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Water reuse in France - Social perception of an unknown practice

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Abstract:

In France, wastewater reuse (WWR) is an emerging practice. In light of climate change, French authorities multiply pilot experiments but little data have been collected on public perception of this practice. This study questions French opinions towards WWR and tests variables that influence it.

The most discriminating factors are, in our study, perception, disgust, targeted use and information. The different types of information tested produced contrasting reactions. Our work also shows a strong coherence between attitudes and behavioral intentions. However, the threat of a 20% drop in local customers would not be acceptable in an agricultural and wine-growing area such as Pic Saint Loup.

Keywords: perception; wastewater reuse; information; communication

Introduction

Every second year, half of French departments set up restrictions on use due to water scarcity (CGAAER, 2017). Irrigation is limited or even prohibited for weeks. WWR could be justified in these territories. However, French regulations have long imposed requirements that have limited this practice. Only 0.2% of treated urban wastewater effluents is reused annually in France. In light of climate change, French Water Agencies multiply pilot experiments. Among them, the SOPOLO project focuses specifically on socio-economic issues, sometimes referred to as "social acceptability" (Lazarova & Brissaud 2007). This notion, although "embarrassing" (Barbier & Nadaï 2015), was soon acknowledged as a key element for the development of WWR in the same way as technical issues (Baumann & Kasperson 1974).

In France, national statistics regarding WWR acceptance do exist but few researchers have looked into sociotechnical factors which can slow down the emergence of WWR projects. Cerceau (2015) evokes the lack of awareness of water scarcity and the restrictive regulatory framework. Berry et al. (2016) reveal difficulties related to the rise of controversies. Indeed, water is a controversial subject in France, whether for the justification of irrigation (Granjou & Garin, 2006), or the quality of drinking water (Hervé-Bazin, 2014).

Our study focuses on the representations and the opinions of a representative sample of the Pic Saint Loup territorial community in South of France. This Mediterranean wine-growing territory has undergone several droughts that could intensify in the coming years. WWR is an alternative currently explored on the territory. Our work concentrate on public attitudes towards this emerging alternative.

Material and Methods

For this study, a questionnaire was administered by master students at the University of Montpellier. They conducted their surveys around markets and supermarkets in 10 municipalities. 845 questionnaires have been completed.

This questionnaire combines various methods:

- An associative method (Abric, 2003) to qualify the social representations of the object "treated wastewater".
- In line with the work of the theory of planned behavior (Ajzen, 1991), questions aim to establish relationships between attitude, norm and intention of behavior.
- Finally, in the same survey, we wanted to check if different forms of information could reinforce consumer confidence (Pichon, 2006). In the literature, the influence of information on the attitude towards WWR is not a consensus (Fielding et al., 2018).

Results and Discussion

1/ Associative method

The table below presents the analysis of 3-word associations pronounced and ranked at the beginning of the interview by the participants in response to the statement "treated wastewater". These rankings include the words after lemmatization. For

example, we have grouped the terms "connection", "pipeline", "water tower" and "pipe" under the same term "network".

The rareness indices (word cited only once by one person) and diversity indices (number of different responses) are 0.14 and 0.22 respectively before lemmatization. This reflects the poverty of the lexical field associated with WWR. For comparison, a similar study conducted on water obtained indices of 0.58 and 0.72 (Garin et al., 2018). These figures show that WWR hasn't been much discussed among the population, which is at the origin of social representations (Abric, 2003). It can be explained by the low media coverage of this object in France.

The following table ranks the words statistically according to their frequency and significance (in relation to the average rank, from 1 to 3, given by the interviewees).

