DEMOWARE

D5.2 Trust in Water Reuse

Review report on international experiences in public involvement and stakeholder collaboration

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Abstract	This report presents international experiences on public perception, support, opposition and involvement in international water reuse practices. The report discusses how water reuse organisation may build trust and public acceptance for water reuse through public education, involvement and communication strategies.

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Executive Summary

Irrespective of technical optimism and the gravity of the water crisis, and even despite some encouraging signs that levels of support may be growing, public opposition is currently considered a major challenge for water reuse. This report presents international experiences on public perception, support, opposition and involvement in international water reuse practices. One of the key arguments is that public support and opposition to water reuse is fundamentally influenced by trust, including trust in the technical process and regulation, trust in the water reuse organisation itself, and ultimately, trust in the quality and safety of the final product: reused water. Given this importance, this report elaborates on the variables that may influence (enhance or reduce) public trust in the quality and safety of recycled drinking water.

The first variable that underlies public trust in recycled water relates to sensorial information (organoleptics), i.e. the characteristics of water that affect our senses of taste, smell and sight. The second underlying variable is the contextual information that provides information on the quality of water in an indirect manner, including information on the way in which water is extracted, distributed, and consumed. How people perceive and trust the quality and safety of (recycled) drinking water also relates to personal experiences, including personal memories of (health) problems that are (rightly or wrongly) attributed to the quality of water. Given the relative novelty of the product, in the case of recycled water personal experiences (with incidents) often relate to the actual non-occurrence or absence of problems after the use of this water. Information on water reuse is the fourth variable influencing public trust in recycled water. The fifth and the last variable is trust in water reuse organisations and regulatory authorities. Given that this last variable is of special interest when considering the promotion of water reuse initiatives, trust in water reuse organisation is not discussed as simply an independent variable influencing trust in recycled water, but also as a dependent variable. Five variables are highlighted that determine public trust in competence and integrity of water reuse organisations, including perceived performance, acceptance modus operandi, personal experience, (media) information, and the communication and information-provision by water reuse organisations themselves.

Among the above variables, two variables in particular are remarkably well suited to be influenced by water reuse initiative holders: their own communication strategy and the personal experience of people by means of creating participation possibilities. Various scholars highlight one or both of these paths as key measures to build public acceptance. Indeed, stakeholder (including public) involvement is generally considered a good method to deal with the frequently observed discrepancy between technical risk analysis and risk perception. Although some authors argue that a very high level of involvement is required for the approval of projects, the international examples of water reuse initiatives discussed in this report seem to indicate that there is no direct link between the degree of involvement and likelihood of acceptance. On the other hand, these examples do suggest that a too low level of, or poorly executed, participation can raise public opposition. Finally, although there is no one fits all solution with regard to the extent of public involvement, timing seems to be important in any

project. Public involvement opportunities should start early, ideally before the planning of concrete projects. Public education and communication is needed to make people aware of the water cycle, the need to recycle water and of the associated benefits of reuse.

As for communication, often seen as “essential” to any modern water reuse project, three so-called attention- and support-seeking strategies to demonstrate the significance of a problem and to convince a wide range of participants about preferred solutions are important. The demonstration strategy appears important to change mental models about wastewater effluent and show that water reuse is the appropriate solution to an important and pressing problem (water scarcity). The exploitation of focusing events, especially droughts, can be very powerful in making the public more aware of a need for, and benefits of, alternate water sources. Last but not least, the strategy of rhetorical persuasion may be used to change preferences regarding water reuse through argumentation and framing. Although, except for a few key messages that are always important, such as “water is always reused”, there is no silver bullet when it comes to the structure and content of information messages on water reuse, an understanding on the perceptions and concerns of the target audience is a precondition for an effective communication strategy, as the messages need to be tailored to each specific group of stakeholders. But if information is properly presented so that it attracts and holds attention and gives knowledge and understanding of water use and reuse, much research, along with several successful case studies, convincingly show that public trust in water reuse technologies will grow, and levels of acceptance will increase.

Introduction

The DEMOWARE project aims to overcome the barriers which constrain the widespread implementation of water reuse schemes around Europe and worldwide, with in Work Package 5 a special focus on the governance barriers. Whereas Deliverable 5.1 presented an analysis of the overall governance challenges in European water reuse demonstration sites, including policies, regulatory frameworks, financing and pricing, this report explicitly focuses on the dynamics of public perception, support, opposition and involvement in water reuse practices.

Despite the fact that public opposition is currently considered a major challenge for water reuse, most cases where public resistance prevented the successful introduction of such schemes are not well documented, and the public responses to reclaimed water are often poorly understood (Hurlimann & Dolnicar 2010; Omerod & Scott 2012). The aim of this report, in which we argue that public support and opposition to recycled water is largely based on trust, is to learn from the international water reuse experiences, and to gain a better understanding of the role, meaning and (potential) function of trust. Furthermore, this reports intends to further contribute to our understanding of the value and need for stakeholder (including the general public) involvement, and to better understand the "do's and don'ts" of communication on water reuse.

The report is structured as follows. The first chapter provides an overview and analysis of a number of international experiences with water reuse, both successful and failed, in which we highlight the role of public acceptance and identify trust as a key factor in understanding support or opposition. Chapter Two delves deeper into the topic of trust, and discusses the most important variables affecting public trust in the quality and safety of recycled water, and in relation to that, the most important variables affecting public trust in water reuse organisations. Then, Chapter Three addresses the two manners in which water reuse organisations might affect public trust, and with that, public acceptance of recycled water: involving stakeholders and an active, deliberate, and tailored communication strategy. A brief summary and the conclusions are given in Chapter Four.

1 Water Reuse and Public Acceptance

1.1 Introduction

Water is a unique resource vital to all life, and has no substitute. Yet, with increasing pollution, decreasing supplies of reliable rainfall, and at the same time a growing population and water demand it is predicted that without improved water resource management, water shortages will affect two-thirds of humanity by 2025. Indeed, global water demand is projected to increase by 55% by 2050, mainly due to growing demands from agriculture, manufacturing, thermal electricity generation and domestic use (Kemp et al. 2012; UNESCO 2015). By 2050, OECD projections even predict that 240 million people are to remain without access to clean water (OECD 2012). Already in the 1990s the severity of this water crisis has prompted the United Nations (e.g. UNESCO 1998) to speak of a 'looming water crisis', a designation supported by many scholars and numerous local, regional and inter/non-governmental organizations.

Water scarcity is not "just" a problem of the future - for example, according to the United Nations Food and Agriculture Organization (FAO), the drought of 1999 in the Near East resulted in a relative decline of food production of 51% - nor just a problem in faraway arid areas. In fact, according the same FAO study the economic impact of, for example, the 2003 drought in Europe exceeded €13 billion (Lazarova 2013). In Europe, water scarcity is particularly pressing in semi-arid regions such as the Mediterranean area, but also in other regions of the continent water demand approaches, or even exceeds, water availability (European Environmental Agency 2012). In response to these challenges, many regions of the world are exploring the use of alternative water sources for both potable and non-potable use (Leonard et al. 2015). In this exploration, water reclamation is increasingly considered as an important solution.[1] Indeed, many water resource professionals consider water reuse an important and underutilized element of sustainable water resource management (Hartley 2006).

However, irrespective of this technical optimism, and despite the gravity of the crisis, some water reuse projects around the world have failed - before, during or after their execution – as a result of public opposition (Friedler & Lahav 2006). In fact, and despite major attempts to better understand and manage the public perception, negative public consumer attitudes and public opposition is currently considered the key challenge to implementing successful (potable) water reuse projects (Bruvold et al. 1981; Bridgeman 2004; Dolnicar and Saunders 2006). In the words of Dishman et al. (1989: 158), the technical aspects of potable water reuse can be resolved, but it ultimately is "the issue of public acceptance [that] could kill the proposal". In a similar vein Postel (1997) concludes that the major barrier to reuse of wastewater is psychological rather than technical, and Hartley (2006) suggests that "the people side" of water reuse projects can be equally, and often more, challenging than solving the technical problems. According to Omerod & Scott (2012) public opposition is currently considered the "primary barrier" or the "greatest obstacle" to successful potable water reuse projects. At the

[1] In this report the terms water reuse, water reclamation and water recycling are used interchangeably.

same time, there is increasing evidence suggesting that public support for water reuse may be growing (Smith et al. 2015). The next section discusses various international (non-European) reuse initiatives, with a particular focus on precisely "the people side", including efforts of public involvement and stakeholder collaboration around these schemes.[2] Emphasis is put on examples of public acceptance in potable water reuse schemes as learning from these examples will be relevant to non-potable water reuse schemes, such as urban reuse, as well.

1.2 Examples of International Reuse Initiatives

1.2.1 Failed, downsized or mothballed water reuse schemes

The literature is ample with examples of high profile indirect potable water reuse projects in Australia, the USA, and Europe that failed after they encountered severe public opposition (see, for instance Hartley 2006 and Hurlimann & Dolnicar 2010). Khan & Gerrard (2006) even suggest that the number of projects that are failing and being abandoned as a direct result of a lack of public trust is growing. This section discusses four well-known examples of international experiences of failed, downsized or mothballed water reuse projects, all summarized in Table 1.

Toowoomba, Queensland, Australia

A well-known failed reuse initiative is the planned potable re-use scheme for Toowoomba, a small city (~100,000 residents) in Queensland, Australia. In 2005 the city council launched the "Water Futures Initiative" to ease the severe water restrictions in place (Hurlimann & Dolnicar 2010). The plan included the construction of an advanced water treatment plant for indirect potable reuse (Meehan et al. 2013). Although this initiative was to include a three year public engagement program, Hurlimann & Dolnicar (2010) argue that the initial announcement lacked basic information regarding the project. The opposition movement, "Citizens Against Drinking Sewage" (CADS) organised and collected 10,000 signatures to petition against the initiative (Reynolds 2006). The lack of information accompanying the initial plan gave CADS the opportunity to frame the issue (Hurlimann & Dolnicar, 2010), shifting the debate to politics and opposition to vested interests (Thorley, 2007). A heavily politicized campaign followed, in which the city council responded to the arguments brought forward by CADS (Hurlimann & Dolnicar 2010). The "engagement campaign" was now perceived as one aimed purely at persuasion (Hurlimann & Dolnicar 2010), which is not considered to be an effective acceptance building strategy (Po et al. 2003). A referendum was set-up in March 2006 by the federal government, which the then-mayor has since criticized for overriding the authority of the (elected) city council (Thorley 2007). Fishman (2012) suggests that the motivation for this referendum was to provide political cover and to avoid accusations that Too-

[2] Unlike D5.1 with a specific focus on the governance challenges in the Demoware water reuse demonstration sites, this report focusses on the lessons and factors for success in various international (non-European) reuse initiatives. Drawing from the findings of this international analysis, Task 53.3 will develop tailored advice for some selected demonstration sites.

woonbans would have been forced to accept poo-water. Despite the urgent need for more water and the promotion of recycled water as the solution, the extremely well-funded opposition by the CADS carried the day and the proposal was voted down in July 2006, with over 60% of the residents voting against the project (Hurlimann & Dolnicar 2010; Fishman 2012). Beside the way the debate had been framed around vested interests (Hurlimann & Dolnicar, 2010), explanations for the referendum result include a fear of health risk, that people felt like they were being used like lab rats, and that people did not want the towns image of a "Garden City" become replaced by "Poowoomba" (Balderson 2006).

