Water Exchange and Wastewater Reuse to Achieve SDG 6: Learning from Agriculture and Urban-Tourism Coexistence in Benidorm (Spain)

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1. Introduction

The mismatch between water demand and availability across temporal and geographical scales is one of the key challenges to be solved to guarantee sustainable development (Knieper and Pahl-Wostl 2016; Bertule et al. 2018). Additionally, shifts in precipitation patterns and the occurrence of extreme weather events driven by climate change, such as droughts, heatwaves, or floods, will likely lead to significant changes in water resource availability and quality standards (AghaKouchak et al. 2020; Cramer et al. 2018). In this context, ensuring universal and equitable access to drinking water and sanitation has been appointed as the sixth Sustainable Development Goal (SDG6) (Adshead et al. 2019). In addition to the leading global targets, which focus on achieving access to water and sanitation and the reduction in water pollution through improving wastewater treatment (targets 6.1, 6.2, and 6.3), the SDG6 also focus on the increase in water use efficiency and on ensuring a sustainable water supply to address and reduce water scarcity (target 6.4); the implementation of integrated water resources management at all levels (6.5); and the support and strengthening of local stakeholders to improve water and sanitation management (Mainali et al. 2018).

To achieve some of these targets, water exchange is considered an exceptional opportunity for cooperation between stakeholders' interests. At the same time, reclaimed water use has been raised as a mechanism to overcome water scarcity challenges and future water shortages in arid and semi-arid regions (Aleisa and Al-Zubari 2017; Perry and Praskievicz 2017; Reznik et al. 2019). Both mechanisms are especially relevant in those regions in which urban-tourist and agricultural users coincide, where water disputes and conflicts between users may appear (Ortega and Iglesias 2009; Baldino and Saurí 2018; Ricart and Rico 2019). Although agriculture is a key player for achieving SDG 6, as it is by far is the largest water consumer, accounting for 70% of annual water withdrawals globally (Norton-Brandao et al.

2013), in some specific contexts, urban and tourist development may represent a large part of the water demand at local and regional scales (Dinar et al. 2019; Mekonnen and Hoekstra 2016). Furthermore, tourism sector activities, which generally concentrate on those driest seasons and warmest regions, coexist with other confronted water demands (agriculture) and requirements (environment) during water scarcity periods (Sun and Hsu 2018). In rural contexts, irrigation has been developed through freshwater water rights. However, urban-tourism activities have been mainly promoted without policies or strategies for ensuring water supply, which brings extra pressure to local and regional water resources, particularly in coastal regions where seasonal water use is relevant (Gössling 2015).

On the one hand, the implementation of water exchange agreements requires establishing a good water governance framework, which is an essential pillar for implementing SDG 6, considering stakeholders' individual and everyday water needs (Megdal et al. 2017). The success capacity of stakeholder engagement when configuring water exchange depends on several factors, such as power asymmetries in decision-making processes or political will to address oncoming challenges. However, advances in one context do not guarantee the same success in other situations (Guerrero et al. 2015). However, according to Eberhard et al. (2017), stakeholders tend to get involved in water exchange (1) to reduce existing tensions in favor of future water supply stability when drought or scarcity periods appear, (2) to provide an answer to water emergencies by agreeing on water strategies, plans, and measures to be applied in a consensual way and (3) to decentralize water responsibilities and increase the ability to react to climate risk. On the other hand, the promotion of wastewater reuse has been justified according to different associated benefits: (1) stability (as wastewater flows do not present wide variations seasonally and are independent from climatic conditions), (2) cost (in addition to being cheaper than other options, such as water transfers or desalination, savings on fertilizer costs are achieved), and (3) quality (wastewater treatments have been improved to achieve consistent and controlled quality standards). Furthermore, wastewater reuse contributes to environmental protection if it prevents the over-exploitation of surface or groundwater resources (Goonetilleke and Vithanage 2017) while guaranteeing ecological flows or landscaping (Nas et al. 2020). Additional benefits are related to the promotion of the circular economy (Neczaj and Grosser 2018) and nutrient recycling and fertigation through life cycle assessment (reducing the demand for conventional fossil-based fertilizers and, consequently, the consumption of water and energy) (Lam et al. 2020). However, although wastewater reuse can help meet the increased requirement for water across both the agricultural and domestic sectors, irrigation with reclaimed water carries both agronomic and environmental risks that require special consideration (Zhang and Shen 2017)—for example, microbial pathogens and micropollutants, as well as the higher salinity of the soil (Shakir et al. 2017). Furthermore, higher concentrations of plant growth-inhibiting ions such as sodium and chloride can lead to additional potential hazardous effects due to the increased sodium adsorption ratio (SAR), which may degrade soil's physical and chemical properties in the long term (Erel et al. 2019). Finally, other concerns, such as regulation and farmers' risk perception (yuck factor), have not been assessed or seriously considered, usually being disregarded (McClaran et al. 2020).

