process has effectively been shelved, it has nonetheless led to an ongoing Europeanization of Turkish water law through the implementation of the EU environmental acquis (Demirbilek & Benson, 2018). Multiple by-laws and national laws have been enacted, particularly to support the adoption of river basin management planning under the Water Framework Directive (ibid.). In total, 25 river basins have been established nationally; including the Konya Closed Basin and Küçük Menderes Basin (Figure 10.1). Another important related measure for agricultural water allocations is the by-law on the Control of Water Use and Reduction of Losses in Agricultural Irrigation Activities (16/02/2017, No. 29981). This regulation aims at ensuring irrigation water efficiency (Article 1). In addition, it gives priority to surface water resources in irrigation, preventing water users from taking more water than the amount foreseen in the irrigation water distribution planning according to actual needs, plus using appropriate modern irrigation methods that save water and prevent water loss leaks. However, there is no comprehensive national water law that can aggregate all these laws together, including the Groundwater Law and river basin management planning by-laws, and solve current water management issues (Bulut & Birben, 2019). Therefore, a Draft Water Law, still under Parliamentary consideration, should be enacted to provide a comprehensive legal framework.

However, a national policy does exist for integrating river basin planning and water allocations. The 2014 National River Basin Strategy identifies the need to coordinate water allocations with river basin planning, and sets the goal for water allocation plans to be completed by 2020 for all basins in Turkey, while the short-term target was five basins by 2015 (OSIB, 2014). To achieve this goal, the Strategy obliges government agencies to generate the necessary data for sectoral water allocation and establish a water allocation board (ibid.). Additionally, the National Water Planning policy states that competition for water resources between economic sectors highlights the importance of government departmental coordination as each sector has different regulatory institutions (Ministry of Agriculture and Forestry, 2019).

10.2.2 The nature of water rights

Under Turkish law, ownership of water has changed from historical private water rights to state control. According to Article 679 of the repealed Turkish Civil Code (1926, No. 743), groundwater was considered as spring water and belonged to the landowner[4]. In addition, according to Articles 718 and 756, both surface water resources and groundwater were the property of the landowner from whose land they originate. However, since the 1960s a trend towards state ownership has occurred. The Groundwater Law (23/11/1960, No. 138) made such waters subject to the provisions and disposal

[3] The Groundwater Law (1960, No. 10688): https://www.mevzuat.gov.tr/MevzuatMetin/1.4.167.pdf.

[4] https://www.mevzuat.gov.tr/MevzuatMetin/5.3.743.pdf

of the State (Başpınar, 2016). According to Article 1(1), groundwater was included in state-owned general waters thereby removing the property rights of the landowner (ibid.). Article 756(3) of the Civil Code (No. 4721) was also amended so that groundwater became one of the waters subject to public interest, with the provision added that owning land does not result in owning groundwater (ibid.). In parallel, Article 3(1) of the Draft Water Law, still not enacted, mandates that water resources are under the control and disposal of the state, regardless of the owner or user of the land on which they are located. However, the owner and user of the land still has the right to benefit from such water for their drinking needs (Article 3(2) of the Draft Water Law)[5].

As opposed to water ownership rights, water use rights in agriculture have undergone a limited shift back from state control to privatization in recent decades. Under Law No. 6172 on Irrigation Unions 2011, the government (i.e. the DSI) began to withdraw from governing irrigation, which is the largest water-consuming sector in Turkey, and transferred control of facilities to irrigation unions (Aydoğdu *et al*., 2015; Şengül, 2013). Irrigation unions consequently manage irrigation facilities under their control and receive payments regarding water provision, infrastructure maintenance and management expenses, with tariffs determined by the DSI. Additionally, irrigation unions collect an irrigator participation fee, water use service charge, and fines that are applied. Not only are the unions responsible for managing some water bodies but also for cooperating with the Agriculture and Rural Affairs Ministry department regarding deciding crop patterns depending on water quantity[6]. While 5 million hectares are irrigated in Turkey, according to DSI data 23 percent is administrated by irrigation unions (Sarıtaş *et al*., 2001).

