D4.2
Final report on societal acceptability

AUTHORS: HEATHER SMITH, CAITRIONA SHANNON, MARINE PONCET (UCRAN)

DATE : 10.12.2021

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Technical References

Project Acronym	NextGen
Project Title	Towards a next generation of water systems and services for the circular economy
Project Coordinator	KWR
Project Duration	01/07/2018 – 30/06/2022

Deliverable No.	4.2 Final report on societal acceptability
Dissemination level [1]	PU*
Work Package	WP4 – Address the Social and Governance Challenges to Uptake of Circular Solutions for Water Systems and Services
Task	T4.1 – Societal acceptability of circular solutions
Lead beneficiary	UCRAN
Contributing beneficiary(ies)	KWR
Due date of deliverable	M24
Actual submission date	M24 Part A, M30 Part B, M42 revised, M55 final

[1] PU* = Public, but temporary embargo (restricted for members of the consortium, including the Commission Services) until published in open access paper form.

Document history

V	Date	Beneficiary	Author
1. Part A (quantitative)	26 June 2020	UCRAN	Caitriona Shannon, Heather Smith
2. Part B (qualitative)	14 December 2020	UCRAN	Heather Smith, Marine Poncet
3. Revised & combined	10 December 2021	UCRAN	Heather Smith
4. Revised post review	9 January 2023	UCRAN	Heather Smith, Marine Poncet

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Updates of previous versions

The following updates from previous versions have been made to this document, based on review feedback from the project officer (see Document History list above for version numbers):

Version 3 (December 2021)

- Parts A and B combined into a single report, with synthesised conclusions and recommendations
- Provided additional explanation and rationale for the selection of demo cases / countries on which to focus the work of the task
- Provided additional rationale for the surveys being conducted at national scale
- Provided additional explanation about how the work in this report informed other activities within the NextGen project
- Elaborated on the specific recommendations for demo cases

Version 4 (January 2023)

- Provided additional clarification on the national scale approach for the surveys
- Provided additional detail for the qualitative part about the selection criteria for interviewees and the number of interviews conducted
- Added this summary of updates

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Executive Summary

The NextGen project as a whole is about understanding and supporting the shift towards a circular economy in the water and wastewater sector across Europe. The work described in this deliverable is linked with Task 4.1 in the project, which is focused on understanding the social acceptability of circular solutions. This deliverable is a follow-up to D4.1 *Interim report, with preliminary findings, on societal acceptability*. As described in the interim report, the empirical work in this task has two streams – a quantitative stream (involving large-scale surveys) and a qualitative stream (involving in-depth interviews). Here we present the full findings from both streams of work.

In the quantitative study, we present the findings from three large-scale surveys of the general public in the UK (*n*=1028), the Netherlands (*n*=751) and Spain (*n*=800). The surveys focused on two circular solutions utilised in the water and wastewater sector – the use of recycled water for drinking purposes, and the use of recovered nutrients to grow food. The aim of the surveys was to investigate acceptance of these solutions from the perspective of three dependent variables: willingness to consume, support for, willingness to pay more for, the products of those circular solutions (recycled drinking water and food grown with recovered nutrients). By comparing findings for two circular solutions, between three different countries, this research contributes to a better understanding of societal acceptance of circular solutions within Europe.

Our analysis was structured around three central hypotheses: H1) that there would be a significant difference between responses to water recycling for drinking purposes and responses to the use of recovered nutrients to grow food; H2) that there would be significant differences in responses between countries; and H3) that all independent items would be significant predictors of the three dependent variables.

Overall results show that *support for the two circular solutions appeared high* in all three countries. The proportions of respondents who supported or strongly supported the use of recycled water for drinking were 67% (UK), 73% (ES) and 75% (NL). The proportions of respondents who supported or strongly supported the use of recovered nutrients to grow food were 74% (UK), 75% (NL) and 85% (ES). There were significant differences in responses to water recycling and responses to recovered nutrients, with the latter having higher acceptance in all three countries and across all dependent variables. We therefore accept H1. There were also significant differences between countries in most of the dependent and independent variables, meaning we can also accept H2. However, although the differences were statistically significant, they were often modest, and with many variables the three countries followed a broadly consistent pattern of responses.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Regression analysis showed that not all independent variables were significant predictors of the dependent variables, and therefore we reject H3. The key conclusions from this analysis are that, for two of the dependent variables (support and willingness to consume), *social norms and emotions* emerged as two of the strongest predictors, for both circular products and in all three countries. This means that respondents in all three countries are more likely to support the circular solutions, and consume the products from them, if they feel positively towards them, and if they believe that others would do the same. For the third dependent variable (willingness to pay more) the picture was more mixed. Social norms had the strongest role in predicting willingness to pay more for food grown with recovered nutrients, while knowledge had a stronger role in predicting willingness to pay more for recycled water.

In the qualitative study, the work takes a holistic perspective based on the concept of legitimacy, to present a comprehensive view of societal perceptions towards circular solutions. Using a qualitative approach, rooted in legitimacy theory, we interviewed key stakeholders associated to two selected demo cases (Gotland and La Trappe; two of the most outward-facing of the demo sites). Each demo case implemented one or more circular solutions (water reuse and/or materials recovery).

Results showed that the selected demo cases *stimulated the four legitimacy dimensions* (cognitive, pragmatic, normative and regulative) and engaged in different legitimisation strategies for their adopted circular solutions. The La Trappe demo case lacked the incorporation of public consultation and involvement which weakened the pragmatic dimension of legitimacy, while its focus towards visitors and customers strengthened the branding aspect of the pragmatic dimension. The Gotland demo case was found to evolve within a highly engaged and influential community (pragmatic and normative dimensions of legitimacy) although shortcomings were found regarding the comprehensibility of the circular solutions (cognitive dimension of legitimacy). From a theoretical standpoint, results developed the legitimacy framework further by including new elements to already well established categories (pragmatic and regulative legitimacy). Case-specific and wider recommendations addressed particular blind spots of each demo case and general aspects of the circular economy in the water and wastewater sector.

Based on our conclusions we make the following **key recommendations** which are intended to inform any public outreach or engagement activities undertaken in relation to circular solutions (both within the NextGen consortium and more widely):

Gotland:

1) Develop inclusive and comprehensible frames to talk about a circular solution

La Trappe:

2) Increase locals and public involvement in decision-making processes

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

3) Investigate the potential for marketing circular products

General recommendations:

4) Develop engagement strategies that specifically utilise social norms

5) Develop engagement strategies that specifically target emotional reactions

6) Highlight the role of circular solutions in addressing global challenges, rather than local ones

7) Take a boarder and holistic approach to highlight circular solutions' impacts and benefits, rather than restricting it to a financial gain

8) Build a heterogeneous network of stakeholders that can influence the design and implementation of circular solutions

9) Implement circular solutions within environments (or create environments) that embeds a rich variety of projects related to global challenges (climate change, water scarcity, sustainability)

10) Look into a broader range of laws rather that circular laws only

11) Do not assume that public acceptance is necessarily a barrier

Disclaimer

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Table of Contents

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

1. Introduction

1.1. Objectives

The work described in this report is linked with Task 4.1 in the NextGen project, which is focused on understanding the social acceptability of circular solutions. As discussed in *D4.1 – Interim report, with preliminary findings, on societal acceptability*, which preceded this report, work in this task was split into a qualitative stream of work (drawing from in-depth interviews) and a quantitative one (drawing from large-scale surveys).

The quantitative stream focused on examining and comparing public perceptions from the UK, the Netherlands and Spain. Because this task was focused on perceptions of the general public, and because the NextGen demo cases are not well known by the general public, the work was conducted at national scale (rather than focusing on specific perceptions of the demo cases themselves). This was viewed as a more valuable approach to generating insights for the NextGen project as it: 1) enabled us to collect data from a much wider pool of respondents (not just communities in the vicinity of the demo cases); and 2) enabled comparisons between the selected countries. Therefore, the aims of this stream are to explore broad public perceptions and attitudes towards circular solutions, and to understand: 1) willingness to consume recycled water for drinking purposes and food grown with recovered nutrients; 2) support for water recycling for drinking purposes and the use of recovered nutrients to grow food; and 3) willingness to pay more for recycled water for drinking purposes and food grown with recovered nutrients.

A survey instrument was developed, with an emphasis on water recycling for drinking purposes and nutrient recovery from wastewater for agricultural use. For a general public audience (which is the target sample), these two aspects are considered the most tangible and understandable representations of the circular economy for the water sector because they both involve products that the public can actually consume, and that is why they were selected for emphasis in this survey. Previous evidence has indicated (Fig. 1) that water recycling for potable applications tends to generate the most controversy and/or resistance in public reactions, and that applications involving less human contact tend to have higher acceptance. Other 'products' from circular solutions (e.g. recovered nutrients, recovered energy) have not yet been explored from the perspective of public perceptions. However, the evidence from water recycling lends credibility to the premise of focusing the survey instrument on the two aspects noted above, as they are the two that feature the most human contact (ingestion of water and food), and are therefore more likely to generate stronger reactions. As a result, the findings generated through public responses to these products are likely to provide insight into potential reactions to less controversial products and (by extension) receptivity towards the circular economy more widely. Including more than two

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

products in the survey was not deemed feasible as it would render the survey instrument too long and complex for respondents.

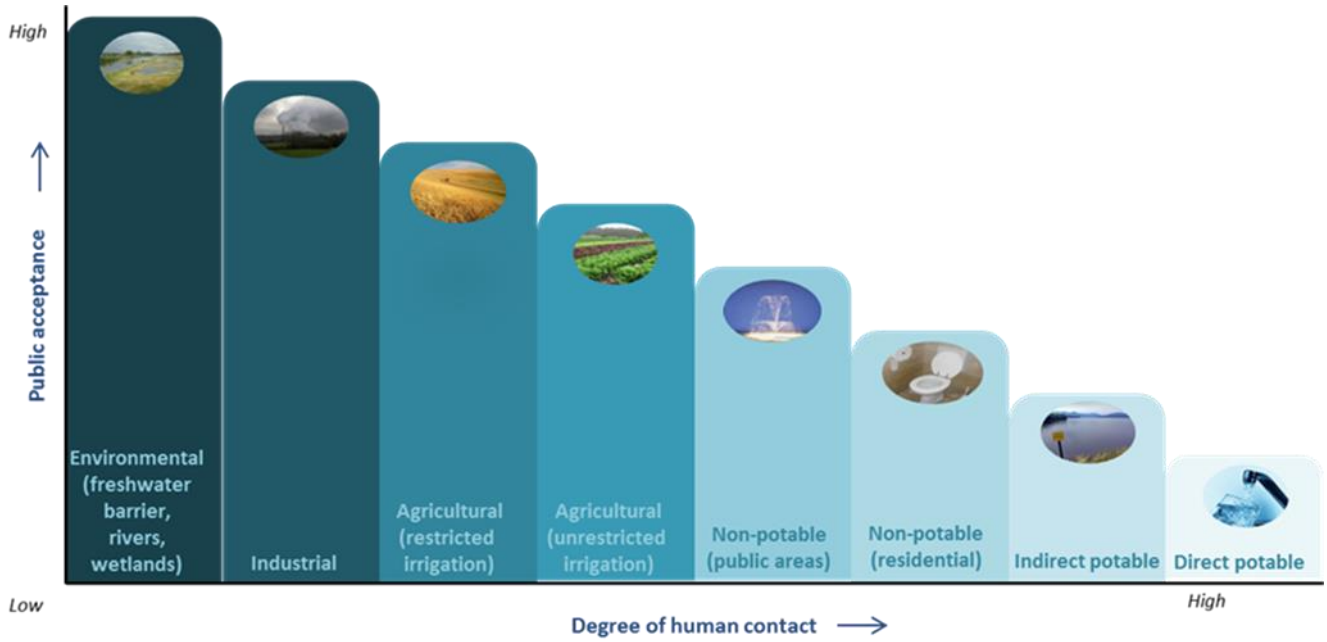

Figure 1 - Relative acceptability of different applications for recycled water (Brouwer et al., 2015)

The qualitative stream focused on examining perceptions of legitimacy towards circular solutions at selected NextGen demo cases (Gotland and La Trappe), by drawing insights from in-depth interviews with key stakeholders associated with each case. Through a review of academic and grey literature, we unpacked the concept of legitimacy, and how it can apply to circular solutions, and outlined four dimensions that highlight the different ways in which people might attribute legitimacy towards circular systems. We then undertook empirical work with the selected demo cases in order to explore how the perceptions of different stakeholders might reflect these different dimensions of legitimacy. This enabled us to gauge the extent to which the circular solutions were perceived as 'legitimate', and why – i.e. which dimensions of legitimacy appeared stronger or weaker in each case.

By combining the insights from both sets of evidence, we are able to build more substantiated recommendations, both for specific demo cases and for wider society, on how to support the acceptance and legitimacy of circular solutions in the water sector.

1.1.1. Role within NextGen

The results of the quantitative (survey) study are intended to help a number of NextGen demo cases by providing national-scale evidence, from a range of European contexts, on public views towards circular solutions. This will support demo sites that are seeking to argue for the wider adoption of circular solutions across their respective countries.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

The combined results in this deliverable have also shaped the public engagement activities being undertaken in WP3, by providing insights into the range factors that underpin support for circular solutions, to help shape messaging activities. The results also shape the outreach activities being undertaken in WP6, particularly outreach targeted at policy makers at all levels, by providing some insight around how the regulatory framework can influence the legitimacy of circular solutions. Finally, the results will directly inform the last stages of WP4, which involves the development of a European roadmap towards circular economy in the water sector (D4.4).

Throughout the work, we actively sought to communicate the findings from this study to the rest of the consortium, and more widely through outreach activities. Results were discussed with partners in each PSB meeting, through bilateral meetings between work packages (especially partners in WPs 3 and 5), and within CoP meetings for the demo cases. Findings were also presented at the Water Projects Europe meeting on inclusive governance (June 2021), and more recently at the Blue Planet Berlin Water Dialogues (November 2021). Final results will be presented again at the final project event and the IWA WWC in Copenhagen.

1.2. Literature review

Interest in the 'circular economy' has grown significantly in recent years. But while the overall concept has matured significantly, in many sectors it is still in operational infancy (Ghisellini et al., 2016). Some have suggested that the principle challenges to achieving a circular economy are not primarily technological, but more related to economics, governance and society (Owen & Liddell, 2016; Kehrein et al. 2020). The water and wastewater sector has considerable potential to support circular approaches, due to the wealth of potentially recoverable resources – including organic fertilisers, inorganic nutrients (N and P), biogas, heat, cellulose, biopolymers, heavy metals, pharmaceutical products, and water (Brockett, 2017; EMF, 2017; Kehrein et al. 2020). However, while current technologies allow for many resources to be recovered, their uptake can be hindered by concerns over economic feasibility, which is affected by perceptions over the societal acceptability and marketability of recovered resources (Desmidt et al., 2015; Kehrein et al. 2020).

In order to ensure long-term adoption and support for circular economy solutions in the water and wastewater sector it is important understand and address the implications of social acceptability and support (Velenturf and Purnell, 2017). As discussed above, the research described in this report is focused on understanding the acceptability of water reuse for drinking purposes and nutrient recovery from wastewater for agricultural use, and the sub-sections below review the state-of-the-art understanding of public perceptions towards these two activities. Both are seen as potential solutions to address growing pressures on global resources (Van der Bruggen 2010), but while water reuse has been the subject of considerable perceptions research, the same cannot be said for nutrient recovery. By combining insights

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

from public perceptions towards both activities, we can start to develop a more complete picture of societal acceptability of circular solutions in this sector.

1.2.1. Recycled water for drinking purposes

Of all the potentially recoverable resources in this sector, the recycling and reuse of water (for potable and non-potable purposes) is the most thoroughly explored in the literature. It has been identified as an important and somewhat underutilised element of sustainable water resource management (Brouwer et al., 2015; Hartley, 2006; Smith et al., 2018). The European Commission recognises the potential of treated wastewater, and has called for "closing the loop" through a circular economy approach (The European Commission, 2016). Globally, the 2030 Agenda for Sustainable Development provides a shared blueprint adopted by all United Nations Member States. Sustainable Development Goal (SDG) 6 calls for clean water and sanitation ("ensure available and sustainable management of water and sanitation for all", United Nations, 2019). In order to achieve SDG 6, there must be worldwide adoption of desalination and reuse technologies. Furthermore, the percentage of untreated wastewater being released into the environment should be halved by 2030, and this requires a substantial global increase in the recycling and safe reuse of treated wastewater. This calls for greater international cooperation in activities and programmes relating to water and sanitation, including desalination, wastewater treatment, and recycling and reuse technologies (Leong and Lebel, 2020).

Despite signs that levels of public support may be growing for water reuse (Glick et al., 2019; Goodwin et al., 2018, 2015), concerns about public opposition are still considered a major challenge for the sector (Hurlimann and Dolnicar, 2016; Ormerod and Scott, 2012; Smith et al., 2018). This is particularly true for schemes that recycle water for potable purposes, for which public opposition is still considered a key challenge to implementing successful projects (Fielding et al., 2019; Harris-Lovett et al., 2015; Sokolow et al., 2019).

Public acceptance of, and support for, particular technologies is shaped by a range of direct and indirect factors. Direct factors include climate, household characteristics (e.g. size, composition, income), regulatory environment (e.g. rebates, incentives, restrictions) and personal characteristics (e.g. intention and knowledge on water conservation). Indirect factors relate more to the personal characteristics (injunctive, descriptive and subjective norms, attitudes etc), environmental and water conservation values and a sense of trust and fairness to institutions and other consumers (Beal et al., 2013; Corral-Verdugo and Frías-Armenta, 2006). These factors ultimately determine how an individual will respond to a particular technology, and their level of support towards it, which ultimately shapes their willingness to interact with or consume that technology and/or its products (Etale et al, 2020). For environmental technologies, it has been argued that the degree to which an individual feels connected to the natural world can be a positive predictor of pro-environmental behaviour

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

(Beery and Wolf-Watz, 2014; Klaniecki et al., 2018; Upham et al., 2018), which could translate into engagement with technologies seen as more environmentally friendly.

Many (but not all) of these factors have been explored in relation to potable water reuse. For instance, emotional reactions have been found to be one of the strongest determinants of support and behaviour around water reuse (Nancarrow et al., 2009; Po et al., 2005). One facet of this is the so-called 'yuck factor', or feelings of disgust that are generated by the association of recycled water with human waste, and this has often been at the core of public opposition or lack of support for water reuse projects (Schwartz, 2015). Another facet of these emotional reactions is the feeling of fear or dread that can be associated with perceptions of health risks from consuming potable recycled water, and positive emotional reactions are often closely correlated with lower perceptions of risk towards recycled water (Fielding et al., 2019).

Fear reactions and perceptions of risk can also be associated with new technology, and this aspect is not as well explored in relation to water reuse. Fear and discomfort over new technologies can develop as people often like to stick to what they know, rather than challenging the way things have been done in the past and asking if historical practices are sustainable (Lowe, 2009). New technologies that are in conflict with established norms and regulations, are incomprehensible to a wider audience, or provide intangible benefits to end users, are likely to be confronted with major doubts about their utility and reliability (Binz et al., 2016). Where technologies or processes are seen as 'familiar' or 'controllable', risk perceptions decrease and more positive emotions increase, which often predicts acceptance (Fielding et al., 2019; Gibson and Burton, 2014; Napier et al., 2004). Therefore, the extent to which potable water recycling is considered familiar or commonplace, as opposed to something new and radical, could have a significant influence over acceptance.

