ABSTRACT

Title: Why dare to involve people in water reuse projects?

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Abstract: *(minimum 300 words)*

Water reuse is one of the main exponents of circular economy approach. However, one of the main problems concerning the projects based on water reuse is the public acceptance. The components of water reuse projects are clearly defined and include technical options, legal and institutional frameworks, heath risks, knowledge and building capacity and financing opportunities that are clearly interlinked but, as a central point, public acceptance ((United Nations World Water Assessment Programme, 2017). In fact, negative public perception is seen as one of the main potential barriers to water reuse projects (Deloitte, 2015). In this way, social marketing and persuasion seems to be ineffective in influencing people to use recycled water (CSIRO, 2003). The problem seems to be in large part psychological. Literature includes two basic psychological processes that influence recycled water rejection, on the one hand, the yuck factor, term coined by Arthur Caplan to describe the influence of instinctive responses against new technologies (Schmidt, 2008) and on the other hand, contagion (law of contagion). At the same time, lack of acceptance of water produced by modern techniques that cut the time and distance that would naturally intervene between wastewater discharge and potable water generation (Rozin el al. 2015) are seen as another factor of this problem. In this context and even if water reuse projects are technically well designed, feasible in terms of finance and have incorporated appropriate health protection measures, water reuse schemes can still fail, if planners do not adequately account for the dynamics of social acceptance. After reviewing different cases of success, we find that a good communication strategy and the involvement of people from the beginning of the project are the key for changing public perceptions and improving acceptance.

Keywords: *water reuse projects, yuck factor, circular economy*
JEL codes: L97,O35, P48, Q25

Content

1- Introduction

The last report on wastewater of IWA (IWA, 2018) focuses on the cities and their opportunity, as drivers of the global economy, of leading the water revolution to enable a transition to a circular economy. Recovering water, energy, nutrients and other materials embedded in wastewater is an opportunity not only for cities but mainly to transition to the circular economy and contribute to water security. The United Nations World Water Development Report in 2017 focused in wastewater as an untapped resource saying "wastewater is no longer seen as a problem in need of a solution, rather it is part of the solution to challenges that societies are facing today". Water demand is expected to increase not only for increasing population but for demand increasing in other uses (agriculture, industry, energy) and for maintaining ecosystems. In this sense, climate change is influencing the water cycle dynamics and water scarcity and floods are new challenges. All these facts make thinking that now is the time for water reuse. Specifically, water scarcity has been moving up on the global political agenda, including the 2030 Agenda for Sustainable Development. The establishment of SDG 6: *Ensure availability and sustainable management of water and sanitation for all*, reflects the increased attention on water and sanitation issues in the global political agenda. For all these reasons, improving wastewater management including the reuse of water is a rational way in the context of circular economy (Voulvoulis, 2018)

Although the technology is developed and fits different uses for reused water[1], the reuse projects lack on financing and governance issues. Although these barriers are important in less developed countries, in developed countries the most important barriers are social, cultural and consumer ones. In other words, the public perception about wastewater use and reuse relies on trust, mainly, in managing health risks and trust is costly to achieve and to maintain. We analyze the perceptions of reuse water and the

[1] See different chapters (4,5,6,7,8, 17 from UN Water (2017)

instruments allowing building trust and increasing awareness on water reuse projects.

The basic idea is simple: although we have a perfect project on water reuse, if we left aside public acceptance, the project will fail. The major challenge concerning social acceptance is to overcome the “yuck factor”.

We don’t split public acceptance between direct and indirect water reuse, we think that although there are a lot of projects on water reuse, the specificities and local context plays an important role. The question of direct and indirect use is a next phase in public acceptance although there are some experiences. Usually, in places where indirect potable reuse has reached a positive public perception, it is easier to collect support for direct potable reuse. The existing evidences allow finding specificities for each case.

