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From scarcity problem diagnosis to recycled water acceptance: A perceptive-axiological model (PAM) of low and high contact uses

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ABSTRACT

Water scarcity is a major problem that affects a greater number of countries every year. A possible solution is using recycled water systems. However, to implement the use of recycled water, public acceptance is needed. In this study, we propose a perceptive-axiological model (PAM) to understand the reasons for public acceptance or rejection of recycled water. This is the first model to jointly consider three conceptual dimensions: the diagnosis of the environmental situation, the axiological influence and the public perceptions regarding recycled water. The sample in this study consisted of 726 randomly selected participants who completed an online questionnaire. A key factor considered was the type of water use (low- or high-contact). Additionally, the model's ability to predict acceptance in regions of high and low water stress was tested. The model showed good fit and predictive capacity for both low ($R^2 = .272$) and high ($R^2 = .501$) contact uses and partial equivalence between regions. Threat perception was the most distal variable in the model which, together with identity, affected the attribution of responsibility. These variables, along with trust in scientists, affected the three direct predictors of acceptance: perceived health risks, moral obligation, and cost-benefit analysis. Perceived health risk was the most important predictor in both types of contact ($\beta = -.642$ in high-contact, $\beta = -.388$ in low-contact uses). Moral obligation had a greater impact in high-contact ($\beta = .170$) than in low-contact ($\beta = .099$) uses; the opposite outcome occurred with respect to costs-benefit analysis ($\beta = .067$ in high-contact, $\beta = .219$ in low-contact uses). The PAM offers a general framework that identifies the importance of the three dimensions and how they interact with each other, which facilitates the development of strategies to increase acceptance. On the one hand, the PAM works as a tool to assess the profile of a specific population and, on the other hand, it highlights the specific factors which are the best suited for interventions to increase public acceptance.

1. Introduction

The global freshwater shortage situation is alarming. Of the 171 countries for which estimates of the degree of water stress are available, 31 show water stress levels between 25 and 70%, 22 countries have values above 70%, and 11 have values of 100% (United Nations, 2018).

Amongst the different strategies aimed at guaranteeing water supplies, the use of recycled water is one of the most promising. Recycled water is treated wastewater (McOmber et al., 2021). The UN (2017) recognised this strategy for its value both in reducing water consumption and in the recovery of its nutrients.

Despite the success of water recycling efforts in some parts of the world (Lee and Tan, 2016; Sanchez-Flores et al., 2016), there are sectors of the population that still do not accept the practice. In fact, public opposition has paralyzed some of water recycling projects (Brouwer et al., 2015; Ellis et al., 2021; Hurlimann and Dolnicar, 2010).

Therefore, understanding the reasons for the acceptance and rejection of recycled water is a key issue. Studies in the field have highlighted the importance of several variables, ranging from threat perception (Mankad and Tapsuwan, 2011) to the perception of risks (Domènech and Saurí, 2010) and benefits of recycled water (Hurlimann et al., 2008), as well as public trust in science (Fielding et al., 2015). The information offered by these studies is highly relevant; however, it should be noted that the variables were analysed individually. Prior studies have not assessed the interaction between the different variables and the contextual conditions that affect the acceptance of recycled water using an integrated model.

The objective of this study is to integrate these conditions by

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verifying a model of acceptance for recycled water that is based on three fundamental premises. Firstly, for the use of recycled water to be considered, it is necessary to perceive that a problem of water scarcity exists and that it poses an imminent threat to the planet and to people's wellbeing (Garcia-Cuerva et al., 2016; Gómez-Román et al., 2020). Without this understanding, there would be no reason to change current water-related behaviours. Secondly, if this perception exists, it should be translated into the development of pro-environmental values and identity. These factors would contribute to the acceptance of behaviours linked to environmental commitment (de Groot and Steg, 2007; Whitmarsh and O'Neill, 2010). Thirdly, the population may see advantages, disadvantages or both relating to the use of recycled water. Depending on each person's analysis, a person's acceptance of recycled water will be greater or lesser (Baghapour et al., 2017; Hurlimann, 2006). These premises can be grouped into three conceptually distinct dimensions: (a) the diagnosis of the environmental situation, (b) the axiological influence, and (c) the perception of recycled water.

1.1. The diagnosis of the environmental situation: threat perception and attribution of responsibility

People can change their attitudes and behaviours if they feel that there are sufficient reasons to justify a change; for example, a new water scarcity problem that must be addressed might shift public perceptions about recycled water. In this sense, cases where the public experience significant water restrictions contribute to a higher degree of acceptance of recycled water (Dolnicar et al., 2011; Etale et al., 2020). Other authors have pointed out that it is the perception of the problem – and not necessarily the actual water supply situation – that determines levels of public acceptance of recycled water (Fielding et al., 2018). Thereby, perceiving water scarcity as a real and imminent threat to humanity can serve as a fundamental condition for acceptance (Gómez-Román et al., 2020).

To assess the degree of threat posed by a particular situation, at least two aspects must be considered: the severity of the event and one's perceived vulnerability to it (Rogers, 1975, 1983). When the level of these two variables is high, people are more inclined to adopt alternative responses to the situation. This insight suggests that one's perception of a threat facilitates acceptance of responses to it. We are not aware of any literature that specifically evaluates this phenomenon with respect to the topic of recycled water, although the phenomenon has been identified in the adoption of different decentralised systems for wastewater treatment (Mankad et al., 2011).

In addition to estimating the threat level that water scarcity poses, it is also necessary to consider who people attribute the origin and evolution of this problem to. If people perceive and assume that they are responsible to it in some way, they may consider the approaches proposed to solve it more favourably. Nancarrow et al. (2008) analyse how personal responsibility affects public perceptions of recycled water, concluding that it is not a significant predictor of public intention to use recycled water. However, in our view, this study raises two fundamental problems. First, the authors evaluate the degree of responsibility to guarantee the water supply; that is, the authors consider the responsibility for the evolution of the problem, but not for its origin. Second, the authors evaluate the responsibility of the individual, the community and the authorities jointly, not separately.

We argue that it is more appropriate to evaluate the concept of attribution of responsibility (Feather, 1969; Heider, 1958), which refers to how each person decides to whom to attribute responsibility for both the creation and maintenance of the problem. An individual will express the attribution of responsibility for water shortages in two ways: (a) by indicating that he or she is directly responsible for the water shortage problem as a consequence of his or her action or inaction (internal attribution) or (b) by pointing out that the agents causing the problem are 'others', such as companies or governments (external attribution).

1.2. The axiological influence: environmental identity and moral obligation

Another relevant factor to understand the public's possible responses to recycled water pertains to the values and beliefs that people have towards the environment. A person's system of values and beliefs is a fundamental factor to understanding why he or she has certain sustainability preferences and perspectives or behaves in a pro-environmental way (Steg et al., 2014). Nevertheless, its importance as an antecedent of pro-environmental behaviour is due to the influence it has on two specific processes. Firstly, values and beliefs make up the central core of one's environmental identity (van der Werff et al., 2013). Secondly, they facilitate the activation of one's sense of obligation to act according to this set of moral precepts (Stern, 2000).

Environmental identity has been identified as a consistency predictor for a wide range of pro-environmental behaviours, such as reducing waste and conserving energy and water in the home (Whitmarsh and O'Neill, 2010). Thereby, pro-environmental identity should also affect the use of recycled water insofar as it is also a pro-environmental behaviour. In this study, we take a more specific approach to analysing citizens' identities in relation to water, adapting the notion of environmental identity proposed by Clayton (2003). Our approach can be defined as the portion of environmental identity that forms our self-concept through a sense of connection with water, affecting how we perceive and act in the world; the belief that water is important to us, and that it is part of who we are.