10.2.3 Controlling access to water and collaborative decision-making

In Turkey, controls on accessing water are multi-level and complex. The authorized institution responsible for water permitting and charging in basins is still primarily the DSI, through the issuance of water use certificates. Irrigation unions manage water allocations in irrigated areas, under DSI oversight. However, the General Directorate of Water Management (GDWM) is, since the adoption of the National River Basin Strategy, authorized to determine sectoral water allocations in the preparation of river basin management plans, in coordination with different stakeholders within planning processes (Ak *et al*., 2019). But this inter-actor split in responsibilities has caused coordination problems. River basin planning, coordinated by the GWDM, is still evolving and lacks the full participation of the DSI plus agricultural actors such as irrigation unions. Representatives of the latter are allowed to participate in Basin Management Committees and Provincial Water Management Coordination Committees but their role is merely consultative. Water allocation plans, moreover, have yet to be completed for all river basins. The target set for 2020 was not achieved, with only five basin plans established.

10.3 DEFINING THE AVAILABLE RESOURCE POOL

The water allocation plans calculate environmental needs on which to base management targets. Different methods for calculating 'minimum environmental flow needs' have been used in the plans. One of the most widely used is the Tennant method. This method calculates the 10 or 20 percent of available surface water depending on good or poor ecological status. In all sectoral water allocation plans, the Tennant poor ecological condition was used, which means considering only 10 percent of yearly available surface water resources (SYGM, 2017, 2018a). A WEAP modeling system (Water Evaluation and Planning) may also be used to assess the existing water bodies and calculate secured

[5]https://www.tmmmb.org.tr/images/GORUSLERIMIZ/SU_KANUNU_TMMMB_GORUSLERI_KASIM12.pdf

[6]https://www.mevzuat.gov.tr/MevzuatMetin/1.5.6172.pdf

water resource reserves based on historical data. The planning process incorporates these values and makes allocations based on existing and sustainable thresholds, with the aim not to go beyond sustainable levels of resources (SYGM, 2017, 2018a, 2018b; TOB, 2019). Unfortunately, in many cases, these sustainable levels are exceeded in drought periods as allocation plans should also account for sectoral needs during these events (see next section on allocation rules).

Konya's annual water availability is 4.3 billion m^3 but annual water use is 6.5 billion m^3 (Berke *et al.*, 2014). A deficit of nearly 2 billion m^3 then results in lower groundwater levels each year in the basin as users, mainly farmers, over-abstract from these sources. This leads to decreasing groundwater levels and an increasing number of sinkhole occurrences (Tapur & Bozyiğit, 2015). Because of these sinkholes, some farmers in the surrounding area have given up on agriculture and left their fields fallow, while these vast sinkholes create hazards for people and animals (Bozyiğit & Tapur, 2009). As a result, farmers have decided to migrate to urban areas such as Konya or Kayapinar (ibid). Given these problems, a fairer water allocation regime is needed for the sake of a sustainable ecosystem but also for the continuance of some agricultural practices. In addition, future inter-basin surface water transfer has been assessed, in this case, water conveyance from the River Euphrates to the Konya Closed Basin, and via the Blue Tunnel from the Eastern Mediterranean Basin (SYGM, 2018a).

Such environmental issues are replicated in other Turkish river basins. In the Küçük Menderes Basin, several measures have been adopted to reduce water use and the resulting pressure on water needs for ecology. A vast amount of treated wastewater, 125 hm^3 per year, is added back to the water cycle in the Küçük Menderes Basin, putting it amongst the most advanced watersheds for recycling and reusing water resources in Turkey (SYGM, 2019). A minimum environmental flow was calculated for the basin using the Tennant method. Here, 20 percent of surface water for March, April and May was classed as 'good ecology', however, for the rest of the year, 10 percent of surface water was categorized as 'poor' (ibid). Environmental impacts of water abstraction for agricultural activity are often severe. Pressure on surface waters and groundwaters is increasing, with more than 10 000 wells sunk in the basin (ibid.).

