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# Challenges of Urban Water Cycle Management in Small Spanish Municipalities: The Case of the Province of Granada

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**Abstract:** Urban water service management in Spain presents two very distinct realities: populated service areas and small population centres. Despite the professionalised management of resources to provide a comprehensive, high-quality service in the largest service areas, small population centres face significant deficits and shortcomings that pose a major challenge for the Spanish public administration. This article reviews the existing problems surrounding the management of urban water cycle services in small-population municipalities in the province of Granada. This case study describes a reality that can be extrapolated to a significant number of small municipalities in the rest of Spain, where the management of urban water cycle services is directly assumed by City Councils. Having reviewed the problems, the article concludes with a series of recommendations for improving urban water cycle management in small municipalities. The conclusions emphasise the study and creation of optimal service areas, as well as the creation of an independent regulatory body.

**Keywords:** urban water cycle; Spain; rural areas; governance



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## 1. Introduction

Water and sanitation are fundamental to sustainable development; they are fundamental requirements, which underpin poverty reduction, economic growth, and environmental sustainability [1]. Within the framework of the 2030 Sustainable Development Agenda, states committed in 2015 to the goals of SDG 6: Clean Water and Sanitation [2]. Among the proposed targets are ensuring access to water, promoting the efficient and sustainable use of water resources, and improving water quality. To achieve these goals, the United Nations advocates for the adoption of a polycentric water governance model that engages all sectors of society [3]. This approach entails participation, dialogue, and coordination among the various stakeholders involved in decision making.

The challenges associated with accessing water and sanitation for residential use vary greatly across the world [4,5]. In developing countries, much progress needs to be made in order to fulfil the human right to access water and sanitation. At the other extreme, in Europe and North America, access to water and sanitation is virtually guaranteed for the entire population [6]. In these regions, the challenges are to advance water circularity, efficiency, and the decarbonisation of all phases of the process.

While water policies in Europe focus on circularity and decarbonisation, part of the population continues to suffer from a lack of access to water and sanitation. The second principle of the United Nations 2030 Agenda advocates "Leaving no one behind", which entails combating poverty and avoiding situations of discrimination. Regarding access to water and sanitation, this principle is reflected in the United Nations World Report,

published in 2019 [7]. In response to this call, the European Union's Directive 2020/2184 states that Member States must improve access to water for human consumption for vulnerable and marginalised groups [8]. Reference is made to the installation of outdoor and indoor equipment in public spaces, which allows these groups access to drinking water.

Likewise, without reaching situations of extreme vulnerability for certain groups, in terms of access to water, part of the European population is being left behind in the advances being made in urban water cycle services. Population centres with fewer inhabitants, typically located in rural areas and dependent on the agricultural sector, present significant deficiencies in public water and sanitation services. These deficiencies encompass material, financial, organisational, political, and technical aspects.

This situation is more evident in Member States with greater population dispersion among small municipalities. Spain is one example; there are 6813 municipalities with fewer than 5000 inhabitants, accounting for 84% of the total [9]. Faced with the difficulties in providing urban water cycle services, many of these municipalities have opted to form larger service areas under various forms of association. This is a way to take advantage of the industry's economies of scale. Other municipalities have opted for concessions as a way to professionalise service provision. Finally, there are municipalities where the service is provided directly by the city council. It is in these cases where the technical and financial deficiencies are most evident. In general, it can be said that, despite the professionalised management of resources providing a comprehensive, quality service in the largest service areas, small population centres face deficiencies and shortcomings that pose a challenge for public administration. This is a situation acknowledged by the Government of Spain in the Green Paper on Governance in Spain [10], as well as in the report [11] prepared for the section on the Integrated Water Cycle in Small and Medium-Sized Municipalities of the Green Paper on Water Governance in Spain.

Institutional reports and academic research tend to be biased toward the study of the management of the urban water cycle in large cities. One explanation is the easier access to data; another possible reason is a greater interest for addressing issues that affect a larger share of the population. From a socio-political perspective, the challenges faced by large urban areas tend to have a greater impact and attract more attention. This article analyses the different situations and challenges that may arise in the provision of residential water services in small municipalities. To this end, the case of the province of Granada is as a good example. The objective of this paper is to demonstrate that, while the focus and progress towards circularity and decarbonisation are being focused on in large service areas, much remains to be done in small municipalities. Therefore, there is a clear risk that the gap in the management of urban water cycle services between large and small service areas will further widen in the coming years. Internal documentation was consulted, and information was obtained from a working group of the Provincial Council of Granada.

The work is structured as follows. After this introduction, the research methodology is briefly explained. We then focus on the area of study. The distribution of the population in the province of Granada and the management method for urban water service provision are described. Section 4 then describes the problems and causes of urban water service management in small municipalities under direct management. A brief discussion and policy implications are included in Section 6. The article concludes with conclusions and recommendations.

## 2. Methodology

The research was conducted using information obtained from the Granada Provincial Council and is the result of a programme promoted by the Provincial Council in 2022, in which the City Council and the University of Granada also participated. Within the

framework of this programme, an intense debate has taken place in recent years with the aim of improving the management of urban water cycle services in municipalities under direct management. This covers 106 of the 174 municipalities in the Province of Granada.

The concern for urban water cycle services in Granada originated in a diagnostic report prepared in 2013 and entitled "Technical and Operational Study of the Urban Water Cycle in Various Municipalities of the Province of Granada" [12]. This report was supplemented by studies conducted in 2019 and 2020 [13–17]. This background evidence shows that concern about urban water cycle services in small municipalities has been ongoing for some time. This series of reports highlights many structural shortcomings in water service management in Granada.

At the same time, between 2016 and 2021, regular meetings were held by the Water Working Group of the Granada Network of Municipalities Towards Sustainability (GRAMAS Network), made up of mayors, municipal technicians, provincial council staff, and researchers from the University of Granada. The GRAMAS Network is an initiative promoted by the Granada Provincial Council that has the aim of incorporating the principles of sustainability and good environmental practices into municipal management through the exchange of experiences and institutional cooperation. In order to achieve the set objectives, a participatory methodology is used based on practical actions developed through working groups that seek common solutions to shared problems through the exchange of experiences and the adoption of good practices.

Based on this background, it was decided to launch the General Programme for the Improvement of the Complete Water Cycle [18]. Within the framework of this programme, two main objectives were established: the identification of the causes of the problems detected in the management of urban water services and the proposal of measures to improve the economic and technical performance of the services. For the development of this research, use has been made of the internal documentation of the Provincial Council of Granada, which was generated within the framework of the General Programme for the Improvement of the Integral Water Cycle [18], and the content of the information from the meetings that continued to be held in the GRAMAS Network until the completion of this research.

For the processing of information and the presentation of results, an exhaustive review was conducted of both the technical reports produced by the Provincial Council of Granada and the minutes from the GRAMAS Network. In Section 3, data extracted from the provincial council's reports are used to describe how urban water cycle services are managed across municipalities in the province of Granada, classified by population size. Additionally, the section highlights specific shortcomings in service provision, particularly in small municipalities operating under direct management models. Section 4 presents an analysis of the main factors that hinder the effective management of urban water cycle services. The methodological approach involved identifying the most frequently cited issues in the GRAMAS Network's discussion groups and in provincial council reports. These issues were compiled into a list of contributing factors that were subsequently classified and grouped based on their origin, with special attention given to the roles played by the various stakeholders involved.