The effect identity has on people's behaviour is reinforced when their sense of moral obligation is activated in a way that motivates them to act in accordance with their values, despite inconveniences and associated costs (Sabucedo et al., 2018; Vilas and Sabucedo, 2012). In this regard, moral obligation is a very relevant personal variable when it comes to understanding public social acceptance of recycled water usage. To our knowledge, this concept has not yet been included in analyses of public rejection or acceptance of recycled water, although it has been identified as an important variable in participatory irrigation management (Yang et al., 2021) and environmentally friendly collective actions (Molder et al., 2021).

1.3. The perception of recycled water: trust in science, health risks, and costs and benefits

Many citizens may have developed a pro-environmental identity and even a sense of moral obligation to protect the environment. However, this does not ensure that they will accept any sort of proposed solution to a given environmental problem without question. Solutions that some people would consider acceptable may be problematic for others. A solution's perception and consequent assessment – in this case, the use of recycled water – must be verified in the following two ways: (a) trust in the agent that proposes it and (b) analysis of its consequences, particularly its risks, costs and benefits.

Different agents influence citizens' perceptions of any aspect of reality, and their level of influence essentially depends on the degree to which citizens trust them. In the field of recycled water, trust is defined as 'a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviour of the authority responsible for the recycled water scheme' (Ross et al., 2014, p. 62). Of course, not all agents are equally trusted. In the case of the acceptance of recycled water, the trust the public place in the scientific community plays a fundamental role (Fielding et al., 2015; Leviston et al., 2006; Price et al., 2010).

Specifically, the effect of trust on acceptance seems to be mediated by perception of the risk associated with using recycled water; because this water is generated from wastewater, 'it is not surprising that health risk emerges as a major concern of respondents' (Fielding et al., 2018, p. 14). Thereby, the greater the trust in those who promote using recycled water, the lower the risk perception (Hurlimann et al., 2008; Nancarrow et al., 2008; Ross et al., 2014). At the same time, a lower risk perception favours both acceptance (Domènech and Saurí, 2010) and the intention to use recycled water (Nancarrow et al., 2009).

When analysing the consequences of using recycled water, risk perception is undoubtedly an essential factor. However, people will also assess other costs and benefits associated with using recycled water. The economic cost of implementing alternative water systems is of great concern (Mankad et al., 2015), although few studies have analysed its specific role in the acceptance process (Fielding et al., 2018). Nonetheless, a positive relationship has been found between economic benefits and satisfaction (Hurlimann et al., 2008) and the degree of public support (Friedler et al., 2006; Matos et al., 2014). With respect to environmental benefits, they seem to have even greater relevance than economic benefits in influencing public satisfaction with the use of recycled water (Hurlimann, 2008).

The variables described in this section have been raised in relation to the general use of recycled water, without considering different sorts of use for this type of water. However, it must be noted that the degree of public acceptance of recycled water differs depending on its end-use. Uses that involve higher degrees of personal contact or ingestion, such as drinking (Fielding et al., 2018) or irrigating crops (Savchenko et al., 2019), are less accepted than those uses that involve less contact, such as street cleaning (Fielding et al., 2018).

1.4. Objectives and model proposal

Previous studies have mainly focused on analysing the influence that certain factors, independent of one another, have on public acceptance of recycled water usage. This study proposes the development of a comprehensive model to assess: (a) the interrelation between the three dimensions of the diagnosis of the environmental situation, the axiological influence, and public perception of recycled water; and (b) the joint predictive capacity, as well as the relative effect, of the different psychological variables that make up each of the dimensions of public acceptance of recycled water. Fig. 1 introduces the predictive model that will be analysed. The type of recycled water use – classified by its degree of personal contact – and a region's level of water stress will also be considered. To this end, the authors sought evidence for the verification of two predictive models: one for acceptance of low-contact uses (LCA) and the other for acceptance of high-contact uses (HCA). The model will also be tested for its predictive adequacy in determining recycled water acceptance both in regions with high and low water stress levels.

2. Method

2.1. Participants and procedure

Participants were selected by proportional random sampling by sex and age in the two Spanish communities with the most extreme values of water stress. Galicia is the rainiest region in the country and Murcia is the driest (Fig. 2). During October 2019, the average rainfall in Galicia was 197 l/m^2, considerably higher than the 29 l/m^2 of rainfall in Murcia.

Citizens who matched the specified profile (i.e., by gender, age and place of residence) were contacted by email between October 2nd and 23rd, 2019, by a company that specialises in market research. The company compensated participants financially in exchange for their participation. They received a link to an online questionnaire with an estimated duration of 15 min. On the first page, participants received information about the terms and objectives of the study. Subsequently, they gave their consent for data processing. This study was approved by University of Santiago de Compostela's bioethics committee.

Participants had to be at least 18 years old to complete the survey. To guarantee the quality of the responses, the following exclusion criteria were established: (a) questionnaires completed in less than 425 s; and (b) inconsistent responses to items formulated in reverse.

2.2. Measures

The design and development of the questionnaire were reviewed by four experts in social psychology and two experts in methodology. Participants levels of disagreement or agreement with a statement in the questionnaire were measured using two different scale modalities using the Likert response format: (a) from 1 to 5; and (b) from 0 to 10. In

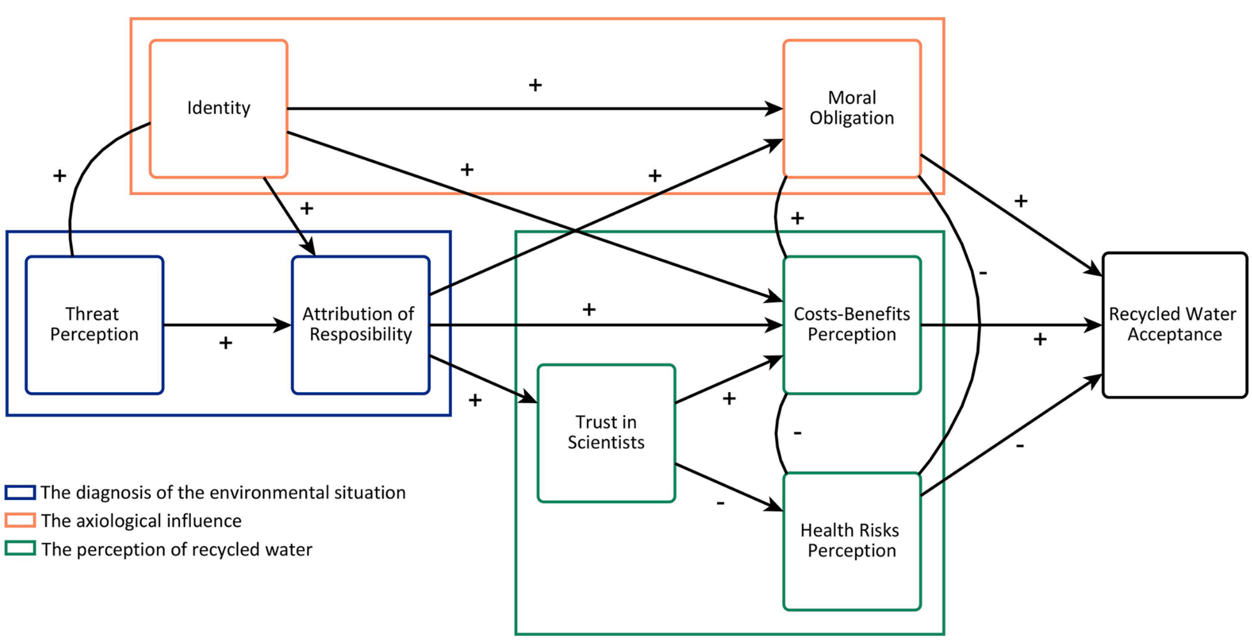

Fig. 1. *Model proposal: perceptive-axiological model (PAM).* The model's variables are grouped into three theoretical dimensions: (1) the diagnosis of the environmental situation, which is made up of threat perception and attribution of responsibility; (2) the axiological influence, which includes water-related identity and moral obligation; and (3) the public perception of recycled water, comprised of trust in science, cost-benefit perceptions and health risks perceptions. These three dimensions converge in the acceptance of recycled water.