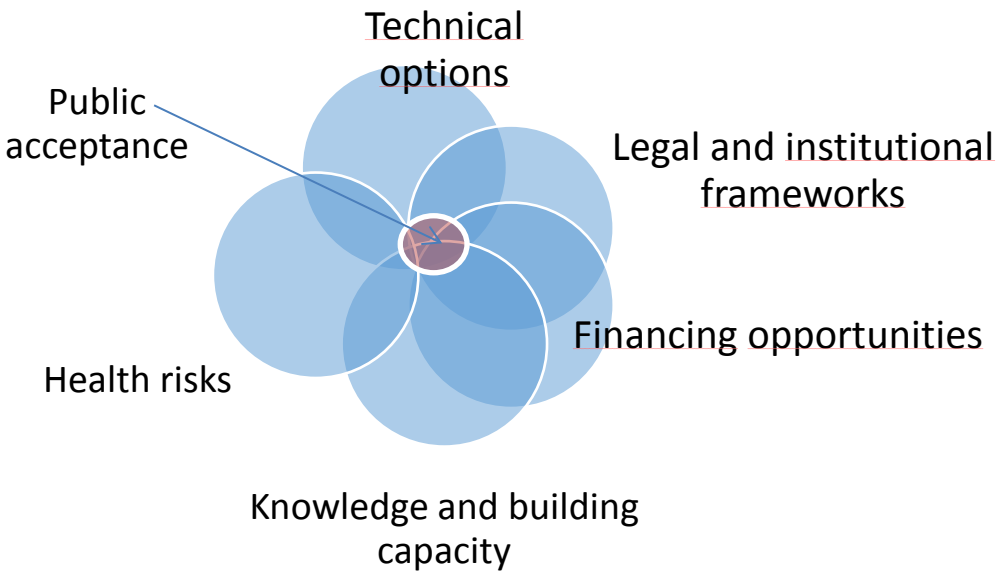
The paper is divided in 5 parts. After the introduction we will revise the literature about the components of water reuse projects highlighting the role of public perception on water reuse (part 2). Part 3 is focused on the factors concerning public perception and acceptance and shows, clearly, the agreement in the literature about these factors. In part 4 we focus on the basis of some of previous factors, specially, the yuck-factor and the law of contagion. The next part (part 5) is devoted to a discussion about the instruments for increasing public acceptance and awareness based on education and communication. We finish with our conclusions. We added two short annexes with two cases: San Diego and Los Angeles.

2- The components of water reuse projects

In order to understand the difficulty of being successful in water reuse projects, the United Nations World Water Assessment Programme (2017) insist on creating and enabling environment. This implies to have in mind different components as is shown in Figure 1. As we can see, the idea is going beyond only technical options in order to include all issues and do not forget the specifities of particular situations. Nevertheless,

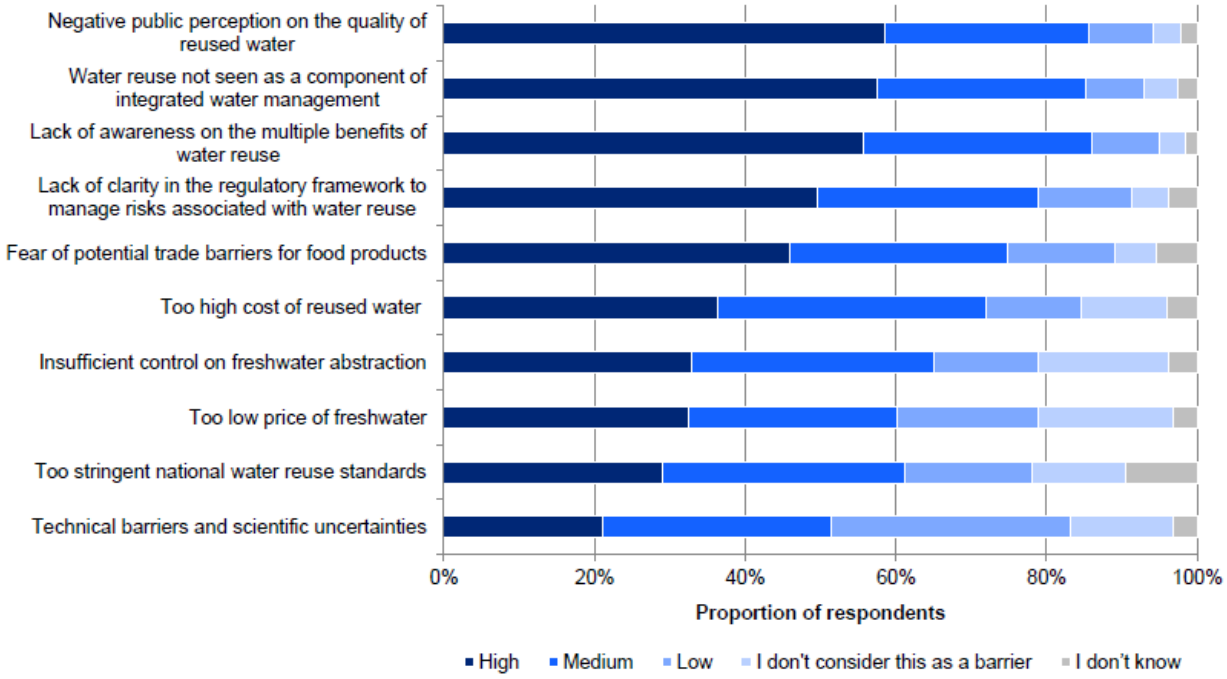
as intersection of all these elements and that never can be neglected, the most important thing is to foster public acceptance.

