



# Does the Ownership of Water Utilities Influence Water-Saving Advice Provided to Service Users? An Analysis of the Spanish Water Sector

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## Abstract

This paper addresses the need to ensure the sustainable use of water, in line with the United Nations' Sustainable Development Goals. Using statistical methods, this paper analyses whether the ownership of the water utility is an explanatory factor for (1) the provision of water conservation advice on utilities' websites; and (2) how comprehensive this advice is in terms of tips on (i) installing efficient technology and (ii) adopting sustainable habits and behaviours. The paper focuses on the Spanish water industry, which is considered particularly appropriate for the analysis due to the coexistence of utilities with different ownership structures. The results reveal statistically significant differences according to the ownership of the operator and the size of the population served. For example, more private companies provide some advice on their websites, while public companies offer more tips per online advice section. The evidence should encourage national governments and regulatory authorities to pass a regulation that establishes guidelines on how these companies, both public and private, should provide water conservation advice on their websites.

**Keywords** Public companies · Private companies · Information campaigns · Sustainability · Water saving · Corporate Social Responsibility

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# 1 Introduction

## 1.1 Motivation

Promoting efficient use of water resources is crucial due to the worsening water scarcity worldwide, and the growing number of uses and users (Addo et al. 2019). In its 2030 Agenda, the UN dedicates Sustainable Development Goals (SDGs) 6 and 12 to finding a balance between providing universal access to water and ensuring its sustainable use (UN 2015). The responsibility for achieving this goal lies with all stakeholders, including utilities, regardless of the ownership of the operator. However, there is an ongoing debate on the desirability of private participation in the industry. The main argument against private ownership is that these companies prioritise a cost and market orientation over a customer/user orientation (Lobina 2013; Shen et al. 2016).

Previous research has applied different approaches to demonstrate the effect of ownership on water service provision. For example, studies have examined the relationship between ownership and prices (Wait and Petrie 2017), the perceived quality of the service (Romano and Masserini 2020), or the loss of water through networks (Martínez-Espiñeira et al. 2017). Yet, there is little evidence on the relationship between ownership and the promotion of sustainable behaviour by service users; some of the few studies in this vein include those by Barrett and Wallace (2011) and Romano et al. (2014).

Educational campaigns constitute a key pillar of water conservation policies in urban environments (Addo et al. 2019). Water utilities recognise that such campaigns are one of the most effective means of reducing per capita water consumption (Tortajada et al. 2019), generating not only cost savings for users but also social and environmental benefits. Moreover, EU Directive 2020/2184 stipulates that water utilities must provide online advice to consumers, including tips on how to reduce water consumption. Consequently, any assessment of their performance must go beyond questions of profitability and financial solvency. However, in the absence of regulatory agencies, the question arises as to whether ownership has a bearing on the design and implementation of information campaigns for service users. This is an important issue because the SDGs are not built on economic logic, but rather are guided by a clear social and environmental purpose. Water utilities are not only central to improving the efficient use of water (SDG 6.4), but can also play a role in achieving SDG 12.8, which is aimed at ensuring that people everywhere have the relevant information and awareness for sustainable development.

Spain is selected as a case study because it has a Mediterranean climate, and the conservation of its inland ecosystems requires changes to the way people use water (Latinopoulos et al. 2016). Moreover, Spanish water utilities are not obligated to promote the efficient use of water to their customers<sup>1</sup> and, although municipalities are responsible for ensuring service provision, they can choose to delegate water supply management to public, private and mixed-capital companies.

## 1.2 Objective and Hypotheses

This paper aims to contribute to the existing literature on the sustainable use of water and reduction of household water consumption by analysing whether Spanish water

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<sup>1</sup> For example, English water utilities have been obligated to promote the efficient use of water to their customers since 1996 (Sharp 2006).

utilities seek to encourage efficient water consumption through online information campaigns, and by identifying the extent to which this can be explained by the ownership of the utility. Specifically, it examines whether ownership is an explanatory factor for (1) the provision of water conservation advice on utilities' websites; and (2) how comprehensive these sites are in terms of disseminating advice on (i) installing efficient technology and (ii) adopting sustainable habits and behaviours. To this end, a logistic regression, a one-way analysis of variance (ANOVA), and an ordinary least squares (OLS) regression analysis are applied to a sample of 341 Spanish service areas.

Considering the inherent contradiction between the pursuit of profit and the promotion of efficient consumption behaviour (Howarth 2011), the main hypothesis to be tested is whether the private company provides less water-saving advice to service users than the public operator. As a counterpoint to this rationale, it could be the case that Corporate Social Responsibility (CSR) overrides the differences between public and private management when it comes to offering water-saving advice.