## 3. The Provision of Urban Water Services in the Province of Granada, According to Population Size

### *3.1. The Distribution of the Population at the Municipal Level: Granada and Spain*

The most commonly used indicator for determining whether a town is small is the number of inhabitants [19]; however, there is no consensus on this figure [20]. In Spain, the Ministry of Agriculture and Fisheries has defined small rural municipalities as those with

fewer than 5000 inhabitants [21]. Based on this definition, both Spain and the province of Granada are predominantly made up of small rural municipalities (Table 1).

**Table 1.** Distribution of municipalities by population size in Spain and the province of Granada, 2024 (prepared by the authors based on [9]).

| | Spain | | | | Granada | | | |
|---|---|---|---|---|---|---|---|---|
| | Municipalities | | Inhabitants in Municipalities | | Municipalities | | Inhabitants in Municipalities | |
| **Size of Municipalities According to Population** | **No** | **%** | **No** | **%** | **No** | **%** | **No** | **%** |
| 0–300 | 3155 | 38.87 | 405,142 | 0.85 | 9 | 5.17 | 2020 | 0.22 |
| 301–1000 | 1828 | 22.48 | 1,038,799 | 2.16 | 65 | 37.36 | 40,997 | 4.41 |
| 1001–2000 | 877 | 10.79 | 1,238,465 | 2.58 | 28 | 16.09 | 38,240 | 4.11 |
| 2001–5000 | 956 | 11.76 | 3,045,156 | 6.34 | 31 | 17.82 | 88,573 | 9.52 |
| 5001–10,000 | 544 | 6.69 | 3,859,439 | 8.04 | 20 | 11.49 | 138,496 | 14.89 |
| 10,001–20,000 | 347 | 4.27 | 4,877,169 | 10.16 | 12 | 6.90 | 173,690 | 18.67 |
| 20,001–50,000 | 272 | 3.35 | 8,032,859 | 16.73 | 7 | 4.02 | 158,651 | 17.06 |
| 50,001–300,000 | 140 | 1.72 | 15,483,019 | 32.24 | 2 | 1.15 | 289,534 | 31.13 |
| >300,000 | 12 | 0.15 | 10,042,467 | 20.91 | 0 | 0.00 | 0 | 0.00 |
| Total | 8131 | 100.00 | 48,022,515 | 100.00 | 174 | 100.00 | 930,201 | 100.00 |

The population distribution in Spain and the province of Granada is similar, so Granada is considered a good example of the Spanish territory. The percentage of municipalities with fewer than 5000 inhabitants is slightly higher than 76% in Granada, while in Spain, it is around 84%. Considering the population living in these municipalities, this represents 18.26% in the province and 12.35% nationally. Figure 1 illustrates that, in most of the Spanish territory, a high concentration of the population inhabits provincial capitals. A significant portion of the remaining population is distributed across small municipalities—this is the so-called "emptied Spain". This pattern only differs in provinces with large metropolitan areas, such as Madrid and Barcelona, as well as along the coast.

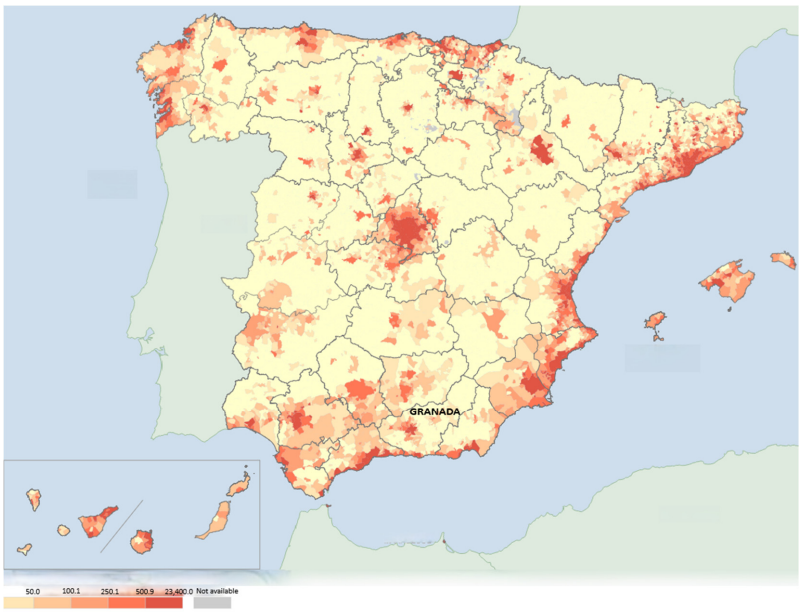


**Figure 1.** Population density in Spain, 2024. (Atlas Digital de las Áreas Urbanas del Ministerio de Vivienda y Agenda Urbana. Accessed on 5 June 2025: https://atlasau.mitma.gob.es/#c=indicator&i=pobevo.densidad&s=2024&view=map4).

### *3.2. Management of Urban Water Cycle Services in Granada*

Population size is a determining factor in service management [22,23]. To take advantage of economies of scale in the industry, some municipalities have opted for municipal grouping [24,25]. In the province of Granada, up to three large supra-municipal management areas can be distinguished (Figure 2). In the Vega de Granada, two municipal groupings have been created for urban water cycle management: the Granada metropolitan area, made up of 15 municipalities and just over 390,000 inhabitants, and the Aguas de la Vega Sierra Elvira consortium, which includes 22 municipalities and provides services to 159,816 inhabitants. In both cases, the management of urban water cycle services has been delegated to a joint venture in which the private partner is a company from the multinational Veolia group. Additionally, on the Costa Tropical, a service area has been created comprising 16 municipalities and 115,000 inhabitants. In this case, the concession was awarded to a joint venture involving the multinationals Aqualia and Acciona.

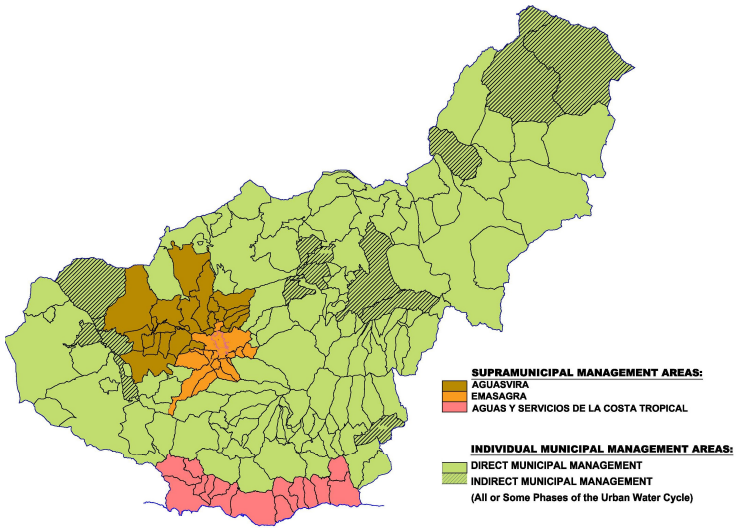


**Figure 2.** Geographical implementation of the different types of urban water cycle management in the province of Granada, 2024. (Own elaboration).

