5. Empirical Analysis of the Jucar

This chapter presents the empirical analysis of the Jucar River Basin District (RBD). Similar to the previous chapter (see Chapter 4), I analyse the implementation of the European Union (EU) Water Framework Directive (WFD) implementation from 2009 to 2019, covering the first and second planning cycle, and focusing on decision-making process on reducing agricultural water consumption. I analyse independent and dependent variables that were theoretically elaborated in Chapter 2, and embedded in the research design of this study in Chapter 3.

The case study addresses four Action Situations (see Chapter 3 on the selection of Action Situations), containing different patterns of interaction. *Hybrids* are identified as dominant patterns of interaction (see Section 5.2), composed of *cooperation* and *competition,* as well as *cooperation* and *hierarchy.* Furthermore, one pattern of interaction consists of a sequence of first *information exchange*, followed by a *gap in interaction*. I also identify one pure form of coordination, namely *incentive-based hierarchy.* Most of the patterns result from a combination of formal and informal rules.

At the level of the overarching governance process, i.e., across Action Situations, the analysis reveals medium performance rates (see Section 5.3). More specifically, process performance assessed across Action Situations, operationalized as *coordinated behaviour,* is moderate. Reasons for this assessment are, most importantly, because incentive mechanisms for water users to reduce their consumption were only established in some cases; while in others, it seems not to be rationale from the perspective of water users to reduce their consumption. Furthermore, I argue that the EU does not provide incentive mechanisms for governmental actors to enforce a reduction of water consumption. Second, *policy output performance,* referring to the status of implementation of the River Basin Management Plan (RBMP) of the second planning cycle, is low. This is because in December 2019, only 21% of measures that were supposed to be completed by 2021 in the RBD had actually been finalized (see MITECO 2020b: 130). Last, *environmental outcome performance* is moderate. On the one hand, agricultural water consumption slightly decreased from 2009 to 2020. However, according to the most recent assessment of the EU Water Framework Directive (WFD), 33% of groundwater bodies are in a poor quantitative status, and 65% of surface water bodies are in a status "worse than good" (CHJ 2014b; 2019b).

The chapter's structure is the same as that of the previous chapter on the Guadalquivir (see Chapter 4): Independent variables which are specific to the case study are characterized first (Section 5.1), followed by analysing Action Situations. This includes variables that are specific to the Action Situation, patterns of interaction and performance assessment (Section 5.2). Lastly, performance across Action Situations is analysed (Section 5.3).

5.1 Independent variables specific to the case study

In this section, independent variables that are specific to the case study are described, including *contextual conditions* and *characteristics of heterogeneous actors*. For more detailed definitions and descriptions of the respective variables included in this section and below, see Chapters 2 and 3.

5.1.1 Contextual conditions

Geographic and hydrological characteristics of the River Basin District

The Jucar RBD is located in the central-eastern part of Spain and covers an area of 42,735 km^2. It extends over five *Comunidades Autónomas* (hereafter: regions), namely the i) Valencian Community, covering 49.4% of the area; ii) Castilla-La Mancha (37.6%); iii) Aragon (12.5%); iv) Catalonia (0.1%); and v) the Region of Murcia (0.1%) (CHJ 2015c: 19) (see Figure 6). The population is 5.02 Million. In this analysis, I only focus on the Valencian Community and Castilla-La Mancha, which jointly cover 87% of the RBD. The Jucar RBD, which is the administrative demarcation for the WFD implementation, includes several river basins and sub-basins (see Figure 7). They are independent from each other but managed under the same RBMP (Ortega-Gómez, Pérez-Martín, and Estrela 2018). The four most important river basins in terms of agricultural water use are firstly the Jucar (net demand of 776.9 hm^3/year), also giving the name to the RBD, Turia (183 hm^3/year), Mijares-Plana de Castellón (134.4 hm^3/year) and Vinalopó-Alcantí (111.8 hm^3/year).[1] In the following, I use the term Jucar RBD to refer to the administrative demarcation for the WFD implementation; and Jucar river to refer to the basin which forms part of the RBD.

The RBD can be divided into two main geographical areas. These are a mountainous region in the western part with an altitude mostly below 1,000 meters, where the three rivers Jucar, Turia and Mijares originate. The eastern part is characterized by coastal plains. The Jucar RBD represents a typical Mediterranean river basin, having a semi-arid climate of irregular precipitations and periods of water scarcity during summer. The annual average of precipitation is 500 mm per year.

1 https://aps.chj.es/siajucar/ (accessed: 08.09.2020)

Important ecosystems in the RBD are firstly the Albufera wetlands, a natural park on the Mediterranean coast protected under the so-called Ramsar Convention, an international treaty for the conservation and sustainable use of wetlands.[2] It is considered as most important aquatic ecosystem in the RBD. Due to its importance for biodiversity and preservation of European wetlands, the natural park is sometimes called "small Doñana" (Interview 29/2019), referring to the Doñana national park in the Guadalquivir. The Albufera is an artificial lake which depends on return flows from irrigation from the rivers Jucar and Turia, contributing approx. 60% of inputs to the Albufera (cf. Haro et al. 2014), as well as on groundwater flows. However, due to reduced return flows from irrigation and lower river flows in the downstream Jucar, the Albufera ecosystem is seriously threatened. Furthermore, the aquifer Mancha Oriental is another highly important ecosystem in the RBD, covering 7,300 km^2 and thereby being the largest aquifer in the Iberian Peninsula. Yet, it is affected by intensive development of irrigated agriculture since the early 1970s. Since the Mancha Oriental and the river Jucar are connected, groundwater overuse in the Mancha Oriental has damaged wetlands of the upstream part of the Jucar river. Further, it led to reductions in river flows in the downstream part, which then also negatively affects the Albufera (Esteban and Albiac 2012).

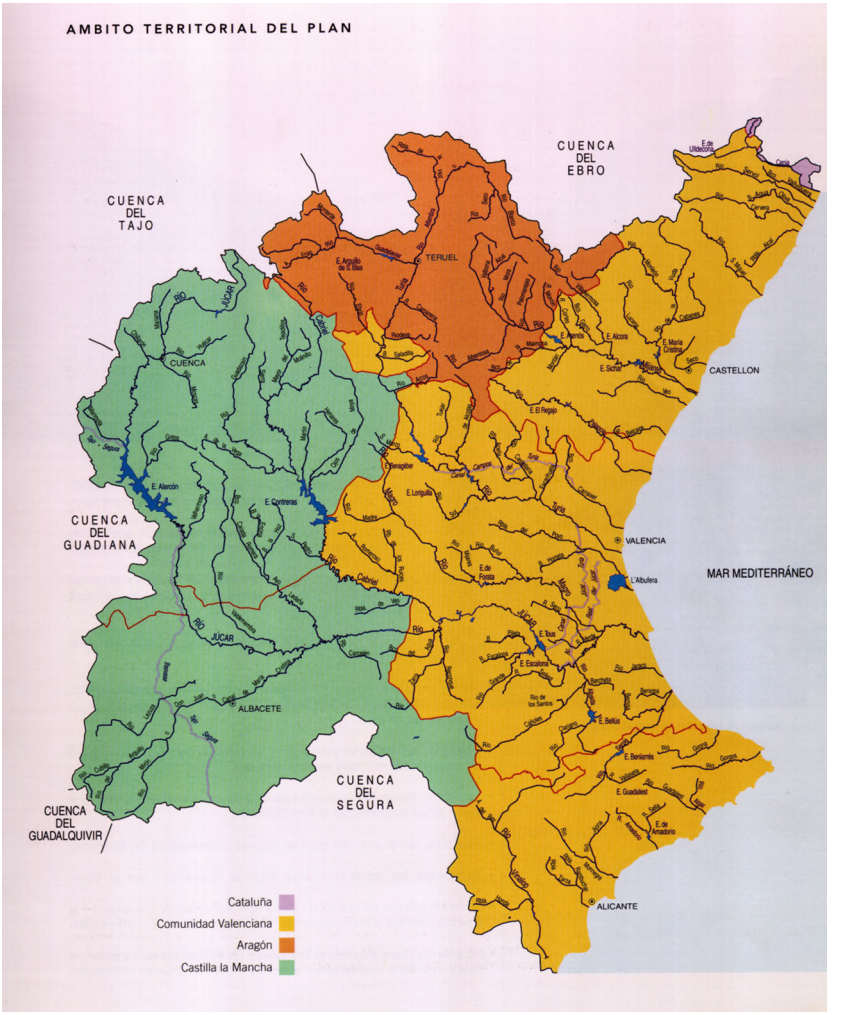
Socio-economic role of irrigated agriculture

Most important economic sectors in the Jucar RBD are service and tourism, followed by industry, and thirdly, agriculture and energy. In 2012, the agricultural sector represented approx. 2.5% of the gross value added (GVA) of the RBD. It is estimated that around 66,000 persons are employed in the agricultural sector, equivalent to 3.7% of the employed population (CHJ 2020a). Adding on that, 10% of employment in the Valencian Community belongs to the agri-food industry.

Agriculture in the RBD is very diverse. The coastline of the Valencian Community is characterized by citrus fruits cultivation in small plots of max. 1 ha (Interview 18/2019). The area has been irrigated "for centuries", dating back to the Middle Ages, and most of the population of the RBD is living there (Interview 18/2019). Agriculture in Castilla-La Mancha, in contrast, only developed in the 1970s, which was very important for the regional economy, with agriculture still representing an important source of income compared to the rest of Spain (Interview 17/2019). It consists mostly of cereals and vegetables production by relatively large farms.