Table 1 Social representations via the analysis of words associated with WWR

| | | Significance | |
|-------------------------|--------------|---|--|
| | | High (rank<2) | Low (rank ≥ 2) |
| Frequency of occurrence | High (≥ 10%) | <i>CORE</i> Wastewater treatment plant (16%) | <i>1st PERIPHERY</i> NONE |
| | Low (<10%) | <i>CONTRASTING ELEMENTS</i> Recycling (9%), environment (7), treated wastewater (6), sanitation (4), pollution (4), dirt (3), clean (3), water (3), water saving (3), positive opinion (2), process (2), cost (2), potable (2), septic tank (1). | <i>2nd PERIPHERY</i> Toilet (2%), disgust (1), network (1), organic pollutant (1), chemical process (1), waste (1), etc. |

In light of these results, "treated wastewater" seems to be strongly associated with "wastewater treatment plant". The participants therefore relate this type of water to its producing entity. Contrasting elements highlight different and less common ways of thinking. They refer here mainly to people who see WWR as an opportunity (recycling, water saving, etc.). In general, there are very few elements with negative connotations. It corroborates CI Eau national water survey (2018) in which a very large majority of individuals (75%) are in favor of using treated wastewater for fruit and vegetable irrigation.

2/ Attitude

The survey question the attitude of citizens towards nine uses: 3 "recreational" uses (golf, roundabout and green spaces) and 6 "agricultural" uses (shared gardens, market gardening, orchards, olive trees, vine and meadows for livestock).

The results support the patterns identify in the literature (Smith et al., 2018) on the relationship between attitude and uses. People are less likely to use treated wastewater for market gardening (70%) than for watering green spaces (90%). This distinction is also confirmed when consumer intentions are questioned. 83% would continue to frequent green spaces irrigated with treated wastewater while only 69% would continue to buy from grocers who sell fruits and vegetables irrigated with treated wastewater.

A statistical analysis was conducted to identify the sociotechnical variables that may be correlated with these attitudes. We obtain the following results for the irrigation of three uses.

Table 2 Chi-Square Test of Independence (p-value<5%)

| | Parks and gardens | Vine | Market gardening |
|---------------------------|-------------------|--------------|------------------|
| Disgust | 0.000 | 0.000 | 0.000 |
| Environmental sensitivity | 0.000 | 0.001 | 0.000 |
| Risk perception | 0.003 | 0.000 | 0.000 |
| Information | 0.811 | 0.007 | 0.001 |
| Trust in technologies | 0.021 | 0.106 | 0.142 |
| Gender | 0.744 | 0.383 | 0.019 |
| Age | 0.409 | 0.259 | 0.092 |
| Information habits | 0.557 | 0.418 | 0.438 |

Disgust, environmental sensitivity and risk perception influence attitudes for all three uses. For instance, people who are reluctant to eat a vegetable that has been irrigated with treated wastewater are less likely (-55 %points) favorable than others to reuse wastewater. For parks and gardens, the more environmentally sensitive participants are, the more likely they are to reuse wastewater (+10pp).

Confidence in technology act on WWR attitudes also, but the probability of independence is less significant between these two variables.

In the literature, the effect of age is different depending on the cultural context. A negative effect is demonstrated in American studies while Australian studies show the opposite (Fielding et al., 2018). Here, age does not seem to have a significant effect. For market gardening, a gender-related effect is confirmed. Men are more favorable to WWR than women (+ 4.57pp).

3/ Effect of information

To analyze the information effect, the sample was divided into four groups, a control group and three groups facing different types of communication: 1/ neutral, presenting WWR with factual elements, 2/ persuasive, emphasizing the benefits of WWR and, 3/ commitment (Bernard & J Joule, 2004), subjecting participants to a preparatory act before delivering the persuasive communication. A flyer was handed out to each participant.

The results presented in Table 3 show an effect of the information on attitudes. This effect does not seem to be homogeneous. It varies according to the type of use and the type of communication.