In some contexts, water exchange and wastewater reuse could be promoted as potential solutions to water scarcity in line with the Integrated Water Resources Management (IWRM) approach, closing the gap between water availability and water supply. However, the "integrated" approach requires overcoming technical issues and promote social learning by involving cross-sectoral collaboration, establishing agreements between confronted water users, and ensuring stakeholders' participation (Pires et al. 2017). Consequently, a water crisis could be considered a governance crisis due to the lack of collaborative management and unequal power relations between water users prevent reaching agreements to avoid water scarcity (OECD 2011). Substantial scientific evidence shows the importance of promoting mechanisms that ensure water management from collaborative governance, social learning, and stakeholders' agreements (Brisbois and Löe 2016; Ferguson et al. 2017; Ricart et al. 2019c). Participation and multi-stakeholder engagement are essential to achieve sustainable development (Benson et al. 2015), especially when addressing the potential of water exchange. However, identifying which factors are helpful for and measuring their effectiveness through indicators is still in its infancy (Guppy et al. 2019). Due to the lack of a universal solution neither a unique way to overcome these water challenges, this chapter address the research question "which are the key driving factors to enable water exchange?". In doing so, this work may be helpful to accomplish SDG 6 in other water scarcity regions by pointing out through social learning which water management components are facilitating or detrimental to the water exchange and wastewater reuse. Accordingly, this chapter goes deeper into the benefit of promoting water exchange and non-conventional water resources between agricultural and urban-tourism activities to close the gap between water supply and water demand while reducing water scarcity risk in the Marina Baja County in Alicante (Spain). This study case is an opportunity to translate some SDG6 theoretical objectives into concrete and innovative actions and improve the challenges and benefits of water cooperation among stakeholders.

2. The Marina Baja County and Benidorm City as Case Study

The Marina Baja County is located in the South-East of Spain (Alicante), on the Mediterranean coast. Its almost 580 km^2 area present sharp topographic and climatic differences, which cause that water resources are relatively abundant in the hinterland while the coastal area belongs to one of the driest regions in Spain. Likewise, there is relevant interannual variability of rainfall, so drought periods are frequent and, in some cases, may last for several years (Zaragozí et al. 2016). Furthermore, the land use activities vary significantly between the coast, dominated by tourism activities and inland irrigation development. In recent decades, the population of this county has strongly increased, currently standing at around 190,000 inhabitants, to which it must be added the seasonal population that can double or triple the resident population. Most of this socioeconomic growth has been generated around Benidorm, the most important mass tourism resort of Mediterranean Spain, attracting international and national visitors (Martínez-Ibarra 2015).

2.1. Water Supply System and Management

The recurrence of drought episodes in the Marina Baja County, together with an intense tourism development, has produced up to seven severe water crisis since the 1960s (1965–1969, 1978, 1981–1984, 1992–1996, 1999–2001, 2005–2008, and 2014–2016) (Hernández-Sánchez et al. 2017). The water crisis of 1978, which caused the shortage of Benidorm and required the arrival of tankers vessels to supply the city, was especially intense. A few years before, in 1976, the Marina Baja Water Consortium (from now on water consortium) was constituted by the most populated municipalities of the county, including Benidorm. The impact that the 1978 drought episode had on tourism, which had been turned into the main economic activity of the county, required the strengthening of the water supply system. Consequently, the water consortium relies on several water sources, including surface water, stored by two reservoirs, Guadalest (13 hm^3) and Amadorio (16 hm^3), from where the homonymous pipelines depart for urban-tourist water supply (Figure 1). Likewise, the water supply system includes groundwater resources from two karstic aquifers (mainly the Beniardá and the Algar pumping wells). During drought periods, groundwater pumping is increased, even inducing transient overexploitation, but its piezometric levels are recovered quickly since present a high recharge capacity during heavy rains. Additionally, it should be mention that the Algar-Guadalest and the Amadorio basins are interconnected through the Canal Bajo del Algar (a semi-open irrigation channel) and the 900 mm pipeline, that allow the mobilization of water to irrigation uses and municipal water tanks, and even the pumping water to the Amadorio reservoir through the Torres Pumping station. Finally, the water consortium manages the reclaimed water produced at the Benidorm wastewater treatment plant, conveying it through the reuse pipeline. This reclaimed water incorporates tertiary treatment (an ultrafiltration process) and a desalination stage to correct the conductivity levels required by the irrigators, fixed by the agreement established with the water consortium.