### 1.3 Contribution of the Research and Structure

The main contribution of this paper is that it is the first study on the relationship between ownership and the content of online information campaigns to analyse the two dimensions of conservation messaging identified by the literature on the effectiveness of educational campaigns (Nauges and Wheeler 2017). The research therefore adds to the ongoing debate about the influence of ownership on the performance of water utilities.

This paper is structured as follows. Section 2 offers a review of the literature. Section 3 describes the methodology. The results and discussion are presented in Section 4. Finally, Section 5 reports the conclusions and provides some recommendations.

## 2 Literature Review

### 2.1 Ownership and CSR

The behaviour of public enterprises is considered to be driven by criteria that go beyond the economic logic of profit-maximisation (Megginson and Netter 2001). Guided by the general interest, the ultimate goal of a public shareholder is to maximise profits while meeting the needs and expectations of citizens. In terms of water services, the general interest from the point of view of environmental sustainability would be the preservation of water resources, avoiding waste and over-consumption. As such, public utilities are expected to pursue cost recovery but not profits (Lauesen 2011), and are likely to be more driven by the goals of raising environmental awareness and conservation (Shen et al. 2016). In order to legitimise their actions and existence, public utilities have strong incentives to disclose more social and environmental information than private firms do (Cormier and Gordon 2001). Therefore, they are expected to share more water-saving advice.

On the other hand, the role of private operators in the water sector can be paradoxical. According to various perspectives, such as the neoclassical view, the objective of operating a business should be profit-maximisation. Indeed, Friedman (2007) argues that this is a firm's sole responsibility. Some authors claim that incorporating

objectives beyond profit-maximisation runs counter to the principles of the market economy (Henderson 2004). When it comes to the private provision of water services, this creates the challenge of reconciling profit-maximisation with social and environmental demands (Rahman et al. 2022), because private companies should not neglect their social and environmental responsibilities when managing public services such as the water supply (Lobina 2013; Cabrera et al. 2022).

Contrary to neoclassical approaches, Elkington (1998) claims environmental and social issues should be as important as economic ones. In this context, CSR emerges as an integrative model for business ethics, combining economic, social and environmental objectives (Diop and Bah 2018). According to Lantos (2001), CSR should focus on two aspects: (1) preventing any harm that could result from business activities; and (2) achieving strategic business objectives.

Implementing CSR implies that companies have decided to go beyond the minimum legal requirements and collective bargaining obligations, striving to address the needs of society (The British Academy 2021). The motivation behind this behaviour can be interpreted in two ways. First, according to the resource-based view, companies may believe that being seen as socially responsible will give them a competitive advantage, enabling them to achieve better economic performance because good relationships with stakeholders can lead to higher financial returns (Li et al. 2020). Second, legitimacy and stakeholder theories focus on external pressures to explain engagement in CSR activities. For private companies, CSR could be a way to reconcile their economic objectives and their social obligations, because companies use the disclosure of CSR activities to demonstrate their commitment to socially desirable behaviour (Branco and Rodrigues 2008).

However, private water utilities may not have good incentives to disseminate conservation advice. Educational campaigns seek to achieve considerable water savings by changing people's water-use habits (García-Valiñas et al. 2015), thereby lowering their profits in the short term (Argento et al. 2019). Instead, they may well turn to CSR strategies that do not come into conflict with their economic objectives, such as sustainability reports (Lauesen 2016), which can bolster their financial rather than social prestige (Markopoulos et al. 2020).

CSR can also be applied by public companies, although the specific nature of their stakeholders must be considered. Unlike in the for-profit sector, public enterprises show an interdependence of stakeholders (Lauesen 2011), with citizens being their ultimate stakeholders (Greiling et al. 2015). Consumers are of paramount importance in modern water and sanitation services; especially because they are simultaneously customers and potential voters with the power to elect politicians (Lauesen 2011). Thus, the use of pricing instruments, although effective in reducing consumption, may be less commonly used by public companies due to the negative effect on the political prospects of those who govern (Klien 2014), motivating them to implement alternative demand management strategies. Conversely, in private organisations, there is a natural gap between stakeholders' interests (Crane et al. 2008), usually in terms of profits, which discourages the promotion of consumption efficiency and encourages the use of pricing instruments. Finally, information campaigns that motivate households to implement efficient water-use behaviour and that disseminate conservation advice can be understood as social marketing products (Romano et al. 2014). As such, they can be analysed as a CSR instrument, given that they aim to influence social behaviour to benefit users and society as a whole, including the environment, rather than directly benefitting the company itself (Zainuddin and Gordon 2020). However, the relationship between ownership and these types of CSR initiatives remains understudied.