San Diego, California, United States

Located in South California, San Diego has little renewable water sources (Bridgeman 2004). In the 1990s, most of the city's water (~90%) was being imported (Hartley 2006). At the same time, the city was struggling with the future of its primary water treatment facility, which was discharging into the Pacific Ocean below government requirements regarding effluent quality (Bridgeman 2004). As part of an agreement with the U.S. Environmental Protection Agency, the city would be allowed to leave its treatment facility unchanged, as long as the volume of effluent could be reduced (Bridgeman 2004). To comply with this agreement, the city built a water treatment plant, which enabled part of the discharge reduction to be met through non-potable uses (Hartley 2006). Since the non-potable demand could not cover the supply, the city decided to use the remaining reclaimed water in an indirect potable reuse scheme, in order to prevent having to discharge this purified water into the ocean (Hartley 2006). The water, after having gone through an advanced treatment facility, including microfiltration, reverse osmosis, and ultra-violet light, would be added to the main drinking water reservoir, in which it would reside for a year (Po et al. 2003). Extensive public involvement was planned, consisting of public education on how water reuse works (Van Riper & Geselbracht 1999), as well as opinion surveys and engagement with community leaders, both of which indicated support for the project (Po et al. 2003). Still, Marks (2006) criticizes the fact that public involvement was limited or non-existing in the first planning stage, making it more of a "marketing" effort than true involvement. The proposal further faced concerns over social justice, with opponents claiming that the project aimed to supply low-income neighbourhoods with wastewater from wealthy areas (Hartley 2006). As a result, despite approval by the California Department of Health Services and support from panels of technical experts (Hartley 2006), the project faced severe public opposition for health concerns, in which stigmatizing terms and phrases like "Toilet to Tap" and "Sewage Beverage" sensationalized by the media proved to be successful manners of the framing strategy to campaigning against the implementation of this initiative. Jansen et al. (2007) hypothesize that electoral considerations by local officials may have played a role in catalysing public opposition, whereas various communication specialist especially criticised the information campaign, suggesting that robust information on reuse practises of the already imported water was lacking. In the political process that followed, the City Council converted the project from a potable to a non-potable scheme (Po et al. 2003).

Tampa, Florida, United States

To prepare for dry periods and reduce dependence on groundwater, the city of Tampa, Florida, evaluated a range of alternative water supplies from 1983 to 1998. One of these alternatives was using treated wastewater to supplement the local river or reservoir, both used to

produce drinking water (Marks 2006). This water would be obtained by upgrading the local wastewater treatment plant to provide at- or above river water quality water (City of Tampa 1997). As part of the proposal, a pilot project was started to evaluate health risks and other factors, including performance and reliability (National Research Council 1998). Planned public involvement included an information campaign, as well as open houses and a review committee (Baird et al. 1997). But, as in the previous two cases, this involvement may be considered to have started too late (Marks 2006). As in San Diego, political candidates may have played a role in catalysing public opposition (Jansen et al. 2007), which in this case was further helped by the fact that two other alternatives seemed viable (Miller 2008). The water reuse scheme was eventually shelved in favour of a desalination plant (Marks 2006).

Western Corridor, Queensland, Australia

The Western Corridor Recycled Water Project represents an interesting case not only because it was supposed to be one of the largest water reuse schemes in existence (Meehan et al. 2013), but also because it shows how projects, from a technical perspective already completed, may nevertheless be mothballed as a result of public opposition and an apparently non-convincing communication strategy. The project, constructed between 2006 and 2008, consists of three advanced treatment plants, of which two can supply the main drinking water source for the city of Brisbane (Meehan et al. 2013). Contrary to the Toowoomba case, no referendum took place for this project, although (ironically) Toowoomba residents were among the intended recipients for the reused water (Hurlimann & Dolnicar 2010). Although there have been plans to hold a referendum at first, this idea was scrapped in 2007 (Meehan et al. 2013). Public opposition and negative reporting by the media made the state government decide to only augment drinking water reservoirs if dam levels fall below 40%, which effectively “mothballed” the indirect potable reuse part of the project, even if meanwhile the infrastructure already had been built (Roberts 2008; Johnstone 2009; Meehan et al. 2013; Price et al. 2015). Also later, a season of increased rainfall created a situation where reuse (which was clearly portrayed as an emergency measure) was no perceived no longer necessary). As a consequence, only about half of the design capacity is currently being used, mostly as cooling water for local power plants (Johnstone 2009).

Table 1 provides a summary of the scale, status and original plans of all four examples of failed, downsized or mothballed water reuse schemes.

Table 1: Reuse Schemes Scrapped, Downsized or Mothballed

Project	Year	Plan	Scale	Status
Toowoomba, Australia	2007/8	Indirect potable		Scrapped
San Diego, United States	1993-1999	Indirect potable (reservoir augmentation)	75,700 m³/day	Converted to non-potable use only
Tampa, United States	1983-2000	Indirect potable (river flow)		Scrapped
Western Corridor, Australia	2006	Indirect potable (reservoir augmentation); Non-potable (industry)	232,000 m³/day (planned); 112,000 m³/day (current)	Potable use suspended largely because of public opposition negative media reporting, most of current production used as cooling water in power plants or discharged into river.

Compiled from City of Tampa 1997; Po et al. 2003; Bridgeman 2004; Hartley 2006; Hurlimann & Dolnicar 2010; Meehan et al. 2013.

1.2.2 Successful water reuse schemes

Although above table with examples of reuse initiatives that as a result of a lack of public support and trust have been scrapped or mothballed could in theory easily be doubled lengthwise, it would be a mistake to conclude that all reuse projects fail or that reuse would be rare. In fact, there are numerous instances of water reuse in Europe and beyond. Four well-known examples of schemes in operation or under construction are briefly discussed below (see Table 2).

Singapore

A well-known and frequently quoted success story on water reuse is Singapore. This city-state in Southeast Asia, with a population of about 5,5 million people, started a water reuse programme around the turn of the millennium (PUB 2015). The use of recycled water would lower dependency on Malaysia, where Singapore imports most of its water from, and be cheaper than desalination techniques (Po et al. 2003). An intensive public education campaign was run (Khoo 2009), and (trust in) the relatively authoritarian system in Singapore has likely made it easier to go ahead regardless of hesitation to drink reused water (Po et al. 2003). In addition, as a means to enhance trust, a public acceptance and visitor centre was

built where commemorative bottles of water directly bottled from the effluent of the plant have been distributed. A survey by Forbes Research confirmed the success of the programme. At the end of 2002, the programme – successfully branded as NEWater - had garnered a 98 per cent acceptance rate, with 82% of respondents indicating that they would drink the reused water directly, another 16% only when mixed with reservoir water (Guan & Toh 2012). NEWater now makes up around 30% of Singapore's total use, by 2060 Singapore's national water agency plans to triple the current NEWater capacity as to meet 50% of Singapore's future water demand. (Lazarova 2013; PUB 2015). Today, the water is mostly used by industry, including high-tech industries requiring ultra-pure water (Growing Blue 2011), s only a very small percentage of NEWater is blended with reservoir water used to produce drinking water (PUB 2015).

Windhoek, Namibia

The oldest direct potable reuse system in operation is located in Windhoek, Namibia (Lazarova 2013; Po et al. 2003). Despite public hesitation centred around health concerns (Lazarova 2013) the construction of this reuse system never face severe coordinated opposition, mainly because of the paramount need for water and the lack of other options. Indeed, alternative water sources up to 500 km away had all been exploited already (Law 2003). Over time, the facility has undergone various technical upgrades, most recently in 2002, and now supplies around 30% of the area's water, with the mixing ratio capped at 35% (Lazarova 2013). Public acceptance today is high, aided by the fact that people now have good experience with the technology, including the absence of health-related incidents, but arguably also related to the fact that current levels of awareness are questionable (Lazarova 2013). Another factor mentioned to be of influence on acceptance today is the level of "pride" felt by local residents to be at the forefront of water reuse (du Pisani 2006).

Orange County, California, United States

Orange County is located in Southern California, and houses a classic example in water reuse (Meehan et al. 2013). A large scale artificial groundwater recharge scheme exists in the area, providing a much-needed freshwater barrier to intruding seawater (Wehner 2010). Part of the injected water consists of recycled water, starting as of 1976 with Water Factory 21, which used reverse osmosis and high lime to clean the water (Law 2003). This plant was decommissioned in 2004 and has since made place for a new project with a higher capacity, under the name of Groundwater Replenishment System (Meehan et al. 2013). This newer scheme uses the newer technological combination of reverse osmosis, microfiltration, and ultra-violet light (Law 2003). Plans are also underway to further increase the capacity of the system (Meehan et al. 2013), which already provides up to 20% of the water used by the county (Chu 2011). Whereas the original scheme was realised before the era of extensive public involvement, the Orange County Water District, responsible for the scheme, foresaw the potential opposition the expansion might face. Four million dollars were spent over a ten year time period to build acceptance (Farrel 2008). This public involvement and education campaign consisted of speeches by representatives of the Orange County Water District, many tours, as well as opinion surveys to identify common concerns (Kix 2012). As a result, the project could count on wide support and commitment, and ended up facing virtually zero public opposition (Farrel 2008).

San Diego, California, United States

Despite the aforementioned setback in the 90s, the effort to increase the share of recycled water in San Diego was rekindled with an extensive study in 2006. This time, starting with workshops with community leaders and further telephone surveys to gauge the public stance with respect to recycled water (City of San Diego 2006). A demonstration project was started in 2007, aimed at performing various feasibility studies and encourage public involvement (City of San Diego 2013). Accompanying the demonstration project, a large scale outreach programme was set-up, including public talks, visits to the facility, attendance by project representatives at various events, and outreach via news and social media (Smith 2015). An indication of the success of this campaign may be given by the fact that public support of wastewater purification for potable reuse rose from 26% to 73% between 2004 and 2012 (City of San Diego 2013). In 2014, a twenty-year program was approved to augment the main drinking water reservoir with reused water. The goal is for this water to eventually provide about a third of the city's water use (City of San Diego 2015).

Table 2 provides a summary of the scale, status and original plans of all four discussed examples of water reuse schemes in operation or under construction.