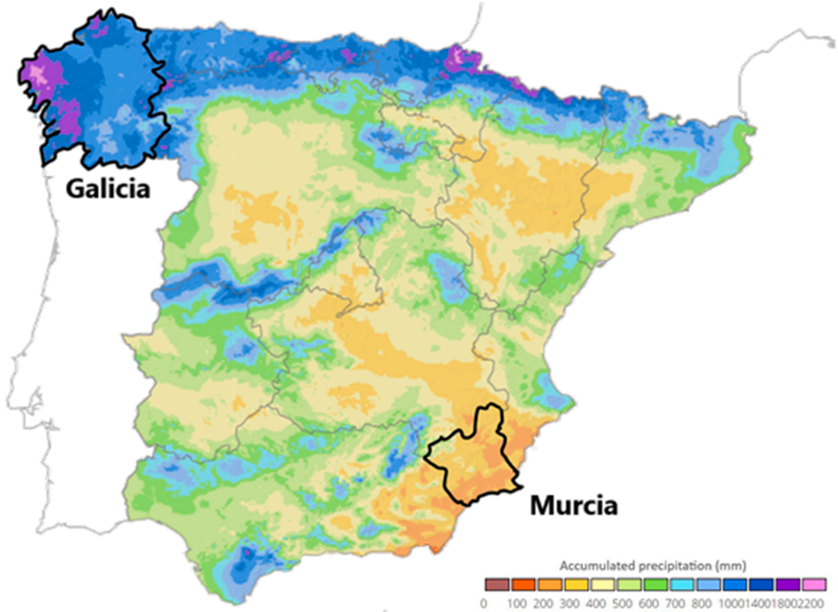

Fig. 2. *Annual cumulative precipitation map of Spain.* Adapted from the Spanish State Meteorology Agency (http://www.aemet.es).

Table 1
Cronbach's alpha coefficients (α) and item example for each variable.

Variable		Label	Item Example	N° items	α
Threat Perception		TP	I think there is a serious water crisis	4	.832
Attribution of Responsibility		AR	Each person is responsible for consuming less water to avoid shortages	3	.634
Water-Related Identity		I	I consider myself a person interested in the subject of water	4	.879
Moral Obligation	Low-Risk Moral Obligation	LMO	I feel morally obligated to use recycled water even if it means confronting people close to me	5	.888
	High-Risk Moral Obligation	HMO		5	.946
Trust in Scientists		TS	I believe they provide information that can be trusted	3	.854
Costs-Benefits Perception		CB	Indicate if you consider that the use of recycled water could be harmful or beneficial for… "the environment"	3	.859
Health Risks Perception	Low-Contact Uses	LR	Indicate if you consider that there is any type of risk to human health when using recycled water	3	.892
	High-Contact Uses	HR	for… "washing clothes"	4	.859
Recycled Water Acceptance	Low-Contact Uses	LCA	Would you agree to use recycled water for the following uses? "Drinking"	5	.894
	High-Contact Uses	HCA		11	.951

addition, questions about sociodemographic characteristics were included to guarantee the proportionality of the sample.

Table 1 lists each scale's variables, the number of items, an item example and internal consistency. The items related to the variables of perceived risks and acceptance correspond to different uses of recycled water. Each of these scales was divided into two categories, according to the level of personal contact with recycled water: LR and LCA for low-contact, and HR and HCA for high-contact. This division was corroborated by factor analysis of both exploratory and confirmatory types. To more accurately observe the participant's degrees of moral obligation, this scale was presented to participants twice in succession. In the first presentation, the participants had to answer a question about what degree of moral obligation they have, thinking about recycled water uses that they had previously classified as low-risk (LMO); in the second, they answered the same question but were asked to consider the uses that they had previously classified as high-risk (HMO).

2.3. Data analysis

The analysis of the statistical data began with a description of the sample. In addition to balancing the sample by sex and age, it was assessed that there were no significant differences between regions with respect to participants' education level, employment status and monthly income. Then, two analyses were carried out. First, Structural Equation Models (SEMs) to check to what extent PAM adequately predicts acceptance for both low-contact and high-contact uses. We adhered to the following reference values as evaluation criteria for model fit (Hu and Bentler, 1999): .95 for CFI (Comparative Fit Index) and for TLI (Tucker-Lewis Index), .06 for RMSEA (Root Mean Square Error of Approximation), and .08 for SRMR (Standardized Root Mean Square Residual). Second, a multiple-group analysis to assess whether the predictive capacity of PAM was equivalent between regions with opposite levels of scarcity. As evaluation criteria for the unconstrained and constrained analysis of the models we used the Chi-Square difference statistic (Byrne et al., 1989) together with the change in CFI (Cheung and Rensvold, 2002). Invariance was met when a non-significant difference in Chi-Squares and a CFI change of .01 or lower occurred between unconstrained and constrained models. These analyses were performed with Mplus Version 7.4., using the maximum likelihood method as the estimation method.

3. Results

3.1. Socio-demographic information

The final sample consisted of 726 participants (50.1% males; M_{age} =

43.90, $SD = 13.17$, $Range = 18–88$), of which 359 resided in Galicia (48.7% males; $M_{age} = 45.77$, $SD = 13.40$, $Range = 18–88$) and 367 resided in Murcia (51.5% males; $M_{age} = 42.05$, $SD = 12.68$, $Range = 18–82$). There were no significant differences between locations regarding sex ($\chi^2 = .550$, $df = 1$, $p = .458$), educational level ($\chi^2 = 2.584$, $df = 3$, $p = .460$), employment statuses ($\chi^2 = 8.883$, $df = 4$, $p = .064$) and monthly incomes ($\chi^2 = 9.452$, $df = 9$, $p = .397$). Significant differences were found with respect to age ($\chi^2 = 11.041$, $df = 2$, $p = .004$), although this particularity can be attributed to the use of proportional sampling according to the age distribution in both populations. Taken together, the data indicate that both sub-samples show a considerable degree of similarity.

3.2. Structural models of recycled water acceptance for low- and high-contact uses

The main purpose of this analysis was to check the model's capacity to predict both recycled water acceptance for low-contact uses, as well as for high-contact uses. The models for low- and high-contact showed good fit and predictive capacity. The values obtained for the low-contact model are as follows: χ^2 (12, $N = 726$) = 24.776, $p = .016$; CFI = .984; TLI = .965; RMSEA = .038 (*90% CI* [.016, .060]); SRMR = .027; $R^2 = .272$, $p < .001$. The results relative to the high-contact model are the following: χ^2 (12, $N = 726$) = 20.042, $p = .066$; CFI = .991; TLI = .979; RMSEA = .030 (*90% CI* [.000, .053]); SRMR = .024; $R^2 = .501$, $p < .001$.

Although both models showed good fit, the predictive ability of the model for low-contact uses was lower than the high-contact uses model. However, the data show that the models maintained a similar relationship structure, as shown in Figs. 3 and 4. People who perceived the scarcity situation as being threatening also identified more strongly with aspects related to water. In addition, the results show that a high score on both variables encouraged people to assume the personal responsibility for the scarcity.

Furthermore, the results indicate that people who identified with water and who assumed responsibility for the water scarcity expressed a greater sense of moral obligation to use recycled water and perceived that the benefits of its use outweigh the costs. In addition, they also show trust in the science, which contributes to increasing the benefits of using recycled water and reducing the perception of health risks.

As hypothesised, the results show that moral obligation, costs-benefits perception and perceived health risk were direct predictors of acceptance of recycled water use. Although all three contributed significantly to the two models, there are important differences between them. In the high-contact use model, the effect of risk perception and moral obligation was greater than in the low-contact model. In contrast, the effect of the cost-benefit analysis was more relevant in the low-contact use model. Of the three, the variable with the greatest explanatory power on the acceptance of recycled water in both models was health risks perception.