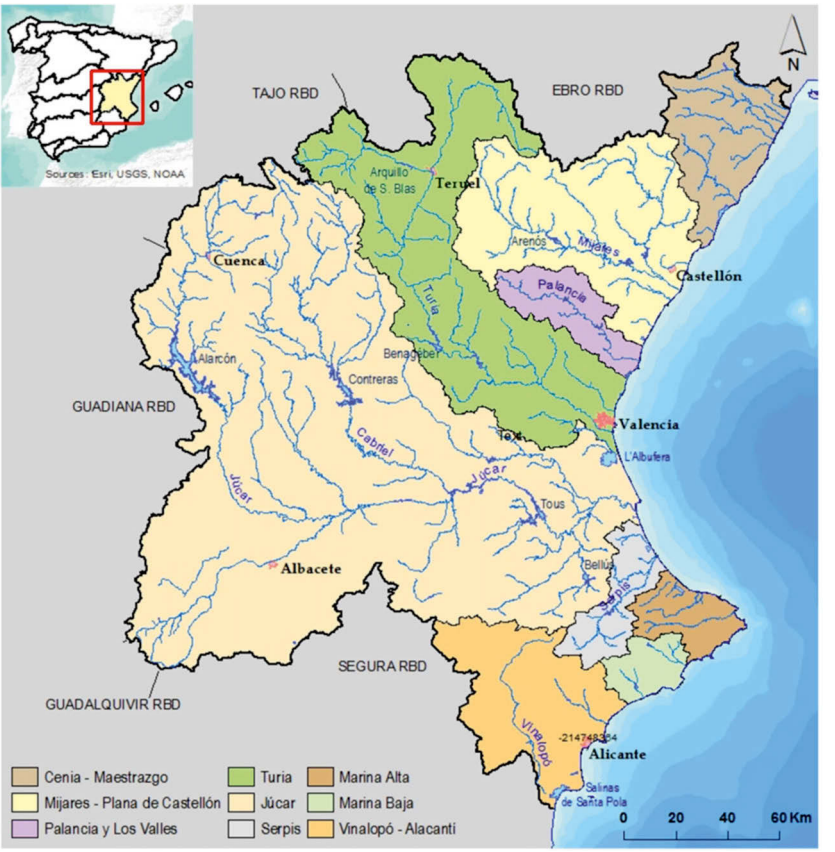
2 https://rsis.ramsar.org/ris/454 (accessed: 22.04.2022)

Figure 6: Administrative map of the Jucar River Basin District



Source: Blog Institut Cartogràfic Valencià (https://bit.ly/3K4LDoc)

Figure 7: Map of the Jucar River Basin District and its nine basins



Source: Ortega-Gómez et al. 2018

Irrigated agriculture in the RBD covers 354,138 ha, compared to 967,318 ha of rainfed agriculture located mostly in the southern part of the RBD (CHJ 2019a). Most important irrigated crops in terms of land use are citrus fruits covering 40% of irrigated surface area (130,000 ha), vine (63,801 ha), cereals (44,108 ha) and fruits (37,672 ha) (CHJ 2019a). Even though in terms of land-use, rainfed agriculture exceeds irrigated agriculture, the latter is economically much more important. Fruits, vine and olive, for example, have a productivity rate six times higher compared to production under rainfed agriculture, and citrus fruits cannot even be produced without being irrigated (CHJ 2019a: 335). In terms of water use of cultivated crops in the RBD, rice has the highest water consumption per hectare, followed by corn, and fruits (non-citrus and citrus) (CHJ 2015d). Irrigation in general, and in particular irrigation of

traditional agricultural systems in the Valencian region, is also of high social and historical importance (CHJ 2019a). In this context, interviewees argue that irrigation "is not a question of Gross Domestic Product, […] but it does have a tremendous social, territorial, and environmental value" (Interview 19/2019; also: 22/2019, 26/2019). Without the possibility to irrigate, farmers would leave the region (Interview 22/2019), and "if you take away all this [irrigated] agriculture, […] you can sink the region" (Interview 19/2019).

Water supply and demand

Water supply in the Jucar RBD amounts to 3,317 hm^3/year, and is composed mostly of surface and groundwater resources, followed by treated wastewater, imported water from water transfer, and lastly, to a marginal share, desalinated water (see Table 7). As in the rest of Spain, surface water is highly regulated through large-scale infrastructure such as dams and water transfers between different RBDs (Tajo-Segura) as well as between the different sub-basins within the RBD, namely the canal Jucar-Turia and the transfer Jucar-Vinalopó. While the former is used for urban water supply and irrigation, the latter is not operating due to conflicts over financing of water use (Interview 22/2019). It was built under the RBMP 1998, aiming to alleviate over-exploitation of groundwater bodies of the Vinalopó by providing water for urban water supply and irrigation from the Jucar.

Overall water demand in the RBD is 3,240 hm^3/year. Agriculture accounts for 79% of this water demand, corresponding to 2,567 hm^3/year (CHJ 2015b), out of which around 1,000 hm^3/year is based on groundwater (CHJ 2020b). Water demand thereby approximates water supply, which is why the Jucar RBD is an almost closed river basin with a very fragile equilibrium between water resources, water demand, and the fulfilment of environmental requirements (Interview 27/2019). This is also why most pressing water management issues in relation to agricultural water use at the beginning of the first planning cycle were over-exploitation of aquifers, particularly of the Vinalopó and Mancha Oriental, as well as reduced flow rates due to surface water extractions, mostly in the downstream part of the Jucar river (CHJ 2013).

Table 7: Water supply in the Jucar River Basin District

	Own resources	**Non-conventional resources**		**External resources**	**Total**
	Surface and groundwater	Reutilization	Desalination	Transferred water	
hm^3/year	3,111	121.5	3.5	81.1	**3,317.1**

Source: Based on CHJ (2015b: 93–4). The RBMP does not include separate numbers for surface and groundwater.

5.1.2 Characteristics of heterogeneous actors

The most important public actor in the Jucar is the so-called *Confederación Hidrográfica del Júcar* (hereafter: CHJ) which is responsible for the WFD implementation in the RBD, similar to the Guadalquivir case study (Chapter 4). The CHJ belongs to the Ministry for the Ecological Transition and the Demographic Challenge. Furthermore, there are two important regional actors which are of importance for the case study. These are the Regional Department for Agriculture, Rural Development, Climate Emergency and Ecological Transition of Valencia (*Conselleria de Agricultura, Desarrollo Rural, Emergencia Climática y Transición Ecológica;* hereafter: Regional Department of Valencia); and the Regional Department for Agriculture, Water and Rural Development (*Consejería de Agricultura, Agua y Desarrollo Rural*; hereafter: Regional Department of Castilla-La Mancha).

Financial and human resources of actors

The first important group of actors includes governmental actors. As already discussed in relation to the Guadalquivir (see Chapter 4), *Confederaciones Hidrográficas* in Spain suffer from a general lack of financial and human resources (Interview 17/2019), which also applies to the CHJ (Interview 24/2019). The financial crisis in Spain, lasting from 2008 to 2014, further exacerbated the situation and slowed CHJ's work over the past decade (Interview 16/2019). In terms of human resources, an interviewee describes the CHJ as a "closed" administration of mostly civil engineers, lacking personnel that is trained in economics or ecology (Interview 17/2019). Yet, another interviewee highlights that in recent years, many young, well qualified persons have joined the CHJ (Interview 23/2019); and the CHJ is said to have more human resources compared to other *Confederaciones Hidrográficas* due to international collaboration and research projects (Interview 15/2019).

Regional agricultural administrations, i.e., Regional Departments of Valencia and of Castilla-La Mancha, also have limited financial resources (Interview

22/2019). The implementation of measures related to irrigation infrastructure is thereby slowed down (Interview 24/2019). While this concerns both, the Valencian Community and Castilla-La Mancha, it is to assume that the former dedicates more financial and human resources to irrigation management in the Jucar RBD than the latter. This is because 90.52% of the Valencian Community's territory is part of the RBD, compared to 20.31% of Castilla-La Mancha's (CHJ 2015c: 19). Moreover, the Valencian Community is located in two Spanish RBDs, namely Jucar and Segura, whereas Castilla-La Mancha forms part of seven RBDs, namely Tajo, Guadiana, Jucar, Segura, Guadalquivir, Ebro and Duero. The Valencian Community is therefore arguably more dependent on the RBD's water resources and its management.

The second major group of actors are WUAs. Since numbers on their human and financial resources are not available, I use water rights as proxy (see also Chapter 4). The *Acequia Real del Júcar* is described as one of the most powerful WUAs in the RBD, being also the largest water rights holder (Interview 24/2019). The Acequia Real was founded in 1258 and thus is one of the oldest WUAs in Spain with approx. 25,000 farmers, watering 20,659 ha. It also played an important role in the creation of the CHJ in 1932 and of the National Federation of Irrigation Communities, FENACORE, in 1955 (García-Mollá et al. 2020). A further important WUA in the RBD is the *Junta Central de Regantes de la Mancha Oriental,* founded in 1994. They unite approx. 9,000 farmers managing 130,000 ha and are important representatives of water users of Castilla-La Mancha's part in the Jucar RBD. Besides these large WUAs, there are also smaller and more traditional WUAs. These are often managed by persons of older age and lack technical capacities and training on more recent requirements, such as the need to maintain ecological flows (Interview 16/2019). Lastly, it is important to highlight that resources of WUAs differ between the two regions. As mentioned above, economy, including agriculture and irrigation, developed much later in Castilla-La Mancha than in the Valencian Community. Valencian WUAs therefore have a longer history, which is also reflected by higher amounts of water rights compared to WUAs in Castilla-La Mancha. According to an interviewee, water users in the Valencian Community would perceive themselves as "owners of the river", having "preferential use" (Interview 29/2019). This difference between the regions is also reflected in the degree of political organization of WUAs. While in the Valencian Community, the umbrella organization Federation of Water User Associations of the Valencian Community (*Federación de Comunidades de Regantes de la Comunidad Valenciana,* Fecoreva) exists since 2004, their counterpart in Castilla-La Mancha was founded only recently (Interview 26/2019). However, single WUAs, such as the Acequia Real, seem to be more powerful than Fecoreva even though the latter is organized at a higher level.

Third, there are environmental groups and civil society organizations. Similar to the Guadalquivir, an important civil society organization is the Foundation of New Water Culture (*Fundación Nueva Cultura del Agua, FNCA)*. Further, there are locally or-

ganized groups exclusively working on the river Jucar, such as *Xúquer Viu* or *Acció Ecologista-Agró*. However, no ENGOs working on other sub-basins of the RBD have been identified. This shows that these actors are underrepresented in the RBD compared to agricultural interest groups. Further, resources of these actors are very limited. They almost exclusively depend on voluntary work and external financial support (Interview 17/2019, 23/2019).