Table 2: Reuse Schemes in Operation or under Construction

Project	Year	Plan	Scale	Status
Singapore	2000	Indirect potable (reservoir augmentation)	82,000 m^3/day	In operation
Windhoek, Namibia	1968	Direct potable	4,800 m^3/day (original); 21,000 m^3/day (since 2002)	In operation (upgraded in 2002)
Orange County, United States	1976	Indirect potable (groundwater recharge)	265,000 m^3/day, expanding to 378,000 m^3/day (of which 20% is recycled water)	In operation
San Diego, United States	2007	Indirect potable (reservoir augmentation)	3,750 m^3/day (pilot) 56,800 m^3/day (2023) 315,000 m^3/day (2035)	Under construction

Compiled from Law 2003; City of San Diego 2013, 2015; Lazarova 2013; Meehan et al. 2013.

Besides these singled out examples of schemes involving (indirect) potable recharge, it should be mentioned that, apart from the fact that in various arid areas of the world water reuse is relatively common for irrigation purposes in agriculture or to ensure environmental flow in rivers, the US EPA (2012) reports about several tens of successful water reuse projects. Israel for instance was already reusing 65% of municipal sewage for agricultural irrigation by 2006 (Friedler et al. 2006). The Dan Region Reclamation Project is the largest project in the country, in which wastewater from Tel Aviv is recycled for agricultural irrigation (Icekson-Tal et al. 2003). A commonly cited example of indirect potable water reuse has been operated by The Upper Occoquan Service Authority (UOUSA) in Northern Virginia (USA), since 1978. Although the downstream water treatment facility is a traditional water treatment facility, it operates with the knowledge that the discharge into the Occoquan Reservoir is used to produce drinking water, serving around 1 million consumers (Anderson 2003; Law 2003).

A commonly cited example of water reuse has been operated by The Upper Occoquan Service Authority (OUSA) in Northern Virginia (USA), since 1978. Although officially a “normal” water treatment facility, it operates with the knowledge that its discharge into the river is used to produce drinking water, serving around 1 million consumers (Anderson 2003; Law 2003). The process used relies on a number of conventional treatment methods (Law 2003), and further expansion of the project is thought to be able to provide up to double the current quantity of water (Lazarova 2013).

An important realization to make at this point is that most of the water we drink is reused. Besides the obvious fact that all water passes through the hydrological cycle time and again, a large part of the world’s population lives along rivers, which are often used both as source for (drinking) water and a point of effluent discharge. For instance, in Texas, in the United States, significant unplanned potable reuse occurs between Dallas-Fort Worth and Houston. The National Research Council (2012) estimates that up to 50% of Houston’s drinking water (otherwise meeting all of the relevant drinking water quality standards) may be derived from treated sewage from Dallas-Fort Worth.

1.2.3 Concluding

Whereas our list of failed, downsized or mothballed water reuse projects very clearly indicates that the challenges related to public acceptance of reused water are vast, the international success stories and common practice give reason to interpret these data with care. Indeed, the perhaps most straightforward conclusion that the general public is totally adverse to water recycling would be faulty. Research suggest that the public – in general – often supports the concept of using reclaimed water, and is often even somewhat supportive of reuse initiatives (Hartley 2006). Therefore, important lessons that may be learned from these various international water reuse experiences is that public acceptance is a) very important – various scholars (including, Hartley 2003; Po et al. 2003; Marks et al. 2006; Hurlimann and Dolnicar 2010) even argue that no program using recycled water can be initiated without public acceptance – and b) that it is without doubt a major challenge to achieve this public acceptance and support, but certainly not impossible.

1.3 Public Acceptance

Over the years, many different reasons for the public opposition or support for water reuse schemes have been suggested. Often cited as the key explanation for public resistance to potable reuse projects is the so-called "yuck factor", a term used to describe the visceral reaction of dread and disgust associated with drinking reclaimed wastewater (e.g. Po et al. 2005; Schmidt 2008; Schwartz 2015). Psychologists define this term as "magical contamination", an emotion that describes a "once in contact, always in contact" emotion felt by many people (Rozin et al. 1986; Rozin et al. 2015).[3]

Various other previous studies have for instance examined the associations between recycled water acceptance and demographic characteristics, including age, gender, and educational level (Kemp et al. 2012). For instance, some previous studies have found that women (Po et al. 2005) and younger age groups (Porter et al. 2005) are relatively more negative and risk-averse towards using water from reuse schemes, whereas higher-income individuals tend to be more accepting (Hills et al. 2002). However, other studies assessing the causes for support or opposition to recycled water (including e.g. Friedler and Lahav 2006, Dolnicar et al. 2011, Smith et al. 2015) have found no, relatively few, unclear or contradictory associations between demographic characteristics and recycled water acceptance.

Based on a review of studies undertaken up to early 2000, Hartley (2006) identified ten factors contributing to the degree of public acceptance of water reuse. This review suggests that community acceptance of water reuse is higher when:

1. Degree of human contact is minimal
2. Protection of public health is clear
3. Protection of the environment is a clear benefit of the reuse
4. Promotion of water conservation is a clear benefit of the reuse
5. Cost of treatment and distribution technologies and systems is reasonable
6. Perception of wastewater as the source of reclaimed water is minimal
7. Awareness of water supply problems in the community is high
8. Role of reclaimed water in overall water supply scheme is clear
9. Perception of the quality of reclaimed water is high
10. Confidence in local management of public utilities and technologies is high

The first factor Hartley (2006) suggests is contributing to the degree of public acceptance of water reuse – the degree of human contact is minimal – is supported by a number studies investigating public acceptance of recycled or other treated non-traditional water. Indeed, as

[3] Another famous example of the magical contamination phenomenon, that has been studied as a heuristic arising from the "behavioural immune system", is that many people do not want to drink from a glass of water in which a heat sterilized cockroach was dipped (Rozin et al. 1986; Schaller & Park 2011).

depicted in Figure 1, research has often shown that the level of support for using recycled water decreases with its degree of closeness to, or contact with, people. So despite the fact that a range of studies show support for the idea of water reuse (Marks et al. 2006; Friedler 2008; Smith et al. 2015), there appears a certain NIMBY-effect; public support for water reuse diminishes once respondents become the intended users in real practice (Hills et al. 2002; Po et al. 2003; Hartley 2006). In addition, closer analysis of public acceptance of reused water suggests that people are generally very open to use recycled water for external uses with low personal contact, such as outdoor irrigation (for agricultural production), although also here the level of supports varies from one crop to another, among others, depending on whether it involves crops that might be eaten uncooked (related to unrestricted versus restricted irrigation), and which steps may or may not be involved before consumption (including washing, peeling, etc.) (Po et al. 2003; Friedler & Lahav 2006). Even if there are indications that preferences are changing, people are, generally even less supportive or even adverse of using recycled water in their homes, and even more reluctant to adopt recycled water for uses with high personal contact involving personal skin contact or the possibility of ingestion (such as bathing, let alone drinking) (Bruvold 1985, 1988; Hills et al. 2002; Robinson et al. 2005; Marks 2006; Marks et al. 2006; Syme and Nancarrow 2006; Dolnicar et al. 2011).

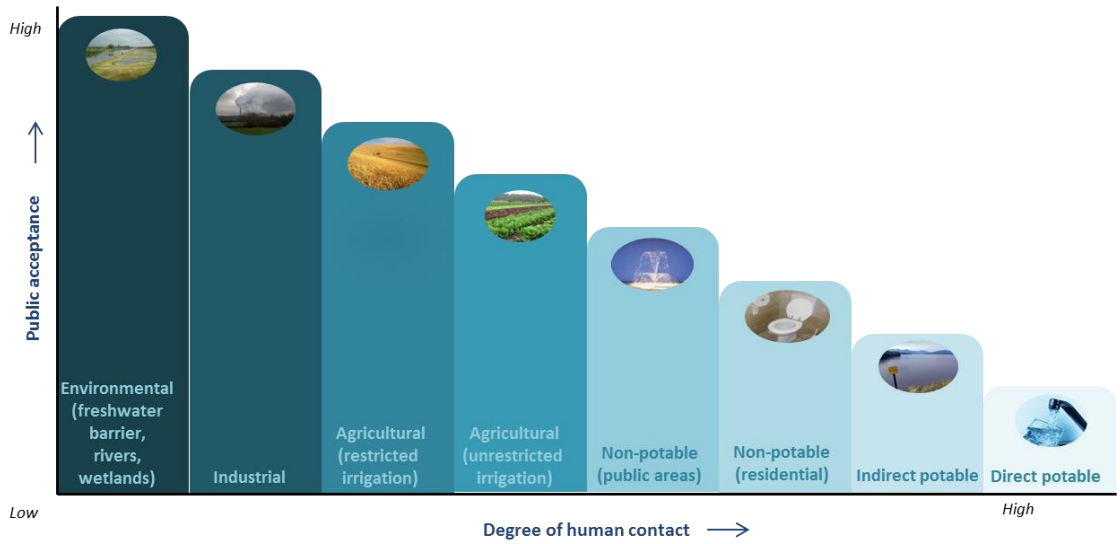

Figure 1: Public acceptance of reused water vis-à-vis human contact
(see e.g. Bruvold 1985, 1988; Hills et al. 2002; Po et al. 2003; Robinson et al. 2005; Friedler et al. 2006; Marks et al. 2006; Friedler 2008)

Various other factors according to Hartley (2006) contributing to the degree of public acceptance of water reuse, such as 'awareness of water supply problems in the community is high', and 'role of reclaimed water in overall water supply scheme is clear', principally relate to communication and perception, whereby one should take into account that when the benefit is perceived to be high, the perception of risk is lower (Slovic 1987). Arguably the most important factors influencing the degree of public acceptance of water reuse, however, relate to trust and confidence in the process ('confidence in local management of public utilities and technologies is high'), and ultimately, trust in the quality and safety of the final product: reused water ('perception of the quality of reclaimed water is high').

Five years later, and once again based on an extensive literature study, Dolnicar et al. (2011) undertake a similar exercise in their efforts to get a better understanding of the explanations for the level of acceptance towards alternative water sources. Leaving apart the demographic variables, they identify six key explanatory factors for the acceptance towards water from alternative sources:

1. Knowledge and information
2. Past experience with alternative water sources
3. Health concerns
4. Perception of good water quality
5. Perception of risk
6. Trust in authorities associated with recycled water use

Apart from information and communication, these factors once again point to trust in the quality and safety of recycled water as the ultimate key to understanding public perception and acceptance of recycled water. In fact, the importance of trust has very often been identified as a crucial factor in determining public acceptance of risks, of course generally (e.g. Slovic 1987), but certainly also specifically in relation to water reuse (Hartley 2006; Khan and Gerrard 2006; Marks 2006; Marks et al. 2008).

Given above suggestions that public support and opposition to recycled water is fundamentally influenced by trust, the next chapter will take a more detailed look at public trust in the quality and safety of recycled potable water, including an extensive elaboration of the key factors that may influence (enhance or reduce) this trust. Chapter Three addresses the manners in which water reuse organisations might affect public trust, and with that, public acceptance of recycled water: involving stakeholders, education and an active, deliberate, and tailored communication strategy.