3.3. Multiple-group analysis: the PAM's equivalence between dry and wet regions

The model was tested in Galicia and Murcia to explore its predictive capacity in regions characterised by extreme water scarcity and abundance. Table 2 shows that the model adequately predicts acceptance in each of the regions. Figs. 5 and 6 show the estimated relationships between variables.

Once the model was estimated for each region, a multiple-group analysis was conducted. This analysis allowed us to check whether the model is equivalent in both dry and wet regions. The multiple-group strategy was incremental. Firstly, the unconstrained analysis of the model shows whether the general structure of the model is shared between regions. Secondly, the constrained analysis of the model indicates whether the weight of the relationships is similar between both regions.

The results for the unconstrained model are satisfactory for low-contact uses: χ^2 (24, $N = 726$) = 38.320, $p = .032$; CFI = .983; TLI = .962; RMSEA = .041 (*90% CI* [.012, .064]); SRMR = .033. The values were similar for the high-contact model: χ^2 (24, $N = 726$) = 30.375, $p = .172$; CFI = .993; TLI = .984; RMSEA = .027 (*90% CI* [.000, .053]); SRMR = .028. These results indicate that the structure or general form of the model was shared between the two regions. This suggests that the proposed model is suitable for predicting acceptance of recycled water in regions with water scarcity and water abundance.

The analysis of the constrained models indicates that, in addition to the structure, the weight of the relationships in both regions is partially equivalent both for low-contact ($\Delta\chi^2$ [15, $N = 726$] = 24.233, $p = .061$; CFI diff = .01), and high-contact uses ($\Delta\chi^2$ [12, $N = 726$] = 19.571, $p =$

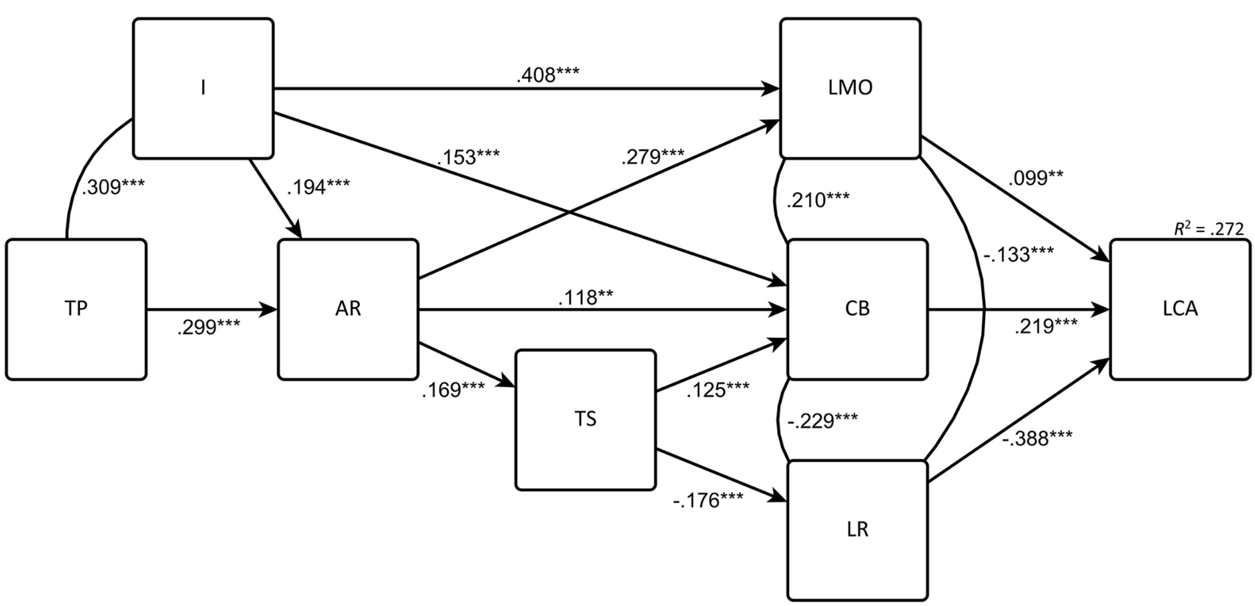

Fig. 3. *Structural model of recycled water acceptance for low-contact uses.* Statistics represented by a straight line are standardised regression coefficients. Statistics represented by a curved line are correlations. TP = Threat Perception; AR = Attribution of Responsibility; I = Water-Related Identity; TS = Trust in Scientists; LMO = Low-Risk Moral Obligation; CB = Cost-Benefit Perceptions; LR = Perceived Health Risks in Low-Contact Uses; LCA = Recycled Water Acceptance for Low-Contact Uses. ** $p < .01$. *** $p < .001$.

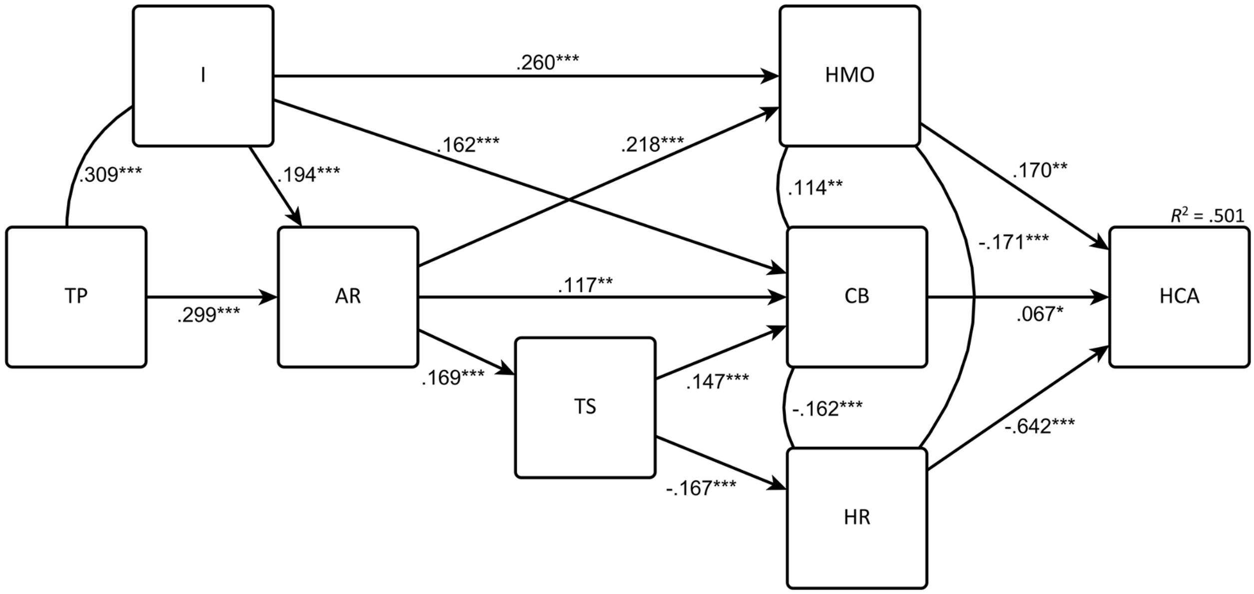

Fig. 4. *Structural model of recycled water acceptance for high-contact uses.* Statistics represented by a straight line are standardised regression coefficients. Statistics represented by a curved line are correlations. TP = Threat Perception; AR = Attribution of Responsibility; I = Water-Related Identity; TS = Trust in Scientists; HMO = High-Risk Moral Obligation; CB = Cost-Benefit Perceptions; HR = Perceived Health Risk in High-Contact Uses; HCA = Recycled Water Acceptance for High-Contact Uses. *$p < .05$. ** $p < .01$. *** $p < .001$.

Table 2
Goodness-of-fit statistics by region.