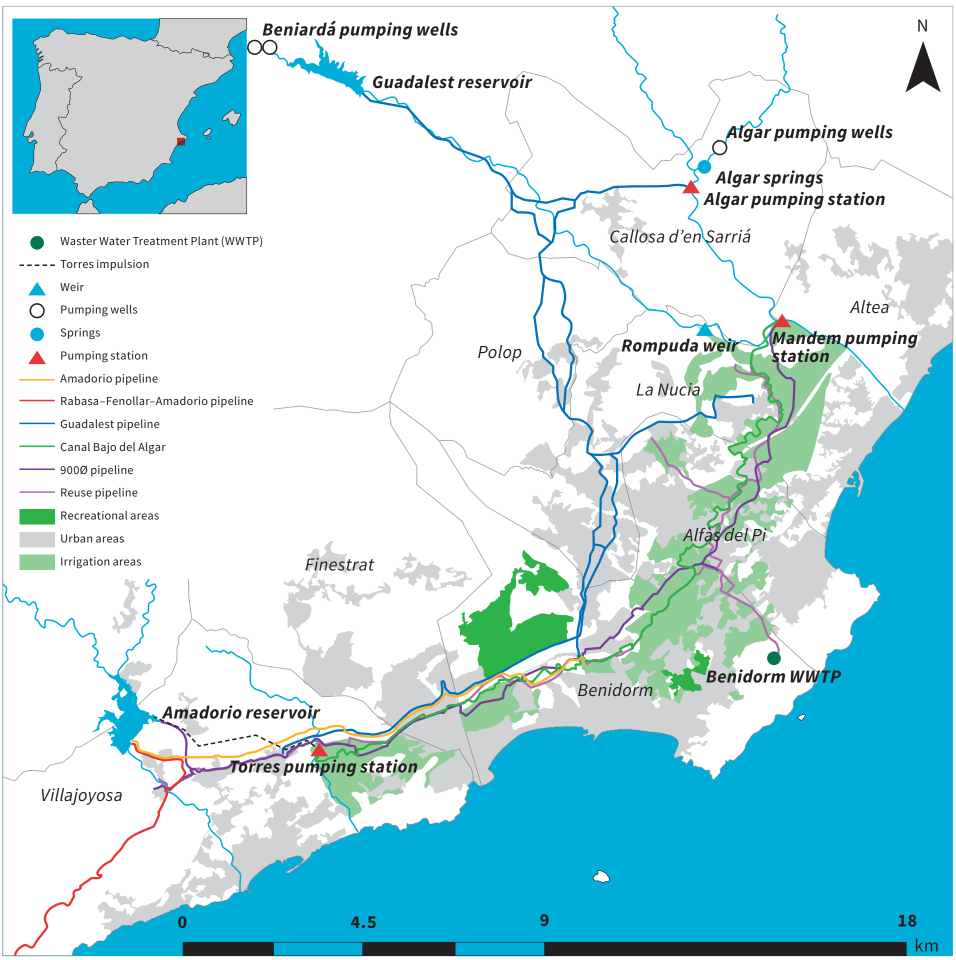

Figure 1. Water supply system and water demand areas of the Marina Baja Water Consortium municipalities and the Canal Bajo del Algar irrigation community. Source: Adapted from Ricart et al. (2019a).