Figure 1 Component of creating and enabling environnement. AWWA (2017)



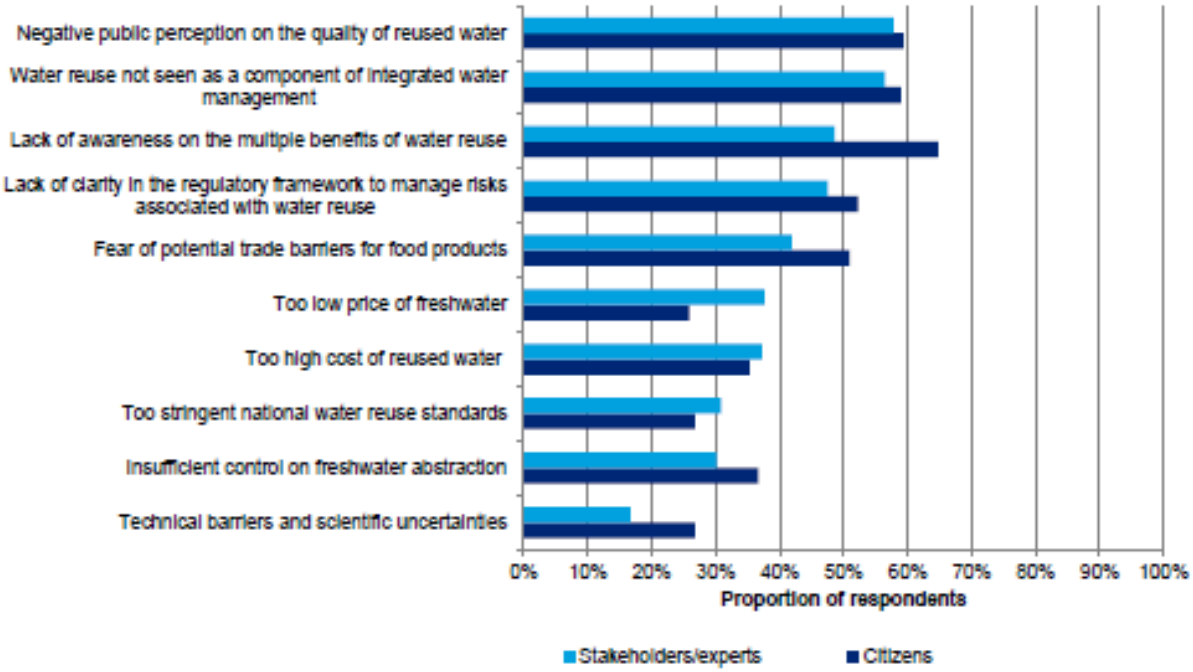
Usually, public acceptance is not taken in to account and can drive the project to failure. This idea is found in IWA (2018) where the inclusion of the need of increasing the acceptance of water reuse is one of the lessons learned in all the cases analysed. There are some evidences related to public acceptance relevance, Deloitte (2015a) summarises the potential barriers to water reuse projects insinting on the idea of negative public prrceptions as one of the main barriers and with a high proportion of respondents (Figure 2) . The second important barrier is that water reuse is not seen as a part from all the other sources. This implies that the management of water resouces lacks of public perception of all possible sources and can prevent the implementation of a real integrated water management, making a partial approach. In fact, it is perceived a lack of knowledge by the public on water reuse side although some of the perceived barriers are real ones.

Figure 2: Potential barriers to water reuse



At the same time, the results of the public consultation by Deloitte shows that the barrier of negative public acceptance is perceived as high (more than 50%) by stakeholders and by citizens too (Figure 3) . In the same report, the lack of awareness on the benefits of water reuse is seen by the SME and large companies as one of the most important barrier and also considered as high barrier but compared with citizens, the proportion is less than 50%. In the case of citizens the percepction as a high barrier is more than 60% .