Narratives on water management

A first group of actors, consisting mostly of agricultural administration and WUAs of the Valencian Community, adheres to the *demand-side narrative* where water scarcity is perceived to be the result of an excess in water demand. Traditional irrigation systems with low efficiency rates are widespread in the Valencian Community, which is why mentioned actors consider improved irrigation infrastructure – which shall reduce water demand – as main instrument to address water scarcity. During the RBMP development, they therefore argue to include these measures in the RBMP (Interview 16/2019, 20/2019, 21/2019). Representatives of the Acequia Real stress the importance of combining irrigation efficiency measures with reductions of water rights (Interview 21/2019), thereby following a *knowledge and governance narrative*. In addition, many WUAs also support the *supply-side narrative*. They perceive water scarcity as a result of missing infrastructure, which is why water supply shall be increased through new infrastructure and technology (Cabello, Kovacic, and Van Cauwenbergh 2018). Indeed, in participatory processes for the RBMP development, groundwater users in the Vinalopó-Alcantí advocate putting into operation the water transfer Jucar-Vinalopó to replace the over-exploited groundwater through surface water (Interview 24/2019). Similarly, water users in La Mancha Oriental plead for replacing groundwater by renewable resources (Interview 29/2019).

Actors of ENGOs and civil society mostly adhere to the *knowledge and governance narrative*, perceiving water scarcity as a problem of governance. In this context, they argue for changes in the Common Agricultural Policy at the EU level. Subsidies should, for example, be linked to achievements of the WFD aims; and not include irrigation efficiency measures or support large-scale irrigated agriculture which is said to undermine efforts of river basin management, e.g., in Castilla-La Mancha (Interview 17/2019). Furthermore, aforementioned actors also use arguments consistent with the *deep ecology narrative*, which is about adapting societal activities to ecosystems conservation (Cabello, Kovacic, and Van Cauwenbergh 2018). More specifically, civil society actors demand to "drastically reduce the consumption" of agriculture and re-introduce rainfed agriculture even if this is done at the expense of competitive advantages on the international market (Interview 17/2019; also 23/2019). Further, they argue to consider requirements of river ecosystems as starting point of RBM planning, rather than agricultural needs for irrigation (Interview 23/2019). In this context, the protection of the Albufera is one of the main topics for

ENGOs and civil society organizations which they defend in participatory processes of the RBMP development (Interview 17/2019, 28/2019).

As last actor, it is to mention the CHJ which follows a combination of *demand-* and *supply-side*, as well as *knowledge and governance narratives*. Indeed, a CHJ representative argues to better align irrigation efficiency measures with the reduction of water rights, i.e., to make the latter legally binding for all WUAs that receive public subsidies to increase irrigation efficiency (Interview 27/2019). In general, allocation of water resources through the management of water rights is considered highly important (Interview 18/2019). Nevertheless, also supply-side measures, such as dams and water transfers, are important instruments for the CHJ.

In addition to these narratives, I want to discuss opposing interests of the two Regional Departments as well as their water users, reflected in an upstream-downstream conflict on the Jucar river. As already explained above, agriculture has developed at different rates in the two regions, resulting in differences in the amount of water rights. However, there is a strong interdependence of water users: WUAs in Castilla-La Mancha mainly draw on groundwater resources of the aquifer La Mancha Oriental which is connected to the Jucar river. Actors in the Valencian Community therefore accuse groundwater users in Castilla-La Mancha of reduced water resources in the downstream part of the Jucar river. On the other hand, actors in Castilla-La Mancha claim that water allocation should not be based on historic water rights, but rather on current needs that shall be balanced between the two regions. Moreover, they trace over-exploitation in the Jucar back to water transfers to the other two river basins Turia and Vinalopó-Alcantí, rather than their own consumption (Interview 25/2019, 29/2019). These water transfers within the RBD are a recurring source of conflict between users of the different river basins (Interview 17/2019).

Against this backdrop, there are also conflicting interests on RBD boundaries for WFD implementation between the two regions. Castilla-La Mancha, on the one hand, claimed that sub-basins which are located entirely within the Valencian Community should be governed by the latter as intra-regional river basins, and not within the Jucar RBD. The reason arguably is that the territory of the Valencian Community in the RBD would thereby be reduced, leading also to a decrease of Valencian Community's representatives in the CHJ's organs; and a relative increase of representatives of Castilla-La Mancha (Albiac, Calvo, and Esteban 2014). The political influence of Castilla-La Mancha over the RBD would thus increase (De Stefano and Hernandez-Mora 2018). The Valencian Community, however, refused to assume responsibility for these intra-regional basins. The underlying reason is that they are connected with other sub-basins of the Jucar RBD through water transfers; and that transferring water between different RBDs is subject to stricter legal criteria than transferring water within a RBD (López-Gunn and De Stefano 2014; Interview 17/2019). In 2011, the Supreme Court ruled in favour of the Valencian

Community. The respective intra-regional basins therefore form part of the Jucar RBD and are governed by the CHJ. This dispute still shapes the relationship of the involved regions, and claims related to this conflict are frequently put forward by Castilla-La Mancha during the RBMP development.

5.2 Analysing and evaluating Action Situations

This chapter analyses and evaluates interaction of actors within the four Action Situations River Basin Management Plan Development, Dam Release Commissions, Increasing Irrigation Efficiency, and Reduction of Water Rights (for the description and selection of Action Situations, see Chapter 3). The analysis of each Action Situation is organized similarly as in the other empirical chapters: First, independent variables specific to the respective Action Situation (*overarching rules*, *social problem characteristics*) are outlined. Since several variables are identical to the Guadalquivir case study, with both being inter-regional RBDs, I only summarize respective variables and refer to the Guadalquivir chapter to avoid duplications. Second, patterns of interactions (i.e., *cooperation, competition, hierarchy, hybrids,* and *gap in interaction* and *information exchange*) that emerged within the respective Action Situation are outlined, and traced back to formal and informal rules directly structuring the Action Situation. I thereby rely on Ostrom's (2005) rule typology (see Chapter 2). Third, the analyses conclude by assessing performance at the level of the respective Action Situations (*process performance*, *intermediate output performance)*.

5.2.1 Development of the River Basin Management Plan

The Action Situation Development of the River Basin Management Plan is regulated by formal rules of the WFD and the National Water Law and therefore undergoes the same steps as in the Guadalquivir (see Chapter 4): informal meetings; formalized participatory processes, including written consultation and presentation of the Scheme of Important Issue as well as the Draft RBMP; and final approval of the RBMP by the River Basin Water Council. In this Action Situation, I identify a *hybrid* pattern of interaction between the CHJ, the two Regional Departments, WUAs and ENGOs and civil society organization based on a combination of formal and informal rules. This *hybrid* is composed of *cooperation* and *idea-based competition:* while the CHJ builds cooperative relationships with aforementioned actors, the latter also compete for influence towards the CHJ.

Independent variables specific to the Action Situation

Overarching rules specific to this Action Situation are determined by the 2001 National Water Act and are therefore identical to the Guadalquivir case study (see

Chapter 4). To summarize, *de jure autonomy* of the CHJ is moderate. While it is in charge of the development, monitoring, and revision of the RBMP, it is restricted in its autonomy due to the requirement to coordinate with concerned actors. All other actors have no formal authority in this Action Situation and strongly depend on the CHJ, which is why their *de jure autonomy* is rated low. *Formal rules for coordination* define the functioning of the River Basin Water Council, which needs to approve the RBMP before passing it to the National Water Council and the National Government.

Social problem characteristics are almost identical to the Guadalquivir and imply medium to high coordination requirements of the CHJ with other actors. In a nutshell, *uncertainty* is assessed at different levels, and is evaluated as high: from the perspective of stakeholders, it is uncertain whether their interests will be integrated into the RBMP; from the perspective of the CHJ, there is medium *uncertainty* concerning the question whether public actors will implement measures at a later stage; and there is high *uncertainty* for the CHJ whether WFD objectives of a good water status will be achieved. Further, I argue that *frequency* is low since the RBMP has to be developed every six years only; *excludability* is also assessed to be low, with the RBMP being a public good; and *asset specificity* is medium since on the one hand, there is a very heterogenous target group, but on the other, measures are mostly financed through the RDP and are therefore transferred from one policy to another. The only difference to the Guadalquivir is the *scale*. While in both cases, the RBMP Development refers to the RBD, implications are different: the CHJ needs to coordinate with two regions, i.e., with the Regional Departments of Castilla-La Mancha and of the Valencian Community.

Pattern of interaction: Hybrid of cooperation and competition

I identify a *hybrid* pattern of interaction in this Action Situation, consisting of *cooperation* and *idea-based competition*. First, *cooperation* results mostly from informal rules according to which the CHJ acts as orchestrator promoting mutual understanding and strengthening trust among actors in order to reach joint goals of the WFD. Empirically, this concerns official participatory processes as well as informal meetings between the CHJ and stakeholders. Regarding these participatory processes, the CHJ organized four so-called "territorial tables" for the different basins and subbasins to present the Scheme of Important Issues and to receive feedback by stakeholders (*choice, information rules*) (CHJ 2015e: 20). All stakeholder groups were invited, i.e., administrations, water users, trade unions, ENGOs and universities from the respective area (*choice, boundary rules*) (Interview 16/2019, 23/2019). Second, 14 intersectoral meetings were organized by the CHJ to present the draft RBMP, consisting of two rounds. Actors discussed main problems of water status of groundwater and surface water bodies, as well as possible measures to achieve environmental aims. Topics raised by participants were inter alia increasing irrigation efficiency in

the Turia and the Jucar, environmental flow requirements, and the need to improve monitoring of water use (CHJ 2015e). Prior to these participatory processes, information is provided by the CHJ (*information rule)* (Interview 26/2019). In addition, informal meetings are organized by the CHJ. These are on the one hand bilateral meetings with administrations, WUAs, ENGOs and civil society representatives, respectively; and on the other, cross-sectoral trilateral meetings to unite different actors, such as WUAs and ENGOs, to jointly discuss specific topics (*choice, boundary rules*). These meetings continue after the planning process, and usually take place twice a year with the different actor groups that are also part of the official CHJ bodies (*choice, boundary rules)* (Interview 23/2019, 27/2019).