2.2. Agricultural and Urban-Tourism Water Demands

The approval of the Benidorm urban Master Plan in 1956 motivated the promotion of tourist activity as a strategy for social and economic progress, for which more than 60% of the tourist activity in the Valencian Community was concentrated in the Marina Baja County. Most of this activity takes place in the city of Benidorm, which accounts for 70,000 inhabitants and a floating population of 150,000 inhabitants each year (Olcina et al. 2016; Baños et al. 2019). Benidorm attracts around 2 million visitors and 16 million overnight stays (Hernández et al. 2017), which places the city as the fourth most visited tourism destination in Spain after Barcelona, Madrid, and the Canary Islands. Benidorm's great urban-tourist activity consumes half of the urban water supplied by the water consortium, around 10 hm^3/year, located in this municipality. About two-thirds of this water consumption is for tourist, recreational and commercial activities (Yoon et al. 2018). However, the water consumption per capita in Benidorm is lower (200 l/person/day) than that produced in other residential-tourist municipalities due to the high-density urban model and the implementation of several water efficiency measures in the hotel sector, such as the introduction of Mediterranean gardens or the installation of water-saving devices in bathrooms, kitchens and outdoor uses (Rico et al. 2019).

The agricultural sector, which counts for more than 4000 ha of irrigated land, uses about half of the total water managed by the water consortium. It should be noted that the water sources supplied to irrigation vary widely from year to year according to the availability of freshwater sources. During drought episodes, the share of reclaimed water used for irrigation uses may reach 70%, as happened in 2000, but usually this figure oscillates between 8% and 38%. The main crops grown in Marina Baja County are medlars, citrus, and other fruits, coexisting with dryland crops such as carob, olive, and almond trees (Bellot et al. 2007). Irrigation modernization systems (such as drip irrigation) have been promoted, and nowadays, water efficiency systems are applied in about 80% of the plots.

2.3. Agreements between Key Stakeholders

The water supply system managed by the water consortium has been possible thanks to the agreements established with the irrigation communities consisting of the shared use of the main water infrastructures and the exchange of water resources (Gil and Rico 2018). In this regard, the agreements carried out with the Canal Bajo del Algar irrigation community are significant and can be traced back to 1964, even before the consortium's foundation. Until 1990, most of the agreements were verbal based on goodwill between stakeholders, but there were numerous agreements written at the beginning of the decade. One of them was signed to establish the permanent rules of water exchange: during drought or water scarcity situations, reclaimed water from the wastewater treatment plant of Benidorm will be supplied to the irrigation community in return for freshwater from the Algar-Guadalest watershed, whose water rights belongs to the irrigators. This agreement also establishes that the water consortium should assume the maintenance and operational cost of the water distribution system and an annual contribution of EUR 600,000 a year to the Canal Bajo del Algar irrigation community to guarantee up to an equivalent volume of 3 hm^3 of reclaimed water. Likewise, in 1991, a second agreement between the water consortium and the Canal Bajo del Algar irrigation community allows the joint use of the Canal Bajo del Algar for the water conveyance from the Algar-Guadalest river to the Amadorio reservoir.

3. Methods

Thematic analysis is a method to qualitatively analyze and evaluate non-empirical data, such as transcribed semi-structured interviews (Thomas et al. 2019). This method proposed by Braun and Clarke (2006) and later adapted by Zhu et al. (2019) allows the identification and characterization of common themes (topics). A theme is an abstract entity that brings meaning to a recurrent experience and its variant manifestations or patterns. It captures and unifies the nature or basis of the experience into a meaningful whole (Nelson et al. 2019). Applied in our case study, the main objectives of this analysis are (1) to identify the main factors that have enabled the water exchange between agricultural and urban-tourist users, and (2) to point out the potential social learning of this case study for the promotion of water exchange between agricultural and urban-tourist activities in other water scarcity regions.

Face-to-face semi-structured interviews were conducted in June 2018 with the two main stakeholders in Marina Baja County: the Marina Baja Water Consortium and the Canal Bajo del Algar irrigation community. Both interviews were undertaken in the city of Benidorm at the irrigation community's office. Each interview was conducted in Spanish and lasted 75 minutes in duration for the water consortium and 90 minutes for the irrigation community. Each stakeholder was previously informed about the research and contacted by email to fix the interview day. Both stakeholders collaborated voluntarily after providing their oral consent to participate in the study. An interview script was used following the standard tenets of thematic analysis and applying a deductive approach to identify those main driving factors of water exchange considered in the literature: (1) water management (Buurman and Padawangi 2018), (2) water quality standards (Ricart et al. 2019b), and (3) water charging (Cortignani et al. 2018). However, the sub-topics were not closed, and findings were presented to and discussed with interviewees to generate an integrative framework about the present and future water exchange in Benidorm. The audio of the interviews was recorded.