2 Trust in water reuse

2.1 Introduction

Public trust in the quality and safety of drinking water, including reclaimed or recycled water, is about the extent to which the public believes that water is safe and of good quality. Trust (in drinking water) is, in other words, inherently subjective, a feeling, and notwithstanding the obvious correlation, cannot one-to-one be translated with the actual reliability (of water). Slovic et al. (2004) suggest that it is very well possible that the general public, especially when it concerns relatively unknown risks, may perceive risks as unacceptable, even if the same risks by experts are viewed as small or even negligible. Also in the domain of water, research suggests that the public perception may deviate significantly from technical analysis, and is therefore seldom easy to predict (Doria et al. 2005; Doria 2010). An interesting example in this respect is a study conducted in Taiwan, where the satisfaction of drinking water could not be related to the level of dissolved solids present, hardness, or alkalinity, that is, where the public perception on the quality and risks of drinking water differs from the assessments of experts (Lou et al. 2007). What is more, it has been illustrated that many people may not only evaluate water quality differently than experts, but that they may also trust their own personal impressions more than the technical assessments of experts (Hartley 2006; Khan & Gerrard 2006). Also when we look at the acceptance of and perceptions about the quality of recycled water we find a problematic correlation between technical analysis and perceptions; despite considerable technical improvements since the 1980s, community support for its use since then has been stable, and in some cases even decreased over the years (Khan & Gerrard 2006).[4]

An important reason for the frequent discrepancy between technical risk analysis and risk perception can be found in the fact that various factors important for the risk perception of lay people are disregarded in technical analysis. Unlike technological risk analysts who primarily assess risks based on statistical analysis in order to calculate the probability of adverse effects, such as the annual expected number of victims, the general public relies more on intuitive judgements. As a result, in risk analysis and risk perception different factors may be relevant, including the degree to which risks are perceived as controllable, unnatural, and the voluntary or involuntary nature of the exposure (Slovic 1987). In general, people most fear difficult to control and involuntary risks that have the potential to affect many people, explaining for instance that people generally worry more about airplane crashes than vehicle accidents, even if air travel is far safer than driving in a car (Poortinga et al. 2000).

From a formal risk analysis perspective, risk perceptions of lay people are often viewed as irrational and illogical. Social science research on risk analysis emphasizes, however, stresses

[4] Yet another example can be seen in consumption of bottled water. Indeed, from a technical point of view, there is very little scientific evidence that bottled water has better quality than tap water as is often believed by consumers. Based on an extensive review of over 40 papers investigating the chemical quality of tap and bottled water, Marcussen et al. (2013), conclude that some bottled waters have indeed better chemical quality than tap water, whereas for other bottled waters the opposite is true. Despite these technical analysis and notwithstanding the fact the regulation for mineral water is less strict compared to the regulations for tap water, consumers often have the feeling bottled water is superior in quality, safety, and taste (Doria et al. 2005; Doria 2006; Doria et al. 2009; Doria 2010; Marcussen et al. 2013).

that public perceptions of risk should not be dismissed as irrational and ignorant, but as representatives of complex social and psychological processes (Slovic 1987). While experts approach risks with logic, reason, and scientific analysis, the general public relies more on feelings, and quick, instinctive and intuitive responses to risk (Slovic et al. 2004). Hence to fully understand (risk) perceptions and attitudes to the use of reused water, the instinctive and emotional responses that many people have to wastewater from human origin need to be considered and taken into account (Khan & Gerrard 2006). Scholars suggest that the integration of such public perceptions may be very difficult, especially for water engineers trained to find optimal technical solutions (Barraqué 2003; Doria 2010). Nonetheless, these scholars argue that it is of paramount importance to take these perceptions very seriously. Doria (2010) suggests that ignoring public perceptions may result in public dissatisfaction and implementation problems. Policy exclusively based solely on technical risk analysis may not be accepted by consumers and undermine public confidence (Barraqué 2003; Kher et al. 2013). A better understanding of the (relevant processes in relation to) public perception of water quality may instead entail great benefits, including, most importantly, a higher consumer confidence and satisfaction (Doria 2010). Where up to the early 90s quality standards have generally been accepted as a scientific standard, at present it is increasingly recognized that these public perceptions are important, and not solely within academic circles. For example, the World Health Organization writes that "the judgement of safety—or what is an acceptable level of risk in particular circumstances—is a matter in which society as a whole has a role to play" (WHO 2011: 3). The International Water Association also acknowledges the important role of consumers, and states that the quality standards should explicitly take into account the needs and demands of consumers: "standards should be based on the protection of human health and consumer acceptability" (IWA 2004: 15).

2.2 Trust in recycled water

Based on an extensive literature review, the next section systematically analyses which factors may influence (enhance or reduce) public trust in the quality and safety of drinking water with, where relevant, a specification for recycled water.[5] Specific research on trust in the quality and safety of drinking water is scarce, and the number of studies focussing on the factors influencing the perception of water quality is limited. However, available research does indicate that the public perception concerning (reused) water quality and associated risks depend on various interacting variables or factors, all presented in the following subsections.[6,7]

[5] Unlike studies that focus on factors that explain (and/or predict) trust (including factors such as gender, age, and income), this analysis focuses on the factors that may affect (enhance or decrease) existing levels of trust.

[6] As a consequence of this study's focus and definition of trust, as well as the observation that the two elements are largely influenced by the same cognitive and emotional processes, this study, in contrast to, for example, Doria et al. (2005), Doria et al. (2009), and Doria (2010), views risk perception as such, i.e. the extent to which people perceive the consumption of water as risky, not as an independent determinant, but instead as an integral part of the perceived level of trust.

[7] In defining and distinguishing (independent) variables, one always has to balance detail and conciseness; in this study the primary goal at all times was to maximise the level of clarity and insight in inevitably highly complex realm of perceptions. For models with more complex and causal relationships between for example trust, confidence and cooperation this study refers to Siegrist et al (2006); more complex models between risk perception and trust are, among others, discussed in Slovic (1993), Doria et al. (2009), and Violet & Goddard (2012).

2.2.1 Sensorial information (organoleptics)

Public trust in the quality and safety of water, and in relation to this, the perceived risks of consuming water as well as the satisfaction level of the service and willingness to pay for it, in the first place relates to the organoleptic qualities of water, i.e. the characteristics of water that affect our senses of taste, smell and sight. Research suggests that lay people often relate organoleptics to health risks. Particularly relevant are sensorial information from turbidity, colour, odour, and taste of water (Doria et al. 2005; Doria et al. 2009; Doria 2010).

Although it is clear that the organoleptic qualities flavour, odour, and colour are closely related and mutually influence each other, the precise significance of each of these sensory characteristics is time – and culture – dependent. For example, in Western countries, water taste is usually identified as the most important sensorial information (Doria 2010). It is very difficult in this respect to specify what exact taste, odour or colour water should have in order to gain the highest trust of consumers. Much more than objective measures, research shows that this trust is strongly connected with familiarity (Doria et al. 2005; Doria 2010). Hence, trust in water with an identical physicochemical composition may therefore vary geographically. Independent of which colour, taste, or odour the consumer is accustomed to, a change in one or more of these organoleptic qualities of water almost always affects the level of consumer trust. Hence, even though taste tests suggest that it is difficult to identify by taste and smell the source of water, an important lesson for potable water reuse initiative takers may be that it is very important that the recycled water has the same (and stable) organoleptic qualities as the water the intended users are used to have. As explained below, the precise degree and direction of the effect of changing organoleptic qualities is dependent on individual social and psychological factors and attitudes.

2.2.2 Contextual indicators

Next to the organoleptic qualities of water, contextual indicators may also affect the level of trust in the quality and safety of drinking water. In the perception of the drinking water consumer also elements such as taps, the distribution network, and the location of extraction and/or consumption, although in an indirect manner, can provide information on the quality of water (Doria et al. 2005; Doria et al. 2009; Doria 2010).[8]

Specific research on the impact of these contextual factors influencing the perceived trust of drinking water is scarce and mostly limited to the distribution network. Various scholars, including Parkin et al. (2001), Contu et al. (2005), and Kher et al. (2013) suggest that in relation to regular drinking water the general public in particular fears the contamination of their water by heavy metals such as lead. The influence of the perceived quality of the physical environment is not limited to the distribution network of water service providers. For example, Syme & Williams (1993) demonstrate that also the level of satisfaction with the neighbourhood where the water is consumed affects the acceptance of the quality of drinking water within this area. Johnson (2003) suggests that personal concerns about the quality of drinking

[8] In the case of bottled water, especially information on the shape, colour and material of bottles, as well as the (design of) the labels is important in this respect (Doria et al. 2005; Doria et al. 2009; Doria 2010).

water correlates to (any) worries about environmental problems within or close to where respondents live. Perceptions about the quality and risks of drinking water also relate to the perceived quality of the source and location where this water is extracted (Doria 2010; Kher et al. 2013). When specifically looking at recycled water, research suggests that especially the location or source of extraction is relevant. Indeed, Russell and Lux (2009) suggest that the "yuck factor" response may be tempered by the use of environmental buffers such as rivers or lakes, whereas Hartley (2006) reports that the proximity to the waste source may also reduce feelings of disgust; he found that people may be more willing to use recycled water from their own wastewater than from a common public source.

Besides the fact that the precise influence of these contextual indicators may vary from country to country and from time to time (Doria et al. 2005; Doria et al. 2009), their influence, just like all other factors, is also determined by social and psychological factors and attitudes.

2.2.3 Personal experience

How people perceive and trust the quality and safety of (recycled) drinking water also relates to personal experiences. Personal memories of (health) problems that are (rightly or wrongly) attributed to the quality of water, may affect the perceived quality and associated risks for a very long time (Doria et al. 2005. Doria et al. 2009; Doria 2010).[9] Not surprisingly, especially personal experience with serious incidents may have long-lasting effects on the feelings and emotions of people, and therefore result in changes in behaviour (Slovic 1993). For instance, the outbreak of Cryptosporidium and Giardia in the late 90s in Sydney, Australia had a huge effect on the consumer's trust in the safety and quality of tap water, and hence the Australian consumption of bottled water. Not only during or just after the crisis when the bottled water consumption increased with 40%, but also in the years after this incident the consumption of bottled water continued to grow (Doria 2006). This example suggests that personal experiences with serious disasters can have a long-term impact on risk perceptions, and thus on consumer confidence, does not stand in isolation. For instance, Kher et al. (2013) demonstrate that Polish consumers are still very concerned about the effects of the Chernobyl nuclear accident in 1986 on the quality and safety of their drinking water, 25 years after this disaster.

Interestingly, in the case of recycled water personal experiences (with incidents) is not so much about the occurrence of problems, but given the (perceived) novelty of the product in the specific situation, very often about the non-occurrence or absence of problems after the consumption of this water. Indeed, both Dolnicar et al. (2011) and Mainali et al. (2013) suggest that prior experience with using water from alternative sources increases the stated likelihood of use. Potential initiative takers of water reuse projects could therefore greatly benefit from the establishment of demonstration sites prior to construction of full scale schemes (Friedler & Lahav 2006). An interesting example in this regard is London where, in cooperation with the Olympic Development Authority, Thames Water operated the Old Ford Water Recycling Plant, using reused water to flush toilets and to irrigate green spaces at the

[9] Personal experience also affect the manner of how people interpret new information, i.e., personal memories not only affect perceptions directly, but also indirectly.