In contrast to these three large service areas, management in the rest of the province is at the municipal level. There are 15 municipalities where urban water cycle management is provided by a private company. The average population of these municipalities is 3700. The management companies are Aqualia (eight municipalities), Gestagua (six), and Acciona (one).

Finally, there are 106 municipalities where management is carried out directly (Figure 3); this represents almost two-thirds of the municipalities (60.92%) and one-fifth of the population (20.65%).

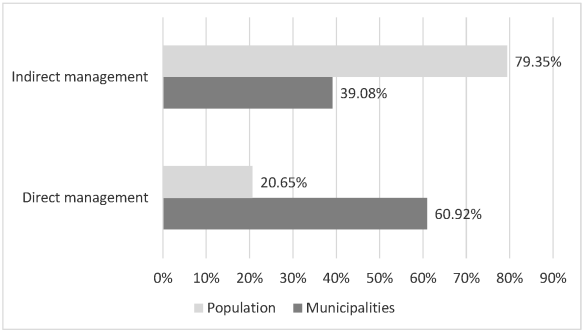


**Figure 3.** Types of urban water cycle management in the province of Granada, 2023. (Own elaboration).

### 3.3. First Approach to Urban Water Service Management in Small Municipalities Under Direct Management

Municipalities under direct management are characterised by small populations and limited financial and technical resources for providing water services. The main water resources come from wells [26]. Overall, there is a highly dispersed population, as well as significant decentralisation of infrastructure, which prevents the exploitation of industrial economies of scale and complicates the management of urban water cycle services.

There are multiple deficiencies. The first shortcoming is the widespread lack of both technical and economic–financial data, which hampers decision making. Basic information, such as the volume of water withdrawn and injected into the network, the volume of water consumed by users, and operating costs, is lacking. Among the reasons for the lack of data on water consumption are the absence of residential meters in 11.3% of smaller municipalities and the age of existing ones [13] (Table 2). It has also been found that 70.5% of tanks do not have outlet meters [14]. Furthermore, there is no independent economic accounting to quantify the costs of municipal water services and, consequently, determine whether the cost recovery principle is being met [17].

**Table 2.** Indicators of the urban water cycle service in municipalities with direct management of the water service in the province of Granada.

| Description | Indicator |
|---|---|
| Percentage of municipalities in the province of Granada with direct management | 60.92% |
| Percentage of the population in the province of Granada living in a municipality with direct management | 20.65% |
| Percentage of municipalities are supplied by groundwater | 92% |
| Percentage of groundwater bodies in danger | 41%. |
| Percentage of municipalities with regulatory deposits in regular, poor, or very poor condition | 21% |
| Percentage of municipalities that have problems of insufficient drinking water supply | 17% |
| Percentage of municipalities with a supply network in poor or very poor condition | 18% |
| Percentage of municipalities in the province of Granada with a deficit of household water meters | 11.3% |
| Technical performance of the networks (ratio between the water recorded by the users' water meters and the water discharged from the regulating reservoirs) | 32.7% |
| Number of wastewater treatment plants that are pending construction | 90 |
| Wastewater treatment plants that do not meet discharge parameters | >90% |
| Percentage of municipalities with sanitation networks in poor or very poor condition. | 16% |
| Financial deficit for urban water cycle services | 23 EUR/inhabitant/year |

Despite the limited information available, the main problem with the supply service is the poor technical performance of the supply networks. On average, the technical performance of the networks is only at 32.7% (the ratio between the water recorded by the users' water meters and the water discharged from the regulating reservoirs). The reasons for the poor performance of the networks are leaks, problems with flow measurement, and illegal connections [17].

Another problem is that, in many small municipalities, wastewater treatment services are not provided, so the urban water cycle service is incomplete. Around 90 treatment plants are pending construction and more than 90% of the existing ones do not meet discharge parameters, resulting in a multitude of sanctions [16]. In the assessment of data from the Survey of Local Infrastructure and Facilities conducted by the Provincial Council

of Granada, 21% of the population lives in municipalities where the infrastructure for urban water management is in a fair, poor, or very poor condition [17].

The following sections delve into the problems surrounding the management of urban water services in small municipalities in the province of Granada. The analysis is conducted from the perspective of stakeholders. The perspectives of public administration, policymakers, and the public allow us to identify the causes of service deficiencies and shortcomings and the complexity of the decision-making scenario. Addressing the deficiencies and shortcomings of water services requires an understanding of their root causes.

## 4. Results

### *4.1. The Lack of Resources from the Public Administration Responsible for Providing Urban Water Cycle Services*

The responsibilities for water supply and sanitation are divided between two levels of the Spanish public administration: the municipality and the provincial council. This distribution is established in Law 7/1985, of 2 April [27], Regulating the Foundations of the Local Government. Municipalities are required to guarantee the provision of residential drinking water supply and sewerage services. They are also recognised as having jurisdiction over wastewater treatment.

Additionally, provincial councils have a duty to assist municipalities with fewer than 20,000 inhabitants in the provision of urban water cycle services. Law 7/1985 [27] establishes that provincial councils may assume direct provision of the service or coordinate the provision of shared management through consortia, associations of municipalities, or other arrangements. This support for municipal governments is also contemplated in Law 5/2010, of 11 June [28], concerning local autonomy in Andalusia.

Within this framework of the distribution of power, municipal governments and provincial councils face two major limitations in providing urban water cycle services: financial and human.

#### 4.1.1. Financial Insufficiency

Domiciliary water services are activities with significant economies of scale, and these are represented by the high proportion of fixed costs in the cost structure. The smaller the population over which the fixed costs are distributed, the higher the cost associated with each user of the service [29]. Since we are referring to municipalities with small populations, the costs per user are very high. However, it is common practice for water bills in small municipalities not to pass on all the costs of the service to users. De facto, the municipality bears the deficit of not passing on all service costs to the user [30]. This is paid for from other municipal revenues, so citizens are financing part of the water services as taxpayers, not as users. This is one of the factors that may help explain why the price of water in Spain is significantly lower in small municipalities with direct management of the service compared to municipalities that outsource management, whether to private or public companies [31].

In the small municipalities of the province of Granada as a whole, the financial deficit for urban water cycle services is estimated at EUR 3 million per year [17]. This is partly due to the limited tax collection capacity in small rural municipalities, driven by the small number of users and the low average incomes associated with agricultural activity [32].

The Granada Provincial Council, based on Law 7/1985 [27], cooperates and financially assists in the provision of urban water cycle services through several concerted programmes that subsidise a portion of the supplies and repairs required after breakdowns in the urban water cycle and implements remote management and digitalisation systems [33]. In the 2024/25 biennial period, these programmes cost a total of EUR 2,098,000 and were

distributed among 106 municipalities under direct management upon request. As a complement to the support given to operating the water services described, the Granada Provincial Council made the urban water cycle improvement programme available to municipalities under direct management, enabling them to carry out actions aimed at solving the main deficiencies, co-financing 70% of the investments. The annual amount allocated to this programme is EUR 1 million [34].