## 2.2 Ownership and Promotion of Sustainable Behaviours

The literature shows that, regardless of ownership, the promotion of sustainable water behaviour is most common in periods of drought and water scarcity (Syme et al. 2000). Therefore, companies in areas with higher levels of water stress are expected to have greater incentives to disseminate water conservation advice. During the early stages of droughts, Kallis et al. (2010) note that public systems are more proactive than their private counterparts in requesting sustainable behaviours from their users. Moreover, Howarth (2011) shows that there is no financial incentive for private water companies to actively reduce demand.

In general, there is evidence that public sector involvement in the water supply is positively associated with promoting sustainable water use. For example, in England, privatised utilities were found to be the only ones that did not offer support for installing efficient showerheads (Barrett and Wallace 2011).

## 2.3 Website Information and Promotion of Efficient Use of Water

Finding solutions to alleviate water stress requires citizens to become knowledgeable about what they can do to reduce their demand (Walker et al. 2015). The literature points to the importance of company websites in the dissemination of sustainability information (Adams and Frost 2006; Rahim and Omar 2017). They offer the advantage of easily accessible, up-to-date, low-cost information dissemination, and wider coverage (Adams and Frost 2006). Moreover, Delorme et al. (2003) show how consumers react favourably to website campaigns designed to educate the population on better water management practices. In this vein, Directive 2020/2184 stipulates that consumers must be provided with a link to a website containing advice on how to reduce water consumption. As such campaigns are especially cost-effective for larger target populations, we would expect to find a positive relationship between the size of the population served and the online provision of conservation tips.

However, the literature to date has not explored whether water utilities seek to encourage a reduction in household water consumption through website information campaigns. The scarce empirical evidence on this issue—from California (Kallis et al. 2010) and Italy (Romano et al. 2014)—suggests that public companies make greater efforts to promote water conservation measures on their websites, but there are no studies on the type of messages disseminated, which is the subject of this research.

# 3 Methodology

## 3.1 Fieldwork

The study covers 341 service areas in Spain, which together account for 67.27% of the country's population. All service areas with more than 20,000 inhabitants were included in the sample.

Websites are representative of water utilities' broader promotion of water conservation and the online information they provide is thus an appropriate measure of their efforts in this area (González-Gómez et al. 2022). Consequently, the websites of the relevant water companies were searched for information on conservation and water-saving tips. Content

analysis was applied to web-based documents, which is a well-established research technique (McMillan 2000). First, a search was conducted to determine whether companies had a specific section on their website dedicated to water-saving tips, followed by a broader search across the website. In cases where no such information was found, companies were contacted through different channels—telephone, social media and email—to confirm whether this information did in fact exist. Note that the choice was made to group municipalities into service areas, because the unit of analysis is not the individual municipality, but the website of the water service provider. Table S1, available in the supplementary material, lists all the municipalities/service areas and their characteristics included in the analysis.

Data on the population supplied were obtained from the Spanish National Institute of Statistics (INE 2021). Data on levels of water stress were collected from the Water Exploitation Index Plus for river basin districts (EEA 2021).

### 3.2 Variables Included in the Study

The variables used in the study are shown in Table 1, noting the stage in which they are incorporated into the analysis. Table 1 also states the hypotheses indicating the expected direction of the relationship, and provides the descriptive statistics for both stages of analysis.

#### 3.2.1 Dependent Variables

To achieve the overall research objective, a two-stage analysis is carried out. Four dependent variables are investigated, depending on the stage of analysis.

##### First stage

- *tips\_presence* (explanation in Table 1).

##### Second Stage

- *efficient\_tech*: an ordinal index that accounts for the presence of tips related to four water-efficient household appliances.
- *sust\_habits*: an index that includes 17 pro-environmental behaviours and habits related to water use.
- *water\_saving\_tips*: a habits index constructed by summing the individual scores of *efficient\_tech* and *sust\_habits*.

The list of tips and the source chosen to build each variable can be found in Table 2.

#### 3.2.2 Independent Variables

The independent variables considered in the study are *ownership*, *water stress* and *population*.