10.4 ALLOCATION AND REALLOCATION RULES

10.4.1 Approach for allocating water between sectors

In the past, allocation was the responsibility of municipalities even dating back to the Ottoman period. Despite the Groundwater Law, it was not prioritized by national government agencies in Turkey until very recently (Demirbilek & Benson, 2018). With the implementation of the Water Framework Directive model, as described above, the General Directorate of Water Management became the responsible government department for strategic water allocation planning in river basins (SYGM, 2017). Allocation and reallocation rules are gradually being developed through the related water allocation plans that seek to reconcile different sector demands with environmental needs in each basin. Most water allocation plans encompass five main sectors: drinking, environmental needs, agriculture, energy, and industry. However, some plans include mining, livestock, geothermal energy, trading and even the tourism sector (SYGM, 2017, 2018b; TOB, 2019).

Water is currently allocated by the DSI and other institutions using the following approach. The DSI has a direct responsibility to implement the planning objectives for water allocation established by the GDWM. The DSI directs water allocation in basins but also other institutions responsible for water provision. For instance, municipalities and special provincial administrations are the institutions responsible for providing domestic drinking water (SYGM, 2018b; TOB, 2019). Municipalities collect revenue through service charges and use it for operational costs (SYGM, 2018a). In addition to these institutions, irrigation unions, cooperatives and the agricultural reform general directorate are included in agricultural water allocation action planning (ibid.). These irrigation unions are not-for-profit institutions that charge for water use. The income is used to invest in irrigation facilities for improving standards.[7]

Currently, water allocations are being calculated based on current and future use but ultimately reflect economic priorities despite recognizing environmental factors. For instance, in the Konya Closed Basin Water Allocation Plan, sectors have been prioritized based on historical use data and income generation. Here, the agriculture sector was prioritized due to its economic value (TOB, 2019).

Water transfer between basins is also included in the allocation plan. The economic added value for each sector was first assessed and the sectoral benefits of water allocation for optimal use were determined (SYGM, 2018a). For instance, industrial use was considered economically more important than any other sector in the Seyhan Basin, so allocation planning prioritized industry needs above those of the other four sectors in the basin (SYGM, 2017). However, the Akarçay Basin allocates the majority of water to the agriculture sector, around 220 hm^3/year, while other sectors are allocated around 49 hm^3/year (2016 is the reference year in the planning process) (SYGM, 2018a).

In the future, sectoral volumetric caps will be set by the water allocation plans. The existing water resources potential was identified while future water potential for individual basins in the case of drought (low-medium-intense) and climatic changes were classified (TOB, 2019). For instance, an intense drought was forecasted for Konya between 2019 and 2021, and the sectoral water allocation plan shows that some of the sub-basins' supply and demand ratio for the agriculture sector would decrease to 80 percent or less (ibid.). Reuse of treated wastewater and water transfer from other basins were discussed and advised (ibid.).

10.4.2 Economic and social performance of the current approach

Economic efficiency of water allocation is desirable for policymakers and water authorities. Here, water allocation could be considered efficient where it supports high-value economic activity, but this is not the case in Turkey. As stated above, 90 percent of water abstracted in Konya is used by agriculture. However, this sector is one of the lowest income-generating sectors per metre of cubic water usage: only 0.45 Turkish liras (tl) per metre of cubic water consumption (SYGM, 2018a). In contrast, the biggest economic generation sectors are energy (1054 tl/m^3), mining (464 tl/m^3) and commerce (553 tl/m^3) (ibid.). Given the amount of water consumption in each sector, the economic efficiency of water allocation nationally is low. There are plans to halve water consumption in the agriculture sector from around 4000 to 2444 hm^3 by 2040 and the expectation is for economic value to double (ibid.). But it would still be far from the economic value created by water consumption in the energy sector.