2012 London Olympics. In this regard, Smith et al. (2015) suggest that especially high-profile events, such as the Olympics, can provide a positive environment for people to learn about new technologies such as reused water.

2.2.4 Information

Apart from personal experience it is commonly assumed that also information from third parties may result in changes in knowledge and emotions, and thus may affect the perceived trust in the safety and quality of drinking water (see Doria et al. 2005; Doria et al. 2009; Doria 2010). Similar to what was observed in relation to personal experience, information on disasters and risks is very important in this respect. Indeed, most consumers only learn about disasters indirectly, through information from friends and family, societal and governmental organizations, companies, scientists or the media. Especially the news media are important in this respect; generally they are very eager to report about risks and incidents all over the world (Slovic 1987; Doria et al. 2005; Doria et al. 2009), and therefore not seldom seen as the source of stigma (Slovic 2009). Literature on the impact of information on people's perceptions often differentiates between three sources of information: (1) media information, (2) information obtained through personal contact such as friends, relatives or colleagues, and (3) technical information, i.e. information supplied by for instance governmental agencies, water (reuse) organisations and/or regulators.[10]

Research indicates that the provision of scientific and technical information to the general public, also compared to the influence of information from friends and family and the media, generally sorts relatively little effect and, for instance, hardly bridges the often observed gap between technical risk analysis and the public perception of risk (Doria 2010). Also, Johnson (2003) concludes that the influence of technical information on the perceptions of drinking water consumers is much smaller than (for instance, as evidenced by the US Safe Drinking Water Act Amendments of 1996, obligating US utilities to annually report to their consumers on the quality of water) originally anticipated by US legislative and regulatory authorities, environmentalists and water companies. The effect of an experiment that distributed alternative versions of water quality reports, containing hypothetical information on drinking water, including specific information on substances found in the water, was much smaller than one might hope, or in other situations perhaps fear, for (Johnson 2003). This, however, does not mean that communication, including education, would not be useful. In fact, as elaborated in Chapter Three, several studies (including Fielding and Roiko 2014) suggest that major improvement the acceptance of drinking water reuse can be achieved by the provision of information and education to the general public.

[10] In connection with this classification, it is important to note that the sources of information are not all trusted equally, i.e. the perceived credibility of different sources of information varies, with possibly far reaching consequences (Poortinga et al. 2000). Omerod & Scott (2012) even suggest that trust in the reliability of information strongly influences whether or not people are or aren't willing to drink recycled water. Research suggests that this credibility mainly relates to the degree to which the information source is seen as competent and impartial. In general, people regard information from scientists, consumer organizations and friends and family as the most reliable. Trust in the media and government is usually lower. Information provided by commercial firms often enjoys the least (perceived) credibility (Eurobarometer 2008).

2.2.5 Trust in water reuse organisations and regulatory authorities

Finally, research indicates that the level of trust in water reuse organisations and regulatory authorities can have a significant impact on public trust in the quality and safety of (reclaimed) drinking water (Syme & Williams 1993; Doria 2005. Doria et al. 2009; Doria 2010) . For instance, Bratanova et al. (2013) conclude that trust in water service providers may well predict the perceived risks of consumers, and hence the acceptance of the water and service provided. In their study on the satisfaction of drinking water consumers, with a special focus on acceptability, risk perception and judgement on the quality of water, Syme & Williams (1993) come to a similar conclusion. Indeed, they show that both the acceptability of the quality of water, as well as perceptions on the water quality risks are mainly determined by the perceived credibility of the (regulatory) authorities. In the same vein, Macpherson and Snyder (2013) argue that assurances about monitoring processes to know that their water is always safe is a key precondition for the public to accept drinking water reuse. These studies are consistent with the general idea that trust in institutions is often closely related to public risk perception and the acceptance of risks (see for example Poortinga & Pidgeon 2005; Terwel et al. 2009; Violet & Goddard 2012; Brasier et al. 2013; Bratanova et al. 2013).

Given the fact that wastewater treatment and the production of reclaimed water is a highly technical process, it can be assumed that trust in the responsible experts and authorities is arguably even more important than it is in relation to the production of regular drinking water. Indeed, Omerod & Scott (2012) argue that given that the risks associated with reused water clearly involves choice, especially trust in the experts from the water reuse organisations and regulatory authorities is paramount to understanding public acceptance of technological hazards, and thus a key variable influencing the trust in the quality and safety of reused water. Given the importance of this variable, the meaning and importance of trust in water reuse organisations is further elaborated in section 3.3.

2.2.6 Concluding

In conclusion, it can be stated that public trust in the safety and quality of recycled water depends on a combination of five, partially interconnected, variables. The importance of the individual variables is likely to differ, varies in time and place, and is dependent on individual perception. For example, and as explained in Chapter Two, various studies have found associations between recycled water acceptance and demographic characteristics (including age, gender, and educational level) as well as individual psychological characteristics (including attitudes towards nature, technology and risks)(Po et al. 2005; Kemp et al. 2012). Auslander & Langlois (1993), for instance, suggest that in Toronto (Canada), respondents that are generally more worried about chemical pollution, also perceive the quality of water as lower. Also the degree to which people feel they have control is relevant to the extent to which people trust the quality of their water (Doria 2010).[11] All five factors affecting the public tryst in the safety and quality of recycled water are schematically depicted in Figure 2.

[11] Similar to all factors affecting trust in the safety and quality of drinking water, also the personal attitudes of people are constantly changing. Research, for instance, suggests that people who are used to certain risks perceive these risks generally less risky compared to people not accustomed to the exposure of that specific risk (Slovic et al. 2004).

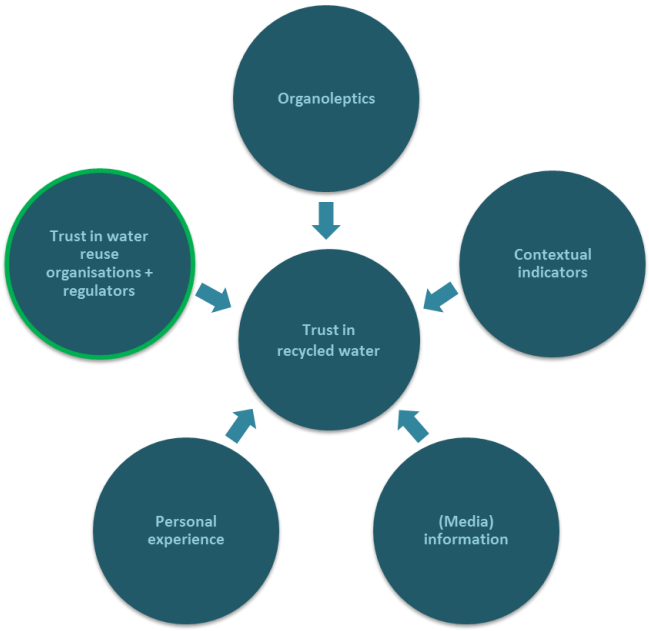

Figure 2: Variables determining public trust in recycled water

What is most striking about the variables determining public trust in recycled water is: (i) the importance of information; and (ii) the importance of trust in water reuse organisations and regulatory authorities, the latter as explained strongly connected with the highly technical nature of recycled water. Given the importance of these two variables, and the fact that, unlike the other variables, water reuse organisations may actually influence them, a separate section is devoted to both of them.[12] Information and communication strategies on water reuse are discussed in Section 4.3, trust in water reuse organisations is discussed further in the next section.

2.3 Trust in water reuse organisations

Whereas in in the previous discussion trust in water reuse organisations was regarded as an independent variable influencing trust in recycled water, in this section, which discusses the results of a literature study on the most important variables determining public trust in water reuse organisations, the same variable will be regarded as a dependent variable. Since some of these variables have also been discussed in the previous section, these will only be shortly explained.

2.3.1 Perceived performance

The first factor that can increase, or decrease, the trust in water reuse organisations is their performance, or, more importantly, the performance that consumers observe. In the first place this relates to the perceived safety and quality of the water provided, and to a lesser

[12] For the same reason (the ability to affect) the discussion in Section **Error! Reference source not found.** is restricted to trust in water reuse organisations only.

extent to issues such as reliable supply and affordability (Kelay et al. 2008). In Renn and Levine's (1991) terms, the public perception of this performance has a direct influence on the perceived competence of, and consequently trust in, water organisations. Doria et al. (2009) and Doria (2010) too argue that trust in water organisations is strongly influenced by the perceived safety and quality of the water. That would mean that if the public perceives the provided water to be of high quality, they will put more trust in the provider of that water. The other way around, it means that if the quality is perceived to be low, trust could be broken down. According to Fife-Shaw et al. (2007) most consumers will only think about their level of trust in water service providers when their supply of safe and reliant water is interrupted, or if tariffs become seen as unreasonable and become a political issue.

2.3.2 Acceptance modus operandi

The degree of public trust in the performance of water organisations not only depends on the reliable supply of safe and high-quality drinking water at a reasonable price, but also relates to the public acceptance of the water organisation's modus operandi, i.e. to the degree to which the public trusts the technologies used. This includes, among other things, techniques related to processes of purification and distribution. This is a reciprocal relation: we already noted in the previous section that consumer's trust in recycled water itself is, among other things, determined by the degree of trust in water reuse organisations. This observation fits within the common assumption that trust in institutions, such as regulating authorities, plays an important part in public perceptions regarding the introduction of potentially high-risk products, technologies, or activities. When this trust is high, this would result in lower perceived risk and a higher degree of acceptance. In line with Bratanova et al. (2013) and building on the work of Eiser et al. (2002), the depicted causal chain model illustrates the idea that trust influences risk perceptions and as such risk acceptance (Figure 3).

Figure 3: Causal chain model (Eiser et al. 2002)

An alternative idea is the associationist model (Figure 4), which presumes that judgments on the acceptance of a certain activity or new technology precede the related risk perception and trust in (regulating) institutions (Eiser et al. 2002).

Figure 4: Associationist model (Eiser et al. 2002)

Besides research that supports the causal chain model, Bratanova et al. (2013) find that research supporting the contrasting model is increasing. Fife-Schaw et al. (2008), accordingly,

suggest that, for instance, proposals to introduce a new process (such as water reuse) may result in an in- or decrease of consumer trust in drinking water organisations themselves. In this sense not only the degree of trust in the water organisation influences the trust in the used sources of supply and methods of treatment, but the acceptance of those sources and methods can also influence trust in the water organisation. In view of this it is interesting to consider the recommendations made by Bruvold (1972). He argues that water organisations can build trust by introducing reused water at low mixing ratios. This way, acceptance of the source and treatment increases, and trust in the water organisation to effectively manage the resource is increased.