Despite the financial resources that the Diputación de Granada allocates to small municipalities under direct management, the aid is insufficient because no substantial improvement in the technical performance of the services is observed (see Table 2). In addition, an increase in funding can improve infrastructure but it does not necessarily imply an improvement in service. This occurs if infrastructure is not managed professionally, due to the limitations of technical staff in the municipalities, as explained below.

#### 4.1.2. Limitations and Deficiencies in Human Capital

A second limitation of small municipalities is the lack of personnel, both in number and training levels [17]. In the small municipalities of the province of Granada, there is no professionalised department for this public service. There are usually only two members of staff: a multi-services officer for field work, such as repairing leaks in the water supply network or cleaning and removing waste from the wastewater treatment plant, and an administrative officer for accounting management. In addition to meeting the needs of the urban water cycle, the staff also performs tasks in other services. The field officer also performs maintenance on public lighting and other municipal facilities, such as the school, the municipal swimming pool, the cemetery, and the town hall itself. The administrative officer is also responsible for other administrative tasks specific to the municipality, e.g., customer services, completing grant applications, and updating the municipal register. Furthermore, no one is usually responsible for the technical and financial oversight of the service, hence the poor technical efficiency of the service despite the aid received from other administrations. The lack of human resources is so evident that, in many cases, the political leader himself has to fill in these gaps. It is not uncommon for the mayor to dedicate part of his time to monitoring the chlorine dosage in drinking water and reading residential meters. Furthermore, the lack of a qualified technical manager often leads to ineffective measures being proposed. A recurring example of this is the proposal to implement new water intakes in response to the apparent problem of water resource scarcity when the real problem is the poor technical performance of the network due to a high percentage of leaks and fraud.

The provincial council offers local authorities a catalogue of technical assistance for urban water cycle services. This includes carrying out technical diagnoses and proposing service improvement plans, technical maintenance work on the remote-control system and wastewater treatment plants, and even wastewater analysis [33]. However, despite having a specific service dedicated exclusively to the urban water cycle, the provincial council does not have the necessary personnel to meet the demands of the 106 municipalities under its direct management. Therefore, in addition to funding, more specialised personnel are also needed.

### *4.2. Ignorance and Distance of Higher Levels of Public Administration with the Problem of the Urban Water Cycle in Small and Medium-Sized Municipalities*

In general, there is a certain disconnection throughout Spain between the upper levels of administration and the existing problems surrounding urban water cycle services in small municipalities. This is largely the result of the distribution of power between the various water services. As previously noted, Spanish regulations explicitly state that urban water cycle services are the responsibility of municipal governments, which are

assisted by the provincial council in municipalities with fewer than 20,000 inhabitants. That the provision of urban water cycle services is a local responsibility is also evident in the institutional and political vision [10].

Although the responsibilities for water supply and sanitation are assumed by local governments, there are two areas of action by state and regional governments that impact the provision of urban water cycle services: regulation and assistance for infrastructure financing.

#### 4.2.1. Regulation

Urban water service managers face multiple regulatory pressures. Central and regional governments approve regulations concerning the use of water, which impacts urban water cycle services. The regulations are extensive. For example, at the state level, the Royal Legislative Decree 1/2001, of 20 July [35], approves the revised text of the Water Law and contains references to the local level, primarily related to upstream water permits and wastewater discharges. With an impact on the quality of services provided at the local level, the following stand out: the Royal Decree 3/2023, of 10 January [36], established the technical and health criteria for the quality of drinking water and its control and supply; and the Royal Decree 509/1996, of 15 March [37] establishing the standards applicable to the treatment of urban wastewater.

Small and medium-sized municipalities are under pressure from increasingly demanding regulatory developments that are not accompanied by the means to comply with the new responsibilities. An example is the new requirement of Royal Decree 3/2023 [36] to install a filtration system in groundwater intakes when the water has a turbidity value greater than 1 nephelometric unit. This will require the installation of new equipment in most municipalities whose water source is groundwater. In the case of Granada, this will affect 92% of municipalities; however, the regulation is not accompanied by an aid programme.

In essence, the new regulations, which impose greater demands on service quality and sustainability in water resource management, pose greater difficulties for small municipalities. They make the technical, knowledge, and financial limitations in small municipalities more evident.

#### 4.2.2. Aid for Infrastructure Financing

Central and regional governments transfer funds to local governments, partly from the European Union budget. Within the framework of various action plans, these funds have been used to invest in the infrastructure necessary to provide urban water cycle services in small municipalities.

Some aid has not been managed efficiently, which is partly due to the disconnection between the bodies that decide on the implementation of infrastructure and the local situation to be addressed. Much of the funding released for the construction of water treatment and wastewater treatment plants has become a problem for small municipalities [11]. The central and regional governments anticipated the investment but the operating and maintenance costs that these small population centres would have to face were not taken into account. The result is that some municipalities have opted to under-utilise expensive water treatment and wastewater treatment plants because they lack the resources to finance the current costs of the activity. It would have been more appropriate to invest from the outset in cost-effective infrastructure tailored to the specific intervention area. There are various alternatives for water purification and wastewater treatment.

This is the case in several municipalities in the province of Granada (Órgiva, Ventas de Zafarraya, Zafarraya, etc.), where activated sludge wastewater treatment plants (WWTP) were built in the 1990s but the high energy costs associated with them led to their aban-

donment [38]. Years later, new treatment plants using biofilm system technology had to be built, and these are currently in operation (Figure 4).

**Figure 4.** Water treatment plants in Órgiva. (Own elaboration). Note: **Left**: Old Órgiva WWTP using activated sludge technology, built in the 1990s and abandoned due to high energy costs. **Right**: New Órgiva WWTP using a bacterial bed system, built in 2004 and currently in operation.

A current trend is the promotion of nature-based solutions that are more environmentally sustainable and, in some cases, associated with lower costs [39,40]. In Torre-Cardela, a water treatment plant using reverse osmosis technology was built. High energy costs made it economically unviable, which led to the consideration of a more cost-efficient technology with a lower environmental impact. The solution was a water treatment plant based on a biological method that employs aerobic granular technology for the removal of nitrates and other contaminants present in water intended for human consumption [41]. A particular case in the municipalities of the Alpujarra region of Granada is the preservation of the water channel system known as acequias de careo. It is an ancestral method of aquifer recharge using meltwater from the snowmelt of the Sierra Nevada [42,43]. Additionally, in some municipalities of the province, contaminants from wastewater are removed in artificial wetlands that replicate the biological processes of natural wetlands.

### *4.3. Difficult Decision Making at the Local Level*

The management of urban water cycle services involves decision making that can generate conflicts between the local government team and the population. In small population centres, these situations can transcend the ideological, political, and economic spheres and become a personal matter. The greater proximity of family and neighbourhood ties can influence the decisions of the government team and will prevent unpopular decisions [42,44]. In line with Agency Theory, guided by political and neighbourhood motives, the local government (the agent) may make decisions that are not aligned with the primary social interest [45]. In the local environment, three sources of conflict can be detected.