That said, the economic significance of agriculture varies between basins and the two cases considered in this chapter illustrate the strategic importance of allocating water to agriculture. For instance, around 5 percent of Turkey's agricultural income is produced in the Konya Basin: 15 billion Turkish liras in 2017 (Yildirim *et al.*, 2018). Additionally, nationally critical crops grown in Konya include wheat, barley, seed production, sugar beet, beans and carrots. The basin is also significant for cattle and milk production (ibid.). Agricultural employment share is more than 70 percent of the total in the basin (SYGM, 2015). In the Küçük Menderes Basin, the average agricultural share of economic production is 18 percent, with water used to irrigate high-value agricultural products including mandarin oranges, chestnuts, cherries, peaches, olives and figs (SYGM, 2018b). Agricultural sector employment rose from 20% in 2010 to 25% in 2015 (ibid.). That said, agriculture is still ranked third from last in economic value generated per cubic metre of water (SYGM, 2019). The drinking water sector is the biggest economic producer followed by the mining and livestock sectors (ibid.). Overall, water allocation in the basin appears economically inefficient given that 70 percent of the water is used in the agriculture sector (SYGM, 2018b, 2019).

[7]https://www.mevzuat.gov.tr/MevzuatMetin/1.5.6172.pdf

One of the most important dimensions of integrated water resource management is social equity (Pena, 2011). In Turkey, there is pressure to allocate water to economically significant sectors such as agriculture, meaning little is left for other sectors of society. This will worsen in the future. Research shows that 96 percent of current agricultural sector water needs in the Küçük Menderes Basin can be met in minor drought conditions while other sectors' needs can still be fully met in the same conditions (SYGM, 2019). However, by the 2040s, the supply/demand ratio is projected to go down to 77 percent (ibid.), which could cause conflicts between industrial, domestic and farming interests.

10.5 MONITORING AND COMPLIANCE

Despite commitments to control water abstraction in river basin sectoral plans, as described above only five allocation plans have been produced. Coordination between the WFD process and water allocation planning is therefore limited, preliminary and still evolving. The monitoring of water levels is also historically underdeveloped: the DSI has only six groundwater monitoring stations for the entire Konya Closed Basin (Orhan, 2021). Therefore, real-time monitoring stations and early warning systems should be expanded to include water and groundwater levels alongside water quality. It is therefore necessary to establish a National Monitoring Network to carry out monitoring holistically (Ministry of Development, 2018).

Regulatory compliance is also weak. For instance, according to Article 14 of the 'Regulation on the Protection of Ground Water against Pollution and Detection', the Ministry of Environment and Urbanization is authorized to conduct inspections regarding the protection of groundwater quality and the DSI is also authorized to conduct inspections regarding quantity-related issues[8]. According to Article 18 of the 'Law on Groundwater' (No. 10688, 1960), the necessary permits must be obtained from the DSI for any activity to supply groundwater (Günhan, 2014). There are three types of permissions to be obtained by the user: 'search permission' to drill wells; 'use permission' for abstracting water; and 'modification permission' for then altering conditions of the permit. Administrative fines may be imposed if activities are carried out without obtaining permits. A well can be closed and a fine imposed on the well driller[9]. Under national regulations, the DSI is also the agency responsible for licensing surface water. Depending on the location and the needs of the individual applicant, municipalities, provincial special administrations, and agriculture and forest provincial directorates can license water use rights, under DSI oversight. Restrictions for water use can be imposed on applicants, while allocations are not made where water resources fall below the environmental minimum flow. That said, the widespread issues with the over-abstraction of groundwaters and surface waters in river basins show that such regulations are poorly enforced, primarily due to institutional incapacity

10.6 THE BROADER POLICY INSTRUMENT MIX

In parallel to this emerging national water allocation regime are established government policy instruments for drought and water quality that impact upon its implementation. That said, there is only limited 'coherence' (Benson & Lorenzoni, 2017) between institutional frameworks and responsibilities, necessitating future coordination in water allocation policy at the basin scale.