This is closely linked to the concept of social norms – i.e. individuals' beliefs about what other people commonly feel and do. Social norms have been utilised to promote the adoption of behaviours with societal benefits, such as recycling behaviour or sustainable product choice (Melnyk et al., 2013). It has been argued that perceived norms have a greater impact on decision making than information alone (Leong and Lebel, 2020). Therefore, understanding how the decisions and actions of others influence an individual's choices can provide insights into how incentives or motivators can be modified for increased participation or engagement in a given initiative (Goette and Tripodi, 2018 in (Leong and Lebel, 2020)). Social norms are thought to play an important role in shaping public reactions towards recycled water, and are thought to be significantly influenced by the role of the media (Ching, 2010; Smith et al., 2018). Previous research has indicated that individuals take the expectations of others into consideration when they decide on appropriate behaviour (Fielding et al., 2019; Nancarrow et al., 2008). However, the specific role of social norms in shaping intended behaviour towards recycled water (e.g. willingness to use) is still not well understood.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Attitudes towards potable water recycling (and other alternative water supplies) may also be linked to perceptions of local water resources challenges. It has previously been hypothesised that people are more likely to be supportive of alternative water sources where they perceive water scarcity to be a problem affecting their own local environment (e.g. Jeffrey and Jefferson, 2003; Hartley 2006). Conversely, support is thought to be less likely in areas where water resources are not seen as a localised challenge. This issue of psychological distance is prevalent with regards to environmental threats (Gifford, 2011). This occurs when individuals tend to underestimate the severity of threat due to the perception that the risk is temporally, socially, spatially or hypothetically distant (Cimi and Kamhi, 2015). Several studies have found that environmental threats, such as climate change, are often perceived as distant rather than localised (Uzzell 2000; Spence et al., 2012; Schultz et al., 2014), while responses to environmental threats are strongest when the threat is perceived to be close (Griffioen et al., 2016). However, in the case of water reuse, instances of strong public opposition to water recycling schemes have arisen in places experiencing acute water scarcity, such as the well-known case of Toowoomba (Hurlimann and Dolnicar, 2010). It therefore remains important to explore how perceptions of water resources challenges might influence receptivity towards recycled water.

Confidence and trust are also recognised as important factors in shaping public reactions towards water reuse. Brouwer et al. (2014) identified three types of trust that may influence support of a water reuse project: 1) trust in the technical process and regulation; 2) trust in the water reuse organisation; and 3) trust in the quality and safety of the final product (recycled water). Additionally, Ormerod and Scott (2012) found that public acceptance of potable reuse was contingent on trust in the authorities that would design the systems, and trust in turn influenced an individual's willingness to drink reclaimed water, with those more willing more likely to trust information provided by government (including wastewater treatment facilities). While such findings are insightful, it is also recognised that trust is a highly complex topic that still warrants further exploration in the context of water recycling. The links between the different forms or expressions of trust, and how these relate to the emotional reactions discussed above, are still not very well understood.

One of the biggest uncertainties in this field concerns our understanding of how these different aspects of public reactions towards water recycling relate to wider societal processes of legitimisation and normalisation of the practice (and other circular economy systems). In some regions, notably California, it has been argued that water recycling (including for potable purposes) has essentially been through this process and it now much more legitimised (and widely accepted) than it was in the past (Binz et al., 2016; Sokolow et al. 2019). But it remains unclear whether such social processes can be recognised, and even influenced, as they are happening, in order to help encourage the legitimisation of circular practices around the world.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

1.2.2. Nutrient recovery for growing food

Similar to water reuse, the use of recovered nutrients to grow food can play an important role in addressing global challenges such as food security (Buckwell and Nadeu, 2016). Nutrient recycling is the process of extracting and recovering nutrients (e.g. nitrogen and phosphorus) in different forms from wastewater streams, and using those nutrients for agriculture in order to satisfy demand (Harder et al., 2019; Lam et al., 2020). As with water reuse, there is concern that negative attitudes and poor acceptability of the practice among food consumers, connected to perceptions of health risks associated using material derived from sewage, could present a significant barrier to the wider uptake of nutrient recovery systems (Buckwell and Nadeu, 2016). However, in contrast with water reuse, there has been little research into the social acceptability of using recovered nutrients to grow food, and it has been noted that this aspect warrants further exploration (Harder at al. 2019).

Quality and safety standards for recovered nutrients have been implemented in many European countries, along with monitoring of recovered nutrient products and guidance for farmers on appropriate usage, in order to improve confidence in the sector and mitigate associated health and environmental risks (Buckwell and Nadeu, 2016). Similarly, some public engagement and awareness raising efforts have been encouraged in some European countries to create greater clarity regarding the potential public health impacts of using recovered nutrients for food production (Buckwell and Nadeu, 2016). Some have argued that the general practice of using human excreta in agriculture needs to be 'reframed' in a more positive way, in order to help support public acceptance (Harder et al. 2020). However, there is little empirical data on which to build, or judge the effectiveness of, such efforts.

Research around other aspects of public perceptions and behaviours towards food does provide some initial insights and it echoes many of the findings around perceptions of recycled water noted above. For instance, fear reactions to new foods, or 'food neophobia', has been a central focus within the food perception literature, where studies have measured interest in and fear reactions towards new foods including exotic, functional and ethnic foods (De Boer et al., 2013; Siegrist et al., 2013). Research suggests that people who are neophobic to foods are less likely to try or buy novel foods. Siegrist et al (2013) report that age, income and education all had associations with food neophobia.

Environmental awareness has also been explored in relation to food perceptions. In particular, organic food has received considerable attention in the literature over the last 20 years, as its popularity is due the belief that it does less harm to the environment and potentially presents fewer health risks (Van Doorn and Verhoef, 2011). Attributes such as environmental values and concern are also predictors of consumer acceptance of organic foods and significantly influence willingness to pay more for an organic food (Shin et al., 2017; Van Doorn and Verhoef, 2011). Despite there being a clear willingness for some segments of food consumers to pay more for organic produce, studies around other circular solutions (e.g. urine separation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

nutrient recycling) have found that acceptance decreases when willingness to pay is included as a measure of acceptance (Lamichhane and Babcock, 2013; Pahl-Wostl et al., 2003). Therefore, while environmental credentials may improve the overall acceptance of food grown with recovered nutrients, it is unclear whether consumers might also be willing to pay a premium for such produce.

Additionally, trust has been shown to be an important factor in perceptions and behaviour towards food. In particular, trust in the food industry has played an important role in influencing acceptance of certain foods among consumers and predicting support. Siegrist et al (2008) found that participants that trusted the food industry were more likely to buy functional foods (food claimed to deliver additional or enhanced benefits over and above their basic nutritional value).

1.2.3. From acceptance to legitimacy

Acceptance practices in the water sector put the emphasis on providing experts' knowledge to an uneducated public and restrict the actions to accepting or rejecting a given water solution (Stenekes et al., 2006). However, societal acceptability cannot be viewed in isolation of alternative water solutions (Bell and Aitken, 2008), as this vision does not integrate the full view of what is happening when one considers a given circular solution (Harris-Lovett et al., 2015). Legitimacy differs from public acceptance by providing a more holistic approach (Harris-Lovett et al., 2015). It touches upon end users' personal evaluations (pragmatic legitimacy), the cultural order (cognitive legitimacy), the moral rules (normative legitimacy) and the regulative arrangement of a given community (regulative legitimacy). The legitimacy perspective offers a wider range of actions such as sharing power with end users through decision-making (Binz et al., 2016; Harris-Lovett et al., 2015). In this case, the ultimate goal of legitimacy processes is the widespread trust in circular solutions (Binz et al., 2016; Harris-Lovett et al., 2015; Suchman, 1995). Water, energy and materials derived from wastewater would become "normalised", equal to conventional sources of water, energy and materials (Smith et al., 2018, p. 49).

We apply the concept of organisations (Scott, 1995; Suchman, 1995) and innovations (Binz et al., 2016; Harris-Lovett et al., 2015) legitimacy to circular solutions. Pragmatic legitimacy is based on the self-interest calculations of benefits brought by a circular solution to its end users (Harris-Lovett et al., 2015; Suchman, 1995). Its first constituent, exchange legitimacy, is based on the services or goods provided by a circular solution to its end-users (Harris-Lovett et al., 2015; Suchman, 1995). Its second constituent, influence legitimacy, arises when end users are incorporated into decision-making processes for a circular solution (Harris-Lovett et al., 2015; Suchman, 1995). The last constituent, dispositional legitimacy, appears if the solution is managed by an organisation that shares end-users' values or that is honest and trustworthy (Harris-Lovett et al., 2015; Suchman, 1995). While this constituent usually refers to the personification of an organisation (Suchman, 1995), we scale it up towards circular solutions

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

and refer to the alignment of the "values" of a circular solution with the values a given community. Its last constituent, dispositional legitimacy, also derives its meaning from the development of a "quality brand" for the implementing utility (Harris-Lovett et al., 2015, p. 7554).

Cognitive legitimacy is a passive assumption that an organisation is comprehensible and taken-for-granted (Suchman, 1995). Its first constituent, comprehensibility, occurs when a circular solution meshes with end-users daily life routines and pre-existing cultural beliefs (Scott, 1995; Suchman, 1995). Theorists usually portray the social realm as a disordered environment in which end-users try to order their experiences into coherent accounts (Scott and Lyman, 1968). Moreover, negotiation of social reality takes place within the broader context of cultural beliefs (Scott, 1995). The second constituent, taken-for-grantedness, is the most powerful form of legitimacy and describes a solution as inevitable, necessary and not consciously questioned (Harris-Lovett et al., 2015; Suchman, 1995). The solution is part of a broader cognitive coherence and integrative change (Suchman, 1995).

Normative legitimacy is defined by the active judgment of whether a solution fits social values and norms in a manner that enhances societal welfare (Suchman, 1995). Its first constituent, consequential legitimacy, occurs when it can be demonstrated that a circular solution has a strong history in providing valuable results for the society (Harris-Lovett et al., 2015). However, La Trappe and Gotland demo cases are not fully implemented. Thus, Scott's (1995) and Suchman's (1995) definition stating that consequential legitimacy is based on the pursuit of particular goals defined by the normative system, was followed. Its second constituent, procedural legitimacy, is defined by the normative system as an appropriate and expected way to implement and manage a circular solution (Scott, 1995). Its third constituent, personal legitimacy, differs from procedural legitimacy as it rests on the evaluation of representatives and leaders charisma and not on the evaluation of the organisation's procedures (Suchman, 1995). It further relates to the perceived integrity and trustworthiness of the implementing organisation's leaders or water authority representatives (Harris-Lovett et al., 2015). Its last constituent, structural legitimacy, refers to the constructed capacity to execute a particular type of work, e.g. existence of a quality control department, framework of actors around the circular solution (Harris-Lovett et al., 2015; Suchman, 1995). Scaled-up to the water domain, it can also relate to physical characteristics of a circular solution that enhances its reliability and safety (Harris-Lovett et al., 2015).

Regulative legitimacy is defined as the capacity to set up rules and assess others' congruence to them (Scott, 1995). Binz et al. (2016) apply this definition to technology legitimacy and state that regulative legitimacy is more likely to occur when a circular solution conforms with relevant regulations and laws. Indeed, solutions that need regulative shifts are perceived as being less legitimate (Binz et al., 2016).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

1.2.4. Knowledge contribution from this task

Our work in this task picks up on, and (in many cases) delves further into, the themes identified in the literature above, and looks at how they may be shaping public acceptance of the 'products' of circular economy. These themes include: 1) emotional reactions; 2) risk perceptions; 3) social norms; 4) environmental awareness; and 5) trust and confidence. One of the unique features of this work is that it tries to explore these themes in relation to both potable recycled water and food grown with recovered nutrients. This is helping to fill an important gap in the literature around the need for empirical data highlighting the social acceptance of nutrient recovery. Additionally, by asking similar questions about two different circular economy products (water and nutrients) to the same sets of respondents, this enables us to directly compare how responses to one product relate the other, and therefore draw wider insights about the likely acceptability of other circular economy products from the water and wastewater sector. Such wider insights will also be supported by the fact that our work is conducting a multi-country comparison – this is important because much of the previous work done in this field (particularly around recycled water) is situated in a single country, and expanding the geographic breadth of that work can help develop a more global picture. Ultimately, the work in this task seeks to understand whether such broad empirical evidence (quantitative and qualitative) can be used to unpack, and perhaps accelerate, the wider processes of societal legitimisation of the circular economy.

Furthermore, the understanding of the circular economy from a social standpoint is still relatively limited (Schöggl et al., 2020). Much of the work in this space focuses on 'public acceptance' of products derived from circular solutions (such as recycled water), and although such work is valuable, it is often limited to a binary view of public reactions (accept vs. not accept, willing vs. unwilling to use products). By trying to understand the emerging social legitimacy of circular solutions, we can develop a much broader and more holistic perspective on how societies may react to, and see value in, circular solutions. Although some previous studies have examined the legitimisation of circular solutions in the water sector (Binz et al., 2016; Harris-Lovett et al., 2015), these remain limited and largely conceptual and retrospective. Therefore, this work can contribute to a more robust empirical approach, and an initial qualitative evidence base, for exploring perceptions of legitimacy towards real-world circular solutions, in order to develop a clearer view of the legitimisation process as it unfolds.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

2. Methods

2.1. Countries selected

As discussed in D4.1, the DoA states that Task 4.1 would focus on five demo cases. This remains the case, but based on a re-evaluation of the suitability of the available demo sites for each type of work, La Trappe (having a visitor centre) and Westland (relevant for reuse in both urban and agriculture sector) were selected over Braunschweig and Athens (the latter two were deemed more suitable for Task 4.2 on policy and regulations). Furthermore, the demo sites were split between the two streams of work (the quantitative stream is linked to three sites and the qualitative stream is linked to two sites) in order to make the best use of available resources. These selections are outlined in Table 1 and discussed in greater detail below.

Table 1 - Demos sites selected for different streams of work in T4.1

Demo sites named in DoA	Demo sites selected	Stream of work
Spernal	Spernal	Quantitative (surveys)
Costa Brava	Costa Brava	
Braunschweig	→ Westland	
Gotland	Gotland	Qualitative (interviews)
Athens	→ La Trappe	

Accordingly, the quantitative surveys focused on three countries: the UK, the Netherlands, and Spain. The surveys were intended to be large-scale, in order to obtain a national perspective on public receptivity towards circular economy systems. Because the demo sites themselves are very localised, and not widely known within each country, it was not considered feasible or useful to ask questions about the demo sites themselves within the survey. However, the demo sites selected for this work are those that felt they would benefit from national insights of this nature – all of them deal with recycled water or nutrient recovery in some form, and hope to argue for the wider adoption of circular solutions across their respective countries, and nationwide public acceptance data will be useful for that purpose. The Westland case was selected over Braunschweig because the case 'owners' expressed a stronger interest in this aspect of the work and felt it would be beneficial.

For the qualitative study, the work focused on the Gotland and La Trappe cases. Because these are two of the most outward-facing of the demo sites, in that they both have a significant level of interest and investment in outreach and engagement activities, they were deemed to be

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

the most suitable sites for this task. The Gotland demo case (Sweden) includes rainwater harvesting, water reuse and desalination. The La Trappe demo case (The Netherlands) includes water reuse and materials recovery. During the early stages of the project, La Trappe was ultimately selected over the Athens case because of the presence of a visitor centre and active tourism at the site, which made it a more public-facing site than Athens and therefore more suited to this work.

2.2. Quantitative (survey) study

2.2.1. Recruitment and data collection

Recruitment and completions of an online survey were managed through the survey panel Qualtrics (www.qualtrics.com), who worked with databases of respondents from three countries (UK, Netherlands and Spain) to select respondents to take part. Qualtrics track the demographic data of respondents based on recommendations given by the research team.

The online surveys took between 10-15 minutes to complete. The survey consisted of two sections. The first section comprised of questions and statements about recycled water for drinking purposes (n=40), the second recovered nutrients for growing food for consumption (n=26. Each survey was distributed in the appropriate language (English, Dutch and Spanish/Catalan). Qualtrics undertook a 'soft launch' of the survey (pilot study) for each country to check the quality of responses before full recruitment began. For the UK survey 1066 respondents started and 1028 completed, for The Netherlands survey 763 started and 751 completed, and for the Spanish survey 844 started and 800 completed.

The recruitment used stratified sampling based on census data of the UK, Netherlands and Spanish population, to ensure a representative sample. Equal number of genders were sort (UK: Male 49%, Female 51%; Netherlands: Male 52%, Female 48%; Spain: Male 49%, Female 51%). All age range groups were represented with most respondents aged between 50 and 64 (25%) in the UK, 45-55 (22%) in the Netherlands and 35-49 (31%) in Spain. As with any online surveys, there may be challenges associated with sampling biases and potential methodological biases (e.g. social desirability bias) (Grimm, 2010).

The data collection was reviewed and approved by Cranfield University's Research Ethics Committee, and was conducted in accordance with relevant guidelines on ethical research. All data was collected, stored and analysed in accordance with GDPR. Copies of the full survey and data set will be made available on Cranfield University's online research data repository (https://doi.org/10.17862/cranfield.rd.12205181.v1). It is also worth noting that the survey data from Spain was collected immediately before and during that country's lockdown due to the Covid-19 crisis. Although it does not appear as though this situation had a detectable impact on the resulting data, it was taken into account during the subsequent analysis (particularly the comparative component).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

2.2.2. Survey instrument

To support the stratified sampling above and facilitate analysis, respondents were asked some basic demographic questions, including their gender, age, and where they live. In addition, respondents were asked a range of items that were classified into independent and dependent variables, as detailed below.

Independent variables

Some items remained as single statements; whilst other items were aggregated and given a mean score. Aggregated items were based on satisfactory Cronbach's alpha which is the most common measure of internal consistency ("reliability") (Hair et al., 2006). Cronbach's alpha is most commonly used when there are multiple Likert scale questions. The list of items, the statements used and the overall reliability coefficient for the set of questions that have been combined to create items can be found in Table 2. Where appropriate, Cronbach's alpha was used to assess the internal consistency of combined items.

Challenge for water resources: Respondents were asked to rate their level of agreement with statements that there is a challenge for water sources on a global, national and local level (asked as 3 separate statements, 1=strongly disagree, 5=strongly agree).

Knowledge. The first series of questions asked respondents to rate how much they felt they knew about 1) the treatment processes used by water companies to treat drinking water and/or wastewater and 2) about water recycling (1=none at all, 5=a great deal). Knowledge questions were not repeated for nutrient recovery. The internal consistency for both knowledge questions was evaluated for each country with Cronbach alpha. Cronbach's alpha test is commonly referred to in water management (Goodwin et al., 2018; Ishii and Boyer, 2016) to measure the inter-correlation of question items as an indicator of internal consistency. Due to the satisfactory alpha, these two questions were combined to create a mean 'knowledge' score.

Satisfaction. Satisfaction with water and wastewater services was measured using a 1-5 Likert scale of satisfaction (1=extremely unsatisfied, 5= extremely satisfied) to the statement 'in general, how satisfied are you with your water and wastewater services?' This question was not repeated for nutrient recovery.

Social norms. An aggregated social norm term was calculated from four statements for each respondent where respondents rated their level of agreement (1=strongly disagree, 5=strongly agree). The questions were a standard form of questioning emerging social norms (Dolnicar and Hurlimann, 2009; Leviston et al., 2006).The internal consistency for the four social norm statements was evaluated with Cronbach alpha for both recycled water for

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

drinking purposes and the use of recovered nutrients to grow food. Due to the satisfactory alpha, these four statements were combined to create a mean 'social norm' score for water recycling and nutrient recovery.