Table3 Effect of information on attitude towards WWR

| Attitudes | | Commitment (N=154) | Neutral (N=309) | Persuasive (N=176) | No Info (N=204) |
|----------------------|-------------------|-----------------------|--------------------|-----------------------|--------------------|
| Agricultural uses | Strongly agree | 44% | 55% | 44% | 37% |
| | Agree | 29% | 23% | 32% | 28% |
| | Disagree | 18% | 12% | 17% | 22% |
| | Strongly disagree | 8% | 8% | 4% | 8% |
| | No opinion | 2% | 2% | 3% | 3% |
| Recreational uses | Strongly agree | 61% | 72% | 62% | 64% |
| | Agree | 19% | 16% | 27% | 21% |
| | Disagree | 13% | 7% | 6% | 11% |
| | Strongly disagree | 5% | 3% | 3% | 2% |
| | No opinion | 1% | 2% | 2% | 1% |

Information described as neutral significantly strengthens the favorable attitudes for all uses. This impact could be explained by the mention of the health authority's controls exclusively on this communication medium. The so-called persuasive information changes the opinion of the very opposed participants, but only for agricultural uses. This brochure explicitly mentions agriculture in its slogan "WWR - a resource for our agriculture" and as a local solution to food security. Finally, in the commitment scheme,

participants gave their opinion on short food channel, as preparatory act, before being subjected to persuasive information. The results are contrary to scientific hypotheses. There is even a slight decrease in positive opinions compared to the control group. The relevance of the preparatory act is to be questioned.

The effect of information also appears to be influenced by media consumption habits (radio, TV, web, newspapers). Among those who received an information, being well informed by the media increases by 25pp the probability of responding "strongly agree" rather than "agree" (at the 1% threshold). This supports an Australian study (Dolnicar et al., 2010) on WWR. It points out that the cause of heterogeneity in information responses is more the experience of information processing than socio-demographic data.

Finally, the study also found a strong coherence between attitudes and behavioral intentions ($p\text{-value} = 0.000$). People who are in favor of WWR will not change purchasing habits if they learn that vines are irrigated with treated wastewater. A reassuring effect of the information is also noted. Consumers are less hesitant with information. However, the threat of a 20% drop in local customers would not be acceptable in an agricultural and wine-growing area such as Pic Saint Loup.

Table 4 Effect of information on attitudes and purchasing intentions for wine

| Attitudes | Info | | | No Info | | |
|--------------|------------|-------------|------------|------------|-------------|------------|
| | Purchase | No purchase | Don't Know | Purchase | No purchase | Don't Know |
| Agree | 91% | 23% | 41% | 86% | 22% | 31% |
| Disagree | 7% | 75% | 48% | 13% | 76% | 38% |
| No opinion | 2% | 2% | 11% | 1% | 2% | 31% |
| Total | 75% | 20% | 5% | 66% | 26% | 8% |

The results presented in this table for wine purchases are similar for vegetables or cheeses from breeding that consume fodder watered with wastewater.

Conclusions

On the territory of the Pic Saint Loup, our survey reveals similar results to national statistics. The practice seems to be unknown, as confirmed by our associative method. WWR has not yet raised high-profile controversies covered by the media that could

shape contrasting opinions. The other results are in line with the literature on sociotechnical factors influencing attitudes of WWR. The most discriminating factors are perception, disgust and targeted use.

Finally, these surveys tend to confirm the role of information on the social perception of WWR. However, the effect of this brief information on opinions must be put into perspective. Research has indeed shown the bias of a recency effect with a decrease in the influence of information over time (Kemp et al., 2012).

The differences in results according to the type of information suggest the implementation of specific communication approaches to each territory rather than standardized strategy. However, our study also reveals a paradox related to communication. By communicating, agricultural producers would strengthen the social acceptability of their project at the expense of a potential loss of customers. Historical WWR projects such as Noirmoutier in France do not communicate on the origin of irrigation water. For 30 years, they irrigated potatoes there with treated wastewater without a health scandal. However, in the current social context, the managers of this irrigated perimeter could be accused of a lack of transparency. The current multiplication of WWR pilots may lead to local controversy. Will it be health-related or of a communicative nature?

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