The recorded interviews were transcribed to identify the narrative of each interviewee according to the three themes previously defined in the literature. Inductive research has been applied when deepening each theme to identify the sub-themes considered by each stakeholder and avoid testing preconceived hypotheses (Figure 2). Significant quotations (the shortest part of a text where the primary meaning could be understood without reading a longer part of the text) (Walters 2016) have been hand-coded and grouped to each theme (driving factor), and sub-themes for each driving-factor have been highlighted and checked according to concord or discord among both stakeholders.

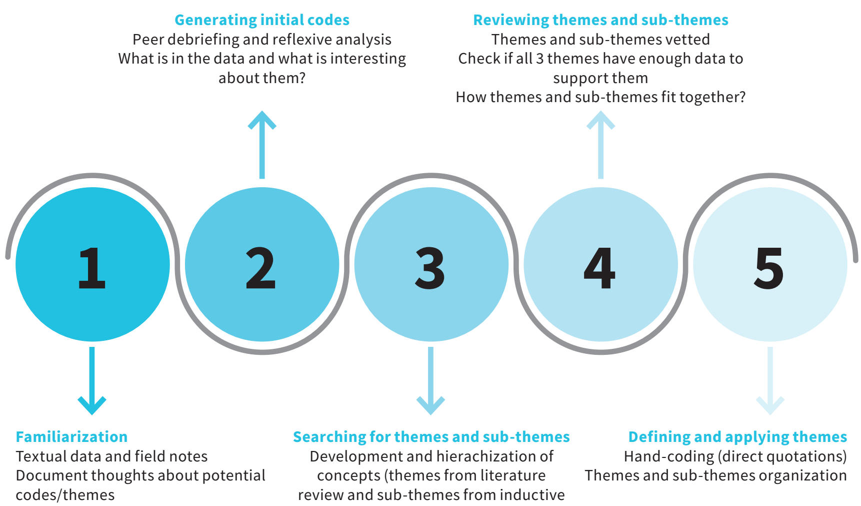

Figure 2. Thematic analysis process. Source: Figure by authors.

4. Results

This section analyzes the driving factors explaining water exchange motivations and discussion between the water consortium and the Canal Bajo del Algar irrigation community. The thematic analysis results, which are synthesized in Figure 3, are divided into three main driving factors (water management, water quality, and water charging) and the eight sub-themes were identified in the interviews considering benefits and barriers for the water exchange.