10.6.1 Drought policy

Turkish water authorities originally recognized drought and other extreme weather events in the 2014 National River Basin Strategy (OSIB, 2014). A drought strategy and drought monitoring system were included within this overarching policy document (ibid.). More recently, a national drought

[8]The Regulation on the Protection of Groundwater against Pollution and Detection (No. 28257, 2012). https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=16038&MevzuatTur=7&MevzuatTertip=5)

[9]The Groundwater Law (1960, No. 10688). https://www.mevzuat.gov.tr/MevzuatMetin/1.4.167.pdf

management strategy and action plan were ratified in 2017 (OSIB, 2017). This plan also added the previous agricultural drought combating strategy and action plan to its framework (OSIB, 2017). The General Directorate of Water Management set the goal for each of the 25 river basins to establish drought management plans covering the period until 2023 (Duygu, 2015). So far, 11 basins have adopted a drought plan, including the Küçük Menderes and Konya Closed basins.

Because of Turkey's location in the Mediterranean Climate zone, the country already experiences frequent and intensive droughts (Seneviratne *et al*., 2012). These are likely to increase under climate change, meaning drought management plays a crucial role in Turkey's water management planning. The drought management plans involve three phases; the first phase (before a drought), the second phase (during a drought), and the third phase (after a drought) (OSIB, 2017). In agricultural drought management planning, there is a coordinating board that consists of a monitoring, early warning and forecasting committee, a risk evaluation board, and agricultural drought centers under the auspices of local governors (Ministry of Food, Agriculture and Livestock, 2013). Agricultural drought management plans and the national drought management strategy plan were predominantly agricultural-centered plans since the majority of water is used in the agriculture sector (Ministry of Food, Agriculture and Livestock, 2013; OSIB, 2017). Lastly, one of the crucial goals of the national drought strategy was to place the concept of 'drought management' within the scope of the national water law, to provide greater national coordination (OSIB, 2017).

Each drought management cycle has four steps which are monitoring, assessment, mitigation and responses (SYGM, 2018a). Depending on drought intensity, different methods and restrictions are used to ease drought effects. For instance, when moderate drought conditions are exceeded, restrictions on water irrigation such as compelling night irrigation and rotational water use planning are used (ibid.). During the most intense droughts, secondary product planting is forbidden, while priority is given to agricultural sectors such as fruit farmers (ibid.). Implementation of the levels of drought management planning in each basin also depends on drought severity: the full action plan is only enacted during the most severe droughts (SYGM, 2018a). Some of the restrictive actions are then relaxed after drought intensity declines (ibid.). Additionally, the national drought management strategy and action plan informs the public and requires them to participate in plan implementation, while conducting the tasks previously established in the agricultural drought combating strategy and action plan (OSIB, 2017). Moreover, while the drought management plan, agreed by water agencies in Turkey, focuses on water use limitation and restriction, the agricultural drought combatting action plan adopted by the Ministry of Food, Agriculture and Livestock tries to protect farmers and mitigate the adverse effects of drought on production (OSIB, 2017; SYGM, 2018a). Here, it aims to increase the water retention capacity of soil by promoting organic fertilizer and the use of mulch, thus mitigating drought-related yield loss (Ministry of Food, Agriculture and Livestock, 2013). Lastly, this plan recognizes forage needs and supply mechanisms for the livestock sector and supports grain aid distribution to those in need, to reduce the possibility of famine (ibid.).