*Ownership* is categorised in two different ways, depending on the stage of the analysis. In the first stage, four dummy variables are included. Within the public ownership category, we distinguish between areas managed directly by the local town council—*municipal\_service*—and those managed by a public company—*public\_enterprise*. However, in the second stage, these

**Table 1** Description of the variables and their descriptive statistics by stage of analysis

Variable	Description	Hypotheses		Descriptive statistics of the variables				
		1 <sup>st</sup> stage	2 <sup>nd</sup> stage	1 <sup>st</sup> stage (N = 341) / 2 <sup>nd</sup> stage (N = 277)	Mean (%)	Std. Dev.	Min	Max
Independent ownership	<i>municipal_service</i>	Dummy variable equal to 1 if the service is managed directly by the local council, and 0 otherwise	+	Not used	5.57 / Not used	0 / Not used	0 / Not used	1 / Not used
	<i>public_enterprise</i>	Dummy variable equal to 1 if the service is managed by a 100% public enterprise, and 0 otherwise	+	Not used	17.89 / Not used	0 / Not used	0 / Not used	1 / Not used
	<i>public</i>	Dummy variable equal to 1 if the service is managed by either a municipal service or a public enterprise, and 0 otherwise	Not used	+	Not used / 14.89	Not used / 0	Not used / 0	Not used / 0
	<i>private</i>	Dummy variable equal to 1 if the service is managed by a 100% private enterprise, and 0 otherwise	-	-	62.46 / 69.67	0	0	1
	<i>PPP</i>	Dummy variable equal to 1 if the service is managed by a public-private partnership, and 0 otherwise	-	-	14.08 / 15.52	0	0	1

Table 1 (continued)

Variable	Description	Hypotheses		Descriptive statistics of the variables			
		1 <sup>st</sup> stage	2 <sup>nd</sup> stage	Mean (%)	Std. Dev.	Min	Max
<i>water stress</i>	<i>low</i> Dummy variable equal to 1 if the region served suffers from low-medium water stress, and 0 otherwise	-	-	6.45 / 3.97		0	1
		+	+	7.04 / 5.41		0	1
		+	+	50.44 / 54.87		0	1
		+	+	36.07 / 35.74		0	1
<i>population</i>	<i>Population</i> Population variable expressed quantitatively			93,371.23 / 102,942.4	374,424.4 / 414,177	19,974	6,545,725
		+	+	31.96 / 33.94		0	1
Dependent	<i>Presence of tips web page</i> Dummy variable equal to 1 if the population served is larger than 50,000 people, and 0 otherwise	-	-	68.03 / 66.06		0	1
		<i>Used</i>	<i>Not used</i>	81.23	0.3910	0	1



Table 1 (continued)

Variable	Description	Hypotheses		Descriptive statistics of the variables			
		1 <sup>st</sup> stage	2 <sup>nd</sup> stage	Mean (%)	Std. Dev.	Min	Max
		1 <sup>st</sup> stage (N=341) / 2 <sup>nd</sup> stage (N=277)					
<i>web_page_content</i>	<i>water_saving_tips</i> Indicator of water conservation tips (explanation in the text)	Not used	Used	Not used / 0.3604	Not used / 0.2143	Not used / 0	Not used / 0.8235
	<i>efficient_tech</i> Index capturing tips related to efficient technology (explanation in the text)	Not used	Used	Not used / 0.25	Not used / 0.3451	Not used / 0	Not used / 1
	<i>sust_habits</i> Index capturing tips on sustainable habits (explanation in the text)	Not used	Used	Not used / 0.3943	Not used / 0.2157	Not used / 0	Not used / 0.8462

**Table 2** Tips considered to build the indicators

Variable		Description
<i>Water_saving_tips</i>	<i>efficient_tech</i>	Water-saving devices in taps <sup>a</sup> Single-lever/ thermostatic taps <sup>a</sup> Water-saving devices in toilets <sup>a</sup> Water-efficient household appliances (Triple A) <sup>a</sup>
	<i>sust_habits</i>	Repair and control leaks <sup>a</sup> Reuse cooking water for other uses (e.g. watering the plants) <sup>a</sup> Collect cold water in a bucket for other uses while waiting for water to warm up <sup>a</sup> Have a bottle with cold water in the fridge so as not to let the water run <sup>a</sup> Defrost food in advance to avoid doing so under the tap <sup>a</sup> Fill the sink before washing the dishes <sup>a</sup> Use the washing machine and dishwasher with a full load <sup>a</sup> Close the stopcock a little to reduce the flow of the taps <sup>a</sup> Keep a wastepaper basket in the bathroom to avoid using toilet as a bin <sup>a</sup> Turn off the water while brushing teeth <sup>b</sup> Turn off the water while soaping <sup>b</sup> Tips on shower frequency <sup>b</sup> Tips on shower duration (or time control) <sup>b</sup>

<sup>a</sup> Habits and technology investments adopted from the 2008 Households and Environment survey (INE 2008);

<sup>b</sup> Habits adopted from González-Gómez et al. (2022)

two variables are grouped together into *public*. Considering the management of private companies, the variables *private* and *PPP* (public private partnership) are introduced. These two variables, used in both stages, capture the areas managed by wholly private companies and public-private partnerships, respectively.