Emotion. Emotional responses to recycled water for drinking purposes and the use of recovered nutrients to grow food were assessed by giving respondents a series of statements to rate their level of agreement (1=strongly disagree, 5=strongly agree). There were six statements based on emotional reactions to recycled water for drinking purposes which were also repeated for recovered nutrients. Again, the internal consistency for these seven statements was evaluated with Cronbach alpha and the six statements were combined to create a mean 'emotion' score for recycled water for drinking purposes and recovered nutrients. Emotion statements were based on positive and negative emotions which have been discussed in the literature (disgust, anxiety, comfort). Negative statements were reverse coded so that, in the overall combined metric, the higher the score the more positive the emotional reaction.

Risk perception. Risk perception was a single statement item measured using a Likert level of agreement scale (1=strongly disagree, 5=strongly agree) to the statement 'recycled water for drinking purposes/ food grown with recovered nutrients is likely to be safe for human consumption'. The higher the score, the lower the perception of risk.

Trust. Trust was a single statement measured using a Likert level of agreement scale (1=strongly disagree, 5=strongly agree) used to measure trust of water recycling systems and nutrient products. Trust was also used as a dependent item.

Confidence: Respondents were asked to rate their level of confidence in their water company delivering recycled drinking water safely (1=very unconfident, 5=very confident). This question was not repeated for nutrient recovery.

Common: To measure how common respondents felt water recycling for drinking purposes was, they were asked to rate their level of agreement (1=strongly disagree, 5=strongly agree) with the statement, "water recycling for drinking purposes is common".

Newness: Similar to the above, respondents were asked to rate their level of agreement with the statement "using recycled water for drinking purposes is a new practice".

Environmental benefit: Environmental benefit was measured using a Likert scale (1=strongly disagree, 5=strongly agree) of agreement to a statement on the perceived environmental friendliness of water recycling systems and using recovered nutrients for growing food.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Table 2 – Question items used for measuring independent variables for all three countries

IDV	Recycled water for drinking purposes	Cronbach's alpha	Recovered nutrients to grow food	Cronbach's alpha
Challenge for water	To what extent do you agree that there is a challenge for water resources: On a global level On a national level On a local level			
Knowledge	How much do you feel you know about water recycling?	UK .853 NL .890 SP .863		
	How much do you feel you know about the treatment processes used by your water company to treat drinking water and/or wastewater?			
Satisfaction	In general, how satisfied are you with your water and wastewater services?			
Social norms	My family and friends would be happy to drink recycled water	UK .902 NL .923 SP .912	My family and friends would be happy to consume food grown using recovered nutrients	UK .917 NL .893 SP .928
	xx residents would support water recycling for drinking purposes		I think X residents would support the use of recovered nutrients to grow food	
	My family and friends would support water recycling for drinking purposes		My family and friends would support the use of recovered nutrients to grow food	
	xx residents would be happy to drink recycled water		I think xx residents would be happy to consume food grown with recovered nutrients	
Emotion	I feel comfortable with drinking water which has been recycled	UK .900 NL .883 SP .858	I feel comfortable consuming food grown with recovered nutrients	UK .894 NL .783 SP .829
	I would be anxious about drinking water which has been recycled (R)		I would be anxious about consuming food grown with recovered nutrients (R)	

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

	I feel positive about the use of recycled water for drinking purposes		I feel positive about the use of recovered nutrients for growing food	
	The idea of water recycling for drinking purposes is disgusting (R)		The idea of recovered nutrients for growing food is disgusting to me (R)	
	Recycled drinking water is likely to taste the same as my existing tap water		Food that has been grown with recovered nutrients is likely to taste the same as other food	
	Water recycling for drinking purposes is appealing to me		Using recovered nutrients for growing food is appealing to me	
Risk perception	Recycled water for drinking purposes is likely to be safe for human consumption		Food grown with recovered nutrients is likely to be safe for human consumption	
Trust	I would trust water recycling systems for drinking purposes		I would trust recovered nutrient products for growing food	
Confidence	How confident are you that your water company could deliver recycled drinking water safely?			
Common	Water recycling for drinking purposes is common			
Newness	Using recycled water for drinking purposes is a new practice			
Environmental benefit	Water recycling is more environmentally friendly than existing systems		Using recovered nutrients for growing food is environmentally friendly	

(R) Reversed items.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Dependent variables

Question items used to measure dependent variables are described below and in Table 3.

Willingness to consume: Willingness to consume was a single statement item measured using a Likert level of agreement scale (1=strongly disagree, 5=strongly agree) used to willingness to drink recycled water and eat food that had been grown with recovered nutrients.

Support: Support for both recycled water for drinking purposes and the use of recovered nutrients to grow food were measured using a Likert level of agreement scale (1=strongly disagree, 5=strongly agree).

Willingness to pay more: Similarly, willingness to pay more was also a single statement item measured using a Likert level of agreement scale (1=strongly disagree, 5=strongly agree) used to willingness to pay more for recycled water and products grown with recovered nutrients.

Table 3 – Question items used for measuring dependent variables for all three countries

DV	Recycled water	Nutrient recovery
Willingness to consume	I would be happy to drink recycled water	I am happy to eat food that has been grown with recovered nutrients
Support	I support the use of recycled water for drinking purposes	I support the use of recovered nutrients to grow food
Willingness to pay more	If the tap water supplied by my water utility was partially or entirely recycled I would be happy to pay more for it than I currently do	If the food I consume was grown using recovered nutrients I would be happy to pay more for it than I currently do

2.2.3. Analysis

All analyses (a combination of descriptive and statistical) were carried out in IBM SPSS Statistics 25 with α=0.05.

Paired t-tests were used for within countries matched samples to determine any significant difference between dependent and independent items. The hypothesis was that **(H1)** there would be a significant difference between responses to water recycling for drinking purposes and responses to the use of recovered nutrients to grow food; more specifically, between relative support for the two practices, and relative willingness to consume the water and food.

A one-way ANOVA (with a Tukey post hoc test) was used to compare each independent and dependent items between countries for the hypothesis that **(H2)** there would be a significant difference between countries.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Finally, following the methodology of Etale et al. (2020), a multiple linear regression analysis was run to test for the significance of the independent items in predicting the dependent items (willingness to consume, support and willingness to pay more) for recycled water and recovered nutrients in the UK, Netherlands, and Spain. The analysis was run separately for recycled water and nutrient recovery and separately for each country. The hypothesis (H3) is that all independent items would be significant predictors of willingness to consume, support and willingness to pay more for recycled water for drinking purposes and the use of recovered nutrients for food production.

2.3. Qualitative (interview) study

2.3.1. Recruitment and data collection

For the selection of interviewees, an initial list of stakeholders for each of the two demo cases was created based on available resources (e.g., lists of participants in local communities of practice) and on the stakeholders selected in previous similar studies that looked at the legitimacy of environmental technologies (e.g., Genus and Iskandarova, 2020; Harris-Lovett et al., 2015; Nölting and Mann, 2018). Each stakeholder organisation on the initial lists was classified according to seven categories: governance, technical, local community, agriculture, communication, research and education, and non-profit organisation (Table 4). Desk research was then used to identify individuals within each stakeholder organisation who could potentially be approached for interviews.

A power-interest matrix was then created for demo case study to categorise and prioritise the stakeholders (Ambrosini et al., 1998; Johnson et al., 2008; Mendelow, 1981). Power is dictated by the possession of resources, authority, influence and the ability to dictate alternatives (Mendelow, 1981) while interest is the extent to which one can demonstrate interest in opposing or supporting a particular approach (Johnson et al., 2008). The power-interest matrix contains four categories (Figure 2): context setters, players, crowd, and subjects (Reed et al., 2009). Each stakeholder organisation on the initial lists was situated on the matrix in one of those four categories. The initial recruitment phase was then focused on those with high power and high interest. Conversely, stakeholders identified as low power and low interest were generally not pursued for interviews. The two power-interest matrices are shown in Figure 3 (Gotland case) and Figure 4 (La Trappe case).

Additionally, scoping discussions were conducted with the NextGen lead of each demo case to validate and complement the initial stakeholder lists and the power-interest matrices. The lists and matrices were refined based on the information gathered in the scoping discussions. During the initial interviews with stakeholders, snowballing was also used to identify additional stakeholders that may have been missed. The final sample of interviewees reflects a spectrum of stakeholders from within and outside the NextGen project. For the Gotland demo case, 21 interviews were conducted, and 11 interviews were conducted for the La

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Trappe case (Table 4). Some stakeholders were approached for interviews, but either declined to participate or could not participate due to time constraints, sometimes exacerbated by the restrictions imposed by the Covid 19 pandemic (which was a particular issue for the La Trappe case).

Table 4 - List of interviewees

Organisation	Gotland	La Trappe
Governance	2	4
Technical (technology and data provider)	3	7
Local community	4	0
Agriculture	2	0
Communication	4	0
Research and education	4	0
Non-profit organisation	*2	0
All	21	11
*Not recorded; notes taken for one interview		

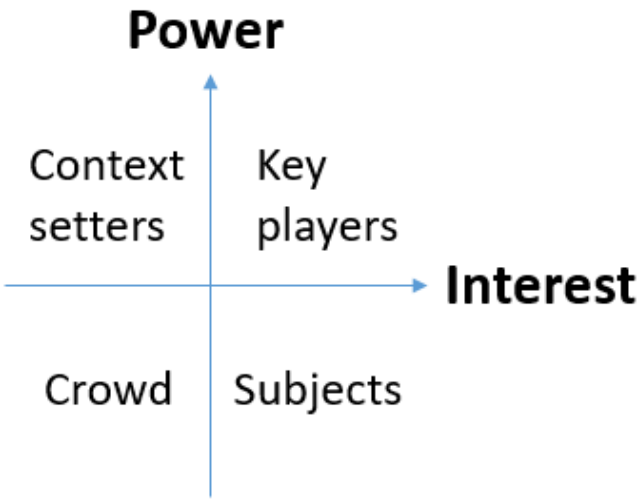

Figure 2 - Interest-power matrix categories (context setters, players, crowd and subjects). Adapted from Johnson, Scholes and Whittington (2008) *and Reed et al.* (2009).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

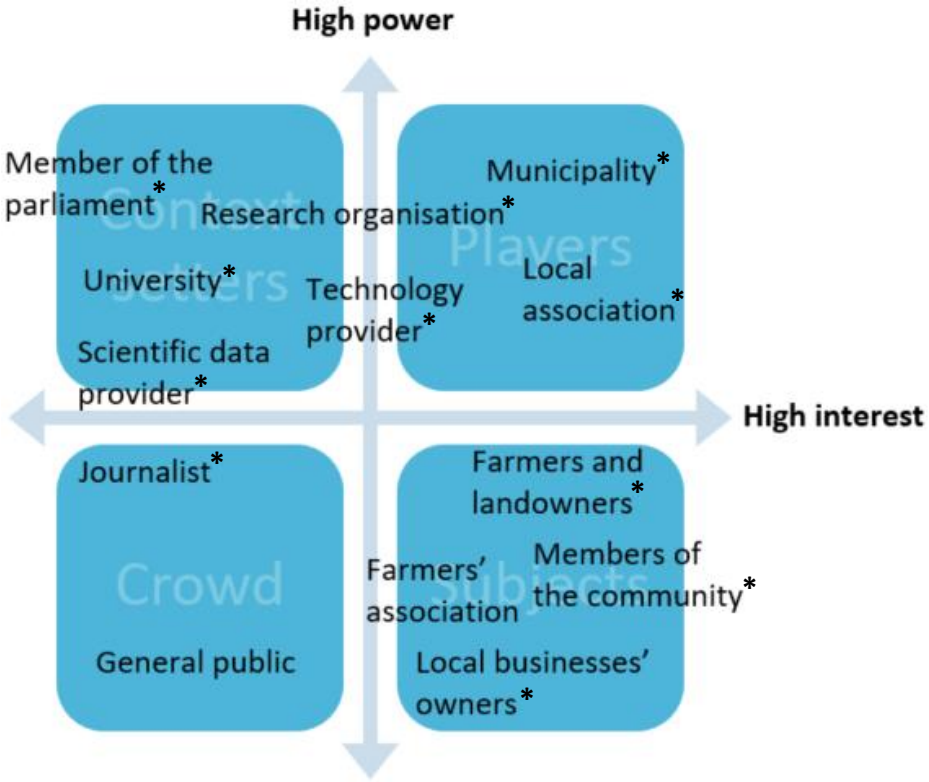

*Figure 3 - Interest-power matrix for the Gotland case (*interviewed stakeholders)*

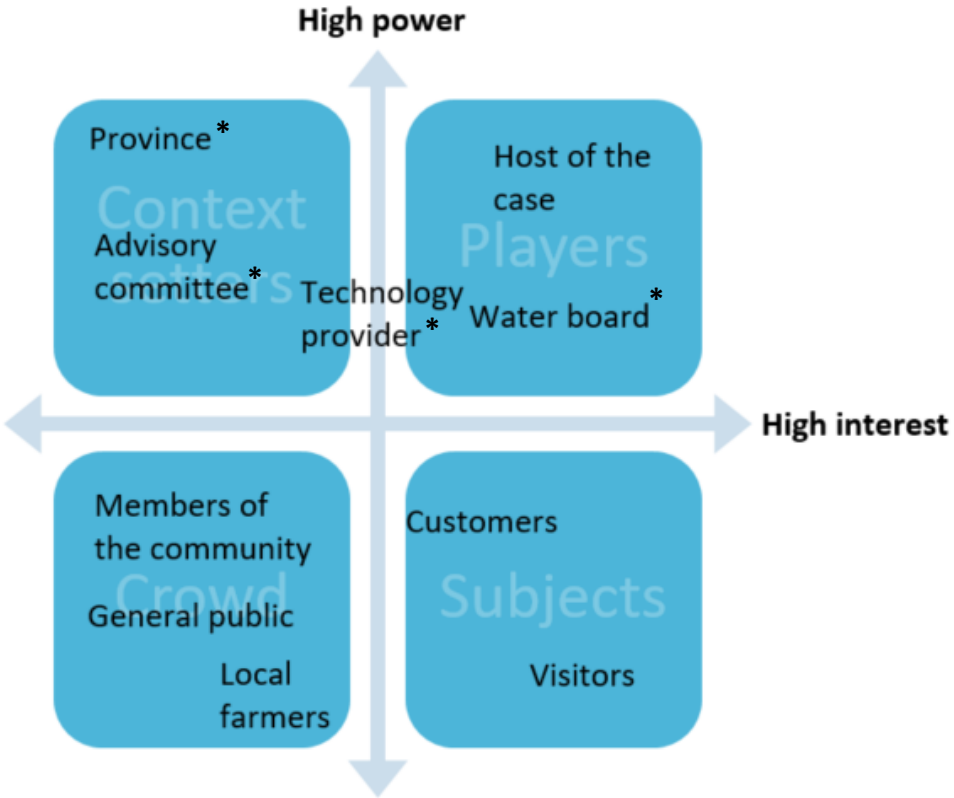

*Figure 4 - Interest-power matrix for the La Trappe demo case (*interviewed stakeholders)*

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Interviews were arranged by key informants and the researcher by email. Interviews were conducted remotely via video call (with in-person interviews impossible due to the Covid-19 pandemic) and were audio recorded. Interviews lasted from 30 to 60 minutes. Ethical considerations were fostered by providing each respondent with an informed consent form. Interviewees were presented with an explanation of the general purpose of the study and were probed and asked for clarification as needed throughout the interview (Wilson, 2013). Semi-structured interviews were conducted, and questions were structured based on the four legitimacy dimensions that were discussed earlier (pragmatic, cognitive, normative and regulative).

The data collection methodology was reviewed and approved by Cranfield University's Research Ethics Committee, and interviews were conducted in accordance with relevant guidelines on ethical research. All data was collected, stored and analysed in accordance with GDPR. Copies of the anonymised data set will be made available on Cranfield University's online research data repository (10.17862/cranfield.rd.13553717).

2.3.2. Interview topic guide

Interview questions were designed to investigate legitimacy perceptions towards the Gotland and La Trappe demo cases. The first section of the interview asked about the interviewee's role (if any) in the development of a given demo case. The second section investigated the general context (environmental, economic, and social) of the demo case. The third section explored the role of the interviewee's organisation and other stakeholders in the development of the demo case as well as interviewee's view on the demo case impacts and benefits. The fourth section investigated the role of the demo case's 'community of practice' (organised under NextGen WP3) and public outreach outcomes. The fifth section asked the interviewee to reflect on locals' views towards the demo case. The last section explored how acceptance of a given demo case can be improved and a separate question explored interviewee's view on the concept of circular economy. All six sections included proxy questions for each four legitimacy types (pragmatic, cognitive, normative and regulative). The full topic guide is provided as an appendix (Appendix 2).

2.3.3. Analysis

Interviews were transcribed into text files and a qualitative analysis software package (NVivo) was used to support the analysis. A thematic analysis was used to analyse the transcripts (Spencer et al., 2014). The researchers reviewed the transcripts and created a thematic framework to assist the coding process. The framework combined predetermined and emerging codes to both keep an explorative angle and remain rooted in the legitimacy framework (Creswell and Creswell, 2018). Predetermined codes focused on the four

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

dimensions of legitimacy previously described (pragmatic, cognitive, normative and regulative). The legitimacy typology was used to pull out interviewees' experiences from the transcripts that relate to the pragmatic, cognitive, normative and regulative legitimacy.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

3. Survey results

3.1. Comparing responses to recycled water and nutrient recovery within countries

Overall support for the two circular solutions appeared high in all three countries. The proportions of respondents who supported or strongly supported the use of recycled water for drinking were 67% (UK), 73% (ES) and 75% (NL). The proportions of respondents who supported or strongly supported the use of recovered nutrients to grow food were 74% (UK), 75% (NL) and 85% (ES).

There were significant within-country differences between responses to recycled water for drinking purposes and the use of recovered nutrients to grow food in all three countries (Table 4). We can therefore accept H1.

Within the UK and Spain, there were significant differences for all dependent and independent items with nutrient recovery having higher scores throughout (Table 4). For example, in the UK support for nutrient recovery (M=4.00, SD=0.98) was significantly higher than support for recycled water for drinking purposes (M=3.75, SD=1.07) (p<.001).