Despite drought measures being adopted in the 2014 National River Basin Strategy and the adoption of basin drought management plans, the long-term climate resilience of Turkey's water resources can be questioned. One reason for this is that climate change is predicted to increase drought events (Seneviratne *et al*., 2012). For instance, the Konya Closed Basin will experience medium and severe drought over the next decade, with water allocation analysis showing that water potential and water allocation cannot satisfy all water needs during significant drought conditions, especially for the agriculture sector (SYGM, 2018a). The supply of water to the agriculture sector could be reduced to 75 percent for some sub-basins in Konya, namely Cumra, Beysehir and Karaman, while the supply ratio is 35 percent for the agriculture sector for the Altintekin sub-basin (ibid.). To address these risks, water transfer and recycled water have been recommended to meet sectoral needs (ibid). To an extent, this will enhance climate resilience. However, water transfer makes the basin dependent on external water bodies and undermines one of the key pillars of water security, namely independence. Transfers also impact the resilience of other basins and may therefore not be sustainable. Other approaches such as crop substitution, and water-saving methods and technologies may be required for future climate adaptation.

Some measures have already been adopted to ensure resilience in the Kücük Menderes Basin. The basin has transferred water from the Gediz basin (SYGM, 2019). While providing a short-term solution to deficits, it puts the long-term resilience of the basin in jeopardy, especially when more water transfer is being advised for severe droughts (ibid.). Not only has water conveyance happened outside the basin but there are also intra-basin water transfers occurring due to sub-basins experiencing water scarcity and loss of water independence (ibid.). This issue involves water security at both local and regional levels, requiring strategic government intervention.

10.6.2 Economic instruments

One important government subsidy related to water allocation is aimed at providing financial support for preventing water loss and leakage, as part of Turkey's national water management strategy (OSIB, 2014). If applied properly, significant water conservation can be achieved, especially in times of water scarcity and drought. Promoting ecologically friendly and organic agriculture, the expansion of pastoral areas and afforestation to increase water conservation are also supported by economic subsidies in Turkey (OSIB, 2014).

10.6.3 Awareness-raising

Raising awareness of water scarcity issues is one important part of efficient water allocation management. In Turkey, this is undertaken through national media and educational programs. Media outlets have been used for increasing public awareness (OSIB, 2017). However, the effectiveness of media information as an instrument of government policy is questionable when it comes to conveying water-related messages to the public, especially farmers.

Educational programs for farmers to increase the recognition of water allocation issues are included in drought management plans (Duygu *et al.*, 2017; Ministry of Food, Agriculture and Livestock, 2013; OSIB, 2017). However, it is difficult to assess the usefulness of these educational programs when they can only be tested during extreme weather events. In the assessment of river basin planning, educational inadequacies amongst key stakeholders were observed as a threat to management schemes (OSIB, 2014). Dealing with these deficiencies requires educational programs for water harvesting, increasing the efficiency of water irrigation techniques and the adoption of water use monitoring methodologies (OSIB, 2017).

10.7 CONCLUSIONS

Despite the abundance of laws on water resources management in Turkey, the case studies show that significant problems exist with water allocation in general and in the agricultural sector specifically. Over-abstraction of water in river basins mainly for irrigation is causing severe environmental externalities and, in Konya, major effects such as sinkhole development (Ak *et al.*, 2019). Economic imperatives to promote agricultural production are, to an extent, driving these impacts, while social equity and long-term climate resilience are also reduced. Sustainability of water resources is therefore poor, suggesting that water allocation should be a national priority concern. Problematically, despite recent institutional innovations around water allocation planning, there is no comprehensive national water law that can aggregate existing water measures (Bulut & Birben, 2019). One consequence is institutional 'incoherence' and a lack of coordination between DSI permitting and GDWM strategic planning in controlling water allocation. The Draft Water Law should therefore be enacted to specify responsibilities but it is still under political consideration. In the meantime, Basin Management Committees should be made the only authorized body at the basin scale for determining all planning and applications related to water resource use and should have legal personality (Ministry of Agriculture and Forestry, 2019). Greater collaboration between committees, government agencies and stakeholders such as irrigation unions and farmers is also required to ensure more sustainable forms of abstraction.

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