Figure 3 Proportion of citizens and stakeholders/experts considering barriers as "high"

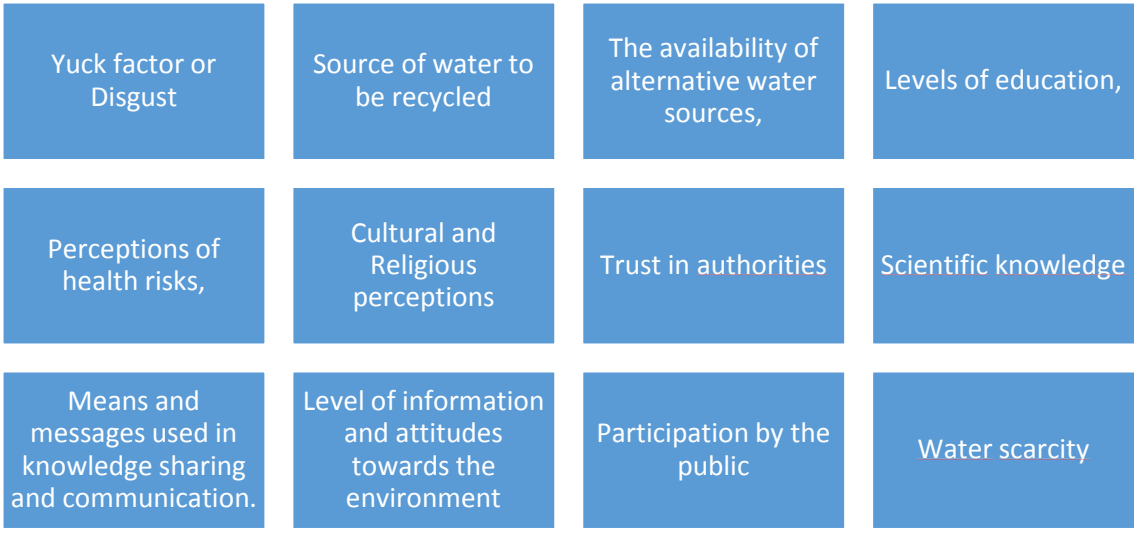


In Smith et al. (2018) an useful review about the factors influencing public reactions is done. The authors hihglight several gaps in research. One of them is that research is mainly based on failed projects due to negative public perception. In this line we can't forget that the shift on public acceptance could appear being on contexts, time and depending on the situation, for example, of drought. But, it seems accepted that when the situation is about necessity, the barriers decreases and are less higher. Despite all the assumptions showed by Smith et al (2018), that the question of public acceptance is present in research and how to deal with it needs more research using social sciences approaches.

3- Factors concerning public perceptions of water reuse

Literature shows some kind of agreement concerning this question. Although the number of actors depends on the approach, the presence of absence of these factors is related to reuse projects success. Po el al (2003) provide a set of factors that can influence the acceptance of reuse water projects (see Figure 4)

Figure 4: Summary of factors influencing water reuse projects



Hartley (2006) identifies five elements seen as critical: managing information for all stakeholders; maintaining individual motivation and demonstrating organizational commitment; promoting communication and public dialog; ensuring a fair and sound decision-making process and outcome; and building and maintaining trust. However and, as Smith et al. (2018) highlight, the yuck factor is not included in Hartley (2006) and it is important for being succesful. For these reasons, it is difficult to say that although to engage people and build confidence and trust is the way, we can't forget how to deal with yuck factor becauset human behaviour and preferences are linked to emotions.

Even if water reuse projects are technically well designed, feasible in terms of finance and have incorporated appropriate health protection measures, water reuse schemes can still fail, if **planners do not adequately account for the dynamics of social acceptance.**

4- What's the problem?

Usually, papers and articles on public acceptance are based on surveys using qualitative methods (interviews and focus groups). This approach provides many useful insights for specific projects and local situations but gives limited information about the general development of water reuse and the improvement of public acceptance. In addition to the socio-demographic factors, many other criteria influence the acceptance of reuse of water projects such as trust in authorities, knowledge and information, risk perception and health concerns, specific uses of recycled water, attitudes toward the environment, past experience and the cost of recycled water, as several literature- reviews (Lazarova et al. 200, Po et al. 2003;Anderson et al. 2008; Dolnicar et al. 2011) states.