#### 4.3.1. Service Delegation

The complexity of urban water cycle management leads small municipalities to choose to operate through associations of municipalities or supra-municipal entities [46]. However, the transfer of service management is a decision that can generate controversy. In small municipalities, the urban water cycle is one of the most important areas of local government activity. The transfer of this local policy transcends the interests of citizens, as it requires external agents to make decisions about service quality, water quality, or water prices. Therefore, it entails a loss of power in matters that affect fellow citizens. The

most controversial situation is when the privatisation of service management is proposed, especially at times when there is a trend toward municipalisation [47]. This option often generates political conflict and, occasionally, citizen backlash [48,49]. As noted in Section 2, in the province of Granada, most small municipalities are not grouped into service areas but retain direct management. The reasons for this are diverse. In some cases, grouping does not occur because they are isolated due to topographical reasons. In other cases, the service is not privatised because the municipalities are of little interest to private companies. Typically, these municipalities have low economic viability due to their small population and poor infrastructure. In other cases, although they are municipalities that could join existing associations and consortiums, they resist transferring the service to a higher authority or privatising the service. Avoiding integration into larger service areas or privatisation means failing to take advantage of the benefits associated with economies of scale and the professionalisation of the service.

#### 4.3.2. Updating the Water Price

A second decision that affects citizens is the price of water. In small municipalities, the price of water takes on more political importance than in large municipalities. Few services are provided, so fewer tax ordinances are debated in the city council plenary sessions. Furthermore, in deprived areas, a change in water prices can have a greater impact on household budgets, as this is a basic service for citizens. In short, updating water prices is an unpopular measure that can influence the behaviour of local politicians [32,50].

Regarding water prices, in the province of Granada, two differentiating factors are observed between direct and indirect management:

1. Prices are updated less frequently under direct management (Table 3). Three-quarters of the municipalities with direct management have rates that are five years old or more; only 15.19% of municipalities published their current rates in the last two years. However, two-thirds of the municipalities under indirect management have tariffs that are valid for less than two years.

**Table 3.** Years of validity of the fiscal ordinances for urban water cycle services in the province of Granada, 2024. (Prepared by the authors based on data from Granada Provincial Council [13]; Official Gazette of the Province [51]).

| Years of Validity of the Rates | Direct Management | | Indirect Management | | Total Province | |
|---|---|---|---|---|---|---|
| | No | % | No | % | No | % |
| rates for less than 1 year | 15 | 14.15% | 45 | 66.18% | 60 | 34.48% |
| rates for less than 2 years | 1 | 0.94% | 2 | 2.94% | 3 | 1.72% |
| rates for less than 3 years | 6 | 5.66% | 1 | 1.47% | 7 | 4.02% |
| rates for less than 4 years | 0 | 0.00% | 0 | 0.00% | 0 | 0.00% |
| rates for less than 5 years | 3 | 2.83% | 0 | 0.00% | 3 | 1.72% |
| rates for equal to or more than 5 years | 81 | 76.42% | 20 | 29.41% | 101 | 58.05% |
| Total | 106 | | 68 | | 174 | |

2. The average water price is lower under direct management (EUR 0.85/$m^3$) than with indirect management (EUR 1.96/$m^3$), see Table 4. The water bill is lower under direct management for two reasons: sanitation and treatment costs are not passed on to the user and/or not all service costs are allocated.

**Table 4.** Average price of urban water service by type of management in the province of Granada in 2024. (Prepared by the authors based on data from the Granada Provincial Council [13]; Official Gazette of the Province [51]).

| | Direct Management | Indirect Management | Total Municipalities Analyzed |
|---|---|---|---|
| Number of municipalities | 40 | 60 | 100 |
| Highest price (EUR/$m^3$) | 1.71 | 2.59 | 2.59 |
| Lowest price (EUR/$m^3$) | 0.05 | 0.38 | 0.05 |
| Average price (EUR/$m^3$) | 0.85 | 1.96 | 1.51 |
| % Municipalities without wastewater sanitation or purification rates | 65.00% | 1.67% | 27.00% |

Note: Estimated price for a family of three with an average daily consumption of 128 litres per person.

#### 4.3.3. Fraud Management

Fraud detection measures can have a positive effect on the service's financial balance. Revenue increases for two reasons: (1) users pay for the service and (2) new users sign up. Furthermore, they encourage sustainable water use. Paying for the water consumed prevents waste. Although the measure may be well received by residents who responsibly pay their bills, it will generate negative reactions among defrauding residents, which may have a political cost [52,53].

The Granada Provincial Council promoted the pursuit of fraud between 2021 and 2023. To this end, it offered municipalities under direct management a subsidy covering 70% of the costs of the anti-fraud campaign. In three years, only 30 out of 106 municipalities requested this aid. It is likely that local governments did not opt for this measure because they wanted to avoid conflict with their fellow citizens.

### *4.4. The Tragedy of the Commons*

The relationship between humans and water is complex. This is largely due to the occurrence of the tragedy of the commons [54]. This theory is applied in cases where there is a private exploitation of common goods. In the short term, individuals tend towards the over-exploitation of natural resources for their own benefit, even when they are aware of the long-term harm this will cause to the interests of the community and even their own interests.

In small rural municipalities, a conflict of interest arises among the citizens when the population, in addition to being residents of the municipality, carry out agricultural activities in the immediate surroundings. Paradoxically, this population living in the municipalities is sometimes responsible for the water supply problems of domestic users. This occurs when they act as agents, generating negative externalities on water sources such as primarily aquifers.

Groundwater is the main source of water supply for small towns in Spain. Seventy percent of the population living in cities with fewer than 20,000 inhabitants consumes water from aquifers [46]. The same is true in the province of Granada, where 70% of its municipalities are supplied exclusively by groundwater. Furthermore, another 22% of municipalities use groundwater along with surface water. Therefore, up to 92% of Granada's municipalities use groundwater for their urban water supply [26].

#### 4.4.1. Water Demand for Agricultural Uses

Agriculture is by far the largest net consumer of water in Europe and, if practices do not change, demand for irrigated agriculture is likely to increase with climate change [55]. This situation also occurs in Spain and Granada, where approximately 80% of the distributed

water is used for irrigation. In the province of Granada, 536,223 hectares are dedicated to cropland, of which just under 30% is irrigated [56].

Furthermore, although dryland can only be irrigated with rainwater, illegal groundwater extraction is widespread in Spain. In southern Spain, an increase in illegal wells has been identified in recent years [57,58]. In the province of Granada, there have been recent cases of illegal well closures [59,60], but it is difficult to estimate the volume of water extracted illegally. What is evident is the decline in water levels in the province of Granada, with 41% of its water bodies being in danger [61–63].

The over-exploitation of water resources due to agricultural activity, both through legal and illegal consumption, is jeopardising urban supplies in some towns. This is the case in Alamedilla, a municipality in Granada, where the proliferation of illegal wells means that the municipality cannot use its usual sources and is forced to extract water from other bodies of lower quality. In other cases, the same wells are still being used but the deeper water is causing energy consumption to increase. Additionally, the drop in groundwater levels has contributed to an increase in the concentration of pollutants deposited at the bottom, such as arsenic.

#### 4.4.2. The Nitrate Pollution Problem

Another challenge is the water pollution caused by excess nutrients from agricultural runoff. The main problem associated with agriculture and livestock farming is diffuse pollution due to the use of fertilisers—which may contain, among other chemical compounds, nitrates, phosphates, and potassium—and pesticides—which may contain, among others, organophosphates and glyphosate [64–66]. The main problem in the province of Granada associated with the use of fertilisers is the infiltration of the fertilisers into the ground. This increases nitrate levels in the aquifers from which water is extracted to supply households. As a result, in addition to the environmental impact, water becomes unfit for human consumption or incurs high purification costs.