*Water stress* is included because it can be considered a proxy for the need to promote sustainable water use to ensure reserve flows and water security (Carvalho and Marques 2011). It is disaggregated into four categories, as indicated by the EEA (2021). Lastly, *population* is used as a proxy variable for the size of the operator and the degree of professionalisation in the management of the company. Following the UN's (2017) recommended classification of localities by size class, we differentiate between areas with more than 50,000 inhabitants and smaller areas.

### 3.3 Analytical Strategy and Data Analysis

#### 3.3.1 First Stage

In the first stage, we checked whether each service area had water conservation sections on their websites. The objective of this stage is to determine whether ownership is an explanatory factor for the presence/absence of these sections. To that end, a logistic regression is applied to the set of 341 observations. The general specification of the estimated equation is as follows:

$$\Pr(\textit{presence of tips}_i = 1) = F(\textit{ownership}_i, \textit{waterstress}_i, \textit{population}_i)$$

### 3.3.2 Second Stage

The second stage focuses on the content of the sections dedicated to promoting sustainable water use. Operators that do not provide advice are eliminated from this stage of the analysis. As a result, 277 service areas serving 60.24% of the Spanish population are analysed.

The objective of this stage is to determine whether ownership influences the type of content offered. According to the literature on the effects of educational campaigns, water savings can be achieved through the adoption of sustainable habits and behaviours and/or the installation of water-saving technologies (Nauges and Wheeler 2017). We thus examine the effect of the ownership on the dissemination of tips differentiating between tips on sustainable behaviour and habits—*sust\_habits*; tips on the use of efficient technology—*efficient\_tech*; and all tips in general—*water\_saving\_tips*, which is the sum of the two previous variables.

We perform an ANOVA, using the Bonferroni test for the post hoc analysis to compare the mean number of tips provided by the three ownership categories (public, private and PPP). The influence of *ownership* on the promotion of water-saving measures is analysed with an OLS regression analysis. The estimations were performed heteroskedasticity-robust standard errors. The general specification of the estimated equation is as follows:

$$\textit{water saving tips}_i = f(\textit{ownership}_i, \textit{water stress}_i, \textit{population}_i)$$

All analyses were conducted first for the whole set of tips, and then again distinguishing between technology-based water conservation measures and those based on behavioural change. Figure 1, available in the supplementary material, presents a flowchart summarising the methodology.

## 4 Results and Discussion

### 4.1 Influence of Ownership on the Presence of Water Conservation Advice on Websites (Stage 1 of the Analysis)

Table 1 contains summary statistics on all variables used in both stages. The values of the population variable indicate that the size of the population served differs markedly between service areas, illustrating an industry in which small local units coexist with very large service areas. Concerning ownership, the most frequent type is *private*, accounting for more than half of the sample. At the other extreme, the least common is *municipal\_service*, with less than 6% of the sample.

Despite not being obligated to promote the efficient use of water to their customers, water utilities' websites seems to be a widely-used instrument to inform users on how to reduce their water consumption in Spain. Only 19% of our sample do not provide any water-saving tips, compared to 57% of Italian water utilities (Romano et al. 2014). Of the service areas in our sample that provide no information, 23.4% are managed by *municipal\_service* and 7.8% by *PPP* companies, while the most represented management types in this regard are *private* (31.3%) and *public\_enterprise* (37.5%).

Table S3, available in the supplementary material, shows that users served by wholly public entities are less likely to find tips on how to conserve water when visiting their water supplier's

website. Indeed, about 80% of the *municipal\_service* websites in our sample lacked such information, while *public\_enterprise* shared conservation tips in just over 60% of the corresponding service areas. In comparison, *PPP* and *private* dedicate space on their websites to water conservation information in 90% of the corresponding service areas. This could indicate that private management is not setting its sights purely on profit-maximisation for shareholders, but is also seeking to provide environmental and social benefits (Elkington 1998).