In the Netherlands, there were fewer significant differences between items. For example, like the UK, support for nutrient recovery (M=4.00, SD=0.89) was significantly higher than that for water recycling (M=3.91, SD=1.05) (p<.001) (Table 4), but there was no significant difference in willingness to consume recycled water for drinking purposes (M=3.78, SD=1.18) vs. food grown with recovered nutrients (M=3.86, SD=0.95) (p=.074).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Table 5 - Within-country comparisons of responses to potable recycled water and the use of recovered nutrients to grow food, for all dependent and independent items (t-test)

Item	UK			Netherlands			Spain		
	Recycled water (*n*=1028) Mean (SD)	Nutrient recovery (*n*=1028) Mean (SD)	*t*-value (df)	Recycled water (*n*=756) Mean (SD)	Nutrient recovery (*n*=756) Mean (SD)	*t*-value (df)	Recycled water (*n*=756) Mean (SD)	Nutrient recovery (*n*=756) Mean (SD)	*t*-value (df)
Knowledge	2.21 (0.91)			2.64 (0.86)			2.43 (0.90)		
Satisfaction	3.86 (0.87)			3.88 (0.84)			3.73 (0.98)		
Social norms	3.25 (0.99)	3.77 (0.91)	-15.636 (1027)**	3.46 (0.96)	3.69 (0.79)	-6.706 (750)**	3.34 (0.99)	4.05 (0.84)	-19.669 (799)**
Positive emotion	3.24 (1.00)	3.58 (0.89)	-12.940 (1027)**	3.62 (0.95)	3.68 (0.62)	-1.505 (749)	3.38 (0.95)	3.76 (0.78)	-12.390 (799)**
Risk perception	3.68 (1.09)	3.83 (1.02)	-4.655 (1027)**	3.80 (1.06)	3.87 (0.89)	-1.970 (734)	3.72 (1.14)	4.03 (0.90)	-8.534 (787)**
Trust	3.39 (1.19)	3.74 (1.04)	-9.823 (1027)**	3.83 (1.05)	3.81 (0.95)	0.779 (739)	3.42 (1.21)	3.99 (0.98)	-14.588 (791)**
Confidence	3.48 (1.10)			3.84 (1.05)			3.08 (1.19)		
Common	3.01 (1.03)			3.57 (1.13)			3.28 (1.12)		
Newness	2.51 (1.12)			2.25 (1.04)			2.12 (1.08)		
Environmental benefit	3.76 (0.92)	4.11 (0.86)	-11.243 (1027)**	3.86 (0.93)	3.90 (.893)	-1.144 (733)	3.93 (1.08)	4.30 (0.86)	-9.867 (799)**
Willingness to consume	3.50 (1.21)	3.85 (1.02)	-9.729 (1027)**	3.78 (1.18)	3.86 (0.95)	-1.792 (749)	3.38 (1.31)	3.69 (0.99)	-6.978 (799)**
Support	3.75 (1.07)	4.00 (0.98)	-6.778 (1027)**	3.91 (1.05)	4.03(0.89)	-2.172 (750)**	3.91 (1.09)	4.29 (0.86)	-9.667 (799)**
Willingness to pay more	2.26 (1.10)	2.35 (1.08)	-3.310 (1027)**	2.51 (1.19)	2.74 (1.18)	-6.739 (750)**	2.30 (1.22)	2.70 (1.26)	-11.773 (799)**

** Indicates significant differences ($p<0.05$).

1= low 5=high (1=Strongly disagree, 5=Strongly agree)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

3.2. Comparing results between countries

We ran a one-way ANOVA (with a Tukey post-hoc test) to determine the significant differences between countries for all independent and dependent items (Table 5).

3.2.1. Recycled water for drinking purposes

Dependent items

There were significant differences between all countries for all dependent items for recycled water for drinking purposes (willingness to consume, support, willingness to pay more) (Table 5). We can therefore accept H2.

Respondents from the Netherlands had significantly higher willingness to consume recycled water for drinking purposes compared to the UK ($p<.001$) and Spain ($p<.001$). There was no significant difference in willingness to consume between the UK and Spain ($p=.071$).

Respondents from the Netherlands ($p=.009$) and Spain ($p=.007$) were significantly more likely to support recycled water for drinking purposes compared to the UK.

Respondents from the Netherlands were significantly more willing to pay more for recycled water for drinking purposes compared to the UK ($p<.001$) and Spain ($p=.001$). There was no difference between responses from Spain and the UK for willingness to pay more for recycled water for drinking purposes ($p=.699$).

Independent items

In regard to knowledge, respondents from the Netherlands ($p<.001$) and Spain ($p<.001$) had significantly higher knowledge compared to the UK. Respondents from the Netherlands also significantly reported higher knowledge than respondents from Spain ($p<.001$).

Respondents from Spain were significantly more satisfied with their water and wastewater services compared to respondents from the UK ($p=.004$) and the Netherlands ($p=.002$), but there was no significant difference between satisfaction for the Netherlands and UK ($p=.908$).

Respondents from the Netherlands had significantly higher trust in their water company compared to the UK ($p<.001$) and Spain ($p<.001$), and there was no significant difference between the UK and Spain for trust ($p=.838$).

Respondents from the Netherlands also reported higher confidence than both the UK ($p<.001$) and Spain ($p<.001$), with the UK also reporting significantly higher confidence than respondents from Spain ($p<.001$).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Table 6 - Between-country comparisons (one-way ANOVA) of mean scores for dependent and independent items

	Recycled water for drinking purposes					Recovered nutrients to grow food				
	UK (*n*=1028) Mean (SD)	Netherlands (*n*=751) Mean (SD)	Spain (*n*=800) Mean (SD)	*F (df)*	*p*	UK (*n*=1028) Mean (SD)	Netherlands (*n*=754) Mean (SD)	Spain (*n*=800) Mean (SD)	*F (df)*	*p*
Knowledge	2.21 (0.91)	2.64 (0.86)	2.43 (0.90)	51.225 (2)	(*p*<.001)					
Satisfaction	3.86 (0.87)	3.88 (0.84)	3.73 (0.98)	7.024 (2)	(*p*=.001)					
Social norms	3.25 (0.99)	3.46 (0.96)	3.34 (0.99)	8.864 (2)	(*p*<.001)	3.77 (0.91)	3.69 (0.79)	4.05 (0.84)	38.419 (2)	(*p*<.001)
Positive emotion	3.16 (1.00)	3.59 (0.94)	3.45 (0.71)	55.601 (2)	(*p*<.001)	3.53 (0.89)	3.62 (0.65)	3.78 (0.80)	21.393 (2)	(*p*<.001)
Risk perception	3.68 (1.09)	3.80 (1.06)	3.72 (1.14)	2.085 (2)	(*p*=0.125)	3.83 (1.02)	3.87 (0.89)	4.03 (0.90)	11.072 (2)	(*p*<.001)
Trust	3.39 (1.19)	3.83 (1.05)	3.42 (1.21)	35.974 (2)	(*p*<.001)	3.74 (1.04)	3.81 (0.95)	3.99 (0.98)	15.042 (2)	(*p*<.001)
Confidence	3.48 (1.10)	3.84 (1.05)	3.08 (1.19)	90.174 (2)	(*p*<.001)					
Common	3.01 (1.03)	3.57 (1.13)	3.28 (1.12)	58.381 (2)	(*p*<.001)					
Newness	2.51 (1.12)	2.25 (1.04)	2.12 (1.08)	30.897 (2)	(*p*<.001)					
Environmental benefit	3.76 (0.92)	3.86 (0.93)	3.93 (1.08)	7.137 (2)	(*p*=.001)	4.11 (0.86)	3.90 (.892)	4.30 (0.85)	41.008 (2)	(*p*<.001)
Willingness to consume	3.50 (1.21)	3.78 (1.18)	3.38 (1.31)	21.975 (2)	(*p*<.001)	3.85 (1.02)	3.86 (0.95)	3.69 (0.99)	22.156 (2)	(*p*<.001)
Support	3.75 (1.07)	3.91 (1.05)	3.91 (1.09)	6.206 (2)	(*p*=.002)	4.00 (0.98)	4.03(0.89)	4.29 (0.86)	28.079 (2)	(*p*<.001)
Willingness to pay more	2.26 (1.10)	2.51 (1.19)	2.30 (1.22)	10.959 (2)	(*p*<.001)	2.35 (1.08)	2.74 (1.18)	2.70 (1.26)	31.449 (2)	(*p*<.001)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Respondents from the Netherlands were significantly more likely to consider water recycling for drinking purposes common compared to UK (p<.001) and Spain (p<.001). There was also a significant difference between respondents from the UK and Spain (p<.001), with respondents from Spain considering it more common compared to the UK.

Respondents from the UK were significantly more likely to agree that recycling water for drinking purposes is a new practice compared to the Netherlands (p<.001) and Spain (p<.001).

There were significant differences between responses for environmental benefit. Respondents from Spain were significantly more likely to consider water recycling more environmentally friendly than existing systems compared to the UK (p=.001), but not the Netherlands (p=.337). There was also no significant difference in concern between respondents from the UK and the Netherlands (p=.069).

For water resource challenges, respondents from all three countries were fairly consistent in showing high agreement that water resources were a challenge at a global level (see Table 6). However, more significant differences emerged between the countries in the responses to water resource challenges at national and local level. Respondents from the UK and the Netherlands were significantly *less* likely than Spanish respondents to agree that water resources represented at challenge at national or local level (p<.001 in all cases).

Table 7 - Between-country comparisons (one-way ANOVA) of responses to statements concerning water resource challenges at global, national, and local level

	UK (n=1028) Mean (SD)	Netherlands (n=751) Mean (SD)	Spain (n=800) Mean (SD)	*F (df)*	*p*
Local	3.21 (1.15)	2.77 (1.28)	4.11 (1.07)	271.33 (2)	<.001
National	3.73 (1.00)	3.11 (1.19)	4.25 (0.97)	225.63 (2)	<.001
Global	4.36 (0.78)	4.21 (0.84)	4.31 (0.86)	6.85 (2)	.001

Note: The mean scores in the table are based on Likert-scale responses where 1=strongly disagree and 5=strongly agree, see Table 1 for statement text

3.2.2. The use of recovered nutrients to grow food

Dependent items

There were significant differences between all countries for all dependent items for the use of recovered nutrients to grow food (willingness to consume, support, willingness to pay more) (Table 4).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Respondents from the Netherlands had significantly higher willingness to consume products grown with recovered nutrients than respondents from Spain (p=.003), but there was no significant difference between the Netherlands and the UK (p=.993).

Respondents from Spain were significantly more supportive of the use of recovered nutrients to grow food compared to the UK (p<.001) and Netherlands (p<.001). There was no difference in support for the use of recovered nutrients to grow food between the UK and Netherlands (p=.779).

There was a significant difference between countries for willingness to pay more. Respondents from the Netherlands were significantly more likely to be willing to pay more for products grown with recovered nutrients compared to respondents from the UK (p<.001). Similarly, respondents from Spain were also significantly more willing to pay more than respondents from the UK (p<.001). There was no difference in willingness to pay more between the Netherlands and Spain (p=.216).

Independent items

There were significant differences between all countries for all independent items for the use of recovered nutrients to grow food (Table 4).

Respondents from Spain had significantly higher social norm scores towards the use of recovered nutrients to grow food compared to both the UK (p<.001) and Netherlands (p<.001). There was no significant difference between social norm scores for the UK and Netherlands (p=.276).

Respondents from Spain reported significantly more positive emotional responses for the use of recovered nutrients to grow food compared to respondents from the UK (p<.001) and the Netherlands (p=.023). Respondents from the Netherlands also had significantly more positive emotional responses for the use of recovered nutrients to grow food compared to respondents from the UK (p=.012).

Risk perceptions were broadly consistent across the countries. Respondents from Spain had a significantly lower level of perceived risk compared to respondents from the UK (p=.001), but not compared to respondents from the Netherlands (p=.191). There was also no significant difference in risk perception between the UK and the Netherlands (p=.177).

Trust was also broadly consistent. Respondents from Spain reported significantly higher trust than respondents from the UK (p<.001), but there was no significant difference between respondents from Spain and the Netherlands (p=.051). There was also no significant difference between respondents from the UK and the Netherlands for trust (p=.076).

Respondents from Spain also had significantly higher perceptions of environmental benefit compared to respondents from the UK (p<.001) and the Netherlands (p<.001). Respondents

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

from the UK also had significantly higher perceptions of environmental benefit compared to respondents from the Netherlands. (p<.001).

3.3. Predicting societal acceptance

Multiple regression analysis was performed for each of the three dependent items (willingness to consumer, support, and willingness to pay more) in each of the three countries. Not all variables emerged as significant predictors, and we therefore reject H3. The full quantitative results from the linear regression analysis are found in **Appendix 1**, and the key findings are summarised here.

3.3.1. Social norms

Social norms emerged as an important predictor of dependent items, particularly in the UK. In the UK, it was the strongest predictor of willingness to consume recycled water and willingness to consume food grown with recovered nutrients. It was also the strongest predictor of support for both practices. Finally, it was the strongest predictor of willingness to pay more for food grown with recovered nutrients, and the second strongest predictor of willingness to pay more for potable recycled water.

In the Netherlands, it was the strongest predictor of willingness to consume food grown with recovered nutrients, but not the strongest predictor of willingness to consume recycled water (although it was a statistically significant predictor). It was also a significant (but not the strongest) predictor of support for both practices. It was the strongest predictor of willingness to pay more for food grown with recovered nutrients, but not a significant predictor of willingness to pay more for recycled water.

In Spain, it was the strongest predictor of willingness to consume recycled water, and willingness to consume food grown with recovered nutrients. However, although it was a statistically significant predictor of support for both practices, it was not the strongest predictor in either case. It was not a significant predictor of willingness to pay more for either product.

3.3.2. Emotion

Emotion also had a strong predictive role. In the UK, it was the second strongest predictor (behind social norms) for many of the dependent items. The exception was willingness to pay more, where emotion was not a significant predictor for recycled water nor for food grown with recovered nutrients.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

In the Netherlands, emotion was the strongest predictor of willingness to consume recycled water, and the strongest predictor of support for recycled water. It was a significant (but not the strongest) predictor of both items for recovered nutrients. It had no significant role in predicting willingness to pay more.

In Spain, emotion was the strongest predictor of support for recycled water. It was a significant (but not the strongest) predictor of support for nutrient recovery, as well as willingness to consume both items. It had no role in predicting willingness to pay more.

3.3.3. Environmental benefit

In the UK, perceived environmental benefit was a significant (but not the strongest) predictor of support for nutrient recovery, and willingness to consume food grown with recovered nutrients. However, it had no significant role in willingness to pay more for food grown with recovered nutrients, or in any dependent variables related to recycled water.

In the Netherlands, perceived environmental benefit was the strongest predictor of support for nutrient recovery, and the second strongest predictor of willingness to consume food grown with recovered nutrients. However, as with the UK, it had no significant role in predicting willingness to pay more or any dependent variable related to recycled water.

In Spain, perceived environmental benefit was the strongest predictor of support for nutrient recovery, and (unlike the other two countries) it was the second strongest predictor of support for recycled water. But it had no significant role in predicting willingness to consume either product, and no significant role in predicting willingness to pay more.

3.3.4. Other independent variables

Age and gender

Gender appears to have little role in predicting any of the dependent variables in any of the countries. Age had more of an effect on one variables – in all three countries it is a statistically significant predictor of willingness to pay more for nutrients grown with recovered nutrients, where younger respondents appear more willing to pay more than older respondents. However, the same relationship did not exist in willingness to pay more for recycled water, or any other dependent variable.

Knowledge (recycled water only)

The knowledge variable had a strong role in predicting willingness to pay more for recycled water. In the Netherlands and Spain, it was the strongest predictor of that dependent variable, while in the UK it was a significant predictor (but not the strongest). But it did not have a strong relationship with any other dependent variables.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Satisfaction (recycled water only)

Satisfaction had no significant role in predicting any of the dependent variables in any country.

Risk perception

In the Netherlands, risk perception was found to be a statistically significant (but not strong) predictor of support for potable recycled water and the use of recovered nutrients to grow food (where those who perceive less risk are more likely to be supportive).

In Spain, risk perception was also a statistically significant (and relatively strong) predictor of willingness to consume recycled water, and willingness to consume food grown with recovered nutrients (where those who perceive less risk are more likely to say they'll consume it).

Other than those two instances, risk perception was not identified as being a significant predictor of dependent variables.

Trust

In the UK, trust was a statistically significant (but not the strongest) predictor of willingness to consume recycled water and food grown with recovered nutrients. However, trust did not have a significant role (or had only a weakly significant role) in predicting the other dependent variables.

In the Netherlands, it has a weakly significant relationship with willingness to consume food grown with recovered nutrients (but not recycled water), but no significant relationship with any other dependent variable.

In Spain, trust had a significant (but not the strongest) role in predicting willingness to consume recycled water, but it was only a weakly significant predictor of willingness to consumer food grown with recovered nutrients. It was also a significant predictor of support for nutrient recovery (but not recycled water), and a weakly significant predictor of willingness to pay more for recycled water and food grown with recovered nutrients.

Confidence (recycled water only)

In the UK, confidence in the water service provider was the second strongest predictor of willingness to pay more for recycled water, but it had only a weakly significant relationship in predicting willingness to consume recycled water, and support for recycled water.

In the Netherlands and Spain, confidence was similarly the second strongest predictor of willingness to pay more for recycled water, but it had no significant relationship with the other dependent variables.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Newness and commonness (recycled water only)

In the UK, the perceived newness of recycled water was a statistically significant predictor of willingness to pay more for recycled water, where those who did not see it as new were more likely to be willing to pay more for it. It was also a weakly significant predictor of support for recycled water, but had no significant relationship with willingness to consume recycled water.

In the Netherlands, the perceived commonness of recycled water was a significant and relatively strong predictor of willingness to consume recycled water, and support for recycled water, where those who see it as a common practice are more likely to consume it and support it. However, it had no significant relationship with willingness to pay more.

In Spain, neither of the two items were significant (or were only weakly significant) predictors of any of the dependent variables.

Challenge for water resources

For all three countries, agreement with water resources being a global challenge was a significant (but not a strong) predictor of willingness to consume recycled drinking water, and support for recycled drinking water. However, it did not significantly predict willingness to pay more for recycled water in any of the three countries.

Agreement with water resources being a challenge on a national level had no significant relationship with any of the dependent variables in any of the countries. Similarly, agreement with water resources being a challenge on a local level had no significant relationship with any of the dependent variables in any country (with the exception of the UK where it had a slight relationship in predicting willingness to pay more for recycled water).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

4. Interview results

Findings suggest that the meaning of legitimacy towards the circular economy in the water sector is complex and dynamic. As a reminder, legitimacy refers to the perceptions that a circular solution brings benefits to its end users, is aligned with a given community's values and that end users feel included in the decision-making processes (*pragmatic legitimacy*). Another dimension can cover perceptions that a circular solution is understandable to a wide range of actors, is as necessary as other well-established circular solutions (e.g., domestic waste recycling), is connected to end users' daily lives and makes users feel comfortable using water, energy and materials derived from wastewater (*cognitive legitimacy*). Further, legitimacy can include judgments that a circular solution contributes to societal welfare, is managed appropriately, is safe to use for a given community and is led by trustworthy representatives (*normative legitimacy*). Finally, legitimacy might also derive its meaning in terms of congruence of a circular solution with laws and regulations (*regulative legitimacy*).

4.1. Pragmatic legitimacy

Results showed that the two demo cases stimulated pragmatic legitimacy in a different manner as they displayed different information and communication strategies. La Trappe stimulated a strong *dispositional* dimension by putting the emphasis on visitors and customers while Gotland stimulated the *influence* and *exchange* dimensions with a strong public engagement. In the results, pragmatic legitimacy was stimulated by the perceived benefits and impacts of the demo case, the information and communication strategies, public involvement and influence as well as the brewery brand (La Trappe case).

Gotland

Perceived benefits of the Gotland demo case were strongly represented in the data. It was perceived to provide a more reliable and cheaper water supply, although concerns were raised if prices were to increase for the local community. One respondent mentioned that the circular solution may not make financial sense. It was also perceived to bring local awareness of the different solutions implemented to solve the water problem. Although the strategy is to demonstrate what the locals will gain from the demo case, inhabitants do not all realise the impact the demo case will have on them. Although the demo site will not supply water to rural areas, it was still perceived positively.

Perceived benefits were also turned towards the demo case's stakeholders. The demo case was perceived to help developing companies that are on board by promoting and spreading their technologies and getting additional knowledge about their technologies. Gotland's strategy was to inform the local community before publishing information about the demo case in the media. It was believed to be key to the demo case success. Gotland inhabitants

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

were not directly involved in the decision-making process but were invited to information meetings. The outcomes of such meetings left inhabitants informed and clear about the demo case. Gotland's community is highly engaged which allows them to learn and feel the importance of the demo case. Additionally, a book was written to educate Gotland's community on the different projects implemented on the island. Although the strategy of Gotland was to inform its population, non-permanent residents found it hard to get access to information about the demo case. Finally, the Gotland demo case demonstrated a good local and international media coverage (TV, radio, newspaper).