2.3.3 Personal experience

As in the discussion on trust in water, personal experience plays an important part in determining public trust in the water reuse organisation. Meaning, it is determined by the degree to which the organisation has been found trustworthy by the consumer in the past (Fife-Schaw et al. 2007; Kelay et al. 2008). When consumers have personal experience in the failure of water organisations, having gone through incidents, this can have a long-lasting effect on their trust (Doria et al. 2009). Positive experiences however, have a relatively smaller effect, but do of course contribute to trust (Kelay et al. 2008). One way of creating positive personal experiences may relate to the opening of possibilities for stakeholder involvement.[13] For instance, Russell & Hampton (2006: 221) suggest that public involvement may provide a view of an "open, honest, accountable and trustworthy" organisation. The subject of stakeholder involvement in relation to trust and perception is elaborated on in Section 4.2.

2.3.4 (Media) information

As in the previous discussion on factors that influence public trust in the safety and quality of drinking water, information on the functioning and performance of water organisations plays an important role in influencing public trust in these organisations (Doria et al. 2009). Besides information obtained from friends and family, media reporting is an important element here. Especially incidents and scandals play a large part (Poortinga et al. 2000); negative (trust-destroying) events are more striking and are seen as more important in the perception of people than positive (trust-building) events. This effect is exacerbated by the fact that people usually perceive sources of negative news as more reliable than source of positive news (Slovic 1993).

2.3.5 Communication by the water reuse organisation

A final important factor in determining public trust in the integrity and competence of water organisations is the communication and information-provision by these organisations themselves (Kelay et al. 2008). Doria (2010) states that providing transparency, through for instance organizing public visits to water treatment plants, can increase the trust in water organisations. Terwel et al. (2009) suggest that for trust, it is important that organizations

[13] Building on the work of Khan & Gerrard (2006), in this report we view stakeholders as organisations and individuals with an interest in a particular project.

communicate in a way that fits their identity. They show that NGOs that communicate with environmentally related arguments and companies that communicate with economic arguments, are more trusted than NGOs using economic arguments and companies using environmental arguments. Terwel et al. (2009) argue that when organisations attempt to raise their image with pro-environment arguments that will only decrease trust in the organization. The same study also shows that when information appears to be distorted, trust may be decreased. Another message found in the literature is the importance of being consistent in communication (Renn & Levine 1991).[14] Hereby it is not only relevant what and when water organisations communicate, but also what and when they do not. Research by Slovic (1993) shows that events in which information is being kept silent have a strong negative influence on the level of trust.

Communication provided should be expressed in words that people can understand - acronyms and jargon must be avoided. It should attract and hold attention and avoid stigmatising words (MacPherson, 2010).

2.3.6 Concluding

In summary we can ascertain that just as public trust in the safety and quality of water, public trust in the competence and integrity of the water reuse organisations is dependent on a combination of five, partially interrelated, variables. The importance and the effect of each variable changes over time and place, and is further dependent on individual perceptions, emotions, and significance. Figure 5 depicts the five variables determining public trust in competence and integrity of water reuse organisations schematically:

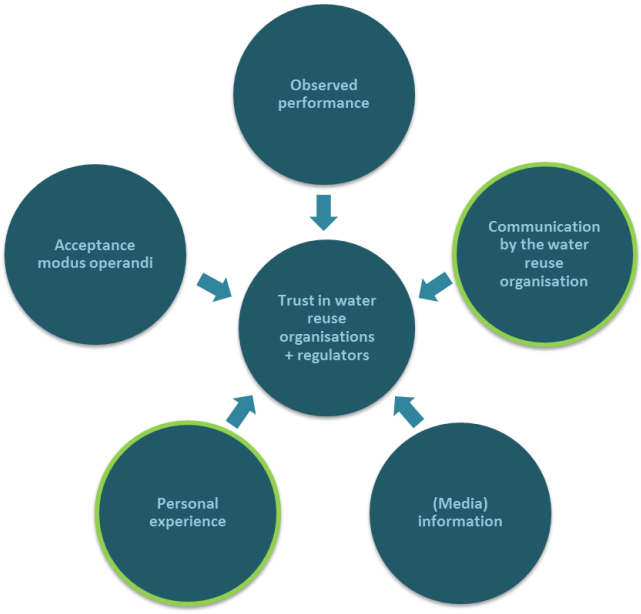

Figure 5: Variables determining public trust in water(reuse) organisations

[14] The question to what extend communication influences trust in the communicating organisation is a different one than the question – which is outside of the scope of this study – what influences the perceived trustworthiness of communication. Especially when this communication relates to risk, this is an important question.

When viewing all factors influencing the trust in water (reuse) organisations, two variables in particular are remarkably well suited to be influenced by water reuse initiative holders: (i) their own communication strategy, and (ii) the personal experience of people by means of creating participation possibilities. In the next chapter both these elements are extensively discussed.

3 Significance for water reuse organisations

3.1 Introduction

For the supporters of recycled water it must be encouraging that precisely communication (including education) and public and stakeholder involvement, which in the previous chapter are recognised as remarkably well suited to being influenced by water reuse initiative holders, are seen by various scholars as the key measures to ensure public acceptance of water reuse schemes. For instance, Hartling (2001) suggest that three measures are crucial to ensure such acceptance: 1) to be transparent and reveal all the facts about the project; 2) to talk to the public on their own level, in a language they understand, and in a clear and interesting way; and 3) to have the public participate in the decision making process. Both the first and the second measures come down to communication by the water reuse organisation, measure three clearly links to public and stakeholder involvement. Khan & Gerrard (2006) come to the same conclusion; they suggest that in cases where the community associates a high level of risk with a water reuse project, trust can be maximized when the community has access to independent sources of information, can ask questions, and is involved early; when dialog is sustained; information is available to everyone – i.e. all related to communication –, as well as when behaviour is non coercive; everyone's opinion matters; and when citizens have some level of control in the process, i.e. when the stakeholders can participate. Communication and stakeholder involvement are also viewed as the two key ingredients for what is called effective, efficient, and fair risk governance within the so-called International Risk Governance Council (IRGC) framework (2005).[15]

3.2 Stakeholder and Public Involvement

As mentioned in the previous chapter, public perception of water reuse risks may differ from the "expert analysis" (Doria et al. 2005; Doria 2010). As a result, proponents of water reuse often view public opposition as the result of a "misconception" of the associated risk (Russell & Hampton 2006). This discrepancy between technical risk analysis and risk perception can be explained by the term ambiguity, which has been argued to result in "several meaningful and legitimate interpretations of accepted risk assessments results" (IRGC 2005: 31). These interpretations can be the result of differences in the way certain information is understood, or the result of differing value judgements (IRGC 2005). A recent report by the OECD (2015) concludes that stakeholder involvement is a way to "bring together groups with opposing views and fears, who need to be assured that their views will be taken into account" (p. 25); trust is a key outcome of this process. Important here is that it is suggested that all affected stakeholders need to be involved to fully deal with the ambiguity that water reuse entails (OECD 2015; Renn 2015). Marks (2006: 143) even states that: *"the cooperation of residents is*

[15] This framework offers a conceptual approach for describing and investigating risk governance, as well as a guideline for improving decision-making and risk handling.

fundamental to the long term success of integrated water initiatives (…) public involvement is inevitable in the processes of acceptance and effective management of reclaimed water".

Part of gaining this trust consists of aligning with the value judgement of the general public (Omerod & Scott 2012). For such an alignment to be possible in the first place it is important to know where people that will be affected by the water reuse scheme stand (Marks 2006). In well-designed stakeholder processes, the public should have the opportunity to express its concerns (OECD 2015), and there should be a true, so-called two-way dialogue structure in place (Gudowsky & Bechtold 2013). If that is indeed the case, the process can build ownership of the decision, as well as trust between the actors (Renn et al. 2011). This true dialogue can be compared to one of the factors to which various scholars ascribe trust building (e.g. Po et al. 2003; Hartley 2006), namely the (public's) belief that the decision-making process was fair, including whether concerns were listed to and addressed to a satisfying extent.

Public engagement should not be considered as a binary variable that is either present or absent. Instead, public and stakeholder engagement has many different faces, whereby on the one end of the continuum the public might only be informed about local water reuse schemes, whereas on the other end stakeholders may be actively involved in co-creation processen, or even be "in control". A classic reference point in the discussion on the different levels of engagement is the participation ladder by Arnstein (1969). On this ladder, eight rungs of participation are distinguished, starting with *manipulation* and *therapy*, which Arnstein defines as essentially being types of "non-participation" in which the public is "educated" or "cured". The next rung, *informing*, provides citizens with essential knowledge to effectively participate, but the flow of information is usually one-way. The *consulting* rung aims to involve the opinions of citizens, but gives no guarantee that citizen's input will be taken into account in practice. In the *placation* case, this is somewhat less of a problem, for instance through including community representatives on decision-making boards, but the project's initiators may still have exclusive decision-making power through a larger number of votes or the right to ignore given advice. At the *partnership* level, citizens are given more direct influence on the content of a project: rules regarding participation are laid down and may thereafter not be changed without consensus across actors. Only at the highest two levels, *delegated power* and *citizen control* are citizens given (part of) decision-making power.

Figure 6: Ladder of Participation by Arnstein (1969)

Although many authors advocate participation high on the ladder – Marks (2006) for instance argues that mere consultation is not enough, but that the public should be actively involved in the decision-making process, even if that ultimately means the adoption of a different technology (e.g. desalination) – examples of reuse initiatives with true decision-making authority shifted to stakeholders are scarce.[16] Indeed, Russell and Hampton (2006) note that although the different involvement levels are often recognised, they are rarely put into practice effectively. When we consider the international examples of water reuse schemes discussed in Chapter 2, we see a similar pattern (see also Table 3). Some projects that are initially lauded for their extensive public involvement, such as in Tampa or the first proposal in San Diego (Van Riper & Geselbracht 1999), do not come much higher than the *consultation* rung on Arnstein's ladder. Singapore's NEWater programme, as well as the recent expansion of the Orange County scheme have both primarily consisted of *informing*. And whereas the Toowoomba scheme was to include extensive public involvement up to the *consultation* rung, the negative framing by the opposition movement caused the city council's informing campaign to be perceived as "persuasion", opening the floor up to a referendum (essentially a form of citizen control) in which the proposal was shot down (Hurlimann & Dolnicar 2010). Arguably the only publicly documented project in which public involvement was taken a step further (*placation*) was the second San Diego case, where an extensive study was performed with the cooperation of community leaders in the early planning stages (City of San Diego 2006).

[16] A relevant distinction does exist here between non-potable and potable water reuse; the generally lower acceptance of the second is argued to mean that the level of public involvement should be higher (Khan & Gerrard 2006; Marks 2006).