Table 3 indicates that *ownership* is a significant variable in explaining the provision of online water-saving advice ( $p < 0.01$ ). *Private* users are about four times more likely to find water conservation advice on their supplier's website than *municipal\_service* users. Our results, in line with Giacomini et al. (2020) and Argento et al. (2019), who note that *municipal\_service* had a lower percentage of posts disclosing environmental issues, show that public management is less likely to provide online advice than privately owned utilities are.

Despite expecting a negative relationship for private and PPP, all categories of ownership are found to have a positive and significant influence, providing evidence of the effect of CSR. Another possible explanation can be found in the distribution of ownership by population density of the service areas. Additional calculations reveal that 76.6% of the analysed websites without water conservation advice correspond to areas with fewer than 50,000 inhabitants, which happen to be less profitable (González-Gómez et al. 2013) and where *municipal\_service* tends to be more common. However, these data contrast with evidence from California, where public companies are more likely to proactively ask their users to reduce consumption (Kallis et al. 2010).

*Population* is also significant. The analysis shows that populations of under 50,000 have a negative effect on *tips\_presence*, as predicted in the hypothesis ( $b = -1.348$ ,  $p < 0.01$ ). Small utilities are less predisposed to this and other voluntary commitments, presumably due to limited resources (Roeger and Tavares 2020), even though service managers in small

**Table 3** Logit analysis for *tips\_presence*

		<i>tips_presence</i>
<i>Ownership</i>	<i>public</i>	1.571*** (0.588)
	<i>private</i>	3.816*** (0.586)
	<i>PPP</i>	3.138*** (0.775)
<i>Water stress</i>	<i>medium</i>	1.045 (0.683)
	<i>high</i>	2.372*** (0.552)
	<i>extreme</i>	2.082***
<i>Population</i>	< 50 M	-1.348*** (0.441)
	<i>Constant</i>	-2.274*** (0.732)
	N	341
	Pseudo-R <sup>2</sup>	0.2738
	$\chi^2$	65.59

Robust standard errors in parentheses

\*\*\* $p < 0.01$

populations perceive website campaigns as a cost-effective strategy (Romano et al. 2013). Our results are in line with García-Sánchez et al. (2013), who found a positive relationship between population size and the disclosure of sustainability information by local governments, due to the variety of stakeholders they have to deal with. This finding is consistent with previous literature that suggests that large organisations tend to report more environmental information (Romano et al. 2014) because they face more pressure from society to behave in a socially responsible way (Argento et al. 2019; Garde-Sánchez et al. 2018). In fact, additional calculations show that 12 of the 15 service areas without online advice managed by a *municipal\_service* are located in towns with fewer than 50,000 inhabitants, and most *private* operators without information campaigns are located in less populated areas. Another explanation could be that companies have less interest in reducing water consumption, especially when they have fewer customers, as it would entail a drop in revenues and net profits (Howarth 2011).

The expected relationship for *water stress* is also confirmed, but only *extreme* and *high* are significant ( $p < 0.01$ ). Although areas that have *high* water stress values seem to have a slightly more significant effect than those with *extreme* values, our findings show that suffering from water stress is related to the provision of advice, as reported by Lu et al. (2019).

#### 4.2 Influence of Ownership on the Content of Water Conservation Advice on Websites (Stage 2 of the Analysis)

In terms of the kind of advice provided, *sust\_habits* tips (0.3943) are more common than tips on *efficient\_tech* (0.25). A possible explanation for this finding is that behavioural changes involve less monetary sacrifice for users (Hannibal et al. 2019). The focus on advice of a behavioural nature is in line with the aim of encouraging users to be more active in making sustainable use of water (Sharp 2006). In this vein, Kumar et al. (2017) show how attitude positively affects the purchase of sustainable products such as water-saving appliances. Conversely, water utilities officials in four European countries rated campaigns promoting water-saving technologies as the second most effective way of reducing water consumption, behind the renovation and maintenance of networks (Stavenhagen et al. 2018).

The results of the ANOVA and the Bonferroni multiple comparison test (Table S4, supplementary material) reveal statistically significant differences between different ownership categories in terms of the mean values of the index of tips ( $F = 10.17$ ,  $p < 0.01$ ). The differences are between the recommendations provided by *public* and those provided by *private* ( $p < 0.01$ ) and *PPP* ( $p < 0.01$ ), with no significant differences observed between *PPP* and *private*. Consistent with the hypothesis, the data show that *public* utilities offer more water-saving advice on average than *private* and *PPP*. A reason for this could be that private companies' rates per cubic metre are more expensive on average (Martínez-Espiñeira et al. 2012). Consequently, if they were to achieve a reduction in consumption it would mean a more pronounced loss of profit for them than for public companies. Alternatively, public utilities are more vulnerable to external pressures because of the nature of their stakeholders (García-Sánchez et al. 2013).