The existing technologies for removing nitrates have high implementation and operating costs, making them unfeasible in small municipalities [67]. Specifically, in the Montes Orientales area of the province of Granada, the groundwater has high nitrate levels that require the implementation of very expensive technologies to treat the water. Therefore, more cost-efficient technologies are being opted for. This is the case in Torre Cardela, where a pilot plant has been installed with an alternative nitrate removal system based on aerobic granular technology [68].

In addition to agricultural activity, there is the impact of livestock farming. Studies show that poor manure management practices and occasional discharges of slurry from pig farms lead to the bacteriological and nitrate contamination of groundwater [69,70]. This is the case in the northern part of the province of Granada, where large pig farms are proliferating.

## 5. Discussion and Political Implications

In Spain, there is a notable knowledge gap regarding the situation and challenges related to the management of urban water cycle services in small municipalities. The National Statistics Institute provides only aggregated data on water supply and sanitation at the national and regional levels. The Asociación Española de Abastecimientos de Agua y Saneamiento (Spanish Association for Water Supply and Sanitation) partially addresses this gap by publishing the Estudio Nacional de suministro de agua potable y saneamiento every two years [71]. However, due to a low response rate, the association acknowledges the limited representativeness of the data published for municipalities with fewer than 20,000 inhabitants.

Research with a limited thematic and territorial focus enables a closer analysis of the challenges associated with water service management in small Spanish municipalities. For instance, González-Gómez et al. [72] identify population dispersion as a critical factor contributing to the high levels of non-revenue water observed in small and medium-sized municipalities in Andalusia. In another study by González-Gómez et al. [73], based on a sample of 80 rural water utilities in southern Spain, it was found that environmental variables help explain why operators with private sector participation are more efficient than public operators. This may be attributable to a selection bias, whereby private capital tends to engage in the management of services under more favourable conditions. Additionally, Picazo-Tadeo et al. [74] identify the presence of dispersion diseconomies and economies of scale in municipal water services based on a sample of water utilities in southern Spain. Overall, the findings indicate that small service areas are predisposed to lower performance, largely as a result of the scale-related and spatial inefficiencies inherent in the sector. Size influences the ability to obtain financial resources and, in turn, the achievement of economic and environmental objectives. In the international context, research consistently highlights the importance of demographic and territorial factors [75–80]. There are economies of scale and density, but they are not unlimited; moreover, there are dispersion diseconomies that constrain the configuration of optimal service areas.

The research focuses on small municipalities in the province of Granada. It confirms the existence of shortcomings in the management of water services in small population centres. More importantly, and adding value to the study, it provides an in-depth analysis of the underlying causes of poor performance. The shortcomings of the water service in small municipalities in the province of Granada are due to various causes. In summary, they result from a combination of insufficient financial resources and human capital, a lack of coordination between local needs and capacities and higher-level policies and regulations, difficulties and conflicts of interest in decision-making processes within a poorly defined regulatory and institutional framework, and behaviours contrary to the general interest. This section provides improvement proposals and political implications, as well as the main lines of action maintained by the working group of Diputación de Granada.

Table 5 lists the various problems identified in this research, along with a set of measures that have been classified according to the proposed areas of action in [81]. This proposal was developed based on the exchange of experiences within the GRAMAS Network and the information generated during the development of the Granada Provincial Council's General Programme for the Improvement of the Integrated Water Cycle. The information contained herein highlights the need to address a multi-dimensional problem from very different perspectives. Consequently, its resolution requires the design of comprehensive action plans.

Considering the fact that the case study of the province of Granada can be extrapolated to most of Spain [10,11], the information contained in Table 5 gives an idea of the significant challenge facing public administration in Spain in terms of improving the management of urban water cycle services in small municipalities under direct management. It is unrealistic to think of undertaking actions that would resolve these problems in a short period of time. An action plan for gradual implementation would need to be designed. Table 6 shows a time-specific breakdown of the measures that could be undertaken in each of the six areas of action shown in Table 5.

**Table 5.** Classification of urban water challenges by area of action. The case of the province of Granada. (Prepared by the authors).

| Problems in Urban Water Cycle Management in Small Municipalities | Scope of Action in the Face of the Challenges of the Urban Water Cycle | | | | | |
|---|---|---|---|---|---|---|
| | Governance/Regulation | Availability of Resources | Infrastructure | Financing | Agents Involved | Innovation/Technological Research |
| **Urban water service provision in the province of Granada: Low service quality in small municipalities** | | | | | | |
| Population atomisation and dispersion in small towns. | X | | | | | |
| Generalised lack of both technical and economic–financial data, which makes decision making difficult. | X | | | | | |
| Low hydraulic performance of networks | X | | X | X | X | X |
| Lack of supply and treatment infrastructure | X | | X | X | | X |
| **Lack of resources from the public administration responsible for providing urban water cycle services** | | | | | | |
| Financial insufficiency: Failure to comply with the cost–recovery principle. The cost of the service is financed by other taxes. Inefficient subsidies | X | | | | X | |
| Limitations and deficiencies in human capital: Lack of a professionalised service for efficient management. Limited support from provincial councils. | X | | | | | |
| **Lack of awareness and distance between higher levels of public administration and the problem of the urban water cycle in small and medium-sized municipalities** | | | | | | |
| Regulation: New regulations that impose greater demands, in terms of service quality and sustainability, pose greater financial and technical difficulties for small municipalities | X | | X | X | | |
| Aid for financing infrastructure: Lack of coordination between different administrations when planning and implementing infrastructure. State and regional governments implement infrastructure without taking into account maintenance and operating costs | X | | X | X | | |
| **Difficult making at the local leves** | | | | | | |
| Managing urban water cycle services involves making decisions that can generate conflicts between the local government team and the population. Local politicians avoid making unpopular decisions | X | | | | X | |
| Service delegation: The transfer of authority to another administration or the privatisation of the service generates citizen reaction, which influences local policy decisions. | X | | | | X | |
| Water price updates: The frequency of updating water rates and the price of water is lower with the direct management of the service | X | | | | X | |
| Fraud management: Although taking measures to prevent fraud in the service may be well received by residents who responsibly pay their bills, it will generate contrary reactions among defrauding residents. In many cases, it prevents the political decision from being made | X | | | | X | |
| **Conflict of interest. A clear example of the Tragedy of the Commons** | | | | | | |
| The demand for water for agricultural uses: The subscribers themselves are involved in sectors that over-exploit common water resources for water supplies. | X | X | | | X | |
| The problem of nitrate pollution: The subscribers themselves are involved in sectors that cause a loss of quality in the water resources used for water supplies. | X | X | | | X | |

**Table 6.** Measures to improve urban water cycle services according to the proposed scope of action. (Prepared by the authors).