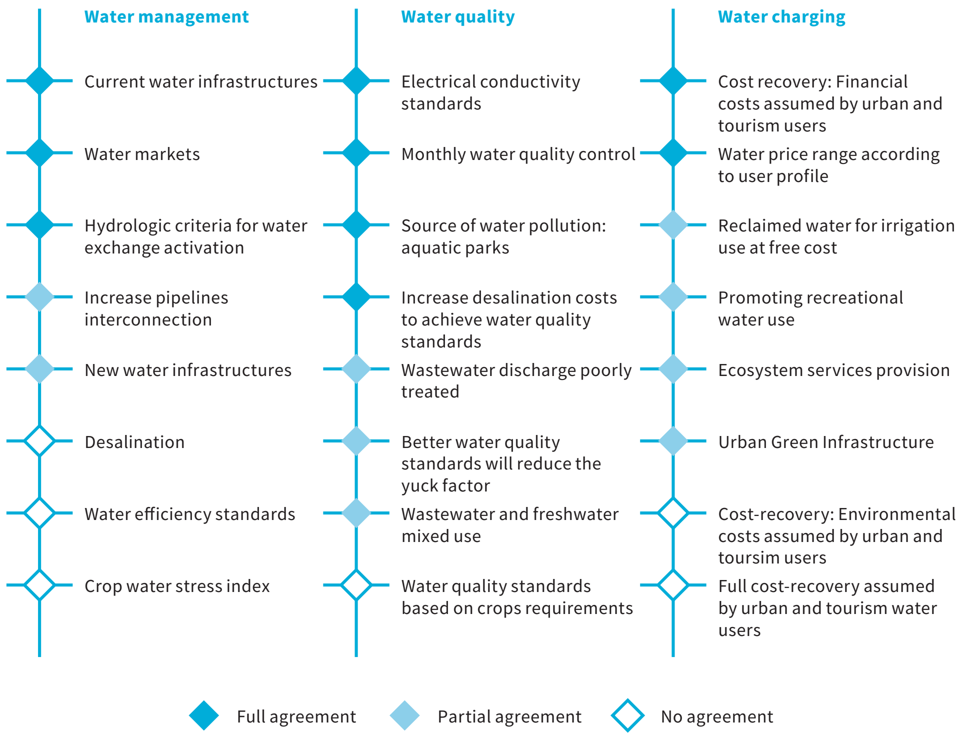

Figure 3. Major driving factors in water exchange identified by both the irrigation community and the water consortium. Source: Figure by authors.

4.1. Water Management

4.1.1. Infrastructures

For both the irrigation community and water consortium, the current hydraulic infrastructures used for the water exchange system are sufficient. However, each actor emphasized different issues related to hydraulic infrastructure. On one side, the water consortium stresses the importance of maintenance tasks to increase water efficiency standards, such as replacing pipelines or water interconnection improvements by converting one-way pipelines into two-way ones. Moreover, irrigators outlined the need to improve the management of the main infrastructures to enable the distribution of water resources among different water demands such as urban, recreational, or irrigation. Additionally, future infrastructure needs have been internally discussed by the water consortium to (1) increase the availability and ensure the management of conventional water resources, (2) promote alternative water resources (such as desalination), and (3) manage future water markets in which private companies could buy and sell water surplus through water exchange.

4.1.2. Water Exchange Protocol Activation

There is no activation protocol per se since water exchange is fixed by the water consortium depending on water availability and raining patterns. According to the water consortium, this means that, when assessing the need to activate or not the water exchange mechanism, irrigators must recognize a high level of trust in the criteria applied by the water consortium following technical recommendations. Although both the water consortium and the irrigators' community agree on the suitability of using water availability criteria to decide about the activation of the water exchange protocol, the irrigators' community considers that this criterion is not sufficient. Accordingly, it would be helpful to set a list of transversal criteria (not only hydrological but agronomic). For example, a crop water stress index would be considered to avoid adverse effects on crop production if there is a delay in the decision to activate the water exchange.

4.1.3. Water Concession

The water consortium has an available water concession of 28.8 hm^3, of which the irrigation community reaches 7 hm^3 of reclaimed water and 2 hm^3 of freshwater. The agreement established between the consortium and irrigators allows the irrigators to obtain about 3 hm^3 of reclaimed water—at no cost—from the Benidorm wastewater treatment plant to assign part of the surface water rights to the water consortium. If irrigators want to request additional reclaimed water, they must pay 50% of the total water cost while the water consortium assumes the rest. This example of solidarity from the irrigators' community is positively recognized by the water consortium, although considers that the tourism sector (tourists) does not perceive it.

4.2. Water Quality

4.2.1. Quality Standards

Electrical conductivity is the main parameter to define the appropriateness of using reclaimed water for irrigation according to the fixed quality standards between the Marina Baja Water Consortium and the Canal Bajo del Algar irrigation community. After the wastewater treatment in the Benidorm plant, the values should be lower than 1300 μS/cm. Notwithstanding, sometimes this level is exceeded according to irrigators, which may harm the soils and the crop productivity. This perception does not match the opinion of the water consortium, for whom water quality standards are completely acceptable, although, on some occasions, the extreme levels of salinity cannot be reduced as no specific mechanism of correction is available. The irrigators proposed reducing conductivity levels by mixing reclaimed water with freshwater from the Canal Bajo del Algar channel. Complementary solutions could include differentiating water quality standards according to crop demands—avocado, for example, is a sensitive crop that requires higher quality water standards, while citrus tolerates higher values, although its production is affected by high boron values. However, this option seems to be theoretical as it would require high investment in infrastructures that the irrigators' community cannot assume, while it is not included in the list of future investments to be carried out by the water consortium.