A second explanation could be that public objectives transcend the logic of economic profit (Megginson and Netter 2001), so instead of resorting to pricing instruments, public companies prefer to encourage more sustainable behaviour through the information they provide on their website (Romano et al. 2013, 2014). However, they may also be driven by the need to rely on strategies other than pricing, due to the negative political

impacts on local government, as suggested by Suárez-Varela et al. (2015). Consequently, given the political strategy of offering low prices and the prevailing demand management approaches, providing information on how to reduce water consumption emerges as a win-win tool for the three stakeholders involved: politicians, users, and the environment. In the CSR framework defined by Lantos (2001), such an approach would allow politicians, who are the ultimate price-setters, to achieve their strategic objective of maintaining a good image, avoiding rate increases and contributing to the sustainable use of water resources.

The results are in line with those of Kallis et al. (2010) and Romano et al. (2014, 2013), who report that public companies show a greater tendency to promote the reduction of household water consumption than private ones. It is remarkable that one of the largest business groups in the industry, covering 108 service areas, only offers a single piece of advice in 48.15% of the cases. Specifically, the advice is “do not use the toilet as a waste bin”. This advice has more of an environmental impact than a consumption reduction effect, which ultimately benefits the company by reducing water pollution. Consequently, it helps the company to prevent environmental damage resulting from its business activities, while allowing it to reduce costs (Lantos 2001). Their water conservation reporting is in line with the level of maturity in CSR found in Denmark (Lauesen 2016), where companies use sophisticated tailored measures in CSR reports following different incomparable standards, but do not promote sustainable behaviour in the way defined by the Brundtland Report. This finding might suggest that they recognise the social importance of providing such a section in their official communications, but do not have sufficient incentives to do so effectively. However, their behaviour is not consistent with recent evidence showing that the public want CRS messages from firms (Saxton et al. 2019).

On the other hand, when breaking down the variable *water\_saving\_tips*, the findings are similar for the variable *sust\_habits* ( $F=3.68$ ,  $p<0.05$ ), in line with the hypothesis. Although *public* companies again offer significantly more tips than non-public companies do, the differences are slightly smaller. The reason for this may be that these activities involve a higher level of personal sacrifice (Ananga et al. 2019) and the general public is often less receptive to these messages when they are delivered by private companies (Kallis et al. 2010). In fact, the literature points out that greenwashing concerns negatively influence sustainable purchase intention (Rausch and Kopplin 2021), and therefore the adoption of sustainable behaviour.

ANOVA results for the variable *efficient\_tech* are not presented because the assumption of homogeneity of variances is not met, but the Kruskal-Wallis test suggests that there are again significant differences between ownership groups ( $\chi^2(2)=32.993$ ,  $p=0.0001$ ). Similarly, for this set of variables, *public* offers substantially more tips.

Table 4 shows the results of the OLS estimations relating to the determinants of the content of the advice for each of the dimensions of the educational campaigns. Again, all categories of ownership are found to be significant and the hypotheses are confirmed. *Private* is found to have negative effect on the online promotion of water conservation measures ( $b=-0.1691$ ,  $p<0.01$ ); both for tips based on efficient technologies ( $b=-0.412$ ,  $p<0.01$ ) and those related to sustainable habits ( $b=-0.094$ ,  $p<0.01$ ). The results are very similar in the case of *PPP*, which is also negatively associated with the number of water-saving tips provided ( $b=-0.137$ ,  $p<0.01$ ). Nonetheless, results reveal a more significant effect on tips related to efficient technologies ( $b=-0.247$ ,  $p<0.01$ ) than on the promotion of sustainable habits ( $b=-0.103$ ,  $p<0.5$ ).

Due to the effectiveness of water-saving devices in reducing water consumption (Stavenhagen et al. 2018), the results underline the idea that water companies are not interested in promoting such devices because a reduction in consumption would lead to a decrease in revenues and profits. On the supply side, the adoption of conservation technologies is rendered