A new concept seemed to refine the legitimacy framework. The *influence* legitimacy is well represented as farmers, landowners and members of the community provided their local knowledge, experiences, and ideas to solve water problems and advices on how to introduce the demo site to the community. That information was considered to be a key factor to the demo case success and influenced practices about the demo case. However, the legitimacy framework could be refined in the sense that local inhabitants (farmers and tourism businesses' owners) asked for a water-related project and approached relevant institutions, making the initiation of the project not exclusively reserved to project stakeholders.
Another element seemed to develop the legitimacy framework (Gotland and La Trappe). *Exchange* legitimacy usually refers to end users' perceived benefits. However, those interviews showed that benefits were more broadly turned towards stakeholders.

La Trappe

The perceived benefits of the La Trappe demo case were improvement in the brewery treatment system, the start of a transition towards circularity, and increased awareness of the demo site among visitors. It was also seen to demonstrate the economic gain of such solutions. Although the demo case was not directly used for marketing purposes, it was believed that it will have an impact on the brewery's brand story telling. Alternatively, if the demo case challenges public perceptions (e.g., bad smell), it could be seen as a threat to the reputation of the brand. Similar to the Gotland demo site, benefits were turned towards the demo case's stakeholders. The La Trappe demo case was also seen to help developing companies that are on board by promoting and spreading their technologies and getting additional knowledge about their technologies.

The La Trappe visitor centre provided visitors with information about the demo case. It was believed that it will act as an eye opener for the public. Meetings, such as "Environmental cafés" were sometimes used to provide information about the demo case to the local community. Finally, the La Trappe demo site demonstrated a good local and international media coverage (TV, radio, newspaper).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

4.2. Cognitive legitimacy

Both the Gotland and La Trappe demo cases showed a strong level of cognitive legitimacy. While cognitive aspects of the Gotland demo case emerged due to its connection with the local community, those aspects emerged due to the La Trappe case connection with its visitors (at the visitor centre). Results showed that one or both demo cases stimulated cognitive legitimacy because they were connected to end-users' daily life experiences, evolved alongside a high number of similar solutions, were known and understood, did not fit in the current market, were likely to be or were already replicated elsewhere, were associated to already legitimate solutions or sectors, were compared to other solutions and were embedded in a favourable culture.

Gotland

The Gotland demo case is highly connected to locals' daily lives. Locals experienced water shortages (e.g., dry wells) for a long time which increased their understanding and awareness of the water cycle as compared to politicians or tourists who do not live on the island. Moreover, the Gotland demo case was perceived to secure water for local inhabitants, local industries and businesses, tourism, farming and the broader economic development of the island (e.g., building more houses). Finally, it was mentioned that some local inhabitants are not connected to the sewage network and are aware that their wastewater goes back to their wells which was seen as a reason why they did not react in a negative way to the Gotland demo case. This element stimulated cognitive legitimacy as circularity is something some locals are experiencing in their daily lives and are comfortable with.

Another element that came out strongly related to the abundance of environmental projects or initiatives around the Gotland demo site. Environmental projects were implemented by a local association and the municipality and initiatives were implemented by locals (e.g., rainwater harvesting at home). They either directly or indirectly aim at improving water quality and quantity on the island. Therefore, the Gotland demo case was not seen in isolation as it evolved amongst similar projects and initiatives that aim to solve a common problem. Evolving in such an environment, both fostered and challenged the perceived legitimacy of the Gotland demo case. On the one hand, the abundance of water-related projects resulted contributed directly to the implementation of the Gotland demo case and to the local inhabitants' positive reactions towards it. This association with other eco-friendly activities also enhanced the overall attractiveness of the scheme. On the other hand, this abundance also made it challenging for locals to fully understand and disentangle the Gotland demo case from other projects and initiatives.

Despite this, locals seemed to have a good awareness of the Gotland demo case. Yet, it is still not part of the common knowledge shared by the Gotland population. It was mentioned that an inclusive and comprehensible vocabulary could help in this matter. The understanding of

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

the demo case's effects on the water situation seemed to be high amongst the local community. However, some misunderstandings were spotted at the start of the demo case planning and still remain, especially for people who are less involved in it.

Both Swedish and Gotland cultures seemed supportive of the demo case. The Swedish culture was described as being open to the circular economy and to innovation in general, while the local culture at the demo case came across as a "save water" and "do it yourself" culture. Results showed that there is a strong desire to replicate and export the demo site to other countries if it is demonstrated to be workable. Numerous companies were already engaged with the demo case and had visited the site. Moreover, tourists and visitors were seen as conveyers of the demo case information to their home countries.

Comparisons of the demo case with other water supply systems seemed to support legitimacy perceptions towards the demo case. The demo case was favourably compared to desalination, also implemented on Gotland. In this context, it was claimed to be easier and cheaper to clean wastewater than it is to clean seawater. Moreover, the Gotland demo case aims to demonstrate that desalination can be avoided. Another comparison contrasted old and new systems. Old systems were designed to get water out of the land as quickly as possible whereas Gotland stakeholders expressed the need to keep the water (e.g., water reuse, rainwater harvesting).

La Trappe

Results emphasised that the La Trappe demo case is connected to its environment and associated challenges in many ways. The experience of droughts for the Netherlands increases and the area around the Brewery is dry. Moreover, the visitor centre was seen to help connect the La Trappe demo case with its visitors and customers. It was believed that visitors' exposure to the demo case will act as an eye opener as it will allow visitors to have a holistic view of wastewater treatment which may increase their awareness of wastewater. While the Gotland demo site was part a broader range of environmental projects, the La Trappe demo site was seen to evolve in a context where concurrent companies (beverage sector) practice water reuse and circularity.

The awareness of the La Trappe demo case in the local area was reported to be low. However, it was claimed that the demo case will increase knowledge of the public and the surrounding farmers (e.g., water quality). The economic and marketing aspects of the La Trappe demo case came out strongly in the data. Although it was considered to be essential that the La Trappe demo case fits the current market, there seemed to be challenges to achieve this goal. Knowing the economic impact and cost of the demo case were seen as addressing this challenge.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Like Sweden, the Netherlands was depicted as having a culture that is open to innovation, suitable for the implementation of circular solutions, and appeared to be one of the most developed countries in terms of circularity. The La Trappe demo case is also associated to an already legitimate sector: space. It appeared to improve the attractiveness towards the demo case. Moreover, the demo case is embedded in a highly visited place (visitors coming for the beer, meditating, staying overnight) which was seen to increase the likelihood for the demo case to be discovered, supporting the further development of legitimacy. Results showed a high ambition to add more circular features to the demo site in the future (e.g., growing from sludge). It appeared that there is a desire to replicate the demo case to other monasteries and companies of any sector producing wastewater. The demo case received a lot of attention as companies willing to implement a similar demo case had contacted La Trappe stakeholders. Moreover, visitors were seen to help spread the idea.

Comparison of the La Trappe demo site with other technologies both challenged and supported the legitimacy of the demo case. The La Trappe demo case was challenged when compared with existing technologies (e.g. efficiency rates being seen as higher for current technologies, or fertilisers coming from chemical industry being seen as more consistent in their formulation). Conversely, the La Trappe demo case was also compared with old systems that were designed to get water out of the land as quickly as possible, and the demo case was seen to keep the water (e.g., water reuse) which was seen as more sensible.

4.3. Normative legitimacy

The Gotland and La Trappe cases similarly stimulated normative legitimacy with a stronger emphasis for the Gotland case. Normative legitimacy was stimulated by strong networks of stakeholders around the cases, trust in the demo cases and the implementing organisations, perceived benefits of the demo cases for the society, locals' reactions towards the demo cases and societal expectations of the local community.

Gotland

The network around the Gotland demo case was already strong and heterogeneous before the start of the project. This local anchoring and existing legitimacy was one of the reasons for the demo case to be implemented and was seen as a key factor for the demo case success. The network around the Gotland demo case is composed of local inhabitants, farmers and land-owners who strongly volunteer in the development of the demo case, political actors, technology providers, municipalities, local associations, communication managers and researchers. Strong believers in the circular economy were part of the network and initiated the demo case. Such stakeholders are trusted, legitimate and influential enough to help deal with local problems and connect stakeholders together. Trust in the demo case was stimulated by the provision of information, facts and guarantees about the demo case.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Perceived outcomes for wider society (beyond the local Gotland community) were various. One considered that negative outcomes of Gotland demo case were tolerable as the demo case would allow a better wastewater management, whereas other views considered that negative outcomes are not acceptable and should be avoided. Moreover, there is a good awareness and understanding of the demo case's societal benefits (more water for housing expansion in Gotland and for the economic development of Gotland) amongst the local community, though some elements challenged that understanding (e.g. locals not being able to see the rise or fall of groundwater levels). Reactions towards the Gotland demo case were positive as farmers, land owners, local inhabitants and political actors supported the case. Additionally, interviewees mentioned that Gotland inhabitants were asked about the future water management on the island. The majority responded positively to direct water reuse, results that projects stakeholders did not anticipate. Despite water quality concerns regarding the demo case (e.g. pharmaceutical compounds), the implementing organisation (municipality) seemed to be trusted. Interviewees indicated that the further recycled water is from people, the better it will be received. Interviewees also indicated that few public reactions challenged Gotland demo case such as the public asking for more desalination plants.

Overall, the Gotland demo case was seen as a good example to showcase circular solutions and help replicate such solutions elsewhere. Additionally, societal expectations strongly influenced the Gotland demo case as locals asked for a solution to help solving water problem on the island, which strongly contributed to this dimension of legitimacy.

La Trappe

The network around the La Trappe demo case was less heterogeneous than Gotland's but included highly skilled partners who are perceived as legitimate and provide established and proven technologies (e.g. the space sector) although technical challenges were experienced. As with the Gotland demo site, strong believers in the circular economy were part of the network and initiated the demo case. Moreover, highly influential actors (the King) visited the brewery and acknowledged the importance of such demo cases in coping with climate and water challenges.

Some challenges remain to fully see the societal gains from the La Trappe demo case. Gains were often associated with returns on investment, which would correspond to pragmatic benefits for the brewery. However, one stakeholder encouraged consideration of the overall impact of the demo case as a more holistic approach (e.g., impact on water quality, pollution and health). Water quality concerns (e.g., bacteria, smell, and taste) were raised. However, this problem has to be put in perspective as recycled water will not be used to produce beers. Interviewees mentioned that the further recycled water is from people, the better it will be received. Although water quality concerns were raised, La Trappe interviewees mentioned that the public would be confident in the controls put in place to avoid any issues.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

In respect of reactions towards the La Trappe demo case, interviewees indicated that previous reactions from the community ("environmental café") were positive. Yet, interviewees also felt that more reactions will be gained from visitors at the visitor centre. More formal recognition was gained as the demo case won the Dutch Water Innovation Award. Moreover, there were indications that the case is supported by the political and scientific community. As with the Gotland demo case, the La Trappe demo case was seen as a good example of circular solution and a workable reference for stakeholders who would like to implement a circular solution in the water sector.

4.4. Regulative legitimacy

Regulative aspects seemed to both inhibit and help the legitimisation processes of the two demo cases. Regulative legitimacy was stimulated by a lack of circular laws and regulations (locally and globally), the influence of a potential political election on the demo case development, the emergence of appropriate laws and regulations as well as the influence of the case in informing policy makers.

Gotland

It was reported that there is a challenge to work within the regulation as laws were designed when such solutions did not exist. Although the current political representatives agreed for the Gotland demo case to be implemented, a new political election could challenge its progress. This potential challenge appeared as one of the reasons why several projects were implemented, to counter a possible threat on one of the projects (rainwater harvesting, water reuse and desalination).

The regulative aspect was seen to foster the establishment of such circular demo cases. Gotland regularly experienced restrictions (e.g., restriction to water the lawn) which indirectly gave Gotland the opportunity to go circular. Moreover, it appeared that new Swedish laws relevant to the demo case were, amongst other reasons, responsible for the implementation of the Gotland demo case. Contrariwise, the demo case was seen to have an impact on the laws and regulations as it will inform policy makers to elaborate regulations to foster circularity.

La Trappe

A couple of regulative challenges were identified for the La Trappe demo case. Data reported that La Trappe demo case does not fit current laws and regulations to a point where the project could have stopped. Non-congruence with laws and regulations seemed to send the wrong message to the public and implied that the demo case was not safe. Moreover, the procurement of a permit to handle "dirty" materials delayed the demo case implementation. An additional challenge will appear if/when introducing recovered products to the market as

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

there is a need for a permit to buy such products. Finally, challenges may appear when selling recovered products to another country as the regulations may be different.

The regulative aspect also fostered the establishment of La Trappe demo case. It was perceived that the requirement to meet established standards may have prompted La Trappe case to adopt circular solutions. La Trappe brewery had to modify its treatment system for it to comply with norms which indirectly gave the opportunity to the brewery to go circular. Moreover, the Netherlands were described to have a stimulating environment in terms of new regulations (e.g., regulations to help sustainable entrepreneurs, plan made by the Dutch government to integrate the Circular Economy by 2050, Delta Programme, changes in policies regarding materials recovery from wastewater). The Water Board being one of the main stakeholders, this will help La Trappe demo case to comply with laws and regulations as they can directly change regulations according to the demo case information.

Results challenged the regulative dimension of the legitimacy framework. The framework indicates that circular solutions that do not comply with current laws and regulations are seen as less legitimate. Although laws are not adapted to circular solutions, parallel set of regulations that are not directly related to circular norms (e.g., ban on watering lawns) fostered the implementation of circular solutions and could indirectly improve their legitimacy.

4.5. Circular economy

Interviewees were asked about their views towards the global concept of circular economy. A common view emerged from the data as the global concept of circular economy was considered as legitimate. The circular economy was seen as the way to go forward, essential, promising for the future, inevitable and necessary, which highly stimulated the cognitive legitimacy and to a lesser extend the normative legitimacy, although the CE could be seen as unfamiliar by one respondent. It also appeared that the circular economy will allow to demonstrate the economic perspective and benefits (pragmatic legitimacy) to companies that are usually legally obliged to incorporate circularity in their management (regulative legitimacy). In that sense, the circular economy was seen as realistic and concrete (cognitive legitimacy) as opposed to a research plan that never gets implemented.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

5. Discussion and conclusions

5.1. Acceptance of circular solutions in Europe

This research took an exploratory approach to evaluating public acceptance towards two circular solutions (recycled water for drinking purposes and the use of nutrients recovered from wastewater for food production). This research was based in part on the understanding that the uptake of currently technologies to achieve a circular economy may be hindered by perceptions over the societal acceptability and marketability of recovered resources (Desmidt et al., 2015; Kehrein et al., 2020). Here we focus on understanding the acceptability of water reuse for drinking purposes and nutrient recovery from wastewater for agricultural use. Both of these technologies are seen as potential solutions to address growing pressures on global resources (Van der Bruggen, 2010), but while water reuse has been the subject of considerable perceptions research, there is limited research in perceptions around the use of recovered nutrients for food production. This research is therefore novel; by combining insights from public perceptions towards both activities, we can start to develop a more complete picture of societal acceptability of circular solutions.

The findings have shown that acceptance of potable recycled water and the use of recovered nutrients to grow food appears generally high in the three countries studied. This adds to the weight of evidence that these kinds of solutions are becoming more legitimised and widely accepted than they were in the past (Binz et al., 2016; Sokolow et al. 2019), countering the assumption that public resistance will necessarily present a barrier. For the emerging sector around the recovery of nutrients, where public receptivity towards recovered products has been less well explored, this should be a particularly encouraging finding.

Even more encouraging is the finding that in all three countries, acceptance was significantly higher for food grown with recovered nutrients, compared to recycled water (Figure 5). These results are interesting in light of the trends found in literature on recycled water, which show that applications involving lower levels of contact tend to be associated with higher levels of acceptance. Here we specifically tested responses to two ‘high-contact’ circular products – the ingestion of recycled water and food grown with recovered nutrients – and we would therefore have expected to see similar levels of acceptance, due to the similar nature of the contact. But this has not been the case. In the minds of respondents, recovered nutrients (and the food grown with them) are perhaps more dissociated from wastewater than recycled water, and are therefore (somewhat) more acceptable.

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N°776541

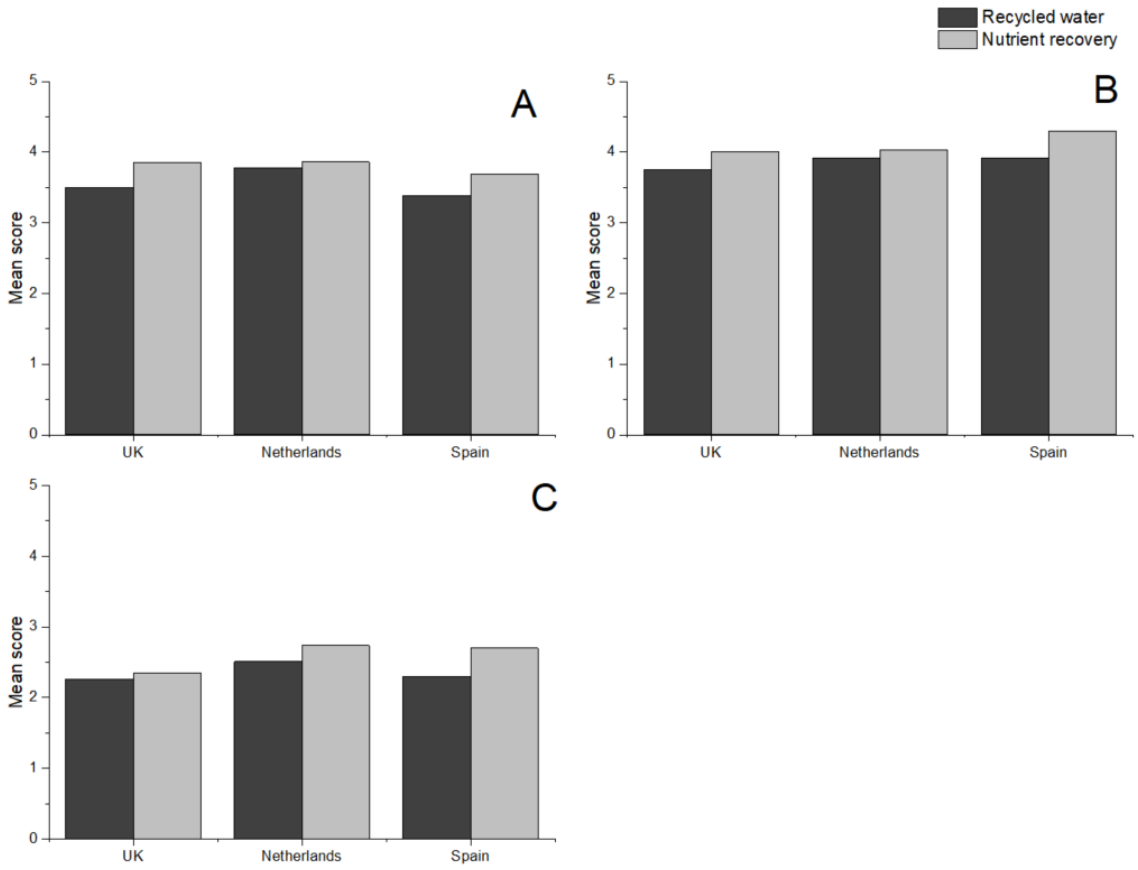

Figure 5 – Within-country differences between responses towards water recycling and responses towards nutrient recovery, for 3 dependent variables: A – Willingness to consume, B – Support, C – Willingness to pay more (see Table 1 for the full statements). Mean scores represent the average of Likert-scale responses where 1=strongly disagree and 5=strongly agree.