With more accuracy, public perception and acceptance of water reuse are recognized as main issue for the success of any reuse project. Nevertheless, social marketing and persuasion is ineffective in influencing people to use recycled water (CSIRO, 2003). Some authors agree that the problem is now in large part psychological. The yuck factor and contagion are two basic psychological processes influencing reclaimed water rejection.

The 'yuck factor' is a term coined by Arthur Caplan to describe the influence of instinctive negative responses against new technologies (Schmidt, 2008). Although the term expresses negative feelings about technology (technophobia), the sense is not exactly the same in the case of reuse of water. Usually, it has been used for explaining barriers to public awareness on nanotechnology for genetically modified food or cloning. In this sense, wastewater reclamation and its use as possible freshwater are possible thanks to the adoption of new technologies that "clean" the water and make it reasonably safe. In this case, the yuck factor is not based on technology but in the perception of the output of the technology implementation going "from toilet to the tap". In fact, the situation could be understandable due to the idea of safety and healthy but, at the same time, can be used for improving the information that the public has about the capacity of technology for cleaning the water. As Oli et al (2012) found,

highly educated people present more support to technological change and they are likely better informed. The situation of asymmetric information in the sense of different levels of knowledge about the technology in wastewater treatment is important because people usually decide support (or not) reuse projects without enough information (because it has not been provided to them). This is one of the reasons for improving the information level and the communication when the project is being planned.

Wester et al (2016) conclude that the yuck factor is important but it is not fixed. In other words, more information you have more cognitive processing when considering reuse of water. Although psychological factors (as disgust) are important, the context variables could help to decrease the uncertainty around water reuse. It seems that changing disgust reaction is possible but the question is how.

Goodwin el al. (2017) analyses the public response to on line news reporting an indirect potable reuse proposal for London. The effect of media framing reducing confidence in specific reuse schemes or improving public engagement is the base for uncertainty about what to do. The authors find no evidence about the relationship between the media news on a proposal on water reuse scheme in London and the comments in internet.

Concerning the contagion (law of contagion) Rozin et al. (2015) explain that although the reuse of water has been working for years, in some cases using natural purification system, the introduction of technology for treating wastewater has provoked some kind of lack of acceptance of water produced by update techniques that cut the time and distance that would naturally intervene between wastewater discharge and water treatment plant. The law of contagion is described by the same authors with a simply idea: “once in contact, always in contact.” This link is not necessarily bad except on the case of disgusting object that pass on the objects or goods that are in contact.

In some cases, although the yuck factor is a real question, the need to resolve the problem of securing water supply is the real engine in the application of reuse schemes, either direct or indirect[2].

5- What to do? Education and Communication

The answer of the question about how improve the public acceptance of water reuse schemes are going in the direction of increasing information, either using long-term instruments as education or short –term instruments as all communication tools.

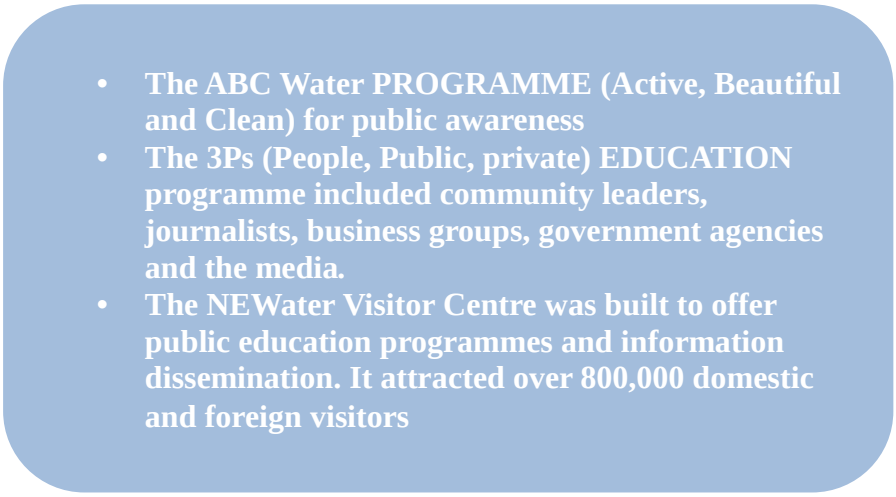
In this sense, a**wareness raising and education are the main tools** to overcome social, cultural and consumer barriers and to significantly contribute to building trust among consumers and changing public perception about wastewater use. Such awareness campaigns need to be designed having in mind different cultural and religious backgrounds of the community.at the same time and in order to be effective, should be inclusive in terms of gender and age. Depending on the specific needs and the local context, the way to promote awareness will be different. Other important point is the dissemination of awareness campaigns and education tools, to use a brand (as the case of NEWater in Singapore or One Water in La). The aim should be to achieve a positive public perception of reclaimed water and minimize the "disgust effect" produced by the yuck factor. At the same time, a good regulatory scheme ensuring human health safety will build and improve consumer trust in administration and will contribute to change public perception (UN, 2017).