| |
|---|
| **1. Resource Availability: Demand, Availability (Quantity and Quality), and Accessibility** |
| - Conduct an assessment of the regulations to identify areas where they are ineffective.<br>- Provide administrations with more resources to establish an efficient monitoring and control system for the inappropriate use of water resources with the following objectives: controlling diffuse pollution and preventing illegal water withdrawals. To this end, digitalisation emerges as an indispensable tool.<br>- Promote the diversification of water resources and resource recovery initiatives through wastewater regeneration.<br>- Promote nature-based solutions.<br>- Urban water cycle services themselves can contribute to these objectives by improving technical performance and properly treating urban wastewater before discharge. |
| **2. Infrastructure** |
| - Encourage the grouping of small municipalities to address the need for infrastructure with greater economies of scale.<br>- Promote the professionalisation of services, with the aim of maintaining infrastructure improvements and extending their useful life.<br>- Plan more efficient infrastructure adapted to specific local circumstances.<br>- Promote the development of infrastructure master plans independent of the political times to ensure their implementation.<br>- Ensure financing to address infrastructure renewal needs through tariffs that include amortisation costs and the efficient use of aid granted by higher administrations. |
| **3. Financing** |
| - Encourage the grouping of small municipalities to achieve viable economic dimensions.<br>- Promote professionalisation to ensure services more efficiently manage all available funding: revenues via tariffs and subsidies.<br>- Establish uniform criteria for both the cost structure and tariff calculations and monitor their application, with the goal of achieving economic sustainability for the service.<br>- Create specific conditional solidarity funds for small and medium-sized municipalities where users' financial capacity sets a tariff ceiling that makes cost recovery impossible. Small municipalities must demonstrate that they are doing everything possible to manage the service efficiently (complete transparency of economic and technical indicators and justifying not needing to belong to a supra-municipal service area).<br>- Create state-level funding lines for small and medium-sized municipalities to address the needs for renovation or construction of new infrastructure resulting from new regulatory requirements. |
| **4. Agents Involved: Participation and Attitudes of Stakeholders** |
| - Promote management through supra-municipal entities to decouple local politics from decision making.<br>- Promote transparency and access to information. On the one hand, this will achieve improved service through the comparison effect; on the other hand, it will raise user awareness about the efficient use of resources and the true cost of service provision, increasing their willingness to pay more for these services.<br>- Promote co-responsibility in urban water cycle management through participatory mechanisms, accountability, and urban–rural partnerships.<br>- Encourage citizens to participate in establishing the optimal service level, since the price of the service will depend on this level.<br>- Ensure that the relationship between public administrations and private operators is governed by specifications that include all the duties and rights that the owner transfers to the manager, as well as the instruments for monitoring their compliance. |
| **5. Technological Innovation/Research** |
| - Promote research into the appropriate technologies to comply with regulatory developments and achieve high efficiency, compensating for the limited economies of scale in small towns.<br>- Ensure the efficient management of current and new technologies by promoting professionalised supra-municipal organisational structures that contribute to increasing economies of scale and the qualifications of professionals.<br>- Promote training programmes to increase the availability of trained and competent professionals in new technologies in rural areas.<br>- Expand the digitalisation of infrastructure in the rural areas of small municipalities to improve the efficiency of fragmented infrastructure. |

**Table 6.** *Cont.*

| **6. Governance/Regulation** |
| --- |
| - Adapt the jurisdictional regime so that municipalities that do not meet quality standards are integrated into professionalised supra-municipal organisational structures. Local entities at the provincial or supra-municipal level, such as associations of municipalities (Mancomunidades) and provincial councils (Diputaciones), or even existing consortiums can be leveraged. Of all of them, the provincial councils appear to be the most prepared for this task, as they are mandated to provide technical support to small municipalities by law.<br>- Design a set of easy-to-calculate and understand indicators that allow for objectively determining the standard to be achieved, both from a service quality and economic perspective.<br>- Ensure transparency and citizen access to information on urban water cycle services. This information will be understandable and readily available to citizens.<br>- Promote citizen participation in a regulated environment, especially in choosing the type of service they require, as this will influence pricing.<br>- Establish the obligation to maintain segregated accounting at the municipal level for urban water cycle services to promote management efficiency and transparency. Uniform rules must be established to allow for comparison between services<br>- Regulate the pricing characteristics of urban water services with the aim of recovering costs and incentivising savings and efficiency.<br>- Create permanent cooperation forums between the various administrations in which the representation of small municipalities is ensured. These forums should comprise political leaders (decision-making sphere), technical and administrative staff (expert support), and social stakeholders (participatory sphere).<br>- Create the regulatory body as an independent public body charged with enforcing the politically, legally, or contractually established standards and supervising the services. |

In general, during the meetings held within the GRAMAS Network, different approaches to addressing the problem were noted. Municipalities maintain a position of greater demands for funding from other administrations to address infrastructure investment and the high operating costs of the service. The priority of local governments is to ensure the supply of drinking water to citizens, given the challenges of transparency, technical and economic efficiency, and environmental sustainability. A short-term and almost one-dimensional vision prevails. The objective is to meet citizens' demand for water delivery to their homes to satisfy basic needs.

In contrast to the more short-term vision of municipal politicians, the provincial council and the University of Granada are more concerned about making structural and far-reaching decisions. While acknowledging the complexity of the problem, they emphasise that the set of actions in the area of governance is a key element, as it is linked to all of the problems identified (Tables 5 and 6). This perspective aligns with [82], which concludes that in the city of Seville—as in Granada, also located in Andalusia—there is a need to improve the governance of water resource management. In fact, effective water governance is key to Integrated Water Resources Management [4,5]. In this context, two preferred lines of action are identified due to their expected positive impacts on the overall problems identified. However, these actions transcend the local level.

In a country with such a dispersed population, a study of optimal service areas should be a priority. This study should be a preliminary step to promoting municipal associations and delegating service delivery to supra-municipal entities. This would allow for the sector's economies of scale to be leveraged, local politics to be decoupled from decision making, and the technical and economic management of the service to be professionalised. Other actions would likely be resolved or complemented by this primary action. Furthermore, undertaking other types of actions without establishing optimal service areas are likely to result in inefficient solutions. Although there are supra-municipal service area initiatives in Spain, they are not the result of a nationally planned strategy, as has been implemented in other countries. In Italy, the reform of Law No. 36 of 5 January 1994 [83] introduced the municipal reorganisation into Optimal Territorial Areas (Ambiti Territoriali Ottimali [ATO]) [84]. Subsequent legislative reforms aimed to, among other

objectives, rationalise and increase the efficiency of the ATOs [85–87]. Currently, there are 62 ATOs, and local authorities are mandated to delegate the management of water services to the operator assigned to each ATO. In Portugal, the creation of optimal service management areas for urban water was state-led and progressively implemented over time. Initially, Decree-Law No. 379/93 [88] played a decisive role by establishing the legal framework for the creation of multi-municipal companies by private law to operate water supply and sanitation systems across multiple municipalities, as well as for the establishment of Águas de Portugal (AdP), which was responsible for designing optimal service areas. In the Portuguese case, municipalities voluntarily join the multi-municipal systems created for each service area. Despite the improvements brought about by the creation of optimal service areas, the significant challenge of financing water supply and sanitation services persists in both Portugal [89] and Italy [90].