	χ^2	*df*	*p*	CFI	TLI	RMSEA	SRMR	R^2
LCA								
Galicia	16.948	12	.152	.990	.977	.034 (90% CI [.000, .068])	.031	.259
Murcia	21.372	12	.045	.974	.942	.046 (90% CI [.007, .077])	.035	.275
HCA								
Galicia	16.524	12	.168	.992	.981	.032 (90% CI [.000, .067])	.032	.570
Murcia	13.851	12	.310	.995	.989	.021 (90% CI [.000, .059])	.023	.431

Note. CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardised Root Mean Square Residual; LCA = Recycled Water Acceptance for Low-Contact Uses; HCA = Recycled Water Acceptance for High-Contact Uses.

.076; CFI diff = .009). This means that, with few exceptions, the weight of established relationships is similar in both regions. First, in Murcia, identity had a greater effect on the perception of the cost and benefits of the recycled water use in both the low- and high-contact models. Secondly, the weight of the trust with respect to the perception of risks and benefits was lower in Murcia, the region with the greatest water scarcity. This difference is especially marked in the low-contact model. Finally, with respect to the direct predictors of acceptance, the effects of moral obligation and the perception of health risks are greater in the high-contact model in both regions. In contrast, the effect of perceived benefits in the high-contact model is lower, especially in Murcia.

4. Discussion

This study has proposed a perceptive-axiological model (PAM) that predicts the level of public acceptance of recycled water is based on three theoretical dimensions: the diagnosis of the environmental situation, the axiological influence, and public perceptions of recycled water. The analyses carried out in this study identify the proposed relationship structure for both low- and high-contact uses, which was duplicated in the two regions, irrespective of their water stress indexes. In this section, we first discuss the results for each of the model's dimensions and conclude by commenting on the overall contributions of the model and some of its limitations.

4.1. The diagnosis of the environmental situation: the basis for the acceptance of recycled water

Although it is commonly assumed that public perception of severe water scarcity is associated with greater acceptance of recycled water, in reality, few studies have attempted to demonstrate the existence of this relationship (Fielding et al., 2018). It is true that water recycling systems are often developed in countries that experience frequent droughts (Brouwer et al., 2015) and that recycled water helps considerably in reducing water scarcity (UN, 2017). However, that does not mean that those who are aware of and understand the shortage necessarily accept the use of recycled water. This research addresses this question by analysing the role that diagnosis of a situation of water scarcity plays in terms of the public's perception of the threat and how they attribute responsibility for it. Our findings point to diagnosis playing an indirect effect. In other words, a perception of the threat of water scarcity as being more severe, together with an internal attribution of responsibility for water scarcity, tends to produce positive perceptions of recycled water and a sense of moral obligation to use it.

The effect of the diagnosis of the situation on the perception of recycled water was similar in Galicia and Murcia, suggesting that the relationship between these variables occurs independently of a situation of objective scarcity. Our results support the thesis that the mere perception of water scarcity is enough to foster favourable dispositions towards recycled water without the need for real water constraints (Fielding et al., 2018).

4.2. The axiological influence: the transversal axis in the process of public acceptance of recycled water

Once a problem is identified, it is common for possible causative agents to be pointed out that tend to be in opposite positions to those

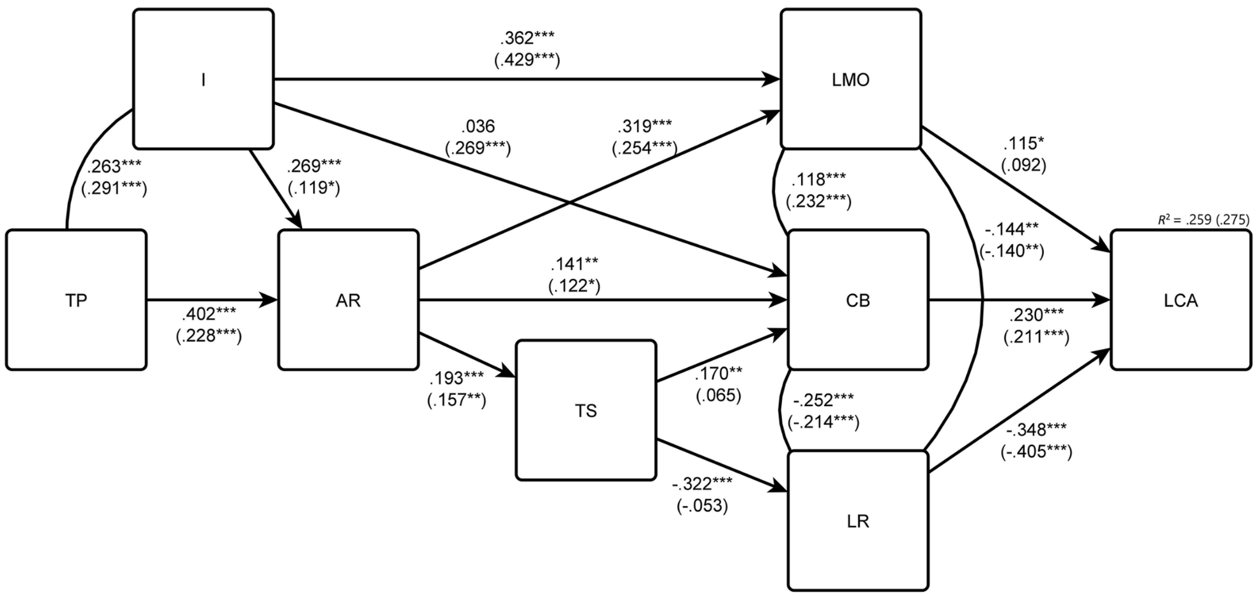

Fig. 5. *Unconstrained multiple-group structural model for low-contact uses.* Galicia ($n = 359$) and Murcia ($n = 367$; in parentheses). Statistics represented by a straight line are standardised regression coefficients. Statistics represented by a curved line are correlations. $*p < .05$. $** p < .01$. $*** p < .001$.

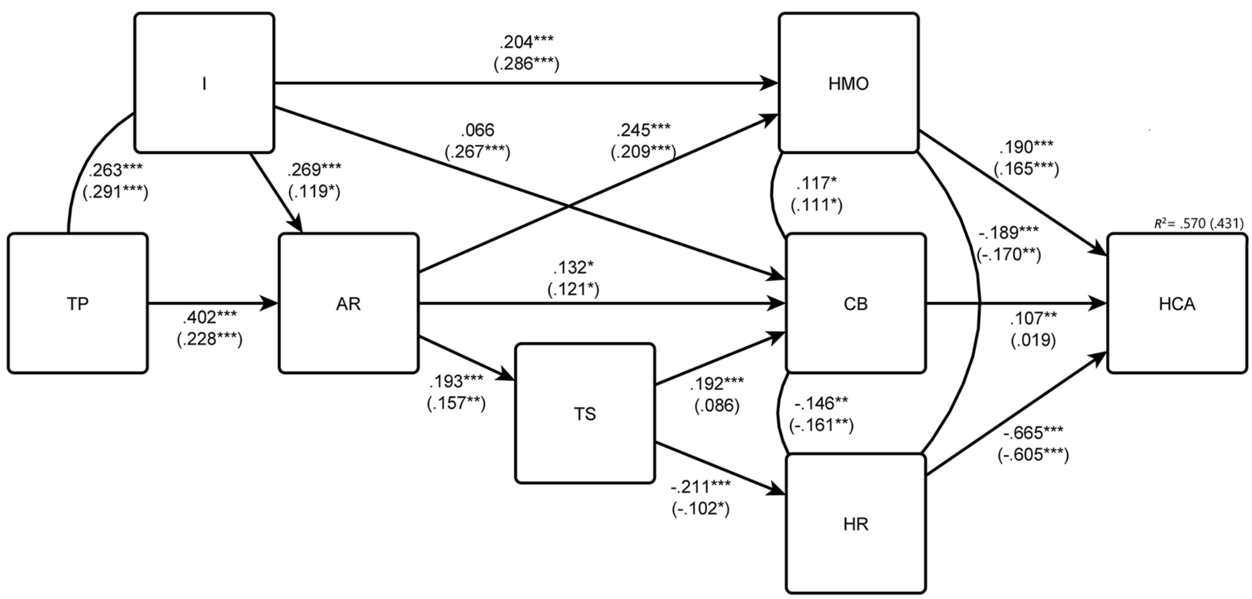

Fig. 6. *Unconstrained multiple-group structural model for high-contact uses.* Galicia ($n = 359$) and Murcia ($n = 367$; in parentheses). Statistics represented by a straight line are standardised regression coefficients. Statistics represented by a curved line are correlations. $*p < .05$. $** p < .01$. $*** p < .001$.