4.2.2. Sources of Water Contamination

The high level of wastewater salinity may be due to several sources: aquatic parks located in Benidorm; geothermal energy use by some hotels; and seawater intrusion into urban sewage networks. The first two activities are based on the extraction of water resources from the salinized coastal aquifer, so may be increasing wastewater salinity since this water is directly discharged into the sewage network without treatment. This process motivated an increase in costs associated with the desalination process and decreased reclaimed water production, which caused water supply delays. Likewise, irrigators pointed out a key factor to explain the high salinity values: the breakage of the brackish water collector executed some years ago in one of the aquatic parks to avoid discharges to the sewerage network. Although the water consortium did not indicate which potential sources of contamination would explain the increase in wastewater salinity, they expressed their concern about this problem. Additionally, the water consortium recommends hotels to end up with high conductivity wastewater discharges to the sewage network, as the Hotel Business Association of Benidorm, Costa Blanca, and Valencian Community (HOSBEC) recognized specific cases in the hotels that use geothermal energy.

4.2.3. Mechanisms of Control

Both the water consortium and the Public Entity of Wastewater Sanitation of the Valencian Community applied specific control mechanisms of reclaimed water quality standards. Furthermore, periodic analytics of electrical conductivity levels have been carried out on the wastewater treatment plant of Benidorm to detect outliers and identify potential sources of contamination. Irrigators, for their part, have also conducted monthly analytics to evaluate conductivity and general water quality standards. In their opinion, mechanisms of control are necessary to reduce the yuck factor expressed by some irrigators: scandals such as the low-quality standards of reclaimed water discharged to rivers or the cross-contamination between reclaimed water and urban water generate distrust on the water consortium role and in the water exchange process.

4.3. Water Charging

4.3.1. Polluter Pays Principle and Recovery Cost

The implementation of the cost recovery principle fixed by the European Water Framework Directive is not a key factor of the water exchange agreement. According to the irrigation community, the fulfilment of this principle, including environmental and resource costs, would mean that urban end-users should guarantee the optimal water quality conditions of returned freshwater into the system by assuming the extra cost of the tertiary treatment and the complementary desalination process conducted by the Benidorm WWTP. Although this possibility has been discussed among irrigators and the water consortium, an agreement was not achieved. For irrigators, only financial costs related to operational and maintenance tasks are currently being recovered by the urban and tourist sector, while the water consortium does not consider the environmental and resource costs.

4.3.2. Water Pricing: Costs and Incentives

The water exchange agreement enables the irrigation community to pay EUR 0.05 m^3 for up to 3 hm^3/year of reclaimed water generated by the water treatment plant of Benidorm, while recreational users assume EUR 0.35 m^3. This price range is established to ensure that the higher prices paid by both golf courses and public and private gardens compensate for the lower water price assumed by farmers. However, the difference between the recreational and irrigation use of reclaimed water is not enough to recover the actual cost of complete wastewater treatment (around EUR 0.42 m^3 considering secondary and tertiary treatment cost). The Consortium assumes the cost of the tertiary treatment for up to 3 hm^3/year, at about EUR 0.20 m^3, while after that volume, irrigators assume part of the cost. The secondary treatment is assumed by the public entity for wastewater sanitation (EPSAR) through the sanitation and purification fee. Future climate scenarios predict an increase in water price, particularly in drought periods affecting water scarcity regions, potentially jeopardizing the irrigators' ability to pay for reclaimed water and existing problems associated with high conductivity levels. Subsequently, the irrigation community has pointed out some strategies. The main one was to modify its foundational statutes to recognize the change in the use of their freshwater rights initially assumed for irrigation to recreational water uses in which non-potable water consumption of golf courses and tourist resorts' gardens could be included. In this way, the change in water use of some recreational users, who are part of the irrigation community, is regularized to avoid legal conflicts concerning the different rates for reclaimed water.