This is also one of the first studies to conduct a multi-country analysis of responses to circular solutions to determine if there are any consistent patterns between different regions of Europe. Previous research in this field has often been limited to a single country. Expanding this into a multi-country-comparison, with three countries that represent different climatic regions, different models of water sector governance, and different levels of experience with circular solutions, is important in expanding geographic breadth of knowledge in this field and developing a more global picture.

Whilst we cannot argue that these results are fully representative of Europe as a whole, it is noteworthy that some of the findings have shown remarkable consistency between the countries (such as in Figure 5). These areas of consistency provide some useful insights in light of the European-level ambitions to support the uptake and expansion of the circular economy. For instance, the results show that in all three countries, there was a segment of respondents willing to pay more for recycled drinking water and (more so) for food grown with recovered nutrients. Whilst it is well understood that the intended behaviours reported in surveys do not necessarily translate into real-world market decisions, this is nonetheless a potentially important finding for those concerned with developing the business models for

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

circular systems. The marketability of products recovered from wastewater is not well understood, and this can impede the perceived financial viability of circular systems in the sector, making them less attractive for investment (Kehrein et al. 2020). If there is a segment of the market willing to pay a premium for recovered products, this could improve their viability.

5.2. Predictors of public acceptance

5.2.1. Social norms

Social norms are predominant behavioural patterns within a group that are supported by a shared understanding of acceptable actions, sustained through social interactions (Nyborg et al. 2016). Social norms rest on the assumption that people want to fit in with what most people do and what 'should be done' (Cialdini et al. 1990; Abrahamse and Steg 2013).

Our findings align with past research which states that social norms play an important role in increasing public acceptance of new technologies and practices. In our research, social norms were significant in all three countries as predictors of the dependent variables. This suggests that an individual's acceptance of circular solutions, and their products (water and nutrients), is driven strongly by what they believe others are willing to accept. This was particularly evident in the UK, where social norms were the strongest predictor of most dependent items. This suggests that the normalisation/legitimisation process for circular solutions could potentially be harder to achieve in the UK because the use of potable recycled water or recovered nutrients may need to achieve a certain 'critical mass' before acceptance starts to become more widespread.

A gradual process is often required for the use of a new technology or approach to become adopted as part of a social norm. For circular solutions, government and industry should be prepared to foster the creation of new social norms by utilising incentives and nudging to increase support and willingness to consume and pay more for 'products' from circular solutions. More investment into marketing, and the inclusion of citizens in the decision-making processes surrounding circular solutions, could potentially increase familiarity and decrease perceptions that using circular solutions is a radical practice. Previous research has shown that marketing messages using social norms can be used to influence responses and behaviours (Melnyk et al., 2013). Citizen involvement in circular schemes (e.g. through demonstration projects) could generate opportunities for activating social norms about water and waste issues, where greater involvement is associated with greater exposure to a range of social norms – including norms that are in favour of more sustainable management (Dean et al., 2016).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

5.2.2. Emotion

This study has demonstrated that positive emotional responses are also important predictors of support for, willingness to consume, and willingness to pay more for the 'products' of circular solutions such as recycled drinking water and food grown using recovered nutrients. It is extremely important to understand emotions in relation to product and technology development, especially for products recovered from wastewater, where new products can evoke safety and risk concerns (Lease et al., 2014). Research has found that emotional responses (e.g. feelings of dread or anxiety) have been a major determinant of public rejection to GM foods (Townsend and Campbell, 2004).

The importance of emotional responses has been demonstrated in relation to recycled water, and here we have shown that they also play an important role in responses to recovered nutrients. This lends further weight to the understanding that public outreach and engagement activities that focus only on rational aspects (such as sharing technical information about schemes that enable interested citizens to learn about potential risks and benefits) are unlikely to be successful. Instead, engagement activities should also specifically seek to elicit positive emotional responses. For instance, generating a sense of pride and satisfaction through outreach activities can be a key contributor to increasing public acceptance (Mankad., 2012). Additionally, Binz et al. (2016) and Harris-Lovett et al. (2015) argued that legitimation processes for water recycling can be enhanced through more experiential outreach activities, and through building positive narratives, which can help address emotional reactions. The result here illustrate that such activities could also be beneficial for other circular products like recovered nutrients.

5.2.3. Environmental benefit

Recovered nutrients were more likely to be perceived as environmentally friendly (compared to recycled water) in all three countries. Likewise, the perception of 'environmental friendliness' seemed to have a stronger role in predicting responses to recovered nutrients (and particularly support for the use of recovered nutrients to grow food), rather than recycled water. However, this variable was not a strong predictor of willingness to pay more for food grown with recovered nutrients. This is significant, because the literature suggests that people are often willing to pay more for environmentally friendly products (Laroche et al., 2011) and organic food products (Shin et al., 2017; Van Doorn and Verhoef, 2011). Although our results clearly show that there is a segment of the market that is willing to pay a premium for food grown with recovered nutrients, this willingness is not necessarily related to perceived environmental friendliness (other variables, namely social norms and knowledge, played a stronger role).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

5.2.4. Trust and confidence

Trust has frequently been identified as a factor in determining public acceptance of water reuse (Hartley, 2006; Ormerod and Scott, 2012; Smith et al., 2018). Higher levels of trust in water authorities are associated with lower perceptions of risk, which in turn are associated with higher levels of acceptance (Ross et al., 2014). Fielding and Roiko (2014) also argue that trust and acceptance is mediated through risk perceptions, where more trust is related to lower risk perceptions leading to greater acceptance and higher likelihood of willingness to consume or use recycled water. Although trust was not widely explored in this study (only a single item in the survey), it did not emerge as having a strong role in predicting responses. It was often a statistically significant predictor of dependent variables, but not consistently so. However, as with several other variables, in all three countries respondents were more trusting towards recovered nutrients than towards recycled water.

As a related variable, we also explored confidence that water utilities could deliver recycled water safely. Again, results here were inconsistent. Although there were significant differences in confidence between the three countries (Figure 6), it often did not significantly predict support for, or willingness to use, recycled water. However, confidence was a significant predictor of willingness to pay more for recycled water in all three countries (though it was never the strongest predictor). Although this variable was only explored in relation to recycled water, there is further potential to understand what experiences influence and predict a consumers' confidence in relation to other products from circular solutions, and in the stakeholders involved in their production and delivery.

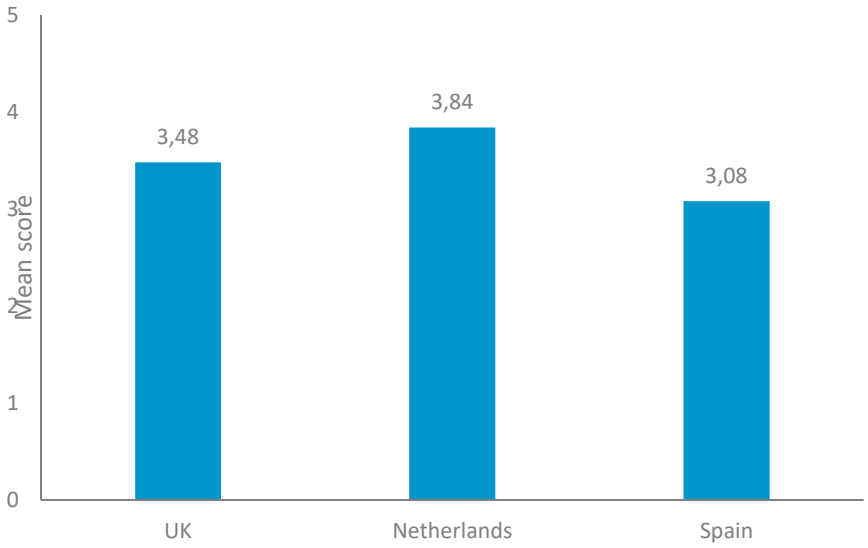

Figure 6 Mean responses to the statement: How confident are you that your water company could deliver recycled drinking water safely?

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

5.2.5. Local place attachment and perceived challenge for water resources

Previous research has argued that local place attachment is a predictor of support and engagement with local environmental challenges and solutions (Scannell and Gifford, 2013). In the literature, increasing citizen engagement in the field of climate change issues often relies on presenting people with local knowledge and examples of impacts (Scannell and Gifford, 2013). Messages often illustrate the local and regional impacts of climate change because these may be more captivating than global impacts, to which people are less able to relate. Research has found that often global concern can be low, but local concern and action is high – for example, despite low concern about global climate change, citizens in the US had taken action against local environmental problems, such as a pollution cleanup effort at Lake Erie (Kates and Wilbanks, 2003). Because individuals tend to think about climate change in terms of global or future images (Leiserowitz, 2005), messages that focus on geographically local and current images might reduce perceived distance to the problem, and thereby increase engagement.

Likewise, in the water reuse sphere, it is commonly assumed that citizens are more likely to accept recycled water if they have direct, local experience of water scarcity. We explored this assumption in our research by examining perceived challenges for water resources at different scales, and what role those perceptions had in predicting responses to circular products. Respondents were asked to state the extent to which they believed that there is a challenge for water resources on a local, national and global level. Figure 7 below illustrates that in all three countries, respondents were more likely to agree that water resources were a challenge at a global level, rather than at a national or local level. This difference was particularly apparent in the UK and the Netherlands. Respondents from Spain were significantly more likely to agree that there is a challenge for water resources at a national and local level, which is perhaps unsurprising given that Spain has one of the lowest rainfall levels in Europe and suffers from water scarcity and is often hit by droughts (Navarro, 2018; Šteflová et al., 2018).

In all three countries, agreement that water resources are a challenge at a global level was a significant predictor of support for, and willingness to consume, recycled water. Conversely, agreement that there is a challenge at a national or local level was not a significant predictor. This effectively rejects the assumption that local understanding of water scarcity and water resource challenges is likely to increase the acceptance of recycled water. As a result, this indicates that messages framing water resource challenges as a global problem might be more effective at encouraging acceptance of water recycling, compared to messages that emphasise local water resource challenges.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

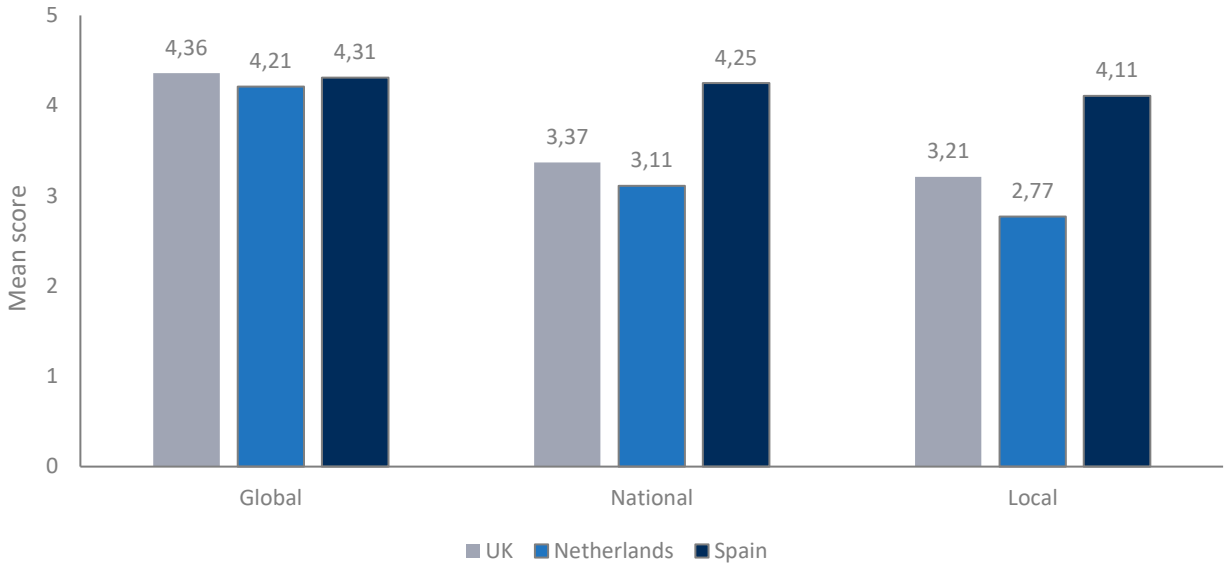

Figure 7 Mean perceived challenge for water on a global, national and local scale. All three countries scored significantly higher for perceived challenge of water at a global scale.

5.2.6. Overall conclusions from survey study

Public acceptance is still considered a major potential obstacle for the uptake of circular economy solutions. In this study, we focused on understanding the acceptance of water recycling for drinking purposes and the use of recovered nutrients for food production, in three European countries.

Acceptance levels were relatively high for both products in all three countries. Acceptance of the use of recovered nutrients to grow food was significantly higher compared to water recycling in all three countries; these provide novel baseline findings, as recovered nutrients are less well explored than recycled water from the perspective of public acceptance.

For two of the dependent variables (support and willingness to consume), social norms and emotions emerged as two of the strongest predictors, for both circular products and in all three countries. This means that respondents in all three countries are more likely to support the circular solutions, and consume the products from them, if the feel positively towards them, and if they believe that others would do the same.

For the third dependent variable (willingness to pay more) the picture was more mixed. Social norms had the strongest role in predicting willingness to pay more for food grown with recovered nutrients, while knowledge had a stronger role in predicting willingness to pay more for recycled water. Confidence in the ability of utilities to deliver recycled water safely also had a consistently significant role in predicting willingness to pay more for recycled water. Emotion generally did not have a significant role in predicting willingness to pay more.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Additionally, although the results clearly show that a segment of respondents were willing to pay more for recycled water and food grown with recovered nutrients, it is worth noting that perceived environmental benefit was not a significant predictor of willingness to pay more for either product. This is a noteworthy finding because the literature often suggests that food consumers in particular are sometimes willing to pay a premium for environmentally friendly products (such as organic products).

Despite the literature arguing that trust is an important factor in shaping responses toward water recycling, trust was not a consistent predictor of any dependent variables in this study. Finally, despite the literature connecting local place attachment to support for, and engagement with, pro-environmental actions, our results found that perceptions of water resource challenges at a global level (rather than a local level) was a significant predictor of support for, and willingness to consume, recycled water. This challenges the assumption that local experience and understanding of water scarcity necessarily improves acceptance of recycled water.

5.3. Legitimacy of circular solutions

The Gotland and La Trappe demo cases seem to have a high degree of legitimacy. It seemed that the legitimacy was greater for the Gotland case due to community support although few or no opposition were reported at La Trappe demo case. The two demo cases engaged in different strategies to address distinct needs. In Gotland, the need for water was experienced as an emergency. Gotland's strategy was turned towards the local community as they were the first to be informed about the demo case. Locals were not only highly informed and engaged, but they also actively contributed and influenced the development of the demo case which signed a strong pragmatic dimension. The pragmatic dimension of legitimacy was slightly weakened as demo case benefits and impacts were not always seen and access to information was sometimes lacking for non-permanent residents. However, such a network (including locals and demo case actors) engaged the demo case in a robust normative dimension of legitimacy. The abundance of water-related projects simultaneously weakened the cognitive dimension of legitimacy as it brought confusion about what the demo case includes, and strengthened the cognitive dimension as the demo case was blended in an established complex of water-related projects. Regulative aspects of legitimacy were weakened by the absence of circular laws but was strengthened by the presence of other rules (e.g., prohibition to water the lawn).

Developing a circular demo case at La Trappe was less of a vital need that it was an evidence for the brewery manager and incentivised by a legal requirement. La Trappe strategy was very much turned towards informing visitors and customers of the brewery. Therefore, the pragmatic dimension of legitimacy seems to be oriented towards La Trappe branding. Yet the

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

pragmatic dimension of legitimacy was weakened by a lack of public and customers' representation and involvement in the decision-making processes. The normative dimension of legitimacy was strengthened by the inclusion of believers of the circular economy as well as the skilled and legitimate space sector in La Trappe network although it lacked the incorporation of locals and the public. The cognitive aspect of legitimacy was weakened by the difficulty to incorporate circular solutions to the current market. Similarly to Gotland, regulative legitimacy was challenged by a lack of circular laws and reinforced by alternative rules (e.g., obligation to meet wastewater standards).

Overall this work has shown that the concept of legitimacy, and the proposed framework of four dimensions, has considerable potential to provide a holistic understanding of societal reactions and expectations towards circular solutions. This work has provided an initial base of social and qualitative evidence for investigating legitimacy perceptions towards real-world circular solutions that goes beyond the binary concept of acceptance.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

6. Recommendations

Below we present a set of recommendations that include specific feedback for the Gotland and La Trappe demo cases, as well as more general recommendations to guide outreach and engagement activities related to the implementation of circular solutions in the NextGen consortium and more broadly. The recommendations are based on our analysis, with combined insights from the quantitative and qualitative studies.

Gotland:

1) **Develop inclusive and comprehensible frames to talk about a circular solution:** The variety of projects on Gotland was found to challenge *cognitive* legitimacy and the lack of information access was mentioned by a few (*pragmatic* legitimacy). By providing comprehensible and inclusive frames, the information could bring clarity (*cognitive* legitimacy) about the circular solution and reach a wider range of actors (e.g., non-permanent residents) (*pragmatic* legitimacy).

La Trappe:

2) **Increase locals and public involvement in decision-making processes:** The La Trappe case was found to lack the incorporation of the public and locals in planning and management although the public was informed at the visitor centre (pragmatic legitimacy). By including the public and locals (e.g., farmers), this could give managers access to local information and needs (e.g., farmers' needs for nutrients) as well as valuable information on how to introduce the circular solution to the public and customers (as it was seen for Gotland). Finally, this could strengthen the network around the case and address some of the normative shortcomings.

3) **Investigate the potential for marketing circular products:** Cognitive legitimacy was weakened as La Trappe stakeholders found it challenging to incorporate circular products to the current market. Results from the quantitative stream of work (large-scale survey) indicated the existence of a market segment willing to pay a premium for food grown with nutrients recovered from wastewater. We extend this recommendation and hope that this helps business model developers (*cognitive* legitimacy) to incorporate such solutions to the current market and policy-makers (*regulative* legitimacy) to issue permits for handling products coming from wastewater.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

General recommendations:

4) **Develop engagement strategies that specifically utilise social norms:** This is a challenging recommendation – social norms take time to emerge, and cannot easily be created or engineered by a particular project. If an individual's acceptance of circular solutions is strongly affected by what they think others are feeling and doing, then overall acceptance may need to achieve a certain 'critical mass' before it becomes a social norm that drives further acceptance. However, the relatively high levels of acceptance that this study has shown indicates that we are perhaps on our way to achieving that critical mass in some parts of Europe. Engagement activities that emphasise this emerging consensus can reinforce and further encourage the social norm.

5) **Develop engagement strategies that specifically target emotional reactions:** Again, this can be seen as a challenging recommendation for a sector where engagement activities often focus on provide factual and technical information about new technologies and approaches. While such activities should not be abandoned, they should increasingly incorporate more emotive techniques, such as positive message framing, narrative building, and the use of more experiential activities (e.g. 'taste tests' for food grown with recovered nutrients).

6) **Highlight the role of circular solutions in addressing global challenges, rather than local ones:** Engagement activities related to circular systems in water and wastewater often focus on their local impacts and local benefits. Again, we do not argue that such approaches should be abandoned, but rather that they should be supplemented with efforts to highlight how individual schemes are linked with global resource challenges, and the role of circular economy in addressing those.