In the case of Singapore (Un World Water Development Report, 2017, p. 135), the Singapore Public Utilities Board (PUB) used a comprehensive approach, including the

[2]" For the city of Windhoek the future is unmistakably tied to intensified water reuse to a point at which the motto of 'every drop counts' becomes a reality to each and every citizen. Building on the success attained by past generations, the planning of an additional direct potable reclamation facility is currently ongoing in an effort to secure medium term water supply as an economically feasible alternative " in Lahnsteiner , J. et al (2018).

ABC Waters Programme for increasing public awareness, the 3Ps (People, Public, Private) education programme and the NEWater Visitor Centre. The 3Ps programme included community leaders, journalists, business groups, government agencies and the media. The presence of multiple stakeholders and representatives of society is key for extending information about the project. The NEWater Visitor Centre was built to offer public education programmes and information dissemination. It attracted over 800,000 domestic and foreign visitors.

Figure 5. Components of PUB approach



The Singapore Public Utilities states that social acceptance regarding wastewater increased as a result of these educational efforts for awareness-raising and outreach. Lefebvre (2018) highlights the success of the Singapore NEWater based on a long-term strategy of the city-state focused on the idea of sustainability. In this case, it seems that putting the focus on the role of water reuse as one of the key factors in achieving sustainability may improve the public acceptance.

The use of serious games or gamification for improving social perception of reusing water can be added as an instrument. For example, REUSETIC is a game[3] that

[3] http://bcn.grupoica.com:8000/

incorporates different technological solutions and potential uses related to regenerated water. Through web cards multiplatform, the player must solve a series of missions selecting the options suitable for unlocking new cards. These missions pose different scenarios in which reuse can be applied in urban and industrial field, using different technologies and appropriate legislative framework. Finally, for checking if you have been able to transmit the raised concepts, an evaluation questionnaire is included.

Concerning **communication**, it is important to learn from success stories and they show that effective communication between **the community, key stakeholders and the project proponent** is crucial to achieve community support. Good communication is based on providing good information and knowledge and, as we said, this is important for building our preferences and giving support to reuse projects. Chen et al. (2015) investigate attitudes of both the general public and professionals towards reclaimed water reuse in Beijing and they find that the perceptions of either the general public or stakeholder professionals on reclaimed water reuse are affected by the general knowledge that they have. At the same time, improving understanding not only on water reuse but in water resources is a condition for implementing reuse projects.

Usually citizens are used to hear the sentence ‘we know what’s best for you’; this culture is based on trusting in the decisions made by public administration. It may be that asymmetric information and knowledge is on the basis of this approach but important changes in the provision of information thanks to internet could be modifying this approach. Citizens want to know how decisions are taken and want to have information and making pressure for transparency. In Spain we have the case of the High Speed Rail in the city of Murcia. The planned route was decided in the Ministerio and divided neighborhood in half. Citizens start with demonstrations that has evolved to be aggressive, citizens has been organized under a civil platform against the project and fighting for undergrounding the route. At the end, the battle against citizens and the police was of high intensity and the administration understood that a change was compulsory (https://www.eldiario.es/murcia/sociedad/Vecinos-celebrar-AVE-soterrado-Murcia_0_794070808.html).

More and more we can find lot of cases that the pressure of the citizens change the final administration decision. This situation is impacting in water reuse projects, too. Availability of full information on where the infrastructure is planned, the technology, impacts on water resources, droughts, risks and so on are compulsory and people should have the possibility to provide some inputs about the project. The perception that you can contribute to the final project makes increase the support on it. In summary, providing key stakeholders with the **opportunity to have informed input during the decision making process is the way to improve trust and engagement.**

The factors that are compulsory in the communication strategy involve different aspects. Between them: 1) A clear and positive terminology should be used. In the case of Singapore, PUB translated technical information and terms into simple language; for example, the term ‘wastewater and sewage’ was changed into ‘used water’, and ‘sewerage treatment plant’ into ‘water reclamation plant’. Information was also provided in simple diagrams and graphs, as well as through entertaining tools for community outreach such as the mobile game ‘Save My Water’. 2) Communication strategy is not universal. Don’t forget that communication strategy depends on local conditions 3) In case of using surveys including educational elements, public acceptance increases 4) The independent scientific support generates more reliability and 5) Emphasis should be placed on water quality and environmental sustainability.