In Spain, certain cases of inter-municipal cooperation emerge from opportunistic circumstances, such as when small municipalities are integrated into larger neighbouring municipalities or metropolitan areas with shared boundaries. In other instances, such cooperation stems from locally initiated efforts—at either the municipal or provincial level—facilitated by specific political alignments, such as when the involved local governments are governed by the same political party. Regardless of the existing cases of municipal aggregation, as long as the decision remains in the hands of local politicians, many municipalities will remain resistant to delegating management to a supra-municipal body. There are issues at the local level related to the creation of optimal service areas that are difficult to resolve and may become sources of conflict. Local municipalities express reluctance towards sharing service management with neighbouring municipalities, citing concerns over the loss of control of such an important local service. Additional concerns include the decision to set a uniform price or different prices for each municipality within the same service area, as well as the possibility of privatising service management. Moreover, questions remain regarding whether the way in which many municipal aggregations are being implemented in Spain is resulting in optimal service areas. It should be noted that such aggregation processes entail a trade-off between economies of scale and dispersion diseconomies.

At the same time, it is recommended to create an independent regulatory body. Among other functions, the regulatory body could design a system of incentives and penalties to improve the technical and economic efficiency. The body would be responsible for setting performance targets according to the initial situation of each service area. Management decisions would be linked to these targets and not to local political interests. One element that could be considered is to condition aid and subsidies for infrastructure investment on meeting the objectives proposed in each service area. The absence of effective mechanisms for controlling the local management of municipal water services means that city councils lack incentives to improve the technical and economic efficiency of the service. Once the service areas resulting from the first proposed measure have been established, the independent regulator would promote management efficiency. An alternative measure would be the establishment of a water observatory; however, its impact would remain limited in scope. Observatories primarily contribute to greater transparency in the sector through the dissemination of data on service management, pricing structures, and service quality. In Spain, such initiatives are spatially constrained. At the regional level, only the Water Price Observatory in Catalonia exists. At the local level, a few smaller-scale initiatives exist, such as the Water Observatory of Emasesa (Metropolitan Water Supply and Sanitation Company of Seville) and the Water Observatory of Terrassa. In these cases, beyond improving transparency, citizen participation in debates and decision-making processes related to water services is also promoted [91].

Over time, regulatory bodies for urban water services, with varying scopes of authority and competencies, have been established in EU countries [92]: in Bulgaria (Energy and Water Regulatory Commission [EWRC]), Chipre (Water Regulatory Council [WRC]), Croatia (Croatian Regulatory Authority for Network Industries [HAKOM]), Denmark (Danish Water Regulatory Authority, integrated into Danish Competition and Consumer Authority), Slovakia (The Regulatory Office for Network Industries [URSO]), Estonia (Estonian Competition Authority [ECA]), Greece (General Secretariat of Natural Environment and Water [HEA]), Hungary (Hungarian Energy and Public Utility Regulatory Authority [HEA]), Ireland (Commission for Regulation of Utilities [CRU]), Italy (Regulatory Authority for Energy, Networks and Environment [ARERA]), Latvia (Public Utilities Commission [PUC]), Lithuania (The National Energy Regulatory Council [VERT]), Malta (Regulator for Energy and Water Services [REWS]), Poland (Polish Waters [WP]), Portugal (The Water and Waste Services Regulation Authority [ERSAR]), and Romania (National Regulatory Authority for Community Services of Public Utilities [ANRSC]). In Germany, Austria, Belgium, Slovenia, Finland, France, Luxembourg, the Netherlands, the Czech Republic, and Sweden there is no national regulator. Instead, observatories have been established at the national or regional level. For example, in France, there is the Observatoire National des Services d'eau et Assainissement, which compares the performance of urban operators using the following indicators: price, drinking water quality, network leakage losses, asset management, network renewal, financial management, and service quality.

Spain is the exception. It is the only country without an independent regulator or a national or regional water observatory. The Spanish Association of Water Supply and Sanitation, the leading industry association in the urban water sector—with over 300 members providing urban water cycle services to 80% of the Spanish population—has repeatedly advocated for the creation of a regulatory body. [93]. However, the Spanish government has not taken this step. The excessive decentralisation of water-related responsibilities across various levels of administration, the difficulty of reaching political agreements, and the high fragmentation of service areas, management models, and service characteristics are among the factors that help explain the challenges in establishing a regulatory authority.

There is a key issue with these two priority measures, as well as with others listed in Table 6. The initiative does not fall to the local government, i.e., to the city councils and provincial councils. The initiative for action falls to the Spanish Government.

## 6. Conclusions and Recommendations

In Spain, there are two very different realities regarding urban water cycle services. While the most populous service areas have sufficient resources to provide quality service, there are shortcomings in small municipalities where direct service management predominates. Currently, sectoral policies focus on promoting digitalisation, decarbonisation, and sustainability. There will likely be greater opportunities to advance these policies in more populous service areas, which will ultimately widen the gap in the provision of urban water cycle services. Without abandoning these lines of action, greater efforts must be made to address the structural problems in small municipalities.

This article analyses the causes of the problems surrounding urban water cycle service management in small municipalities. The study area is the province of Granada, a representative example of the existing situation throughout Spain. An initial conclusion is that the problems surrounding urban water cycle management in small municipalities are broad and complex. Consequently, a first recommendation is to implement action programs that include a broad set of measures.

The research has identified various causes of deficiencies in the management of urban water cycle services. Generally speaking, and as a second conclusion, it is noted that these

structural causes stem from a governance deficit. Therefore, as a second recommendation, it is necessary to conduct a comprehensive review of the regulatory and institutional framework regarding the management of urban water services. Until this important issue is addressed, many of the problems identified in service management in small municipalities cannot be resolved.

A third conclusion is the existence of a certain disconnection and lack of sensitivity on the part of the central administration regarding the situation of water services in small municipalities. Within the four-tier structure of Spanish public administration—central, regional, provincial, and municipal—the central government has delegated powers and responsibilities to city councils and provincial councils. Although this decentralisation of powers is consistent with the application of the European Union's principle of subsidiarity, it is not incompatible with greater involvement and sensitivity from central and regional governments. In this regard, decisive involvement by the central and regional governments is recommended for leading an action plan to foster a change in the regulatory and institutional context that addresses the current governance deficits. In fact, without greater involvement from central and regional governments in this regard, it will be difficult to correct the structural deficiencies and shortcomings detected in urban water cycle services in small municipalities.

In the current context of climate change—characterised by a trend toward lower and more irregular precipitation, as well as rising average temperatures—improvements in water resource management have become increasingly urgent to support adaptation to more adverse conditions. Consequently, within the urban water cycle, changes in the regulatory framework are guiding stakeholders in the polycentric water governance model in this direction. Notable examples include the recent Directive (EU) 2024/3019 of the European Parliament and of the Council of 27 November 2024 on urban wastewater treatment, which requires wastewater treatment in urban areas with more than 1000 inhabitants in all Member States [94], and Directive (EU) 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption, which raises water quality standards and sets out guidelines for the improved monitoring and efficiency of distribution networks [8]. In the coming years, it will be possible to assess whether adaptation to environmental conditions occurs at different speeds depending on the population size of service areas and therefore whether the gap between urban and rural areas in terms of urban water cycle services is narrowing or widening.

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