7) **Take a boarder and holistic approach to highlight circular solutions' impacts and benefits, rather than restricting it to a financial gain:** Similar to the recommendation from the quantitative stream of work (large-scale survey), aiming to highlight the role of circular solutions in addressing global challenges rather than local ones, the qualitative stream of work adds another dimension. A broader and holistic vision of circular solutions impacts and benefits would shift from a *pragmatic* perspective (i.e., what is the return on investment? What is the water price for end users?) to a *normative* perspective (i.e., what is the effect on public health? What is the effect on the ecosystem?). We do not argue that a pragmatic perspective is not useful, rather a normative perspective could positively boost legitimacy and may foster the introduction of circular products in the current market (*cognitive* legitimacy).

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

8) **Build a heterogeneous network of stakeholders that can influence the design and implementation of circular solutions:** Strong networks were found to help *normative* legitimacy processes at Gotland and La Trappe demo cases. A heterogeneous network is more likely to be strong and may include trusted and non-influential actors such as local inhabitants, end users, members of the general public, politician, policy makers, technology providers, researchers, municipalities and communication managers. Such networks (*normative* legitimacy) could shift paradigm from public engagement to public influence where the public would not only be included in planning and management, but would impact the whole process (*pragmatic* legitimacy).

9) **Implement circular solutions within environments (or create environments) that embeds a rich variety of projects related to global challenges (climate change, water scarcity, sustainability):** This strategy was found to be highly successful in Gotland. This increased *cognitive* legitimacy by bringing a sense of familiarity between projects related to sustainability and circular solutions as well as connecting circular solutions to cognitive frames that were already established.

10) **Look into a broader range of laws rather that circular laws only:** Circular laws and regulations are essential for implementing circular solutions and are lacking. However, surrounding laws, regulations and rules might be of great interest to address *regulative* legitimacy shortcomings. Restriction or ban of certain activities may indirectly encourage or direct stakeholders towards circular solutions.

11) **Do not assume that public acceptance is necessarily a barrier:** The evidence presented above demonstrated a high acceptance towards circular solutions, although stakeholders of the Gotland demo case did not anticipate it. This, in addition to the quantitative evidence, can showcase to other stakeholders that circular solutions are highly supported in some part of the world and can increase the *cognitive* and *normative* legitimacy.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

7. References

Abrahamse, W., Steg, L., 2013. Social influence approaches to encourage resource conservation: A meta-analysis. Glob. Environ. Chang. 23, 1773–1785. https://doi.org/10.1016/j.gloenvcha.2013.07.029

Ambrosini, V., Johnson, G., Scholes, K., 1998. Organisational culture and stakeholders, in: Exploring Techniques of Analysis in Strategic Management. Prentice Hall Europe, pp. 152-168.

Beal, C.D., Stewart, R.A., Fielding, K., 2013. A novel mixed method smart metering approach to reconciling differences between perceived and actual residential end use water consumption. J. Clean. Prod. 60, 116–128. https://doi.org/10.1016/j.jclepro.2011.09.007

Beery, T.H., Wolf-Watz, D., 2014. Nature to place: Rethinking the environmental connectedness perspective. J. Environ. Psychol. 40, 198–205. https://doi.org/10.1016/j.jenvp.2014.06.006

Bell, S., Aitken, V., 2008. The socio-technology of indirect potable water reuse. Water Sci. Technol. Water Supply 8, 441–448. https://doi.org/10.2166/ws.2008.104

Binz, C., Harris-Lovett, S., Kiparsky, M., Sedlak, D.L., Truffer, B., 2016. The thorny road to technology legitimation - Institutional work for potable water reuse in California. Technol. Forecast. Soc. Change 103, 249–263. https://doi.org/10.1016/j.techfore.2015.10.005

Brockett, J., 2017. SMART-Plant points way to circular economy [WWW Document]. Water Wastewater Treat. URL https://wwtonline.co.uk/features/smart-plant-points-way-to-circular-economy (accessed 6.17.20).

Brouwer, S., Maas, T., Smith, H., Frijns, J., 2015. Trust in Water Reuse Review report on international experiences in public involvement and stakeholder collaboration 1, 1–46.

Brouwer, S., Pieron, M., Sjerps, R., Etty, T., 2019. Perspectives beyond the meter: A Q-study for modern segmentation of drinking water customers. Water Policy 21, 1224–1238. https://doi.org/10.2166/wp.2019.078

Buckwell, A., Nadeu, E., 2016. Nutrient Recovery and Reuse (NRR) in European agriculture. A review of the issues, opportunities, and actions, RISE Foundation. Brussels.

Carmi, N., Kimhi, S., 2015. Further Than the Eye Can See: Psychological Distance and Perception of Environmental Threats. Hum. Ecol. Risk Assess. 21, 2239–2257. https://doi.org/10.1080/10807039.2015.1046419

Ching, L., 2010. Eliminating "yuck": A simple exposition of media and social change in water reuse policies. Int. J. Water Resour. Dev. 26, 111–124. https://doi.org/10.1080/07900620903392174

Cialdini, R.B., Reno, R.R., Kallgren, C.A., 1990. A Focus Theory of Normative Conduct: Recycling the Concept of Norms to Reduce Littering in Public Places. J. Pers. Soc. Psychol. 58, 1015–

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

1026. https://doi.org/10.1037/0022-3514.58.6.1015

Corral-Verdugo, V., Frías-Armenta, M., 2006. Personal normative beliefs, antisocial behavior, and residential water conservation. Environ. Behav. 38, 406–421. https://doi.org/10.1177/0013916505282272

Creswell, J., Creswell, D., 2018. Research design: qualitative, quantitative, and mixed methods approaches. SAGE, Los Angeles.

De Boer, J., Schösler, H., Boersema, J.J., 2013. Motivational differences in food orientation and the choice of snacks made from lentils, locusts, seaweed or "hybrid" meat. Food Qual. Prefer. 28, 32–35. https://doi.org/10.1016/j.foodqual.2012.07.008

Dean, A.J., Fielding, K.S., Lindsay, J., Newton, F.J., Ross, H., 2016. How social capital influences community support for alternative water sources. Sustain. Cities Soc. 27, 457–466. https://doi.org/10.1016/j.scs.2016.06.016

Desmidt, E., Ghyselbrecht, K., Zhang, Y., Pinoy, L., Van Der Bruggen, B., Verstraete, W., Rabaey, K., Meesschaert, B., 2015. Global phosphorus scarcity and full-scale P-recovery techniques: A review. Crit. Rev. Environ. Sci. Technol. 45, 336–384. https://doi.org/10.1080/10643389.2013.866531

Dolnicar, S., Hurlimann, A., 2009. Drinking water from alternative water sources: Differences in beliefs, social norms and factors of perceived behavioural control across eight Australian locations. Water Sci. Technol. 60, 1433–1444. https://doi.org/10.2166/wst.2009.325

Ellen MacArthur Foundation, 2017. Urban Biocycles, Ellen MacArthur Foundation. Cowes.

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

Etale, A., Jobin, M., Siegrist, M., 2018. Tap versus bottled water consumption: The influence of social norms, affect and image on consumer choice. Appetite 121, 138–146. https://doi.org/10.1016/j.appet.2017.11.090

Fielding, K.S., Dolnicar, S., Schultz, T., 2019. Public acceptance of recycled water. Int. J. Water Resour. Dev. 35, 551–586. https://doi.org/10.1080/07900627.2017.1419125

Fielding, K.S., Roiko, A.H., 2014. Providing information promotes greater public support for potable recycled water. Water Res. 61, 86–96. https://doi.org/10.1016/j.watres.2014.05.002

Genus, A., Iskandarova, M., 2020. Transforming the energy system? Technology and organisational legitimacy and the institutionalisation of community renewable energy. Renew. Sustain. Energy Rev. 125, 109795. https://doi.org/10.1016/j.rser.2020.109795

Ghisellini, P., Cialani, C., Ulgiati, S., 2016. A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. J. Clean. Prod. 114, 11–32. https://doi.org/10.1016/j.jclepro.2015.09.007

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Gibson, F.L., Burton, M., 2014. Salt or Sludge? Exploring Preferences for Potable Water Sources. Environ. Resour. Econ. 57, 453–476. https://doi.org/10.1007/s10640-013-9672-9

Gifford, R., 2011. The Dragons of Inaction: Psychological Barriers That Limit Climate Change Mitigation and Adaptation. Am. Psychol. 66, 290–302. https://doi.org/10.1037/a0023566

Glick, D.M., Goldfarb, J.L., Heiger-Bernays, W., Kriner, D.L., 2019. Public knowledge, contaminant concerns, and support for recycled Water in the United States. Resour. Conserv. Recycl. 150, 1–9. https://doi.org/10.1016/j.resconrec.2019.104419

Goodwin, D., Raffin, M., Jeffrey, P., Smith, H.M., 2018. Informing public attitudes to non-potable water reuse – The impact of message framing. Water Res. 145, 125–135. https://doi.org/10.1016/j.watres.2018.08.006

Goodwin, D., Raffin, M., Jeffrey, P., Smith, H.M., 2015. Applying the water safety plan to water reuse: Towards a conceptual risk management framework. Environ. Sci. Water Res. Technol. 1, 709–722. https://doi.org/10.1039/c5ew00070j

Griffioen, A.M., van Beek, J., N. Lindhout, S., J. J. Handgraaf, M., 2016. Distance Makes the Mind Grow Broader: an Overview of Psychological Distance Studies in the Environmental and Health Domains. Appl. Stud. Agribus. Commer. 10, 33–46. https://doi.org/10.19041/apstract/2016/2-3/4

Grimm, P., 2010. Social Desirability Bias. Wiley International Encyclopaedia of Marketing. https://doi.org/10.1002/9781444316568.wiem02057

Hair, J., Black, W., Babin, B., Andersn, R., Tatham, R., 2006. Multivariate data analysis, 6th ed. Pearson Educatin Inc., New Jersey.

Harder, R., Wielemaker, R., Larsen, T.A., Zeeman, G., Öberg, G., 2019. Recycling nutrients contained in human excreta to agriculture: Pathways, processes, and products. Crit. Rev. Environ. Sci. Technol. 49, 695–743. https://doi.org/10.1080/10643389.2018.1558889

Harder, R., Wielemaker, R., Molander, S., Öberg, G., 2020. Reframing human excreta management as part of food and farming systems. Water Res. 175, 1–8. https://doi.org/10.1016/j.watres.2020.115601

Harris-Lovett, S.R., Binz, C., Sedlak, D.L., Kiparsky, M., Truffer, B., 2015. Beyond User Acceptance: A Legitimacy Framework for Potable Water Reuse in California. Environ. Sci. Technol. 49, 7552–7561. https://doi.org/10.1021/acs.est.5b00504

Hartley, T.W., 2006. Public perception and participation in water reuse. Desalination 187, 115–126. https://doi.org/10.1016/j.desal.2005.04.072

Hurlimann, A., Dolnicar, S., 2010. When public opposition defeats alternative water projects: the case of Toowoomba Australia. Water Res. 44 (1), 287-297.

Hurlimann, A., Dolnicar, S., 2016. Public acceptance and perceptions of alternative water sources: A comparative study in nine locations. Int. J. Water Resour. Dev. 32, 650–673.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

https://doi.org/10.1080/07900627.2016.1143350

Ishii, S.K.L., Boyer, T.H., 2016. Student support and perceptions of urine source separation in a university community. Water Res. 100, 146–156. https://doi.org/10.1016/j.watres.2016.05.004

Jeffrey, P., Jefferson, B., 2003. Public receptivity regarding "in-house" water recycling: Results from a UK survey. Water Sci. Technol. Water Supply 3, 109–116. https://doi.org/10.2166/ws.2003.0015

Johnson, G., Scholes, K., Whittington, R., 2008. Exploring Corporate Strategy, in: Exploring Corporate Strategy. Financial Times Prentice Hall.

Kates, R.W., Wilbanks, T.J., 2003. Making the global local: Responding to climate change concerns from the ground up. Environment 45, 12–23. https://doi.org/10.1080/00139150309604534

Kehrein, P., Van Loosdrecht, M., Osseweijer, P., Garfí, M., Dewulf, J., Posada, J., 2020. A critical review of resource recovery from municipal wastewater treatment plants-market supply potentials, technologies and bottlenecks. Environ. Sci. Water Res. Technol. 6, 877–910. https://doi.org/10.1039/c9ew00905a

Khan, S.J., Gerrard, L.E., 2006. Stakeholder communications for successful water reuse operations. Desalination 187, 191–202. https://doi.org/10.1016/j.desal.2005.04.079

Klaniecki, K., Leventon, J., Abson, D.J., 2018. Human–nature connectedness as a 'treatment' for pro-environmental behavior: making the case for spatial considerations. Sustain. Sci. 13, 1375–1388. https://doi.org/10.1007/s11625-018-0578-x

Lam, K.L., Zlatanović, L., van der Hoek, J.P., 2020. Life cycle assessment of nutrient recycling from wastewater: A critical review. Water Res. 173. https://doi.org/10.1016/j.watres.2020.115519

Lamichhane, K.M., Babcock, R.W., 2013. Survey of attitudes and perceptions of urine-diverting toilets and human waste recycling in Hawaii. Sci. Total Environ. 443, 749–756. https://doi.org/10.1016/j.scitotenv.2012.11.039

Laroche, M., Bergeron, J., Barbaro-Forleo, G., 2001. Targeting consumers who are willing to pay more for environmentally friendly products. J. Consum. Mark. 18, 503–520.

Lease, H.J., Hatton MacDonald, D., Cox, D.N., 2014. Consumers' acceptance of recycled water in meat products: The influence of tasting, attitudes and values on hedonic and emotional reactions. Food Qual. Prefer. 37, 35–44. https://doi.org/10.1016/j.foodqual.2014.04.002

Leiserowitz, A.A., 2005. American risk perceptions: Is climate change dangerous? Risk Anal. 25, 1433–1442. https://doi.org/10.1111/j.1540-6261.2005.00690.x

Leong, C., Lebel, L., 2020. Can conformity overcome the yuck factor? Explaining the choice for recycled drinking water. J. Clean. Prod. 242, 118196.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

https://doi.org/10.1016/j.jclepro.2019.118196

Leviston, Z., Nancarrow, B.E., Tucker, D.I., Porter, N.B., 2006. Predicting Community Behaviour : Indirect Potable Reuse of Wastewater through Managed Aquifer Recharge. L. Water Sci. Rep. 2906 29/06, 0.

Lowe, H., 2009. What is our problem with water reuse : How other countries do it ? 53–62.

Mankad, A., 2012. Decentralised water systems: Emotional influences on resource decision making. Environ. Int. 44, 128–140. https://doi.org/10.1016/j.envint.2012.01.002

Massoud, M.A., Kazarian, A., Alameddine, I., Al-Hindi, M., 2018. Factors influencing the reuse of reclaimed water as a management option to augment water supplies. Environ. Monit. Assess. 190. https://doi.org/10.1007/s10661-018-6905-y

Melnyk, V., van Herpen, E., Fischer, A.R.H., van Trijp, H.C.M., 2013. Regulatory fit effects for injunctive versus descriptive social norms: Evidence from the promotion of sustainable products. Mark. Lett. 24, 191–203. https://doi.org/10.1007/s11002-013-9234-5

Mendelow, A.L., 1981. Environmental Scanning - The Impact of the Stakeholder Concept, in: ICIS 1981 Proceedings.

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

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

Napier, T.., Tucker, M., Henry, C., Whaley, S.., 2004. Consumer Attitudes Towards GMOs: The Ohio experience. J. Food Sci. 69, 69–76.

Navarro, T., 2018. Water reuse and desalination in Spain – Challenges and opportunities. J. Water Reuse Desalin. 8, 153–168. https://doi.org/10.2166/wrd.2018.043

Nölting, B., Mann, C., 2018. Governance strategy for sustainable land management and water reuse: Challenges for transdisciplinary research. Sustain. Dev. 26, 691-700. https://doi.org/10.1002/sd.1739

Nyborg, K., Anderies, J.M., Dannenberg, A., Lindahl, T., Schill, C., Schlüter, M., Adger, W.N., Arrow, K.J., Barrett, S., Carpenter, S., Chapin, F.S., Crépin, A.S., Daily, G., Ehrlich, P., Folke, C., Jager, W., Kautsky, N., Levin, S.A., Madsen, O.J., Polasky, S., Scheffer, M., Walker, B., Weber, E.U., Wilen, J., Xepapadeas, A., De Zeeuw, A., 2016. Social norms as solutions. Science (80-.). 354, 42–43. https://doi.org/10.1126/science.aaf8317

Olsson, P., Galaz, V., Boonstra, W.J., 2014. Sustainability transformations: A resilience perspective. Ecol. Soc. 19, 1. https://doi.org/10.5751/ES-06799-190401

Ormerod, K.J., Scott, C.A., 2012. Drinking Wastewater: Public Trust in Potable Reuse. Sci.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Technol. Hum. Values 38, 351–373. https://doi.org/10.1177/0162243912444736

Owen, A., Liddell, J., 2016. Implementing a circular economy at city scale – a challenge for data and decision making, not technology, in: Proceedings of the International Sustainable Ecological Engineering Design for Society (SEEDS) Conference. Leeds, UK, pp. 132–142.

Pahl-Wostl, C., Schönborn, A., Willi, N., Muncke, J., Larsen, T.A., 2003. Investigating consumer attitudes towards the new technology of urine separation. Water Sci. Technol. 48, 57–65. https://doi.org/10.2166/wst.2003.0015

Po, M., Kaercher, J.D., Nancarrow, B.E., 2003. Literature Review of Factors Influencing Public Perceptions of Water Reuse, CSIRO Land and Water Technical Report.

Po, M., Nancarrow, B.E., Leviston, Z., Porter, N.B., Syme, G.J., Kaercher, J.D., 2005. Predicting community behavior in relation to wastewater reuse: What drives decissions to accept or reject? Water a Heal. Ctry. Natl. Res. Flagsh. 1–116.

Reed, M.S., Graves, A., Dandy, N., Posthumus, H., Hubacek, K., Morris, J., Prell, C., Quinn, C.H., Stringer, L.C., 2009. Who's in and why? A typology of stakeholder analysis methods for natural resource management. J. Environ. Manage. 90, 1933–49. https://doi.org/10.1016/j.jenvman.2009.01.001

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

Said Business School, 2019. The Circular Economy - Boundaries and Bridges.

Sanz, L.A., Gawlik, B.M., 2014. Water Reuse in Europe: Relevant guidelines, needs for and barriers to innovation, JRC Science and Policy Reports. https://doi.org/10.2788/29234

Scannell, L., Gifford, R., 2013. Personally Relevant Climate Change: The Role of Place Attachment and Local Versus Global Message Framing in Engagement. Environ. Behav. 45, 60–85. https://doi.org/10.1177/0013916511421196

Schöggl, J.P., Stumpf, L., Baumgartner, R.J., 2020. The narrative of sustainability and circular economy - A longitudinal review of two decades of research. Resour. Conserv. Recycl. 163, 105073. https://doi.org/10.1016/j.resconrec.2020.105073

Schultz, P.W., Milfont, T.L., Chance, R.C., Tronu, G., Luís, S., Ando, K., Rasool, F., Roose, P.L., Ogunbode, C.A., Castro, J., Gouveia, V. V., 2014. Cross-Cultural Evidence for Spatial Bias in Beliefs About the Severity of Environmental Problems. Environ. Behav. 46, 267–302. https://doi.org/10.1177/0013916512458579

Schwartz, J., 2015. Water Flowing From Toilet to Tap May Be Hard to Swallow. New York Times D1.

Scott, M.B., Lyman, S.M., 1968. Accounts. Am. Sociol. Rev. 33, 46–62.