5. Discussion and Conclusions

Water scarcity is a growing environmental concern and a structural problem in many semi-arid regions, such as the South-East of Spain. Agriculture and urban-tourist water demands are two of the economic activities highly exposed to the effects of water scarcity, which also requires more significant attention to guarantee water security (Gunda et al. 2019). However, water security means much more than coping with water scarcity. It means managing water resources in a sustainable, efficient, and equitable way while delivering water services reliably and affordably to reinforce relationships between service providers and water users (Tundisi et al. 2015). This chapter aimed to more deeply explore ways to face water scarcity risk by promoting water exchange between agricultural and urban-tourism activities and wastewater reuse in Marina Baja County, in Alicante (Spain). The obtained results highlighted how facing water scarcity in semi-arid regions where conflicting water uses coexist can be governance-based rather than technology-based, as demonstrated by the agreements between the water consortium and the irrigation community. This new perspective is an example of desirable transition and transformation towards stakeholders' learning and knowledge integration when addressing sustainability. Both depend on perceptions, values and cognition and are often used to express the ambition to shift from analyzing and understanding problems towards identifying pathways and solutions for desirable environmental and non-linear societal change (Patterson et al. 2017; Hölscher et al. 2018). Increasingly, researchers recognize that water scarcity and water security require analysis from a multidisciplinary perspective that includes governance, social acceptance, and users' needs (Wuijts et al. 2018). Consequently, both pressures on water resources and water users' attitudes define water hotspots and complexities (Dargin et al. 2019).

Although water exchanges are often detrimental to rural interests due to decreased freshwater availability, in our case study, agricultural and urban-tourism activities are mutually dependent and contribute to the sustainability of the water management model. This mutual benefit is motivated by (1) seeking consensus through strengthening collaboration and comprehension between stakeholders and (2) recognizing the solidarity of the irrigation community when sharing their water rights (Ricart et al. 2019a). This case study has shown an experience that differs from the temporary water rights exchanges established in the Consolidated Text of the Spanish Water Law (Articles 67–72, Legislative Royal Decree, 1/2001), since this mechanism grants more flexibility in the water exchange management, which is carried out jointly among the stakeholders. According to the United Nations and World Economic Forum, water exchange could also be considered a mechanism to improve the "nexus approach" required when managing food-energy-water nexus by policy-makers and interdependent sectors and activities (Nie et al. 2019). In the analysis of the Marina Baja County, this nexus has been addressed by (1) focusing on the role and behavior of key stakeholders (SDG target 6b, Participation in water and sanitation management) and (2) sharing local knowledge, social-learning, and expertise in decision-making processes in which water management and good governance must be addressed (Bellamy et al. 2017). Furthermore, water exchange has been promoted and managed through informal agreements before drought periods occurred, as an example of pre-adaptation capacity based on interdependence, mutual commitments, shared responsibility, and reciprocal obligations among stakeholders (Fader et al. 2018).

Water infrastructure (including dams, reservoirs, and water transfer) is often built to cope with drought and water scarcity. These human alterations of water storage and fluxes are often beneficial in the short term, as they can increase water supply for additional urban or agricultural development (Zeff et al. 2016) or ensure economic growth (Fletcher et al. 2019). This supply–demand cycle is self-reinforcing feedback or a vicious cycle, as the occurrence of a new drought or water stress period could further expand water infrastructures. However, future urban-tourism developments in Benidorm and the associated increase in urban water demands jeopardize the current agreement between the water consortium and the irrigation community. The strategy followed by the irrigation community was to modify its foundational statutes to recognize the change of the use of their freshwater rights initially assumed for irrigation to recreational by some water users. This fact reveals a significant issue that claims attention: the number of farmers is declining due to the lack of generational renewal, and arable land decreases similarly. How will both factors affect water rights to guarantee the accomplishment of the conditions fixed in the agreement with the water consortium? This question adds up to significant short-term factors identified in the interviews between the water consortium and the irrigation community, such as effectively managing water infrastructure according to available investment or ensuring water quality standards by overcoming water pollution sources. The irrigation community and the water consortium perceive some questions differently, such as the lack of agronomic criteria to activate the water exchange, the occasional lack of minimum water quality standards, or how to achieve the polluter pays principle and the recovery cost. However, water exchange and wastewater reuse are considered mechanisms to ensure the viability of agricultural and urban-tourist activities by increasing water use efficiency and supply (SDG target 6.4). Furthermore, some learnings can be drawn from the experience in Benidorm when considering if water exchange can also contribute to addressing water scarcity from an integrative perspective (SDG target 6.5, Integrated Water Resources Management). For example, by discussing how water exchange and reclaimed water could be used to promote environmental externalities, such as urban ecosystem services or urban green infrastructure (UGI), especially when addressing compact city development in hydrosocial territories, such as Benidorm (van der Jagt et al. 2019).

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