**Table 4** Regression models of water-saving tips

		<i>water_saving_tips</i>	<i>efficient_tech</i>	<i>sust_habits</i>
<i>Ownership</i>	<i>private</i>	-0.169*** (0.0368)	-0.412*** (0.0642)	-0.0940** (0.0380)
	<i>PPP</i>	-0.137*** (0.0518)	-0.247*** (0.0839)	-0.103** (0.0506)
<i>Water stress</i>	<i>medium</i>	-0.179** (0.0850)	-0.240** (0.113)	-0.161* (0.0909)
	<i>high</i>	-0.163** (0.0714)	-0.123 (0.0937)	-0.175** (0.0728)
	<i>extreme</i>	-0.134* (0.0720)	-0.163* (0.0961)	-0.125* (0.0738)
<i>Population</i>	< 50,000 habitants	0.00934 (0.0271)	-0.000683 (0.0408)	0.0124 (0.0282)
	<i>Constant</i>	0.641*** (0.0788)	0.716*** (0.114)	0.618*** (0.0796)
	N	276	276	276
	F	5.01	8.27	2.89
	R <sup>2</sup>	0.094	0.178	0.058

Robust standard errors in parentheses

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

unattractive by operators' interest in short-term profit (Friedman 2007). In addition, there is evidence that users are less receptive to conservation advice from private suppliers (Barrett and Wallace 2011). This may be another reason that partially explains why *private* and *PPP* provide less comprehensive advice, even though these types of operators have comparatively more websites with water-saving tips.

Although more populated areas are found to have more tips available on suppliers' websites, *population* is not found to significantly influence the content of information campaigns to promote the sustainable use of water.

Contrary to the Italian evidence (Romano et al. 2014), our results show that all water stress categories have a negative effect for each dependent variable. Although water conservation campaigns attract less public resistance in times of water shortages (Katz et al. 2016; Hannibal et al. 2019), the hypothesis that water stress has a positive effect on the provision of more comprehensive information campaigns is rejected. In fact, not all the categories are consistently significant: while *medium* and *extreme* are found to be significant in relation to all the dependent variables, *high* is not significant in relation to *efficient\_tech*. This is especially noteworthy because water stress does have a significant positive effect on the presence of water-saving advice on websites (stage 1).

The evidence indicates that territorial characteristics are more important than water stress conditions, suggesting that companies use these sections on websites as a greenwashing tool (Lauesen 2016). Therefore, confirming the hypothesis, results suggest that public utilities provide better water-saving advice than their private counterparts do. Since these companies do not have to compete *in* the market, but rather *for* the market, it may not seem rational to consider the interests of the environment, users and the community when attempting to create competitive advantages that differentiate them from competitors (Branco and Rodrigues 2008).

## 5 Conclusions, Policy Recommendations and Future Research Directions

This paper studies whether ownership is a determinant of the presence of online information aimed at reducing household water consumption, and the type of content of that information. To do so, it uses data collected from the websites of 341 Spanish management areas. The results can be usefully applied to other contexts where a lack of competition due to a monopoly held by operators might lead water utilities to neglect environmental issues, as may be the case in Italy, Portugal or the Netherlands.

Contrary to the initial hypothesis, results indicate that private companies do seem to recognise the importance of dedicating space on their websites to providing advice to their customers (Tortajada et al. 2019). Indeed, 90% of these companies provide this information on their website, which may be due to a willingness to adhere to CSR practices. On the other hand, fewer public companies have websites with advice, especially when they supply smaller populations, possibly indicating a lack of resources.

In the second stage of the analysis, the results confirm that when public companies do provide advice, their website is significantly more comprehensive than that of private companies. Companies with private ownership provide less thorough advice on water-saving behaviour and efficient technology. Taken together with the results from the first stage, this could suggest that such companies provide advice sections as a greenwashing tool (Lauesen 2016). Thus, while CSR incentivises private companies to create a space with at least one water conservation tip, they provide considerably fewer tips on their websites than public utilities do. This evidence calls into question their commitment to engage in environmental awareness-raising processes and actively contribute to SDG target 12.8, at least in the case of household water management.

The results suggest that public administrations should play a proactive role in raising awareness of efficient urban water use. An additional recommendation for policymakers would be to pass a regulation that establishes guidelines on how companies, both public and private, should provide water conservation advice on their websites. For example, in England, water utilities are obligated to promote the efficient use of water to their customers (Sharp 2006). Such a measure would help to override the economic-environmental conflict by decoupling profits from consumption.

Considering that Directive 2020/2184 promotes the use of websites to provide water-saving tips, the scope of this study is limited to information available on corporate websites. However, in further research, it would be interesting to explore utilities' communication via other media such as social networks, where 82% have accounts (AEAS 2021).

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**Data Availability** The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request

## Declarations

**Ethical Approval** The authors declare that they have no conflict of interest.

**Consent to Participate** The authors declare that they are aware of and consent to their participation on this paper.

**Consent to Publish** The authors give their full consent for the publication of this manuscript.

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