Scott, R.W., 1995. Institutions and Organizations. SAGE.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Shin, Y.H., Moon, H., Jung, S.E., Severt, K., 2017. The effect of environmental values and attitudes on consumer willingness to pay more for organic menus: A value-attitude-behavior approach. J. Hosp. Tour. Manag. 33, 113–121. https://doi.org/10.1016/j.jhtm.2017.10.010

Siegrist, M., 2008. Factors influencing public acceptance of innovative food technologies and products. Trends Food Sci. Technol. 19, 603–608. https://doi.org/10.1016/j.tifs.2008.01.017

Siegrist, M., Hartmann, C., Keller, C., 2013. Antecedents of food neophobia and its association with eating behavior and food choices. Food Qual. Prefer. 30, 293–298. https://doi.org/10.1016/j.foodqual.2013.06.013

Smith, H.M., Brouwer, S., Jeffrey, P., Frijns, J., 2018. Public responses to water reuse – Understanding the evidence. J. Environ. Manage. 207, 43–50. https://doi.org/10.1016/j.jenvman.2017.11.021

Smol, M., Adam, C., Preisner, M., 2020. Circular economy model framework in the European water and wastewater sector. J. Mater. Cycles Waste Manag. 22, 682–697. https://doi.org/10.1007/s10163-019-00960-z

Sokolow, S., Godwin, H., Cole, B.L., 2019. Perspectives on the future of recycled water in California: results from interviews with water management professionals. J. Environ. Plan. Manag. 1–21. https://doi.org/10.1080/09640568.2018.1523051

Spence, A., Poortinga, W., Pidgeon, N., 2012. The Psychological Distance of Climate Change. Risk Anal. 32, 957–972. https://doi.org/10.1111/j.1539-6924.2011.01695.x

Spencer, L., Ritchie, J., O'Connor, W., Morrell, G., Ormston, R., 2014. Analysis in practice, in: Metzier, K. (Ed.), Qualitative Research Pratice, A Guide for Social Science Students and Researchers. SAGE Publications.

Šteflová, M., Koop, S., Elelman, R., Vinyoles, J., Van Leeuwen, C.J.K., 2018. Governing non-potablewater-reuse to alleviate water stress: The case of Sabadell, spain. Water (Switzerland) 10, 1–16. https://doi.org/10.3390/w10060739

Stenekes, N., Colebatch, H.K., Waite, T.D., Ashbolt, N.J., 2006. Risk and Governance in Water Recycling Public Acceptance Revisited. Sci. Technol. Hum. values 31, 107–134. https://doi.org/10.1177/0162243905283636

Suchman, M.C., 1995. Managing Legitimacy : Strategic and Insitutional Approaches. Acad. Manag. Rev. 20, 571–610.

Sun, H., Zhang, H., Zou, X., Li, R., Liu, Y., 2019. Water reclamation and reuse. Water Environ. Res. 91, 1080–1090. https://doi.org/10.1002/wer.1199

The European Commission, 2016. Guidelines on Integrating Water Reuse into Water Planning and Management in the context of the WFD 1–95.

Townsend, E., Campbell, S., 2004. Psychological determinants of willingness to taste and purchase genetically modified food. Risk Anal. 24, 1385–1393.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

https://doi.org/10.1111/j.0272-4332.2004.00533.x

Upham, P., Johansen, K., Bögel, P.M., Axon, S., Garard, J., Carney, S., 2018. Harnessing place attachment for local climate mitigation? Hypothesising connections between broadening representations of place and readiness for change. Local Environ. 23, 912–919. https://doi.org/10.1080/13549839.2018.1488824

Uzzell, D.L., 2000. The psycho-spatial dimension of global environmental problems. J. Environ. Psychol. 20, 307–318. https://doi.org/10.1006/jevp.2000.0175

Van der Bruggen, B., 2010. The global water recycling situation, in: Sustainable Water for the Future, Volume 2- Water Recycling versus Desalination. Elservier, Amsterdam.

Van Doorn, J., Verhoef, P.C., 2011. Willingness to pay for organic products: Differences between virtue and vice foods. Int. J. Res. Mark. 28, 167–180. https://doi.org/10.1016/j.ijresmar.2011.02.005

Velenturf, A.P.M., Purnell, P., 2017. Resource recovery from waste: Restoring the balance between resource scarcity and waste overload. Sustain. 9. https://doi.org/10.3390/su9091603

Voulvoulis, N., 2018. Water reuse from a circular economy perspective and potential risks from an unregulated approach. Curr. Opin. Environ. Sci. Heal. 2, 32–45. https://doi.org/10.1016/j.coesh.2018.01.005

Wilson, C., 2013. Semi-Structured Interviews, in: Interview TechniQues for UX Practitioners. Morgan Kaufmann

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Appendix 1 – Regression results

Table 6a. Multiple linear regression model with predictors of UK respondents' willingness to consume recycled water for drinking purposes and food grown with recovered nutrients.

	Recycled water (R^2 =.753, F=257.27, *p*<.001)			Nutrient recovery (R^2 =.770, F=487.93, *p*<.001)		
	β	t	p	β	t	p
Constant		-1.592	.112		-2.871	.004
Gender	-.024	-1.445	.149	-.008	-.501	.617
Age	-.002	-1.39	.890	-.005	-.298	.766
Knowledge	.039	2.312	.021			
Satisfaction	.017	1.037	.300			
Social norms	.385	14.315	<.001	.436	17.970	<.001
Emotion	.266	9.271	<.001	.298	10.037	<.001
Risk perception	.075	2.549	.011	-.010	-.343	.731
Trust	.142	4.040	<.001	.100	2.987	.003
Confidence	.075	3.107	.002			
Common	-.011	-.582	.560			
Newness	-.025	-1.570	.117			
Environmental benefit	.032	1.698	.090	.174	8.042	<.001

Table 6b. Multiple linear regression model with predictors of Netherlands respondents' willingness to consume recycled water for drinking purposes and food grown with recovered nutrients.

	Recycled water (R^2 =.687, F=134.64, *p*<.001)			Nutrient recovery (R^2 =.568, F=135.33, *p*<.001)		
	β	t	p	β	t	p
Constant		.633	.527		.335	.738
Gender	-.022	-1.034	.301	-.036	-1.422	.155
Age	-.010	-.443	.658	.034	1.356	.175
Knowledge	.060	2.714	.007			
Satisfaction	-.049	-2.226	.026			
Social norms	.248	4.351	<.001	.364	10.235	<.001
Emotion	.515	13.150	<.001	.098	2.346	.019
Risk perception	.073	1.881	.060	.079	1.856	.064
Trust	-.013	-.351	.726	.145	3.235	.001
Confidence	.050	1.643	.101			
Common	.145	4.862	<.001			
Newness	-.058	-2.722	.007			
Environmental benefit	-.010	-.472	.637	.202	6.119	<.001

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Table 6c. Multiple linear regression model with predictors of Spanish respondents' willingness to consume recycled water for drinking purposes and food grown with recovered nutrients.

	Recycled water (R^2 =.646, F=119.75, *p*<.001)			Nutrient recovery (R^2 =.502, F=111.52, *p*<.001)		
	β	t	p	β	t	p
Constant		-3.245	.001		1.659	.097
Gender	-.027	-1.219	.223	.001	.048	.962
Age	.015	.819	.472	-.096	-3.760	<.001
Knowledge	.016	.678	.498			
Satisfaction	.019	.863	.388			
Social norms	.302	8.089	<.001	.375	9.438	<.001
Emotion	.258	6.218	<.001	.214	4.838	<.001
Risk perception	.178	4.661	<.001	.144	3.254	<.001
Trust	.178	4.661	<.001	.103	2.054	.040
Confidence	.037	1.337	.182			
Common	-.078	-2.876	.004			
Newness	-.003	-.142	.887			
Environmental benefit	-.009	-.368	.713	-.052	-1.381	.168

Table 7a. Multiple linear regression model with predictors of UK respondents' support for recycled water for drinking purposes and the use of recovered nutrients to grow food.

	Recycled water (R^2 =.605, F=129.64, *p*<.001)			Nutrient recovery (R^2 =.712, F=360.03, *p*<.001)		
	β	t	p	β	t	p
Constant		4.78	<.001		-.298	.765
Gender	-.001	-.025	.980	-.002	-.087	.930
Age	-.017	-.772	.440	.015	.840	.401
Knowledge	.044	2.102	.036			
Satisfaction	.006	.282	.778			
Social norms	.354	10.398	<.001	.426	15.711	<.001
Emotion	.220	6.061	<.001	.235	7.058	<.001
Risk perception	.044	1.177	.239	.007	.222	.824
Trust	.122	2.734	.006	.014	.377	.706
Confidence	.094	3.073	.002			
Common	-.009	-.373	.709			
Newness	-.060	-2.920	.004			
Environmental benefit	.043	1.835	.067	.274	11.299	<.001

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Table 7b. Multiple linear regression model with predictors of Netherland respondents' support for recycled water for drinking purposes and the use of recovered nutrients to grow food.

	Recycled water (R^2 =.693, F=138.79, *p*<.001)			Nutrient recovery (R^2 =.639, F=182.20, *p*<.001)		
	β	t	p	β	t	p
Constant		2.216	.027		1.362	.174
Gender	.024	1.130	.259	-.068	-2.961	.003
Age	-.009	-.401	.688	.002	.087	.930
Knowledge	.003	.139	.889			
Satisfaction	.003	.161	.872			
Social norms	.120	3.578	<.001	.348	10.713	<.001
Emotion	.438	11.296	<.001	.170	4.482	<.001
Risk perception	.178	4.625	<.001	.095	2.448	.015
Trust	.039	1.059	.290	-.012	-.299	.765
Confidence	-.001	-.048	.962			
Common	.160	5.413	<.001			
Newness	-.047	-2.217	.027			
Environmental benefit	-.010	-.478	.633	.332	10.978	<.001

Table 7c. Multiple linear regression model with predictors of Spanish respondents' support for recycled water for drinking purposes and the use of recovered nutrients to grow food.

	Recycled water (R^2 =.564, F=84.94, *p*<.001)			Nutrient recovery (R^2 =.706, F=265.21, *p*<.001)		
	β	t	p	β	t	p
Constant		.760	.448		3.983	<.001
Gender	.050	2.068	.039	-.018	-.901	.368
Age	-.040	-1.694	.091	-.013	-.642	.521
Knowledge	.010	.388	.698			
Satisfaction	-.017	-.679	.497			
Social norms	.170	3.695	<.001	.366	11.999	<.001
Emotion	.414	8.693	<.001	.123	3.604	<.001
Risk perception	.054	1.333	.183	-.101	-2.961	.003
Trust	.053	1.230	.219	.146	3.783	<.001
Confidence	-.008	-.246	.805			
Common	.029	.930	.353			
Newness	-.014	-.538	.591			
Environmental benefit	.300	7.472	<.001	.400	13.838	<.001

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Table 8a. Multiple linear regression model with predictors of UK respondents' willingness to pay more for potable recycled water and food grown with recovered nutrients.

	Recycled water (R^2 =.306, F=37.32, *p*<.001)			Nutrient recovery (R^2 =.124, F=20.64, *p*<.001)		
	β	t	p	β	t	p
Constant		1.442	.150		6.640	<.001
Gender	.005	.183	.855	-.003	-.090	.928
Age	-.009	-.325	.745	-.142	-4.638	<.001
Knowledge	.166	5.936	<.001			
Satisfaction	-.031	-1.137	.256			
Social norms	.244	5.404	<.001	.244	5.150	<.001
Emotion	.006	.128	.898	.111	1.910	.056
Risk perception	-.098	-1.995	.046	-.111	-1.888	.059
Trust	.086	1.456	.146	.173	2.635	.009
Confidence	.230	5.696	<.001			
Common	.030	.919	.358			
Newness	-.110	-4.077	<.001			
Environmental benefit	.044	1.403	.161	-.090	-2.130	.033

Table 8b. Multiple linear regression model with predictors of Netherland respondents' willingness to pay more for potable recycled water and food grown with recovered nutrients.

	Recycled water (R^2 =.237, F=19.10, *p*<.001)			Nutrient recovery (R^2 =.178, F=22.27, *p*<.001)		
	β	t	p	β	t	p
Constant		-.295	.768		1.319	.188
Gender	.031	.911	.363	-.034	-.977	.329
Age	.010	-.287	.774	-.098	-2.842	.005
Knowledge	.282	8.161	<.001			
Satisfaction	.001	.039	.969			
Social norms	.141	2.658	.008	.258	5.266	<.001
Emotion	-.061	-.994	.321	.189	3.303	.001
Risk perception	.039	.647	.518	-.066	-1.126	.261
Trust	.079	1.352	.177	.002	.025	.980
Confidence	.200	4.165	<.001			
Common	-.028	-.606	.544			
Newness	-.050	-1.497	.135			
Environmental benefit	.002	.073	.942	.072	1.584	.114

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Table 8c. Multiple linear regression model with predictors of Spanish respondents' willingness to pay more for potable recycled water and food grown with recovered nutrients.

	Recycled water (R^2 =.350, F=35.32, *p*<.001)			Nutrient recovery (R^2 =.109, F=13.51, *p*<.001)		
	β	t	p	β	t	p
Constant		-.078	.938		6.005	<.001
Gender	.020	.689	.491	.032	.940	.347
Age	-.049	-1.676	.092	-.167	-4.887	<.001
Knowledge	.279	8.986	<.001			
Satisfaction	-.035	-1.159	.247			
Social norms	.161	3.182	.001	.135	2.540	.011
Emotion	.043	.770	.442	-.038	-.640	.522
Risk perception	.005	.106	.916	.146	2.474	.014
Trust	.159	3.077	.002	.178	2.643	.008
Confidence	.193	5.214	<.001			
Common	-.017	-.474	.636			
Newness	-.006	-.179	.858			
Environmental benefit	-.051	-1.049	.295	-.174	-3.454	.001

Table 9. Multiple linear regression model examining perceptions of water resource challenges at local, national, and global levels as predictors of UK, Netherlands and Spanish respondents' willingness to consume potable recycled water.

	UK Recycled water challenge (R^2 =.046, F=16.601, *p*<.001)			Netherlands Recycled water challenge (R^2 =.038, F=9.902, *p*<.001)			Spain Recycled water challenge (R^2 =.034, F=9.390, *p*<.001)		
	β	t	p	β	t	p	β	t	p
Constant		9.922	<.001		11.740	<.001		10.471	<.001
Local	.061	1.371	.171	-.057	-.852	.395	.041	.612	.541
National	.058	1.183	.237	.096	1.410	.159	.002	.018	.985
Global	.139	3.876	<.001	.173	4.598	<.001	.152	2.407	.016

Table 10. Multiple linear regression model examining perceptions of water resource challenges at local, national, and global levels as predictors of UK, Netherlands and Spanish respondents' support for potable recycled water.

	UK Recycled water challenge (R^2 =.060, F=21.66, *p*<.001)			Netherlands Recycled water challenge (R^2 =.050, F=13.05, *p*<.001)			Spain Recycled water challenge (R^2 =.039, F=10.82, *p*<.001)		
	β	t	p	β	t	p	β	t	p
Constant		12.430	<.001		13.984	<.001		16.118	<.001
Local	.035	.790	.430	-.078	-1.166	.244	.074	1.101	.271
National	.088	1.806	.071	.112	1.651	.099	-.014	-.166	.868
Global	.164	4.588	<.001	.201	5.363	<.001	.151	2.401	.017

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Table 11. Multiple linear regression model examining perceptions of water resource challenges at local, national, and global levels as predictors of UK, Netherlands and Spanish respondents' willingness to pay more for potable recycled water.

	UK Recycled water challenge (R^2 =.042, F=14.950, *p*<.001)			Netherlands Recycled water challenge (R^2 =.067, F=17.913, *p*<.001)			Spain Recycled water challenge (R^2 =.013, F=3.463, *p*<.016)		
	β	t	p	β	t	p	β	t	p
Constant		6.989	<.001		5.681	.005		8.300	<.001
Local	.134	2.993	.003	.090	1.359	.174	.085	1.256	.209
National	.063	1.287	.198	.126	1.875	.061	-.024	-.278	.781
Global	.037	1.039	.299	.105	2.819	.005	.060	.935	.350

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

Appendix 2 – Interview topic guide

The "scheme" refers to the demo case (Gotland or La Trappe).

INTERVIEWEE INFORMATION	
Primary questions	Prompts
What is your role in your organisation?	• Any other professional activity?
CASE STUDY CONTEXT	
Primary questions	Prompts
Can you tell me more about the context and history of the scheme/area?	• Water, waste water management background (issues). • Urban area/agriculture. • Water, waste, agriculture related.
Can you give me an overview of the scheme/project?	
Why has the scheme been put in place? By whom? How?	
Does the scheme comply with any legal rules/government goals/laws?	• Are there any changes in laws?
ORGANISATIONS AND STAKEHOLDERS	
Primary questions	Prompts
How and why has your organisation got involved in the development of the scheme?	
Your role and role of your organisation in the development of the scheme?	
How important is the scheme for your organisation?	
Did/do you work with other stakeholders/organisations?	• How did you work with them? Differences between what they do and what you do. Are there any additional stakeholders who weren't willing to get involved?
What do you see as the aim of the scheme?	What do you expect from the scheme?

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

What do you think will be the impact of the scheme (positive or negative)? Are there any impacts on the local area? Are there any impacts at a national/global level? Are there any benefits? Are there any costs? Do you have any concerns? Does the scheme make sense to you? How do you relate the scheme to farmers, tourists, visitors, general public and workers at the abey lives? How is the development of the scheme going so far?	What are the benefits of the project so far? What will be the benefits in the future? • Output, deliverables, action plan.
COMMUNITY OF PRACTICE MEETINGS (STAKEHOLD VIEW)	
Primary questions	Prompts
Have you been to CoP meetings? What has been the role of CoP meetings in the scheme's development? What has been the general outcome of CoP meetings so far? Other than CoP meetings, to what extent has the scheme been publicised? How? Who do you think know something about the scheme? Can you tell me more about the community centre?	• Who came to the CoP? Who did not come? Whom would you like to see coming? • Do politicians speak about it?
GENERAL PERCEPTIONS AND COMMUNITY OF PRACTICE (PUBLIC VIEW)	
Primary questions	Prompts
What was/is the result of people's interaction with the scheme? Are there any other interactions appart from the CoP?	

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

How are people included in the decision-making process?	
How have people reacted to the scheme? Any CHANGES in opinion from before to now?	• Whom? Why? How do they feel about it? • Right/wrong? Good/bad?
Did they ask questions?	• Whom? Did they ask to go on a tour?
Does the scheme make sense to other stakeholders/people?	• Whom? Why? What meaning do people attribute to the scheme?
Do other stakeholders/people have any concerns?	• Risk
Are there any oppositions?	
Are there any positive elements raised by stakeholders/public/farmers/visitors, businesses, workers at the abey?	
What impact (if any) do people think the scheme might have on the local area? On the country? At a global level?	
Do people see any direct benefits in the scheme? If so, what are they? Do they see any costs in the scheme? If so, what are they?	
How do people understand Gotland's water cycle?	
How do people relate the scheme to their lives (professional and personal)?	• How do they relate the scheme to the water cycle • What did people say was missing for the scheme to be more accepted?
To what extent is the schee accepted?	
LOOKING FORWARD	
Primary questions	Prompts
To your opinion, what needs to happen for the scheme to be more accepted? Circular economy: CE is an approach aiming at increasing the economic growth in a	

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541

sustainable way. Fundamental principles of circular economy strategies focus on reducing, reusing and recycling in order to close the loops of materials and energy flows and eliminate waste (Ellen MacArthur Foundation, 2017; Said Business School, 2019; Smol et al., 2020; Voulvoulis, 2018). What do you think about the circular economy in general?	What does the CE mean? How does the project relate to that?

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°776541