Table 3: Public involvement in selected case studies

Project	Status	Participation
Toowoomba, Australia	Scrapped	Late start of public involvement and education (planned up to the *consultation* rung), campaign ended up being perceived mostly as "persuasion" (*informing*), eventually voted down in a referendum (*citizen control*).
San Diego (A), United States	Converted to non-potable	Extensive public information strategy with a small group of citizens on an advisory panel (*informing*) supplemented with surveys and engagement with community leaders (*consultation*).
Tampa, United States	Shelved	Information campaign (*informing*), participation in review process to voice concerns (partly through review committee; *placation*).
Western Corridor, Australia	Potable use suspended	Initially plans for a referendum, but those were scrapped. Very little public education.
Singapore	In operation	Public education campaign incl. demonstration facility and media tours to other locations (*informing*).
Windhoek, Namibia	In operation	(Unknown/negligible).
Orange County, United States	In operation	Recent upgrade was accompanied by campaign of talks (*informing*) and surveys to gauge common concerns (*consulting*).
San Diego (B), United States	Under construction	Workshops with community leaders in early planning stages (*placation)* and surveys (*consulting)*, followed by public outreach with talks and demonstration (*informing*).

Public involvement perceived as too low on the ladder has the potential to ignite more public turmoil than might otherwise have been the case, as mounting public opposition can be a cause for political opportunism. This may have been the case with the referendum in Toowoomba (Thorley 2007; Hurlimann & Dolnicar 2010) and in Tampa (Jansen et al. 2007). Further, when it comes to (genuine) efforts to consult the public, caution has to be taken with regards to interpretation. For instance, a survey in which the support for reused water is expressed does not imply that the implementation of a specific project can count on the same level of support (Russell & Hampton 2006). In any case, it is important to maintain the public interest and its motivation to participate (Hartley 2006), as well as to set clear rules regarding how the public involvement will be considered in the decision-making (Russell & Hampton 2006; OECD 2015).

Besides the degree of participation, also the timing of public and stakeholder involvement is a recurring theme in the literature, with most authors arguing that public involvement should commence before the planning of concrete projects (Po et al. 2003; Russell & Hampton 2006; Renn et al. 2011). Retrospectively, a perhaps too late official start of this involvement has been detrimental in various projects, including the Toowoomba case. In this example, the project announcement preceded the public involvement campaign, giving opponents the lead and hereby the ability to dictate the rules for a political campaign (Hurlimann & Dolnicar 2010). Unfavourable timing (too late) of public involvement activities has also been cited as an important cause of the failure of both the Tampa and the first San Diego water reuse schemes (Marks 2006). At the same time, research suggests that stakeholder involvement in a too early stage of the planning process may also be detrimental, as it can be a cause for worry or because certain questions cannot be answered yet (Brouwer 2015).

Although public and stakeholder involvement is widely advocated as an important, or even indispensable, element in the processes of acceptance and effective management of reclaimed water, it should not be seen as a one fits all solution or as a panacea. Although a sufficient level of public involvement may be advisable to deal with the ambiguity in the risk of water reuse, it is certainly not guaranteed that a higher rung on Arnstein's ladder will necessarily solve it.[17] In fact, and opposed to the one-dimensional claims on the necessity of public involvement for the success of water reuse initiatives (cf. Marks 2006), the central international examples discussed in our analysis suggest that public involvement does not guarantee success, just like "a lack of" public involvement does not guarantee failure.

No matter what degree of participation is programmed, a correct timing of public involvement efforts is essential. Since information provision will always play a key role in the introduction of a new technology such as water reuse, this information should be made available timely (but not too early). The next section will deal with the content and structure of this information, and how these may affect the promotion of acceptance of water reuse.

3.3 Communication

Besides the promotion of trust through public and stakeholder involvement, communication (including education) is the second measure through which this report argues water reuse organisation may build public acceptance for water reuse (organisations). Indeed, scholars widely recognize that communication and increased knowledge are important tools to build trust between organisations and stakeholders, and in relation to that, that effective communication with stakeholders is of crucial importance for water reuse initiatives to be successful (see e.g. Khan & Gerrard 2006; Renn et al. 2011; Kemp et al. 2012). According to Macpherson and Snyder (2013), the common lack of contextual understanding about (waste)water reuse is even one of the key reasons why gaining public accepting of water recycling is such a challenge, highlighting the importance of public education programs. In the same vein, Khan &

[17] For a detailed description of participation modes to deal with ambiguity, see for instance Renn (2015).

Gerrard (2006) call a well-organised, comprehensive communications program with stakeholders even "essential" to any modern water reuse project. Indeed, they suggest that the failure of various projects around the world because of a lack of community trust, can partly be attributed to inadequate communication between water reuse organisations and their stakeholders. In some cases, they report that people believed that planning operations were being undertaken in secret, whereas in others the need for, or benefits of, water reuse were inadequately promoted. According to Khan & Gerrard (2006) it is even more detrimental when the public perceives that their concerns are being ignored and water reuse organisations are not able to take away fears about risks associated with water reuse.

To structure the abundance of conclusions and recommendations that have emerged from our literature review on the subject, we use the strategic framework of Brouwer (2015) who, within a much broader categorization of entrepreneurial change strategies, identifies three so called attention- and support-seeking strategies to demonstrate the significance of a problem and to convince a wide range of participants about preferred policy, namely: the demonstration strategy; the exploitation of focusing events strategy; and the strategy of rhetorical persuasion. The next sections discuss these three strategies in relation to water reuse, linking them to the examples of international water reuse schemes presented in Chapter 2.

3.3.1 Demonstration strategy

The first attention- and support-seeking strategy is the demonstration strategy, used to obtain attention and to exhibit the significance of problems, as well as to gain support for solutions by making their value evident. An important element of this strategy is to "persuade through testimony", and to collect and show facts and figures to demonstrate the significance of a problem (for instance, water scarcity) and to show the suitability and value of the solution one seeks to promote (for instance, water reuse) (Mintrom 2000; Brouwer 2015). In the water reuse arena various scholars propose essentially the same strategy. Besides showing that water reuse can be used in a safe way, it may be necessary to show that water reuse is the best solution to a pressing problem in the first place.[18] Indeed, first the significance of the problem must be shown, making the public understand that alternative water sources are not just an option, as in a way we might choose to go, but a hard necessity (Dolnicar et al. 2011). The problem definition can be extended by combining (looming) water scarcity with the need to reduce the environmental impact of sewage effluent. Then, water reuse can be shown to be the solution that kills two birds with one stone (Khan & Gerrard 2006).

To demonstrate the suitability and value of the solution one seeks to promote, it is suggested that working examples or pilot projects can be a very powerful tool to create trust and convince policy makers and the general public about the viability of solutions (Roberts & King 1991; Mintrom 2000; Meijerink & Huitema 2010; Taylor et al. 2011). Also when specifically looking at the promotion of water reuse as the solution, Gibson and Apostolidis (2001) argue that demonstration projects are the best method of involving the public. And indeed, in various discussed examples of international water reuse schemes, pilot plants were built to prove

[18] As discussed in the next subsection, to this end, and on the condition that an acute crisis arises, also the exploitation of focusing events strategy can be very effective.

the technology and to demonstrate its reliability. In some cases, including Singapore and the second San Diego scheme, pilot plants were opened to the public with the goal of actively promoting public support. Another appealing example in this respect is the earlier mentioned project run by Thames Water during the London Olympics. In this case, a high-profile event (the Olympic Games) was used to demonstrate a (in the London area) new technology to the public (Smith et al. 2015).[19] Rozin et al. (2015) use Zajonc's (2001) "mere-exposure" effect to argue that the way pilot projects work in building acceptance can be extended to the use of recycled water in general. Indeed, as illustrated by for instance the Singapore case, where public acceptance of NEWater is currently high, it is suggested that a greater use of reused water will automatically promote greater acceptance (Khoo 2009). This supports the idea that widespread water reuse in low human contact situations may provide people with demonstration that will then make the move to higher-contact uses more acceptable, and is in line with Slovic's (1987) theory on the perception of risk, saying that the unfamiliar is more fearful. In the same vein, Dolnicar et al. (2011) recommend the use of voluntary opportunities for the public to come into contact with reused water in non-threatening ways, such as taste tests or public swimming pools that are filled with reused water. It is interesting to note that they recognise that this very same suggestion was also made four decades ago, citing the work of Baumann and Kasperson (1974: 670), who have suggested that to build public acceptance of reused water one has to *"put the reclaimed water in an attractive setting and invite the public to look at it, sniff it, picnic around it, fish in it, and swim in it"*. Finally, the demonstration of successful water reuse practice elsewhere may also act as a promoter of acceptance (Khan & Gerrard 2006). In much of the public information campaigns for the examples of international water reuse schemes highlighted in Chapter 2, the schemes in Windhoek, Namibia, and Virginia & Orange County in the US were deliberately used to demonstrate the suitability and value of water reuse, and in that manner to promote public acceptance.

3.3.2 Exploiting focusing events

The second attention- and support-seeking strategy Brouwer (2015) distinguishes is the exploitation of focusing events strategy, which primarily relates to efforts of getting attention for specific problems, and accordingly, support for preferred solutions. Yet unlike the demonstration strategy, which involves relatively deliberate and rather long-winded activities, this strategy relates to the utilisation of relatively short-lived, mostly sudden and unexpected events that are immediately harmful or expose the risk of potentially greater future harms, also known as focusing events (Birkland 1998). That focusing events can play a role in promoting the acceptance of water reuse initiatives is, for instance, illustrated by Mike Markus, general manager of the Orange County Water District, who remarks that the fact that upgrades to the Orange County scheme were finished during a drought "made us look like geniuses" (cited in Schwartz 2015). Dolnicar et al. (2011) note that experience with water restrictions increases acceptance of water reuse, indicating that messages showing dry conditions nearby may also help to increase acceptance. Nearby may have a broad definition here: for instance, Dolnicar & Schäfer (2009) suggest that the attention paid by Australian media to several years of droughts in much of the country, combined with active water restrictions in

[19] In other cases where pilots were running, including Tampa and the first San Diego project, these were not used to demonstrate the technology to the public, which may be considered to be missed opportunities (Marks 2006).

many places, increased acceptance of water reuse in the country, at least where it concerns using recycled water for garden watering and cleaning uses. Khan & Gerrard (2006) note that water reuse organisations have to be efficient in using focusing events, since if the dry conditions lessen public support for water reuse initiatives may wither. More generally, Birkland (1998) suggests that organised actors with the capability to use focusing events to illustrate the need for their proposed solution are required, meaning that focusing events will only sort effect if they are exploited actively. This may explain why in Toowoomba, the project was voted down, despite severe water restrictions at the time of the referendum (Hurlimann & Dolnicar 2010).

As illustrated by both the Western Corridor and the Tampa project, it should be clear that the exploitation of focusing events strategy may involve the danger of portraying reuse as an emergency stop gap measure only, whereas in order to be successful and economically viable, reuse schemes need to become integrated with conventional supplies, and seen as a realistic means of supplying water all the time. What is more, it should be noted that this strategy may not only be used by supporters of water reuse initiatives, but also by people opposed to the idea of using recycled water. For instance, Russell and Hampton (2006) note that both events directly impacting the water supply (e.g. contaminated reused water, discovery of unknown contaminants), as well as scandals in other (regulated) industries (citing how for example the BSE outbreak not only caused serious damages to that specific industry, but also created distrust in policy makers and regulatory authorities not related to food safety), may have a negative influence on trust in water reuse.