interested in solving the situation (Klandermans, 2002). However, with respect to environmental problems and the study of water scarcity, the locus of responsibility cannot be attributed solely to external agents. The results of this study indicate that those who identified strongly with water also assumed that they themselves, and the public in general, are part of the problem. The assumption of responsibility is established, therefore, as a fundamental value that defines the group. Obviously, this does not mean that one should not point out those who deny or are unaware that a problem exists. Indeed, pro-environmental identity is built in opposition to other identities that do not share the same perspective on the environment.

Our study has shown how pro-environmental identity, specifically with respect to water, influences both how they diagnose the situation of water scarcity and how they perceive recycled water. Identity has an indirect influence on one's perception of risk, which is in line with Ross et al. (2014) result, and a direct effect on the cost-benefit analysis.

Nevertheless, we must consider that the effect of environmental identity on the use of recycled water may not be as crucial as for other more well-known pro-environmental behaviours. The use of recycled water is a novel concept that is not yet pervasive in the public debate in Spain. For this reason, it is possible that the concept of recycled water has not yet undergone the assimilation and accommodation processes (Breakwell, 2014) necessary to become part of the environmental identity. If recycled water becomes linked to environmental identity, the activation of both processes would increase the effect identity has on acceptance of recycled water use, although this will depend on whether the recycled water is positively or negatively associated with pro-environmental identity. The only experimental study that has addressed this relationship points in this direction. When the transmitter of messages favourable to recycled water shared a superordinate identity with the participants, the perceived risks were reduced and acceptance increased (Schultz and Fielding, 2014).

Identity also acts as a direct predictor of moral obligation (Sabucedo et al., 2019). In our study, we adopted a context-specific approach, assessing citizens' moral obligation to use recycled water. The results indicate that a strong sense of moral obligation is associated with greater acceptance, particularly for the high-contact use model. This phenomenon can be explained with reference to two of the elements associated with the definition of moral obligation: a sense of fulfilment of the objective, regardless of the consequences, and a sense of sacrifice (Sabucedo et al., 2018). These aspects illustrate how moral obligation has a greater effect when the moral act comes at a personal cost. In the case of recycled water, the participants perceived the high-contact uses such as drinking or showering to have the highest associated risk or cost. Consequently, the sense of moral obligation will have a greater influence upon the acceptance of those uses.

4.3. The perception of recycled water: the proximal dimension of acceptance

In this work, we have argued that two aspects affect the public perception of recycled water: (a) trust in the agent that proposes the use of recycled water and (b) analysis of its consequences (specifically, its risks, costs, and benefits).

To date, trust has been assessed in relation to the managers of recycled water systems. Specifically, relying on them predicts a lower perception of risk (Hurlimann et al., 2008; Nacarrow et al., 2008; Ross et al., 2014). For this reason, in our study we have specifically evaluated the implication that trust in science since this source is the one that the public find most credible (Price et al., 2010). The results of the model indicate that those who trust science not only perceive there to be fewer risks associated with the use of recycled water, but they also perceive the existence of a greater number of benefits.

Perceptions of risks and benefits also follow the opposite trend when predicting the acceptance of recycled water. The PAM indicates that where the public perceives more benefits associated with recycled water use, these favours increased acceptance. In contrast, people are less accepting of recycled water when they perceive high its use to have a high level of risks. Amongst the two factors, risk perception stands out as the main predictor of acceptance – this result that aligns with the results of previous studies (Domènech and Saurí, 2010; Hurlimann et al., 2008; Nancarrow et al., 2009). Both the anticipation of harmful consequences and the presence of uncertainty underlie the relevance of risk (Yates and Stone, 1992). These aspects, together with the lack of familiarity that certain social groups have with recycled water, can spur prejudice and negative representations like those that other technologies evoke, such as nuclear energy (Finucane et al., 2000).

Precisely the activation of these representations and prejudices would explain why we detect a greater influence of risk in high-contact uses. The representations associated with recycled water would be more negative when the use involves more direct contact with the human body, which could lead to more uncertainty, and the anticipation of harmful consequences and, therefore, to higher rates of rejection. In contrast, the impact perceived benefits have on acceptance is greater with respect to low-contact uses. When recycled water uses does not involve physical human contact with the water, recycled water use tends to evoke more positive representations. As a result, people generally feel that low-contact use poses fewer health risks and will begin to pay greater attention to the positive effects of using recycled water, such as the economic or environmental benefits.

4.4. The PAM's contributions to previous models of recycled water acceptance and limitations

The PAM is the first structural model that responds to the need to integrate variables that consider the diagnosis of the environmental situation, the axiological influence, and public perceptions of recycled water. By incorporating these dimensions, the PAM broadens the contribution of other models that focused on aspects specifically related to perceptions of recycled water (Hurlimann et al., 2008). It also factors in the role of identity in the acceptance process (Ross et al., 2014), considering the importance of environmental identity in an individual's perception of both the problem and recycled water itself.

Moreover, the PAM is the first model to verify its predictive capacity in both high and low water stress regions. In addition, it delves into existing evidence on the differences between low- and high-contact uses of recycled water. In previous studies, the items related to intention, satisfaction, and acceptance were mostly general (Hurlimann et al., 2008). Furthermore, previous studies typically included only one contact category (Nancarrow et al., 2009) or presented an approach that combined high- and low-contact uses (Ross et al., 2014). We are not aware of any studies in which the authors contemplated different models for each level of use.

The difference between the acceptance of low- and high-contact use of recycled water is key. In fact, the model's predictive ability for low-contact use is lower than for high-contact use. This result is not surprising. The more extreme the measured behaviour, the more relevant are the variables that explain it. Two conclusions can be drawn in this respect. Firstly, studies that address the reasons linked to the acceptability of recycled water should, at a minimum, differentiate between the two main types of use (low-contact and high-contact uses). Secondly, in order to promote the acceptance of high-contact uses, special attention needs to be paid to reducing perception of health risks and promoting the moral obligation to accept these uses.

In addition to the above, it should also be noted that although practically all the relationships between the variables that this study has identified are statistically significant, the correlations and predictors are not in all cases as strong as would be desirable. This is especially true for moral obligation and cost-benefit predictors. One possible explanation is the relevance of health risks to these two variables in this context. Consequently, one limitation of this work is that the PAM model highlights predictive relationships for recycled water acceptance, but not causal ones. Future experimental studies could therefore take further steps to build upon the developments presented in this study by, for example, manipulating the degree of health risk and testing its relationship with the other predictor variables and with acceptance.

Another aspect to consider is that, although this model was validated in two regions with different levels of water stress, and water restrictions are common in Murcia, the supply of drinking water and its quality is guaranteed. For this reason, we encourage other researchers to replicate our results in other countries. Different cultural traditions pertaining to water and its uses, as well as the polarisation that currently exists in some societies regarding climate change and science, could also affect the structure of the model or the relationship between its component variables.

5. Conclusions

Despite the problem of water scarcity in many regions of the world, a segment of the public does not accept certain varieties of recycled water use. This paper has presented an integrated model, the PAM, that provides new and relevant information about: (a) what indirect and direct variables influence public acceptance of recycled water, (b) what differential weight those variables have on the acceptance of low- and high-contact uses of recycled water, and (c) what similarities and differences have those variables in predicting acceptance in regions with high and low levels of water scarcity.