There are two main reasons to classify this empirical process as *cooperation*, namely the building of trust and promoting consensus among involved actors; as well as the CHJ's intention to build a relationship in which actors have an equal status. More specifically, the importance of trust-building for the CHJ is reflected in the fact that above-mentioned bi- and trilateral meetings are considered key for the RBMP development: "In the end a lot is resolved in meetings and there is a part that is trust and working together, which is key to making it work" (Interview 16/2019). Similarly, another CHJ representative explains that river basin planning relies fundamentally on two main aspects, which are "rigorous technical studies" and to "talk a lot with the people" (Interview 27/2019). The CHJ therefore only suggests rough measures to the two Regional Departments, which are then further elaborated by them (*choice rule*) (Interview 20/2019, 25/2019). Reasons for this approach by the CHJ is to strengthen regional government ownership and avoid the expectation that the national state will fund respective measures; both is considered crucial by the CHJ to ensure implementation of measures at a later stage (*aggregation* and *payoff rules*) (Interview 16/2019). Similarly, the CHJ also aims to foster understanding of water users on the need to restrict agricultural water use at the benefit of environmental needs to ensure their compliance with these restrictions (Interview 16/2019).

The second indicator of *cooperation* in this context is the building of relationship between actors with a more or less equal status. Indeed, according to an interviewee, all actors participate equally in the planning process, having the same opportunity to raise voice and being heard during the process (*position, boundary rule)* (Interview 26/2019). Further, the CHJ sees itself in the "role of mediation" (*position rule*), which resonates well with statements by other actors describing the CHJ as "arbitrator" (Interview 15/2019, 20/2019). More specifically, a CHJ representative explains to balance between the individual and the general interest, with the overall aim to achieve a "reasonable equilibrium" between agricultural demands on the one hand, and the fulfilment of environmental objectives of the WFD on the other (*scope rule)* (Interviews 27/2019; also 16/2019). A further CHJ representative describes that actors "all pull in their own direction, and we, […] what we have to do is to be more objective and deal with some pretty complicated realities, because we are in the middle" (In-

terview 16/2019). I see this as indicator that the CHJ aims to consider all interests equally in the process.

Second, the *hybrid* consists also of *idea-based competition* between the two Regional Departments, WUAs and ENGOs, which compete for influence towards the CHJ, inter alia by submitting written statements on the Initial Documents, on the Scheme of Important Issues and the draft RBMP (*choice rule)*. The submission of statements in early phases of the planning process is thereby considered particularly important, since later, it is difficult to put new topics on the agenda (Interview 24/2019). For the RBMP 2015–2021, 122 actors submitted written statements, which were mostly water users (64), followed by public administration (24) and ENGOS and civil society organizations (14) (*boundary rules)* (CHJ 2015e: 69). Topics which were addressed the most are distribution of water resources (23%), Program of Measures (17%) and environmental objectives and ecological flows (15%) (CHJ 2015e: 71). Based on these written comments, the CHJ again holds bilateral meetings with the different groups to discuss to which extent the respective statements can be integrated into the RBMP, and to suggest corresponding measures (*choice rule)* (Interview 16/2019, 26/2019).

There are two illustrative examples of actors *competing for influence* towards the CHJ. First, there are the Regional Departments of Castilla-La Mancha and the Valencian Community, as well as the respective WUAs. Discussion concerns how water allocation within and between the different river basins shall be regulated in the RBMP (Interview 26/2019). This goes back to the above-mentioned conflict between fostering rural development of Castilla-La Mancha and maintaining and complying with traditional water rights of the Valencian Community (Interview 16/2019). More specifically, the Regional Department of Castilla-La Mancha as well as water users of that region ask to only fulfil water demands within the Jucar River, rather than transferring water to other basins within the RBD as well as to the Albufera. They thus consider water transfers as reason for overexploitation in the Jucar, instead of overuse within the Jucar River itself (Interview 29/2019). On the other hand, WUAs of the Vinalopó-Alcantí in the Valencian Community request to put into operation the water transfer Jucar-Vinalopó and to overcome "historical interests" of the "surplus basin", i.e., the Jucar River (Interview 24/2019). Every region therefore aims "to try that [they] are the least affected" by river basin planning (Interview 26/2019). However, this conflict also plays out at the political level, which is why administrations themselves can hardly solve it (Interview 19/2019).

Furthermore, also WUAs on the one hand, and ENGOs and civil society representatives on the other, *compete for influence* towards the CHJ. Empirically, this is most evident in their discussion on water allocation for environmental needs, i.e., maintaining ecological flows and recovering groundwater, and irrigation; with the increase of irrigation efficiency in the Jucar River as important example (see also Section 5.2.3 and 5.2.4). ENGOs and civil society argue that higher efficiency rates

lead to a reduction of return flows to the Jucar, which ultimately reduce ecological flows in the Jucar and the Albufera. Saved water should therefore be directly transferred to the Albufera (CHJ 2015f). According to affected WUAs, this transfer is already happening; and increasing irrigation efficiency thus contributes to achieving environmental objectives (Interview 21/2019). However, agreements between these two actor groups are difficult to reach due to the very "disparate ideas on the subject of water" (Interview 29/2019). A CHJ representative therefore explains that "these conflicts are very complicated, which in the end… I almost think that, I'm not going to say irresolvable, but a little bit yes…", where the CHJ has "to be there mediating and fighting, but the conflict will always be there" (Interview 16/2019).

Idea-based competition is also reflected in the River Basin Water Council, emerging from a combination of formal and informal rules (*aggregation rules*), similar to the Guadalquivir case study (see Chapter 4). As explained in the previous chapter, the River Basin Water Council votes on the RBMP to give a non-binding recommendation to the national government (*aggregation rule)*. Traits of *competition* are observable between the different informal coalitions supporting the RBMP on the one hand, and those voting against the RBMP on the other. Voting behaviour of regional administrations is thereby particularly important, usually depending on the respective parties in power at regional and national level, instead of relations between the respective administration and the CHJ (Interviews 16/2019, 17/2019). The RBMP 2015–2021 was approved with 48 votes in favour of the BRMP, 27 against, and 5 abstentions (CHJ 2015e: 74). Dissenting votes came inter alia from Castilla-La Mancha due to the conflict with the Valencian Community on water allocation; and from ENGOs because of disagreement on environmental flow regulations and allocation of water for the Albufera (*choice rule)* (Interview 17/2019, 25/2019, 29/2019). Although the Valencian community usually supported the RBMP, they changed voting behaviour after a new regional government came into power, which was "a shock" for the CHJ (Interview 17/2019). However, it is important to note that agreements are usually already reached informally, prior to the River Basin Council's meeting (Interview 16/2019, 29/2019) (*aggregation rule*).

Performance assessment

Coordinated behaviour of this hybrid form of interaction is evaluated as high. First, *exchange of information* is assessed as high, concerning flow of information between concerned actors and information available on the process as well as the outcome of this Action Situation, namely the RBMP. Regarding the former, interviewees describe information exchange with the CHJ as very positive. A regional administration representative explains: "If I'm asking the *Confederación* 'listen, I need data about this', they immediately give me the data" (Interview 19/2019; also 25/2019). Similarly, according to an ENGO representative, information exchange with the CHJ helps to understand the otherwise very complex RBMP (Interview 23/2019). Moreover, cross-

sectoral exchange between WUAs and civil society improved due to the territorial, instead of sectorial, meetings (Interview 17/2019, 29/2019); and their relationship is described as good and respectful, with the possibility to enter a dialogue (Interview 17/2019, 21/2019, 23/2019). This is also reported for the relationships between the CHJ and different interest groups (Interview 27/2019), and the CHJ is said to be easily accessible (Interview 20/2019). Indeed, the planning process in the Jucar RBD was rated by Transparency International as the second most transparent one in Spain, after the Basque Country.[3] Nonetheless, it is to mention the complexity of the information provided (Interview 26/2019), also due to the amount of information included in the RBMP (Interview 17/2019, 23/2019). According to an interviewee, the CHJ "[wants] to flood us with information so we don't know [anything]" (Interview 23/2019).

Consideration of competing interests is rated as moderate. On the one hand, private and public actors from both sectors claim that their own interests are underrepresented (see 21/2019, 22/2019, 23/2019, 25/2019). More specifically, an ENGO criticizes that written statements have been hardly integrated into the RBMP (Interview 23/2019); whereas representatives of WUAs condemn that too much attention is paid to environmental interests (Interview 21/2019; also 22/2019). As interests contradict each other and thus cannot all be considered equally, I see this as indicator that these different interests are all represented to some degree. Further, in the context of irrigation efficiency measures, the CHJ represents a differentiated picture by acknowledging the risk of a rebound effect (Interview 16/2019, 18/2019, 27/2019). On the other hand, distribution of seats in the River Basin Water Council is highly unequal, with ENGOs and civil society actors being in a clear minority. According to an interviewee, the high representation of irrigators means that they basically "have the power over the water" (Interview 23/2019).

Last, *alignment of incentives* relating to the question whether actors are incentivized to implement measures of the RBMP at a later stage, is rated as high. On the on hand, measures are usually agreed upon jointly and in consensus with regional actors, which is deemed crucial for successful implementation (Interview 19/2019); and a consensus is usually achieved among competing parties regarding the allocation of water resources stipulated in the RBMP (Interview 18/2019). Nonetheless, it is to acknowledge that funds allocated to the RBMP are not sufficient (Interview 23/2019), which is likely to hinder implementation. Furthermore, the CHJ needs to better convince the Regional Departments regarding the importance of implementation of measures. In this context, an interviewee explains: "I mean, the plan is given green light and then they oppose it" (Interview 19/2019). Administrations

3 https://transparencia.org.es/puntuaciones-de-cada-organismo-de-cuenca-en-las-seis-areas-de-transparencia-2015/ (accessed 18.12.2020)

therefore need to understand that "the plan belongs to everyone, and the measures belong to everyone" (Interview 19/2019).