3.3.3 Rhetorical persuasion

The third attention- and support-seeking strategy Brouwer (2015) distinguishes is the strategy of rhetorical persuasion. By exercising this strategy, one tries to get their preferred idea or solution to be adopted by affecting others' attention, by persuading others about their preferred problem definition, and by changing preferences through argumentation. Similarly to how participation in the decision-making process can create ownership (Renn et al. 2011; OECD 2015), careful framing of a problem may also enhance a feeling of ownership (De Bruijn & Ten Heuvelhof 2000, 2008; Wondolleck & Yaffee 2000). Mintrom (1997) suggests that the art of framing is to discover ways of speaking to people that take into account their worries, interests, and expectations, implying that it is important to understand the preferences, plans, resources, and worries of your audience. Macpherson (2010) and Macpherson and Slovic (2011), among others, stress the importance of avoiding jargon, acronyms, and particularly negative terms, and advise instead the use of a positive, clear and direct language. Also the exact framing and defining of processes of treating and retreating water play a large part in public preferences. Water reuse organisations have an important role to play here, as a range of studies show that information messages can have a positive effect on the acceptance of water reuse (e.g. Kemp et al. 2012; Macpherson and Snyder 2013; Fielding and Roiko 2014; Leonard et al. 2015; Price et al. 2015).

What the content of these messages should be has been the topic of particular research interest. As transparency and accountability are essential in building trust, Khan & Gerrard (2006) suggests that water reuse organisations, in the first place, should actively communi-

cate its safety record. More directly related to water reuse projects is a finding by Price et al. (2015), whose survey results indicate that it is better to communicate the low risk of reused water than to centre communication around its benefits. However, other studies do stress the importance of highlighting the economic benefit that water reuse may bring for the community and individuals alike (Friedler & Lahav 2006), without creating the perception that water reuse is only strived after because it is the cheapest option (Khan & Gerrard 2006). This is, among others, illustrated by the Toowoomba case, where a lack of the inclusion of economic messages may have been another negative influence on the outcome of the referendum: reportedly, the alternative water source that had to be implemented because of the opposition has cost taxpayers up to six times as much as the original proposal might have (Toowoomba Chronicle 2011). Another important element of messages here relates to the water quality. As discussed before, framing water as "sewage out of awareness" (Rozin et al. 2015: 61) or conversely, reused water being the logical acceleration of a natural process in a world where much of the drinking water is already derived from unplanned reuse, are appealing examples in this regard (Khan & Gerrard 2006). This includes making sure the public understands the safety of the reused water for the envisioned uses (Khan & Gerrard 200R). Research of the WateReuse Research Foundation (Macpherson and Snyder 2013) suggests that the acceptance of drinking water reuse increases when people become aware that also regular drinking water can come from rivers containing effluent from wastewater plants and agricultural runoff. Indeed, they suggest that when the public fully understands that an environmental buffer actually contaminates the very pure water, they may actually favour direct potable use. As mentioned before with regards to the demonstration strategy, other messages may include the global water shortage and the environmental benefits water reuse can bring (Khan & Gerrard 2006). Similar to what has been observed in relation to the exploitation of focusing events, the examples of international water reuse schemes in this report illustrate convincingly that not only supporters of water reuse initiative use rhetorical persuasion in their efforts to change preferences, also opponents to water reuse schemes try to persuade through argumentation. Interesting examples of framing by opponents are the Toowoomba case (we don't want our town to change its image from "Garden City" to "Poowoomba"), as well as the first San Diego case (where "Toilet to Tap" and "Sewage Beverage" phrases proved successful).

Despite, or perhaps as a result of, all research and practical lessons, it has been recognised that developing an effective communication strategy about recycled water is very complex (Price et al. 2015). For example, there is an ongoing discussion on whether or not to include opposing viewpoints. Price et al. (2015) note that past research has indicated that two-sided messages (refuting the negatives) are more effective than one-sided messages that only present advantages. Their own data, however, indicate that at least where it concerns people with relatively neutral attitudes towards water reuse or people with a high level of uncertainty, the opposite may be true, namely that these groups of people are swayed more effectively by one-sided (exclusively positive) messages. Also the effectiveness of the "inoculation approach", where messages are centred around the refutation of opposition to water reuse, is not a foregone conclusion. Although various studies (including, for instance, Macpherson and Snyder 2013) indicate that this approach may indeed be very effective, especially when individuals are encountering competing or even stigmatizing messages about water reuse, other (experimental design) studies (including Kemp et al. 2012) suggest that a communication

strategy based on an inoculation approach has very limited effect. To make it even more complex, Hartley (2006) reports on a study which suggested that additional information first and foremost results to an intensification of the extremes, indicating that those opposed to the use of recycled water will likely become even more strongly opposed, and those in support of it will become even more strongly supportive after the provision of additional information. There appears to be no agreed upon the silver bullet when it comes to the structure and content of information messages as both these variables are dependent on the audience, making it important to know its stance with respect to water reuse and to tailor the message accordingly (Price et al. 2015). For instance, research has shown the critical importance of the people who have not formed an opinion as these people (often the majority), tend to become more supportive with the provision of information. Macpherson (2010) suggests in this relation that one should provide (graphic) material that is *"easy enough to understand but technical enough to trust",* including the ability, for those that want to, to zoom in into more technical information.

Last but not least, and similar to what we have seen in relation to stakeholder involvement issues, the timing of communication efforts is of great importance. Indeed, Khan & Gerrard (2006) suggest that the timing of communication activities can be of equal importance to their substance. Given that trust can only be built over time, they hold that to maximise trust between water reuse organisations and stakeholders, communication processes need to begin with the decision to seriously consider the development of a scheme, and thus long before actual projects plans are sketched out, and continue throughout all stages of any project, including the construction, implementation and operation. Delays in providing information may lead to rumours, raise levels of concern, and cast doubts on the water reuse organisation's motives and intentions, hereby undermining the stakeholder trust (Khan & Gerrard 2006). Again, this is something that in the Toowoomba case may be distinguished as a double failure: firstly, communication on the project began only after the plan was nearly finalized; and secondly, this late provision of information gave the opposition movement the opportunity to frame the debate (Hurlimann & Dolnicar 2010).

4 Summary and Conclusions

Public opposition is currently considered a major challenge for water reuse. And indeed, as illustrated by various international examples of water reuse initiatives, the lack of public acceptance can form an impenetrable barrier to the realization of water reuse projects. Besides political issues and the role of vested interests, psychologists tell us that the "yuck factor", or magical contamination, is a key element of public opposition. Still, a range of studies indicate that the public is not necessarily opposed to water reuse itself, but that the intended use can be a hurdle, with a lower rate of acceptance as the degree of bodily contact increases. This reports argues that public support and opposition to recycled water is fundamentally influenced by trust, including trust in the technical process and regulation, trust in the water reuse organisation itself, and ultimately, trust in the quality and safety of the final product: reused water. Given this importance, this report elaborates on the variables that may influence (enhance or reduce) public trust in the quality and safety of recycled potable water.

Public trust in the safety and quality of recycled water depends on five partly interrelated variables. The importance of these individual variables varies in time and place, and depends on individual perception and signification. The first variable that underlies public trust in recycled water relates to sensorial information (organoleptics), i.e. the characteristics of water that affect our senses of taste, smell and sight. The second underlying variable is the contextual information that provides information on the quality of water in an indirect manner, including information on the way in which water is extracted, distributed, and consumed. For reused water this relates to the "yuck factor", whereby it has been suggested that environmental buffers, such as rivers or lakes, can mitigate this effect. How people perceive and trust the quality and safety of (recycled) drinking water also relates to personal experiences, including personal memories of (health) problems that are (rightly or wrongly) attributed to the quality of water. Given the perceived novelty of the product, in the case of recycled water personal experiences (with incidents) often relate to the actual non-occurrence or absence of problems after the use of this water. Information on water reuse is the fourth variable influencing public trust in recycled water. This information can be obtained from the media, personal contacts with friends, relatives or colleagues, or from more technical sources, including water reuse organisations themselves. The fifth and the last variable is trust in water reuse organisations and regulatory authorities. Given that this last variable is of special interest when considering the promotion of water reuse initiatives, trust in water reuse organisation is not discussed as simply an independent variable influencing trust in recycled water, but also as a dependent variable. Five variables are highlighted that determine public trust in competence and integrity of water reuse organisations, including perceived performance, acceptance modus operandi, personal experience, (media) information, and the communication and information-provision by water reuse organisations themselves.

Among the above variables, two variables in particular are remarkably well suited to be influenced by water reuse initiative holders: their own communication strategy and the personal experience of people by means of creating participation possibilities. Various scholars highlight one or both of these paths as key measures to build public acceptance. Indeed, stakeholder (including public) involvement is generally considered a good method to deal with the

frequently observed discrepancy between technical risk analysis and risk perception. Although some authors argue that a very high level of involvement is required for the approval of projects, the international examples of water reuse initiatives discussed in this report seem to indicate that there is no direct link between the degree of involvement and likelihood of acceptance. On the other hand, these examples do suggest that a too low level of, or poorly executed, participation can raise public opposition. Finally, although there is no one fits all solution with regard to the extent of public involvement, timing seems to be important in any project. Public involvement opportunities should start early, ideally before the planning of concrete projects.

As for public education and communication, often seen as "essential" to any modern water reuse project, three so-called attention- and support-seeking strategies to demonstrate the significance of a problem and to convince a wide range of participants about preferred solutions are important. The demonstration strategy appears important to show that water reuse is the appropriate solution to an important and pressing problem (water scarcity). To effectively demonstrate water reuse as a viable solution, pilot projects and other opportunities for the public to (voluntarily) "test the waters" can be very effective. Aside from new instances of such opportunities, it can be helpful to point at existing practice at home or elsewhere. The exploitation of focusing events, especially droughts, can be very powerful in making the public more aware of a need for alternate water sources. However, for those events to have the desired effect, it is important that they are exploited actively and in time, as public memory is often short. Last but not least, the strategy of rhetorical persuasion may be used to change preferences regarding water reuse through argumentation and framing. Although the potential for improved acceptance of water reuse through information messages has been demonstrated, the most effective structure and content largely relate to the target audience. For instance, it is contested whether and when it is more effective to focus only on the benefits or (perceived) risk of water reuse, or whether and when it is more helpful to use one- or two-sided messages, which also refute counterarguments. Although there is no silver bullet when it comes to the structure and content of information messages on water reuse, an understanding on the perceptions and concerns of the target audience is a precondition for an effective communication strategy, as the messages need to be tailored to each specific group of stakeholders. But if information is properly presented so that it attracts and holds attention and gives knowledge and understanding of water use and reuse, much research, along with the successful case studies, convincingly show that public trust in water reuse technologies will grow, and levels of acceptance will increase.

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