It is important to i**nvolve citizens in decision-making at all levels** but from the beginning of the reuse project. This way promotes engagement and ownership. As EPA (2017) states “Involving stakeholders from the beginning can be critical for effective policy decisions.”

6- Conclusions

The implementation of circular economy has a very good case in water reuse. It is a common that the main barrier for water reuse projects is public acceptance. In order to understand public rejection of water reuse when, in fact, urban water is already reused emotions are playing a central role. The disgust emotion derived from the yuck factor and contagion must be overcome by the multiple benefits of water reuse. However, if people do not know how large the benefits are and don't have information and knowledge for understanding the technology functioning has a biased opinion. The asymmetry in information between general public and reuse projects providers and managers provokes lack of trust and a negative support. More and more people want to be involved in public decisions and in the case of public service this is a right because, at the end, they are financed by taxes paid by citizens. Increasing knowledge and giving information about projects are a good procedure when the technology component is a central aspect. If institutions give information "from the begining of the project" and work in a transparent way, all of us are able to accept measures for improving our welfare levels without compromising the future of investment and ensure sustainability. Information about projects in other sites help to minimize negative perceptions. At the end, when we don't have enough water for all uses and the need to reusing water become compulsory, feelings and the yuck factor will not be important. At that time guarantee water availability will be on the first lane and will not be yet relevant the acceptance or not by the citizens and we lose a good time for co-creating social sustainable solutions.

The answer to our question about why dare to involve people in water reuse projects is clear. As the research and the evidence show is a way to ensure the success of reuse projects and to build mature and informed societies.

ANNEX 1: San Diego Case

The city of San Diego imports 85% of water from Northern California Bay Delta and the Colorado River and in the last 15 years the cost has tripled and is increasing. Due to this vulnerability, the city design a Long-Range Water Resources Plan (2002-2030) including water reuse with the aim of providing one-third of water supply locally by 2035. The Pure Water program is the title for the reuse activities and investments. The strategy adopted relies on increasing knowledge in San Diego's water supply source and challenges, the science of water purification, and how it can provide a reliable drinking water supply for the San Diego community. In January 2004, the San Diego City Council authorized a comprehensive evaluation of all viable options to maximize the usage of recycled water by doing a Reuse Study done by stakeholders and showing what was their preferred alternative. The study also included analysis and research on the health effects of reuse options and a public participation process. In this sense, San Diego formed the Pure Water Working Group to provide diverse viewpoints and input and also a independent advisory panel. Other action include a guided walking tour through facilities including a video of other sites (Orange County Groundwater Replenishment System), the possibility to make questions to a panel of experts are the components for delivering information to citizens. One of actions is a partnership with the Stone Brewing Company[4] for using purified water for producing beer (additional information on Pure Water San Diego is available at www.purewatersd.org.)

[4] Stone Brewing Co. is a brewery headquartered in Escondido, California, USA. Founded in 1996 in San Marcos, California, it is the largest brewery in Southern California. Based on 2016 sales volume it is the eighth largest craft brewery in the United States.

ANNEX 2: Los Angeles Case

The City of Los Angeles needs to improve its resilience to drought conditions and climate change taking into account sustainable and long-term water supplies. With this aim is developing the One Water LA 2040 Plan based on collaborative approach to integrated water management that means to manage all waters (rain/stormwater, groundwater, drinking water, recycled water, wastewater) as one water . The plan states that "Essential stakeholder understanding and participation will help design the future of One Water LA and ensure a sustainable water future for Los Angeles. The success of One Water LA requires the recruitment of community stakeholders and each individual to take action". In the different phases the plan includes more than 250 stakeholders and more than 150 organizations. Conerning the wastewater facilities plan, the outcomes were, mainly, to prepare water reclamation plants to maximize potable reuse and Implement, monitor, and maintain a reliable wastewater system. Once different policies and actions are accepted, stakeholder will continue being engaged in the implementation committees (more information www.onewaterla.org)

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