Intermediate output performance of this Action Situation refers to *RBMP effectiveness*, which is rated as moderate. I analyse whether actors in charge of i) implementation, ii) financing, and iii) actors affected by the respective measures are specified (see Chapter 2). Regarding irrigation efficiency measures, all three criteria are fulfilled. As I will elaborate below (see Section 5.2.3), actors in charge for implementation are defined. The financing is specified as well, with planned investments for increasing irrigation efficiency up to EUR 431 Million in the time period 2015–2027. This represents 19.2 % of the overall budget of the Program of Measures, and is to a large share allocated to the basins Turia and Jucar (CHJ 2015a: 44). Affected actors are also defined in terms of water users that will receive subsidies as well as in terms of specifying the public benefit by these measures. Concerning the former, priority is given to users of traditional irrigation systems of the *Ribera del Júcar*, and to the replacement of pumps of la Mancha Oriental. Furthermore (and in contrast to the Guadalquivir), the RBMP also addresses public benefit of irrigation efficiency measures. More specifically, the RBMP specifies that the increase of irrigation efficiency is expected to realize brut water savings of 240 hm^3/year (CHJ 2015a: 86). Some part shall be used to increase environmental flows of the Albufera, and another to allocate it to other water users (CHJ 2015c). It is noteworthy that the RBMP also mentions the potential risk of increased water consumption after increasing irrigation efficiency. Furthermore, it is stated that "gross [water] savings […] in no way resemble net savings, which are much lower" (CHJ 2015a: 193, own translation). Additionally, the effect of increased irrigation efficiency on quantity and quality of return flows in the Albufera will be studied (CHJ 2015a).

Concerning the reduction of water rights, two out of three criteria are fulfilled. The CHJ is defined as actor in charge of implementation, and a budget of EUR 3 Million is assigned in the RBMP for "processing, revising, and updating water rights" (CHJ 2015a). On the other hand, although affected actors are mentioned, it remains quite broad. Indeed, it is argued that water rights will be revised where "the generation of additional resources suggest a change in the source of existing water rights" (CHJ 2015a, own translation) – a paragraph identical to the National Water Law, without entering into details.

In addition, it is to mention the critique by the European Commission (2015b) that irrigation efficiency measures included in Spanish RBMPs may hamper the achievement of the WFD objectives (see also Chapter 4). However, the amount of water savings is calculated, and risks of increasing irrigation efficiency are discussed in the RBMP. I therefore argue that the request by the European Commission (2015b) to evaluate how irrigation efficiency measures will contribute to the environmental objectives has been taken into account to a certain extent. This is also why I assess *RBMP effectiveness* as moderate.

5.2.2 Dam Release Commissions

The Action Situation Dam Release Commissions is about decision-making on water allocation to different groups of water users. Similar to the Guadalquivir, members of the Commissions decide upon the filling level of dams during the wet season as well as upon the schedule and volume of water storage releases during the dry season. I identify a *hybrid* pattern of interaction among members of the Commissions, composed of *hierarchy* and *cooperation*. The former result from formal rules, according to which decisions from other Action Situations must be followed through (*scope rule*); while the latter can be explained by informal rules according to which the CHJ acts as arbitrator, mediating between different interests, and trying to reach a consensus among water users (*position rule*).

Independent variables specific to the Action Situation

Overarching rules first look at *formal rules for coordination,* regulating the composition and functioning of the Dam Release Commission. These formal rules are defined by the National Water Law, but there is an important difference to the Guadalquivir. This is because national regulation stipulates that different Dam Release Commissions shall be created if there are several reservoir systems within one RBD that are not directly connected to each other (Royal Decree 927/1988, Art. 46). This results in 12 Dam Release Commissions in the Jucar RBD, corresponding to its hydrological characteristics. While the general composition of actor groups represented in each Dam Release Commission is identical to the Guadalquivir (i.e., CHJ president, CHJ staff, national administration, and agricultural, urban, and industrial water users), the number of respective representatives in each Commission is smaller.

De jure autonomy is identical to what has been elaborated for the Guadalquivir: Water users are involved in the decision-making about water allocation but need to coordinate among each other. Their *de jure autonomy* is thus moderate. Further, *de jure autonomy* of the CHJ is also moderate, since it needs to involve Commission members in the decision-making procedure.

Social problem characteristics are to a large extent identical to the Guadalquivir, with some few exceptions. Overall, coordination requirements of this Action Situation derived from social problem characteristics are low to medium. To summarize, *frequency* is medium, with two meetings per year; *asset specificity* is medium, since decisions of previous year are often the basis for the upcoming year; and *excludability* is high with the allocated surface water representing basically a private good. However, in contrast to the Guadalquivir, the *scale* at which decision-making is organized relates to the level of different reservoir systems, resulting in 12 independent Commissions. While this indicates higher coordination requirements by the CHJ across the entire RBD, we can expect that coordinating different interests *within* one Commission may be easier due to the smaller number of affected water

users. Lastly, *uncertainty* from the perspective of the CHJ is low since water users can hardly deviate from decisions taken in the Commission. From the perspective of WUAs, *uncertainty* is also low – in contrast to the Guadalquivir – since decisions are largely predetermined by the RBMP and the Special Alert and Eventual Drought Plan (hereafter: Drought Plan), as will be elaborated below.

Pattern of interaction: Hybrid of cooperation and hierarchy

In this Action Situation, I identify a *hybrid* pattern of interaction, composed of *hierarchy* and *cooperation* between the CHJ and water users. Meetings are scheduled at least twice a year, but depending on water availability, they meet more often to coordinate respective restrictions (*choice rule)* (Interview 20/2019). Furthermore, meetings are used by the CHJ to share information on the hydrological and climate situation with water users (Interview 27/2019).

Hierarchical traits of interaction in this Action Situation are largely determined by formal scope rules of the RBMP and the Drought Plan, as well as informal *aggregation rules*. The RBMP and the Drought Plan stipulate in advance the range of water volume that can be distributed in periods of reduced water availability (see CHJ 2015g). Based on these clearly defined ranges, Dam Release Commissions thus adapt water allocation if necessary (*scope rule)* (Interview 18/2019). In this context, an interviewee explains that "there is less and less room for manoeuvre. […] Things are more and more planned, more studied, so you [only] have ranges in which you move…" (Interview 27/2019). Interview partners agree that since "it's practically all arranged" through the Drought Plan, little discussions within the Dam Release Commissions are required (Interview 20/2019). The CHJ therefore "[doesn't] have to argue so much with irrigators or anything", also because the distribution furthermore depends on existing water rights (Interview 27/2019). CHJ representatives therefore consider the Dam Release Commissions of limited importance (Interview 18/2019, 27/2019) and explain that also water users would ascribe a higher importance to the planning process of the Drought Plan and present written comments there (Interview 18/2019). Thus, in contrast to formal rules of the National Water Law which grant decision-making power to water users (see *de jure autonomy*), decisions are rather taken hierarchically by the CHJ based on the two planning documents which gained considerable importance in the last decade.

A further indicator of the *hierarchical* pattern of interaction is that the first meeting of the hydrological year, taking place in October, is described as merely informative, without the possibility to influence decision-making (Interview 18/2019). Furthermore, even though water users are asked to share expectations about water distribution in the second meeting in February (*information and choice rules*) (Interview 18/2019), there is no evidence that real voting by Commission members takes place as stipulated by the National Water Law (*aggregation rule)*. Informal *aggregation rules* thus deviate from formal rules.

Nonetheless, some traits of *cooperation* are also observable in this Action Situation. This is firstly influenced by informal *position rules*, which determine that the CHJ is again in the position of an arbitrator, trying to reach consensus among water users. Indeed, according to an interviewee, the CHJ is "in the middle of trying to bring those interests together so that […] in the end everybody wins, and everybody loses" (*position rule)* (Interview 20/2019). The intent to reach consensus is also reflected by the fact that members of the Commissions are said to always agree on allocation quota despite existing conflicts of interest (Interview 29/2019). Furthermore, members of the Commissions seem to share same aims regarding water allocation. Indeed, an interview partner explains that "what we are clear about is one thing: that we cannot use the years of recovery to spend more [water]" since aquifers as well as dams need to be refilled in humid years (Interview 29/2019). Statements of a CHJ representative go in the same direction, since even before the Drought Plan was introduced – restricting leeway for decision-making – water users "always collaborated with the *Confederación*" to reduce water allocation in periods of drought (Interview 18/2019).

Performance assessment

Coordinated behaviour of this Action Situation is evaluated as moderate. First, *exchange of information*, relating to process and output of the Dam Release Commission is moderate. On the one hand, Dam Release Commissions are used as fora to provide information to water users, and WUAs are in permanent exchange with respective dam managers to communicate amount of water needed (Interview 18/2019). On the other hand, availability of information on the output, i.e., decisions taken in the different Commissions, is limited. Indeed, meeting minutes are only available for the year 2014.[4]

Second, *competing interests considered* is medium due to the fact that environmental groups are not officially represented. An interviewee therefore criticizes that "no external party" controls environmental flows, which according to National Law pose a restriction to any type of water use (Interview 17/2019). Nonetheless, the interview partner also acknowledges an increasing awareness for environmental flows due to EU regulations (Interview 17/2019). Although regions are not represented in Dam Release Commissions either, an interviewee of a Regional Department explains that this would not be necessary either (Interview 20/2019). I see this as an indicator that decisions taken in the Dam Release Commission are at least not contrary to interests of the regional administrations.

Last, *alignment of incentives* refers to whether water users are incentivized to reduce their consumption in periods of drought, based on decisions taken in the Dam

4 https://www.chj.es/es-es/Organismo/organoscolegiados/Paginas/OrganosdeGestion.aspx (accessed 15.11.21)

Release Commission. I evaluate it as high due to the high consensus by actors regarding the decisions taken. While during periods of normal water availability or during the RBMP planning phase, it is usually difficult to reach agreements, an interview partner explains that "when the drought comes, and you see the drought and you see the reality, in the end we always come to an agreement" (Interview 21/2019). Similarly, another interviewee explains that "there is conflict, there is always conflict, but when something is agreed upon, even with conflict […] everything is fulfilled. […] Everyone complains, but when you reach and reduce 15%, everyone complies" (Interview 29/2019).