The diagnosis of the environmental situation is the first step to consider in the process of fostering greater acceptance of recycled water use. In other words, citizens will consider recycled water as a possible solution to water scarcity if they perceive the problem as serious and immediate and if they maintain a sense of responsibility to confront the problem head on. Both factors are consistent between regions with opposite extremes of abundance and scarcity indicating that it is the perception of scarcity, rather than the actual existence of it, that truly affects acceptance.

The model also incorporates an axiological dimension. The issue of water scarcity threatens the identity of the individual, which leads him or her to develop a sense of moral obligation to accept recycled water as a solution to the problem. This axiological influence may be even greater when recycled water appears in public debate. Therefore, in order to establish the use of recycled water in society, it is essential that citizens' identity structures incorporate in a positive way the concept of recycled water. If they are not, the mechanisms of identity and moral obligation will be activated in the opposite direction, driving attempts to halt the implementation of recycled water systems.

The PAM proposes a third dimension, related to perceptions of recycled water. The use of recycled water may not pose any danger; however, the mere perception of negative health consequences is sufficient to lead to public rejection of the concept. Trust in the scientific community can counteract these negative perceptions and foster the perception of benefits. In this sense, and in order to ensure that scientific knowledge assists in the development of environmentally sustainable policies, it is necessary that science is not instrumentalised politically, as this would affect its credibility.

The PAM is suitable for predicting public acceptance of recycled water for both low- and high- contact uses, although the predictive power is greater for high-contact uses. Similarly, the absence of large differences between the Galicia and Murcia regions indicates that the predictive model can be applied to regions with unequal water resources. This knowledge facilitates the design of intervention strategies that favour greater public acceptance of recycled water.

CRediT authorship contribution statement

Sergio Vila-Tojo: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Jose-Manuel Sabucedo:** Conceptualization, Funding acquisition, Writing – original draft, Writing – review & editing. **Elena Andrade:** Methodology, Formal analysis, Writing – review & editing, Writing – original draft. **Cristina Gómez-Román:** Methodology, Conceptualization. **Mónica Alzate:** Writing – review & editing. **Gloria Seoane:** Methodology.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

Baghapour, M.A., Shooshtarian, M.R., Djahed, B., 2017. A survey of attitudes and acceptance of wastewater reuse in Iran: Shiraz City as a case study. J. Water Reuse Desalin. 7 (4), 511–519. https://doi.org/10.2166/wrd.2016.117.

Breakwell, G.M., 2014. The Psychology of Risk. Cambridge University Press. https://doi.org/10.1017/CBO9781139061933.

Brouwer, S., Maas, T., Smith, H., Frijns, J., 2015. Trust in water reuse review report on international experiences in public involvement and stakeholder collaboration. DEMOWARE 1-47 http://demoware.eu/en/results/deliverables/deliverable-d5-2-trust-in-reuse.pdf.

Byrne, B.M., Shavelson, R.J., Muthén, B., 1989. Testing for the equivalence of factor covariance and mean structures: the issue of partial measurement invariance. Psychol. Bull. 105 (3), 456–466. https://doi.org/10.1037/0033-2909.105.3.456.

Cheung, G.W., Rensvold, R.B., 2002. Evaluating goodness-of-fit indexes for testing measurement invariance. Struct. Equ. Model. A Multidiscip. J. 9 (2), 233–255. https://doi.org/10.1207/S15328007SEM0902_5.

Clayton, S., 2003. Environmental identity: conceptual and operational definition. In: Clayton, S., Opotow, S. (Eds.), Identity and the Natural Environment: The Psychological Significance of Nature. MIT Press, Cambridge, MA, pp. 45–65.

de Groot, J.I., Steg, L., 2007. Value orientations and environmental beliefs in five countries: validity of an instrument to measure egoistic, altruistic and biospheric value orientations. J. Cross Cult. Psychol. 38 (3), 318–332. https://doi.org/10.1177/0022022107300278.

Dolnicar, S., Hurlimann, A., Grün, B., 2011. What affects public acceptance of recycled and desalinated water? Water Res. 45 (2), 933–943. https://doi.org/10.1016/j.watres.2010.09.030.

Domènech, L., Saurí, D., 2010. Socio-technical transitions in water scarcity contexts: public acceptance of greywater reuse technologies in the metropolitan area of Barcelona. Resour. Conserv. Recycl. 55 (1), 53–62. https://doi.org/10.1016/j.resconrec.2010.07.001.

Ellis, S.F., Savchenko, O.M., Messer, K.D., 2021. Mitigating stigma associated with recycled water. Am. J. Agric. Econ. 1–23. https://doi.org/10.1111/ajae.12256.

Etale, A., Fielding, K., Schäfer, A.I., Siegrist, M., 2020. Recycled and desalinated water: consumers' associations, and the influence of affect and disgust on willingness to use. J. Environ. Manag. 261, 110217 https://doi.org/10.1016/j.jenvman.2020.110217.

Feather, N.T., 1969. Attribution of responsibility and valence of success and failure in relation to initial confidence and task performance. J. Pers. Soc. Psychol. 13 (2), 129–144. https://doi.org/10.1037/h0028071.

Fielding, K.S., Dolnicar, S., Schultz, T., 2018. Public acceptance of recycled water. Int. J. Water Resour. Dev. 35 (4), 551–586. https://doi.org/10.1080/07900627.2017.1419125.

Fielding, K.S., Gardner, J., Leviston, Z., Price, J., 2015. Comparing public perceptions of alternative water sources for potable use: the case of rainwater, stormwater, desalinated water, and recycled water. Water Resour. Manag. 29, 4501–4518. https://doi.org/10.1007/s11269-015-1072-1.

Finucane, M.L., Alhakami, A., Slovic, P., Johnson, S.M., 2000. The affect heuristic in judgments of risks and benefits. J. Behav. Decis. Mak. 13 (1), 1–17. https://doi.org/10.1002/(SICI)1099-0771(200001/03)13:1<1::AID-BDM333>3.0.CO;2-S.

Friedler, E., Lahav, O., Jizhaki, H., Lahav, T., 2006. Study of urban population attitudes towards various wastewater reuse options: Israel as a case study. J. Environ. Manag. 81 (4), 360–370. https://doi.org/10.1016/j.jenvman.2005.11.013.

Garcia-Cuerva, L., Berglund, E.Z., Binder, A.R., 2016. Public perceptions of water shortages, conservation behaviors, and support for water reuse in the US. Resour. Conserv. Recycl. 113, 106–115. https://doi.org/10.1016/j.resconrec.2016.06.006.

Gómez-Román, C., Lima, L., Vila-Tojo, S., Correa-Chica, A., Lema, J., Sabucedo, J.M., 2020. "Who Cares?": the acceptance of decentralized wastewater systems in regions without water problems. Int. J. Environ. Res. Public Health 17 (23), 9060. https://doi.org/10.3390/ijerph17239060.

Heider, F., 1958. The Psychology of Interpersonal Relations. John Wiley & Sons Inc. https://doi.org/10.1037/10628-000.

Hu, L., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equ. Model. A Multidiscip. J. 6 (1), 1–55. https://doi.org/10.1080/10705519909540118.

Hurlimann, A., 2006. Melbourne office worker attitudes to recycled water use. Water J. Aust. Water Assoc. 33 (7) https://doi.org/10.3316/ielapa.200709848.

Hurlimann, A., 2008. Community Attitudes to Recycled Water Use and Urban Australian Case Study – Part 2. Research Report No. 56. The Cooperative Research Centre for Water Quality and Treatment, Adelaide.

Hurlimann, A., Dolnicar, S., 2010. When public opposition defeats alternative water projects – the case of Toowoomba Australia. Water Res. 44 (1), 287–297. https://doi.org/10.1016/j.watres.2009.09.020.

Hurlimann, A., Hemphill, E., McKay, J., Geursen, G., 2008. Establishing components of community satisfaction with recycled water use through a structural equation model. J. Environ. Manag. 88 (4), 1221–1232. https://doi.org/10.1016/j.jenvman.2007.06.002.

Klandermans, B., 2002. How group identification helps to overcome the dilemma of collective action. Am. Behav. Sci. 45 (5), 887–900. https://doi.org/10.1177/0002764202045005009.

Lee, H., Tan, T.P., 2016. Singapore's experience with reclaimed water: NEWater. Int. J. Water Resour. Dev. 32 (4), 611–621. https://doi.org/10.1080/07900627.2015.1120188.

Leviston, Z., Nancarrow, B.E., Tucker, D.I., Porter, N.B., 2006. Predicting Community Behaviour: Indirect Potable Reuse of Wastewater Through Managed Aquifer Recharge. CSIRO Land and Water Science Report 29/06. https://www.water.wa.gov.au/_data/assets/pdf_file/0015/5253/84734.pdf.

Mankad, A., Tapsuwan, S., 2011. Review of socio-economic drivers of community acceptance and adoption of decentralised water systems. J. Environ. Manag. 92 (3), 380–391. https://doi.org/10.1016/j.jenvman.2010.10.037.

Mankad, A., Tapsuwan, S., Greenhill, M.P., Malkin, S., 2011. Motivational indicators of decentralised systems use among householders in south east Queensland. Urban Water Security Research Alliance Technical Report No. 44. CSIRO, Australia, EP104575. https://publications.csiro.au/rpr/pub?pid=csiro.

Mankad, A., Walton, A., Alexander, K., 2015. Key dimensions of public acceptance for managed aquifer recharge of urban storm water. J. Clean. Prod. 89, 214–223. https://doi.org/10.1016/j.jclepro.2014.11.028.

Matos, C., Friedler, E., Monteiro, A., Rodrigues, A., Teixeira, R., Bentes, I., Varajão, J., 2014. Academics perception towards various water reuse options: University of Trás-os-Montes e Alto-Douro - UTAD campus (Portugal) as a case study. Urban Water J. 11 (4), 311–322. https://doi.org/10.1080/1573062X.2013.775314.

McOmber, C., Zhuang, Y., Raudales, R., Vadas, T., Kirchhoff, C., 2021. What is recycled water, anyway? Investigating greenhouse grower definitions, perceptions, and willingness to use recycled water. Renew. Agric. Food Syst. 36 (5), 491–500. https://doi.org/10.1017/S1742170521000090.

Molder, A.L., Lakind, A., Clemmons, Z.E., Chen, K., 2021. Framing the global youth climate movement: a qualitative content analysis of Greta Thunberg's Moral, Hopeful, and motivational framing on instagram. Int. J. Press/Politics 1–29. https://doi.org/10.1177/19401612211055691.

Nancarrow, B.E., Leviston, Z., Tucker, D.I., 2009. Measuring the predictors of communities' behavioural decisions for potable reuse of wastewater. Water Sci. Technol. 60 (12), 3199–3209. https://doi.org/10.2166/wst.2009.759.

Nancarrow, B.E., Leviston, Z., Po, M., Porter, N.B., Tucker, D.I., 2008. What drives communities' decisions and behaviours in the reuse of wastewater. Water Sci. Technol. 57 (4), 485–491. https://doi.org/10.2166/wst.2008.160.

Price, J., Fielding, K., Leviston, Z., Bishop, B., Nicol, S., Greenhill, M., Tucker, D., 2010. Community Acceptability of the Indirect Potable Use of Purified Recycled Water in South-East Queensland: Final Report of Monitoring Surveys. CSIRO Urban Water Security Research Alliance. Technical Report No. 19.

Rogers, R.W., 1975. A protection motivation theory of fear appeals and attitude change. J. Psychol. 91 (1), 93–114. https://doi.org/10.1080/00223980.1975.9915803.

Rogers, R.W., 1983. Cognitive and physiological processes in fear appeals and attitude change: a revised theory of protection motivation. In: Cacioppo, J.T., Petty, R.E. (Eds.), Social Psychophysiology: A Sourcebook. Guilford, London, pp. 153–177.

Ross, V.L., Fielding, K.S., Louis, W.R., 2014. Social trust, risk perceptions and public acceptance of recycled water: testing a social-psychological model. J. Environ. Manag. 137, 61–68. https://doi.org/10.1016/j.jenvman.2014.01.039.

Sabucedo, J.M., Dono, M., Alzate, M., Seoane, G., 2018. The importance of protesters' morals: moral obligation as a key variable to understand collective action. Front. Psychol. 9 https://doi.org/10.3389/fpsyg.2018.00418.

Sabucedo, J.M., Dono, M., Grigoryev, D., Gómez-Román, C., Alzate, M., 2019. Axiological-identitary collective action model (AICAM): a new integrative perspective in the analysis of protest. PLoS One 14 (6), e0218350. https://doi.org/10.1371/journal.pone.0218350.

Sanchez-Flores, R., Conner, A., Kaiser, R.A., 2016. The regulatory framework of reclaimed wastewater for potable reuse in the United States. Int. J. Water Resour. Dev. 32 (4), 536–558. https://doi.org/10.1080/07900627.2015.1129318.

Savchenko, O.M., Kecinski, M., Li, T., Messer, K.D., 2019. Reclaimed water and food production: cautionary tales from consumer research. Environ. Res. 170, 320–331. https://doi.org/10.1016/j.envres.2018.12.051.

Schultz, T., Fielding, K., 2014. The common in-group identity model enhances communication about recycled water. J. Environ. Psychol. 40, 296–305. https://doi.org/10.1016/j.jenvp.2014.07.006.

Steg, L., Perlaviciute, G., van der Werff, E., Lurvink, J., 2014. The significance of hedonic values for environmentally-relevant attitudes, preferences and actions. Environ. Behav. 46 (2), 163–192. https://doi.org/10.1177/0013916512454730.

Stern, P.C., 2000. Toward a coherent theory of environmentally significant behavior. J. Soc. Issues 56 (3), 407–424. https://doi.org/10.1111/0022-4537.00175.

United Nations, 2017. Wastewater: the untapped resource. The United Nations World Water Development Report 2017. UNESCO, París. http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/2017-wastewater-the-untapped-resource/.

United Nations, 2018. Sustainable Development Goal 6: Synthesis Report 2018 on Water and Sanitation. United Nations. https://www.unwater.org/publication_categories/sdg-6-synthesis-report-2018-on-water-and-sanitation/.

van der Werff, E., Steg, L., Keizer, K., 2013. The value of environmental self-identity: the relationship between biospheric values, environmental self-identity and environmental preferences, intentions and behavior. J. Environ. Psychol. 34, 55–63. https://doi.org/10.1016/j.jenvp.2012.12.006.

Vilas, X., Sabucedo, J.M., 2012. Moral obligation: a forgotten dimension in the analysis of collective action. Int. J. Soc. Psychol. 27 (3), 369–375. https://doi.org/10.1174/021347412802845577.

Whitmarsh, L., O'Neill, S., 2010. Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. J. Environ. Psychol. 30 (3), 305–314. https://doi.org/10.1016/j.jenvp.2010.01.003.

Yang, L., Ren, Y., Tang, Z., Zhu, Y., 2021. Impact of institutional constraints on participatory irrigation management: the regulating role of moral obligation. Irrig. Drain. 70 (5), 1287–1297. https://doi.org/10.1002/ird.2602.

Yates, J.F., Stone, E.R, 1992. The risk construct. In: Yates, J.F. (Ed.), Wiley Series in Human Performance and Cognition. Risk-Taking Behavior. John Wiley & Sons, pp. 1–25. https://psycnet.apa.org/record/1992-97821-001.