The second aspect of performance assessment refers to *distribution of surface water adapted,* understood as the extent to which surface water distribution has been adapted in the Dam Release Commission compared to what would be required to meet ecological flow requirements. The variable is rated as medium, even though its assessment is difficult due to the lack of meeting minutes. However, interview data indicates that water allocation got reduced during periods of drought through the different Dam Release Commissions (Interview 21/2019). On the other hand, the share of water bodies where minimum flow requirements were not fulfilled in the period between 2016/17 and 2019/20 ranges from 22% in 2016/17 to 40% in the following year (MITECO 2020c). Although other Action Situations certainly also influence compliance with environmental flow rates, the reduction of water allocation through the Dam Release Commission was apparently not sufficient either.

5.2.3 Increasing irrigation efficiency

This Action Situation analyses the implementation of new techniques such as drip irrigation, as well as the replacement of irrigation canals and ditches with pipes in order to increase irrigation efficiency. Similar to the Guadalquivir, I identify *incentive-based hierarchy* as pure form of coordination between regional and national agricultural administrations, WUAs and the CHJ. This pattern results from formal rules regulating the granting of subsidies to WUAs to implement irrigation efficiency measures; and which put the agricultural administration in a superior position vis-à-vis the WUAs.

Irrigation efficiency measures are particularly relevant in the downstream part of the two rivers Jucar and Turia, flowing through the Valencian community (CHJ 2015a: 47). Traditional irrigation systems, mostly consisting of flood irrigation and open canals of relatively low irrigation efficiency, are dominant in that area (Interview 18/2019, 27/2019). In the upstream parts of the two rivers, flowing through Castilla-La Mancha, irrigation systems are more efficient, which is why the RBMP includes less measures for this area (*boundary rules)* (Interview 27/2019). In the first planning cycle, EUR 405 Million were invested in increasing irrigation efficiency,

and EUR 431 Million are assigned for the second and third planning cycle (CHJ 2015a: 44).

Independent variables specific to the Action Situation

Overarching rules consist of *de jure* autonomy, which is defined by the RBMP, the European Agricultural Fund for Rural Development (EAFRD), and the Rural Development Programs (RDPs) of the two regions, Castilla-La Mancha and the Valencian Community. Similar to the Guadalquivir, actors officially responsible for implementation are the two Regional Departments of the Valencian Community and Castilla-La Mancha, respectively; or the National Ministry of Agriculture, depending on the type of measures. Yet, the National Ministry delegated responsibility for concrete implementation to state-owned companies such as the State Society for Agricultural Infrastructure (*Sociedad Estatal de Infraestructura Agraria S.A.*, SEIASA) and acuaMed (*Aguas de las Cuencas Mediterráneas, S.M.E.,S.A.*) (CHJ 2015a). While in the first years, SEIASA was carrying out most of the projects of national interest, various companies and financial schemes exist now, offering more selection options to WUAs (Interview 17/2019, 24/2019). Similar to the Guadalquivir, *de jure autonomy* of these actors is evaluated as moderate, being restricted by the EAFRD and the RDPs setting clear rules for investment eligibility criteria. However, concrete rules vary between the regions, which will be discussed below.

Formal rules for coordination consist of contractual agreements between the implementing authority and the respective WUAs. Furthermore, the RDPs of the Valencian Community and Castilla-La Manche regulate formal information exchange between the CHJ, WUAs and the agricultural administrations concerning requirements to get subsidies for irrigation efficiency measures.

Social problem characteristics are identical to the Guadalquivir, indicating a high need for coordination of involved actors. In a nutshell, this means that *asset specificity* is high since investments are unique to the respective WUAs. *Frequency* and *excludability* are also high due to the high number of WUAs applying for the measures, as well as the private good character of drip irrigation. *Scale* refers to the level of WUAs; and lastly, *uncertainty* is low for implementing authorities since WUAs usually do not change their behaviour in the process of applying and implementing irrigation efficiency measures, while it is high from the perspective of WUAs due to delays in implementation.

Pattern of interaction: Incentive-based hierarchy

In this Action Situation, *incentive-based hierarchy* as pure form of coordination is identified, emerging between the agricultural administrations at the regional and national level, WUAs and the CHJ. This pattern of interaction results from formal rules.

As also argued in relation to the Guadalquivir, subsidies present a form of incentive for WUAs to implement irrigation efficiency measures (see Chapter 4). WUAs that decide to modernize their irrigation systems thus enter an exchange relationship with the administration. The Valencian Community subsidizes up to 70% of investment costs, with the rest being borne by WUAs themselves (*payoff rules)* (Interview 20/2019; Generalitat Valenciana 2019: 252) – yet only under the condition that several rules which will be described below are met. In Castilla-La Mancha, the level of subsidies depends on the amount of generated water savings (*scope, payoff rule)*. More specifically, public subsidies cover at least 45% of total costs, but the higher the amount of effective water savings, the more subsidies can be increased (*payoff and scope rules)* (Castilla-La Mancha 2020: 106). The incentive-based mechanism is thereby further reinforced. The concrete tasks for the Regional Department or state companies, respectively, after subsidies are granted vary. WUAs can for example opt for Build-Operate-Transfer Contracts, where the respective company is only in charge of building new irrigation infrastructure, which is then transferred to the WUA; or for Operation & Maintenance Contracts, where the company is usually also contracted for operation and maintenance of the newly constructed infrastructure (*boundary, position rules)* (García-Mollá et al. 2020).

Similar to the Guadalquivir, the *hierarchical* element is shaped by formal rules of the European Agricultural Fund for Rural Development (EAFRD) (*scope* and *choice rule*) (see Chapter 4), as well as by additional rules of the two RDPs. These rules give implementing authorities a superior position over WUAs. To recap, the EAFRD sets the following minimum requirements for granting of subsidies: ex-ante assessment of potential water saving of at least 5 to 25% in water bodies of a good status, existence of water rights and water metering; and in water bodies in a status less than good, an effective reduction of at least 50% of the potential water savings shall be ensured at the farm level (*scope, choice rule)* (EAFRD, Art. 46). In addition – and in contrast to Andalusia – the Valencian Community and Castilla-La Mancha, respectively, have included further rules in their RDPs which strengthen the *hierarchical* element: In the Valencian Community, during a period of three years, WUAs must certify the amount of effective water savings based on measurement of consumed water before and after the increase of irrigation efficiency (*information rule)* (Generalitat Valenciana 2017); and beneficiaries in Castilla-La Mancha must inform about water consumption for five years upon completion of the infrastructure project (*information rule)*. Furthermore, the Valencian Community requires an ex-ante condition of at las 10% of water saving (Generalitat Valenciana 2017) instead of 5% as stipulated in the EAFRD. In Castilla-La Mancha, sanctions may be imposed to WUAs if the objective of the subsidy is not fulfilled, and WUAs may have to repay subsidies (*payoff rule)* (Castilla-La Mancha 2019, Interview 26/2019). Furthermore, beneficiaries must commit themselves to the reduction of water rights in order to get subsidies (*payoff rule)* (Castilla-La Mancha 2020) – a requirement not included neither

in the Valencian Community nor in Andalusia. However, information on who these commitments by WUAs are enforced at a later stage is not available, since when interviews were conducted the rule was introduced only recently.

The CHJ is involved insofar as it is informed by the agricultural administrations about planned infrastructure projects and corresponding estimated water savings during the implementation process (Interview 20/2019, 27/2019), as well as about changes in water use after the implementation (Interview 20/2019, 26/2019). Furthermore, the RDPs of both regions stipulate that the CHJ has to proof whether requirements that fall under its competency, such as the existence of water meter or water rights, are met (Castilla-La Mancha 2019; Generalitat Valenciana 2017).

In line with these formal rules, representatives of the regions as well as the CHJ confirm that their overall aim indeed is to generate water savings (Interviews 18/2019, 20/2019, 26/2019). These water savings shall then be dedicated to increase the guarantee of the system through higher availability of water resources, as well as for environmental purposes (*scope rule)* (Interview 18/2019). The most important example in this context is the case of the Acequia Real, where water savings were attributed to environmental uses in the Albufera, as well as to the not yet operating water transfer Jucar-Vinalopó (*scope rules*) (Interview 21/2019, 24/2019).

Performance assessment

Coordinated behaviour of the *incentive-based hierarchy* is moderate. First, *information exchanged* is medium, relating to exchanged information during the process of implementation among involved actors, and information provided about the output. Concerning the former, interview partners report frequent information exchange e.g., through bilateral meetings between the respective Regional Department on the one hand, and WUAs and their regional umbrella organizations on the other (Interview 20/2019, 22/2019). WUAs and the Regional Department of Valencia are described to be working "hand in hand" with each other (Interview 22/2019), and an interviewee explains that "our wish is to reach consensus […] and collaborate" with the administration (Interview 21/2019). Furthermore, there is fluent information exchange also between the two Regional Departments and the CHJ (Interview 26/2019, 27/2019). In relation to data provided on the status of implementation, information on planned, ongoing and finalized infrastructure projects to increase irrigation efficiency are accessible on the CHJ website.[5] However, data on the development of water consumption before and after the implementation of measures is based on estimations, as in all Spanish RBDs, and not on real measurements (see also Chapter 4) (European Commission 2015b).

5 https://www.chj.es/es-es/medioambiente/proyectos/Paginas/Obras.aspx (accessed 01.12.2021)

Second, *alignment of incentives* relates to the level of governmental actors as well as of WUAs and is evaluated as moderate. Regarding governmental actors, an interviewee explains that the control of EAFRD and RDP requirements is of high importance for the two Regional Departments (Interview 26/2019); and there is no evidence that these requirements were not sufficiently controlled. At the level of WUAs, the variable relates to the question whether irrigators are incentivized to follow rules established by the EAFRD and the RDP, i.e., to produce water savings at the farm level. On the one hand, most water users agree on the aim to save water (e.g., Interview 21/2019). They are described to be "increasingly aware" of, and "beginning to internalize" the need to reduce water consumption after increasing irrigation efficiency (Interview 27/2019). On the other hand, Sanchis-Ibor et al. (2017) provide evidence that farmers in the Valencian Community increased irrigation efficiency to facilitate watering, e.g., by avoiding night irrigation and reducing time spent on irrigating, as well as to improve efficiency of fertilizer. None of the farmers mentioned water saving as incentive to implement irrigation efficiency measures (Sanchis-Ibor, Boelens, and García-Mollá 2017).

Last, *consideration of competing interests* is also moderate. On the one hand, environmental interests are not represented by any third actor; and only in few cases, environmental impact assessments are required (Interview 29/2019). However, areas have been designated where irrigation efficiency measures are prohibited, aiming to preserve irrigation systems that are considered historically valuable (Interview 20/2019). Furthermore, critique on irrigation efficiency measures is also acknowledged in the RBMP (CHJ 2015c), as discussed above, which I see as an indicator of considering competing interests.

The second variable of the performance assessment relates to the *status of implementation of measures* and is rated moderate. Since data on the status of implemented irrigation efficiency measures is not available, the share of investment from the RBMP is used as proxy. According to most recent data, only 38.2% of investment foreseen to be implemented by December 2018 for measures to reduce pressure on water bodies through water extraction – as part of the Program of Measures 2015–2021 – has actually been realized at this date (CHJ 2020b: 442). Concerning irrigation efficiency measures in the Acequia Real, only 6.12% of planned investment has been made for the same time period (CHJ 2020b: 444).

5.2.4 Reduction of water rights

The Action Situation Reduction of Water Rights is about reducing water rights after the implementation of drip irrigation. I identify two patterns of interaction: the first one is a *hybrid* composed of *cooperation* resulting from informal rules, and *hierarchy* based on a combination of formal and informal rules. The second pattern includes a

sequence of action, namely *information exchange* which is followed by a *gap in interaction*.

Independent variables specific to the Action Situation

Overarching rules include first *de jure autonomy* which is mainly defined by the National Water Law – and is therefore identical to the Guadalquivir – and the RBMP. To reiterate, since the National Water Law only stipulates that water rights "may be revised" (Art. 65), the CHJ in the form of the Water Commissioner has considerable autonomy to carry out, or not carry out, a reduction. Similarly, measures on the "revision of water rights" are included in the RBMP, but due to the nature of the RBMP, they are not legally binding for the CHJ, and therefore again provide considerable leeway. *De jure autonomy* of agricultural administrations is limited to provision of information to the CHJ on the status of implemented irrigation efficiency measures.

Second, *formal rules for coordination* are only marginally defined. Concerning coordination between the CHJ and water users, neither the RDPs nor the RBMP define how actual reduction of water rights shall be exercised. RDPs of the two regions only specify that beneficiaries must inform the CHJ about infrastructure projects carried out (Generalitat Valenciana 2019; Castilla-La Mancha 2020).

Social problem characteristics are identical to the Guadalquivir, indicating high need of coordination for the CHJ with the different WUAs. To sum up, *scale* refers to the individual water user; *frequency* is high due to the high number of WUAs addressed by the measure; *asset specificity* is high since investments are unique to the respective WUAs; *excludability* is high with water rights being a private good; and lastly, *uncertainty* is high for the CHJ as well as for the WUAs. While the CHJ does not know whether the respective WUAs will accept the decision, WUAs do not know whether water rights will be reduced due to the non-binding character of the measure.

Pattern of interaction (1): Hybrid of cooperation and hierarchy

The first pattern of interaction in this Action Situation is a *hybrid* of *cooperation* and *hierarchy* between the CHJ and the Acequia Real, which presents the most prominent example. More specifically, through a *cooperative* process, the CHJ and the Acequia Real jointly agreed to reduce water rights, which in itself presents a *hierarchical* administrative procedure. This pattern emerged from the combination of formal and informal rules.

The joint *cooperative* agreement to reduce water rights resulted from informal *choice rules*. The key indicator for *cooperation* between the Acequia Real, its members, and the CHJ is that actors reached a consensus on the need to reduce water rights. More specifically, the General Secretary of the Acequia Real took the initiative by convincing WUA members that only a reduced amount of water rights would be needed after increasing irrigation efficiency (*choice rule*) (Interview 16/2019, 21/2019).

The General Secretary is seen as having played an outstanding role in the process; and a CHJ representative explains that the reduction was only possible "because of this collaboration" between the CHJ and the Acequia Real (Interview 16/2019). The main reason for the need of a reduced amount of water – of which water users could be convinced – are specific characteristics of the irrigation systems: Through a special construction, water of the new irrigation system is taken from a reservoir 40 meters above the irrigated area, thereby generating pressure which is used for irrigation. No additional costs for energy consumption are therefore imposed on the WUA. Furthermore, due to a special agreement between the Acequia Real and the state, infrastructure projects were basically "for free" for the WUA (Interview 24/2019). The Acequia Real therefore have "one of the few irrigation systems that are modernized, save water and do not generate an increase in energy consumption" (Interview 21/2019). Members of the Acequia Real are therefore "totally in favour of modernization" since "it is more comfortable with less costs" (Interview 21/2019).

Based on this *cooperation*, the CHJ carried out the administrative, *hierarchical* proceeding of a water rights reduction, resulting from a combination of formal and informal choice rules. The *hierarchical* element consists of a superior relationship between the CHJ vis-à-vis the Acequia Real, with the former being in the position to enforce the reduction of water rights. This reduction was contractually stipulated between the CHJ and the Acequia Real in 2015/16 as well as in 2020, with the consent of all WUA members (Interview 16/2019). In addition, the CHJ and Acequia Real agreed that water rights would also be reduced for future irrigation efficiency measures; and that this must be done up to three years after the completion of construction works.[6] Since the National Water Law only provides the possibility to carry out a water rights reduction, choice rules applied by the CHJ are of formal and informal nature.

While this pattern of interaction is not representative for the Jucar RBD, it is nonetheless of high empirical relevance with the Acequia Real being the largest water rights holder in the RBD (Interview 18/2019). Further, it indicates an important approach by the CHJ since in the future, they aim to "make a deal" also with other WUAs before infrastructure measures are implemented (*choice rule)* (Interview 27/2019). This is because a reduction of water rights is facilitated if water users themselves agree to it (Interview 16/2019). The CHJ itself attaches high importance to the reduction of water rights since without reduced water rights, "there's nothing to force them to consume less" (Interview 27/2019).

In this context, it is to also mention the RDP of Castilla-La Mancha which includes a legal passage on water rights revision, as explained above. More specifically, if water bodies in a status worse than good are affected, water users need to agree in advance that a reduction of water rights corresponding to the amount of saved

6 https://www.acequiarj.es/entidad/concesion/ (accessed 23.11.2021)

water will be automatically conducted (Castilla-La Mancha 2019). This agreement is part of the overall contract between the Regional Department of Castilla-La Mancha and the respective WUAs. However, as this was a relatively recent legal change, no information is found as to how this agreement is coordinated with, and ultimately enforced by the CHJ.

Pattern of interaction (2): Information exchange, gap in interaction

I identify a second pattern of interaction in this Action Situations, which consists of a sequence of *information exchange* between the agricultural administration and the CHJ based on formal rules; which is then followed by a *gap in interaction* resulting from a combination of informal and formal rules. This pattern of interaction is similar to what has been observed in the Guadalquivir case study (see Chapter 4).

After irrigation efficiency measures are completed, the respective Regional Department reports changes in water uses to the CHJ (*information rule)*; which is characterized as *information exchange.* However, this information exchange is followed by a *gap in interaction*. Indeed, the CHJ representatives explain that due to the lack of legally binding rules in the National Water Law, an automatic water rights reduction after the implementation of irrigation efficiency measures is difficult (Interview 27/2019) (*formal and informal choice rules*). The underlying rationale is similar to what has been explained for the Guadalquivir: water users may sue the CHJ in court due to the high legal protection of water rights. Many WUAs therefore kept their water rights. This was also confirmed by a WUA representative, explaining that water rights "were already so low that you don't have to lower them much further either. They were already very limited" (Interview 29/2019). The CHJ therefore foresees to make the reduction of water rights after the increase of irrigation efficiency legally binding in the third planning cycle (CHJ 2020b; Interview 27/2019).

Performance assessment

Coordinated behaviour of the two patterns of interaction is moderate. First, *information exchanged* is high. On the one hand, this concerns information exchange between involved actors, i.e., the CHJ, WUAs, and the agricultural administrations, which is described as positive (Interview Generalitat). Furthermore, also information about the process as such as well as the status of implementation is accessible for outsiders: the CHJ addresses achievements and challenges concerning water rights reduction in planning documents (see CHJ 2020b); the Water Register is accessible online and contains information on amount and type of water rights for every WUA, as well as the respective surface area;[7] and the Catalogue of Private Water publishes informa-

7 https://www.chj.es/es-es/ciudadano/Informacionmedioambiental/Paginas/IncripcionesdeAprovechamientosdeAguas.aspx (accessed 28.09.2020)

tion on changes in private water rights.[8] On the other hand, while progress has been made, the CHJ still aims to further increase transparency on water rights (Interview 27/2019).

Second, *competing interests considered* is moderate. On the one hand, there is evidence for some degree of consensus on the need to reduce water rights within the public administration (Interview 18/2019, 27/2019), as well as among WUAs (Interview 21/2019, 24/2019). However, although the reduction of water rights is subject to a public procedure and actors have the possibility to submit written statements (Interview 21/2019), there is no evidence that actors with potentially competing interests, such as environmental interests, are participating in this Action Situation.

Last, *alignment of incentives* referring to whether the CHJ is incentivized to carry out the reduction of water rights is moderate. On the one hand, the CHJ stresses the importance to reduce water rights (Interview 16/2019, 18/2019, 27/2019), and has also done so in the Acequia Real. However, the lack of legally binding rules at the national level is seen as a major constraint and is pointed out as a main reason why water rights were not automatically reduced at a larger scale (Interview 27/2019).

The *status of implementation of water rights reduction*, compared to what has been stipulated in the RBMP, is rated as moderate. On the one hand, water rights of the Acequia Real were reduced in 2015/16 from 398 hm^3/year to 214 hm^3/year (Interview 18/2019, 21/2019, 22/2019, 27/2019); and to 199 hm^3/year in 2020.[9] This is equivalent to 8% of agricultural water use in the RBD and therefore of considerable empirical relevance. On the other hand, though, water rights of other WUAs have not been reduced (Interview 27/2019). Consequently, the volume of water rights at the RBD level still slightly exceeds the amount of resources available. Also in the most recent planning documents of the third cycle, the CHJ explains that some WUAs still hold water rights which are higher than what they consume, inter alia due to improvements in irrigation efficiency or the switch to less water-intensive crops without a concomitant reduction of water rights (CHJ 2020b: 338–9).

5.3 Performance across Action Situations

In this section, I assess overall performance at the river basin level, i.e., across all Action Situations. This includes *process performance across Action Situations*, followed by *policy output performance* which refers to the overall RBMP implementation, and lastly, *environmental outcome performance*.

8 https://www.chj.es/es-es/ciudadano/informacionmedioambiental/Documents/ActualizacionesCat%C3%A1logoAguasPrivadas.pdf (accessed 26.04.2022)

9 https://www.acequiarj.es/entidad/concesion/ (accessed 26.04.2022)

Process performance across Action Situations

Coordinated behaviour across Action Situations is rated as moderate. It is assessed along two variables, namely *information exchanged* and *alignment of incentives*. The variable *competing interests considered* is identical to what has been discussed at the level of individual Action Situations and is hence not discussed here (see also Chapter 4).

Information exchanged at the level of the overarching governance process is evaluated as moderate. It refers to information exchange of actors between Action Situations, and to information provided on the outcome of the governance process. Regarding the former, it is described as positive. Interviewees confirm, for example, that information exchange between the CHJ, WUAs, and the agricultural administrations concerning the implementation of irrigation infrastructure and changes in water use patterns is positive (Interview 20/2019, 27/2019). Moreover, there is no evidence that actors lack information from specific Action Situations to carry out tasks in an interlinked Action Situation. However, information regarding the outcome of the governance process is only moderate. This is on the one hand because data on water use relies on estimations instead of actual numbers of water consumption (European Commission 2015b) (see also Chapter 4). On the other hand, in most recent planning documents, the CHJ provides information about the status quo of implemented measures, and openly discusses challenges in its implementation (see CHJ 2020b). Thereby, access to information about the overarching governance process is facilitated.

Alignment of incentives is assessed at two levels, namely at the level of WUAs – referring to whether they are incentivized to reduce their consumption – and at the level of governmental actors, referring to whether they have incentives to follow higher-level rules. It is rated as moderate. At the level of WUAs, there are two important instances where incentives are only moderately aligned, with the first concerning the reduction of water consumption after the increase of irrigation efficiency. On the one hand, many WUAs could keep their water rights after irrigation efficiency had been increased. Similar to the Guadalquivir, this means that there are no regulatory mechanisms according to which it would be rational for respective water users to reduce their consumption. This is further accentuated by the fact that maintenance and amortization costs often increased. To compensate for increased costs, water users were then forced to increase their productivity (see also Chapter 4). However, an interviewee points out that the decrease of labour costs, leading to relatively stable costs for farmers, is often neglected in the debate (Interview 20/2019).

On the other hand, in some cases, incentives for WUAs were created that made it rational to reduce their water consumption after increasing irrigation efficiency; or at least to not increase it. This is, first, because the reduction of water rights in the case of the Acequia Real presents an important regulatory incentive mechanism. This is further reinforced by the fact that negative financial incentives – i.e., finan-

cial pressure to compensate for increased costs – are not present in this specific case: Due to the particularities of their irrigation systems, costs for water users remained constant. This means that amortisation costs do not exist, and maintenance costs did not increase. A second incentive mechanisms is represented by the RDP of Castilla-La Mancha. As mentioned above, it stipulates that to get subsidies for irrigation efficiency, water users must commit to adapt water rights if their water rights are not in line with the RBMP measures; and if affected water bodies are in a status worse than good, they must agree on reducing their water rights (Castilla-La Mancha 2019). This may considerably reduce incentives of WUAs to legally oppose a reduction of water rights by the CHJ at a later stage.

A second instance of moderately aligned incentives for water users refers to the control of water use. 80% of surface water use, 90% of treated wastewater use, and 100% of desalinated water use is controlled by the CHJ. However, this only applies to 35% of groundwater use in the RBD (CHJ 2020a: 32). This is explained by lack of financial and human resources of the CHJ (Interview 22/2019). Nevertheless, groundwater control in the La Mancha Oriental aquifer is often quoted as positive example in terms of self-regulation, even beyond Spain (European Court of Auditors 2021; Esteban and Albiac 2012). Indeed, through a collaboration agreement between the CHJ and the *Junta Central de Regantes de la Mancha Oriental*, self-control by water users was strengthened and overextraction of water resources thereby reduced (Interview 22/2019).

For governmental actors, i.e., the CHJ and the two Regional Departments, *alignment of incentives* to follow higher-level rules of the EAFRD and the WFD is low. The argumentation is the same as in the Guadalquivir case study (see Chapter 4): EAFRD requirements for water savings of irrigation projects allow for considerable exemptions by Member States and their regions (European Court of Auditors 2021); and the fact that Member States have to fulfil WFD objectives only until 2027, makes the threat of an infringement proceeding by the European Commission relatively uncertain. I therefore argue that there are no external incentives for governmental actors to enforce a reduction of agricultural water consumption.

Policy output performance

The assessment of the policy output refers to *RBMP implemented*, i.e., to the overall RBMP. It is rated as low, reflected by the statement of the CHJ: "the current pace of implementation of the measures of the Programme of Measures in force does not comply with the provisions of the RBMP itself" (CHJ 2020a; own translation). More specifically, in December 2019, 21% of measures scheduled to be completed by 2021 in the RBD had been completed; and 19% of the budget allocated for the planning phase 2015 – 2021 had been spent at that time (see MITECO 2020b: 130). Besides the already mentioned lack of implementation regarding irrigation infrastructure, also the implementation of larger infrastructure projects, such as dams (Interview

25/2019) or the water transfer Jucar-Vinalopó are delayed (Interview 24/2019). Lastly, a civil society representative criticizes that more fundamental changes of the water governance systems towards integrated water resource management – in line with the WFD – are very slow. According to him, the administration realizes only slowly that it is not only about introducing a "new language", but rather about more fundamental changes of the existing hydraulic paradigm (Interview 17/2019). This concerns, for example, the lack of introducing water pricing based on consumed water instead of irrigated surface area.

Environmental outcome performance

Environmental outcome performance is moderate since agricultural water consumption only slightly decreased, and environmental objectives of the WFD remain unachieved. First, numbers concerning the *development of water use* show a slight decrease. More specifically, the consumptive agricultural water use (i.e., net consumption) decreased by 1.8% from 2009 (1,412 hm^3/year) to 2016/17 (1,386 hm^3/year) (CHJ 2014c; 2019b); and total agricultural water use (i.e., brut consumption) decreased by 6.5%, from 2009 (2,553.7 hm^3/year) to 2017/18 (2,388.5 hm^3/year) (own calculation based on CHJ 2014b; 2019b). Against this backdrop, a representative of the National Ministry identified the Jucar as most important RBD in Spain where water savings were achieved (Interview 22/2018). However, while the CHJ also explains that the increase of irrigation efficiency is a reason for reduced water demand, it also highlights that there have been changes in the methodology of water metering, making comparison difficult (CHJ 2019a: 183).

In relation to the *development of irrigated surface area*, there is no clear empirical evidence. On the one hand, RBMP numbers show an increase of irrigated surface area by 4.75% from 2009 to 2018, from 384,225 ha to 403,019 ha (CHJ 2014b; 2019b). Yet, the CHJ again states that due to changes in the applied methodology, numbers are not strictly comparable (CHJ 2019b: 36). Furthermore, according to interview data, both factors, water use and irrigated surface area, remained relatively stable (Interview 20/2019, 23/2019). Similarly, Sanchis-Ibor et al. (2016) show that at the level of the Jucar river, crop intensification and expansion of irrigated surface area had been prevented by geographical and agronomic conditions of the region. This is also confirmed by a civil society representative referring to the level of the RBD: "a rebound effect as it had happened in Andalusia, there is no evidence that this has also happened here in a generalizable manner" (Interview 17/2019).

Last, the *development of water status* for groundwater slightly deteriorated according to the WFD assessment, with 33% of groundwater bodies in a poor quantitative status in the first cycle, and 36% in a poor status in the third planning cycle (2019a; CHJ 2014b). In addition, water extraction in some groundwater bodies is more than three times higher than the amount of renewable resources allows (CHJ 2020a). Further, 51% of surface water bodies are in a status "worse than good" according to as-

sessment of the third planning cycle (CHJ 2022) (see Table 8). However, a comparison between the cycles is not meaningful here since 24% of surface water bodies were not evaluated in the first planning cycle. Moreover, due to changes in delimitation of water bodies and methodology, numbers are not comparable, neither between the first and second (CHJ 2015b: 378), nor between the second and third planning cycle (CHJ 2019a). Indeed, a MITECO representative explained that improvements in the water status from the first to the second planning cycle were highest in the Jucar RBD compared to the other Spanish RBDs. However, since the CHJ also applied stricter indicators regarding hydromorphology, these improvements are not reflected in the official numbers (Interview 22/2018). To summarize, a civil society representative states that "over-exploitation [was] maintained […] meaning that none of the environmental problems were solved" and the increase of irrigation efficiency "did not help to improve the flow of the river, there is no doubt" (Interview 17/2019).

Table 8: Status of water bodies in the three WFD planning cycles (Jucar)

Category	**Water status**	**Percentage of water bodies**		
		RBMP 2009	**RBMP 2015**	**RBMP 2022**
Surface water bodies (global status)	Good	43 %	35 %	49 %
	Worse than good	33 %	65 %	51 %
	Not evaluated	24%	-	-
Groundwater bodies (quantitative status)	Good	66 %	66 %	64 %
	Poor	33 %	33 %	36 %

Source: Based on data from CHJ (2014, 2015, 2022)