



D1.2 – User Analysis, Use Cases Requirements and Quality Criteria

WP1 – Water Efficiency Enhancement Applications Framework and Baseline Assessment

2023

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ABSTRACT

This deliverable focuses on the creation of a business-case orientation and stakeholder inclusive approach in an effort to ensure that the AquaSPICE technologies and innovations will be relevant and appropriate for the stakeholders they are addressed to.

The report includes the findings and results of work performed under Task 1.2 on stakeholder engagement and business requirements identified for each case study.

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ABBREVIATIONS & ACRONYMS

ACCELI	Acceligenze Ltd
AIC Method	Appreciation-Influence-Control Method
CoP or Community	Communities of Practice
CS	Case Study
CSL(s)	Case Study Leader(s)
LLs	Living Labs
NPD	New Product Development
Project	AquaSPICE Project
Survey	Stakeholder Engagement Survey

1. Executive summary

This document was prepared in the framework of the research project **AquaSPICE: Advancing Sustainability of Process Industries through Digital and Circular Water Use Innovations** (the “Project”) and specifically under Work Package 1, which focuses on water efficiency enhancement applications and the establishment of a water efficiency framework and baseline assessment. This report serves as the deliverable of Task 1.2, the purpose of which is to establish a stakeholder-inclusive approach and ensure relevance and impact of the AquaSPICE innovations to the partners and their communities.

Ensuring that professionals and their stakeholders are actively participating in the pilot technology design, this study reports on the findings and outcomes of engaging stakeholders and the benefits and challenges faced through such participation. The aim is to co-develop water treatment related business user stories for the respective pilot technologies (the “pilots”). For each pilot study, a high-level participation structure is created by inviting both the members of the community of practice and the case study leaders (being the technical partners responsible for the technology development and application) for structured focus group workshops. This is done virtually through online workshops, using Microsoft Teams as the online communication platform sheltering an online visual collaboration tool, used to support the facilitation and for data collection. In a preliminary workshop during the project’s kick-off meeting, with all AquaSPICE partners involved, the stakeholder heterogeneity was captured to enumerate potential participants at the CoPs.

More specifically, this document serves to present the development practices used throughout the project in the efforts of applying a business-case oriented, stakeholder-inclusive approach whilst welcoming (both internal and external) stakeholders to the consortium environment to be part of the community co-creation process.

The Report highlights the identified end-user requirements related to water quantity and quality criteria, which assist in forming the basis for the use case development in later Tasks and Work Packages.

The Report has been prepared drawing on literature review, but also input collected from the project team and stakeholders through online workshops, surveys and questionnaires.

Due to the non-existence of the SynDi plant in CS#4, this CS is considered as void case and no work related to this CS is reported in this deliverable.

2. Introduction

2.1. Background

AquaSPICE is a European Union (EU) funded project under H2020-EU.2.1.5.3. The aim of the project is to materialise circular water use in the European Process Industries and foster awareness in resource-efficiency. It delivers compact solutions for industrial applications, including water treatment and reuse technologies and closed-loop water recycling practices. The Project will also deliver an innovative water cyber-physical-system (WaterCPS) including a system for real-time monitoring, assessment and optimisation of water use and reuse at different interconnected levels.

The Project aims to materialise circular water use in the European Process Industries and to increase awareness in resource efficiency for industrial applications from a single industrial process to an entire industry via:

1. water treatment and reuse technologies,
2. closed-loop recycling practices; and
3. development of a cyber-physical-system controller including a system for real-time monitoring, assessment and optimisation of water use and reuse at different interconnected levels.

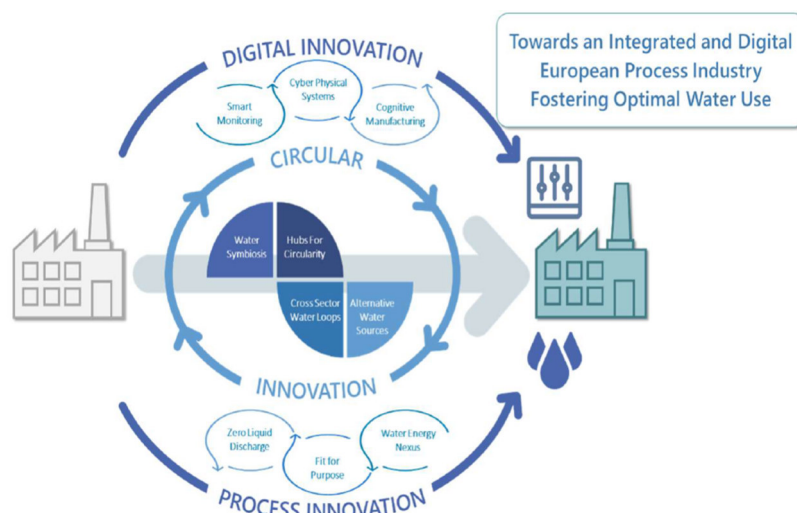


Figure 1 AquaSPICE vision, strategy, and offerings.

These approaches will be developed and adapted in all AquaSPICE Case Studies and involved industrial actors.

AquaSPICE follows a systemic approach in water management where optimal efficiency can be achieved through an adaptation of appropriate technologies and practices at different levels, from a single industrial process (unit operation) to an entire factory, to other collaborating industries (industrial symbiosis) or other sectors (e.g., domestic and/or agriculture).

AquaSPICE enables and facilitates the immediate uptake, replication and up-scaling of innovations, by providing comprehensive strategic, business and organizational plans that offer a range of well-defined and pre-packaged solutions, suitable for various cases with quite different characteristics.

Work Package 1 (WP1) of AquaSPICE is the development of a “*Water Efficiency Enhancement Framework and Baseline Assessment*”. It formulates the scientific, institutional/regulatory, industrial and commercial background for the development of AquaSPICE technological innovations, with an aim to satisfy the requirements of Process Industry actors/stakeholders and technology providers.

WP1 consists of five tasks with Task 1.2 being a review of the “*User Analysis, Use Cases Requirements and Quality Criteria*”.

2.2. Purpose of Task 1.2

The purpose of stakeholder engagement in the Project is to create, from the onset of the project, a business-case oriented approach to the pilot technologies and solutions to be designed and developed throughout the Project.

The main objectives of Task 1.2 include (i) the creation/establishment of a Community of Practice (the “**Community**”) for the partners and stakeholders, (ii) addressing the concept of living labs and how these are defined, understood and designed, (iii) the identification of end-user requirements for use case development in later Tasks (i.e. Task 1.3) with regards to water and water re-usage, and (iv) initiating a consideration of “water as a product”. These allow partners to lead outreach activities to potential external water users and other parties in industrial and other sectors.

Task 1.2 also addresses the defined KPIs for evaluating progress towards business goals and water efficiency and presents the use case requirements related to water quality criteria. Task 1.2 provides work and guidance to be utilized by various other tasks, including Task 6.1 (Stakeholder Engagement Environments at Case Study Level) which aims to hold further detailed conversations with stakeholders of each case study. Specifically, Task 6.1 will (a) initiate and deliver case study working groups whereby case study leaders (“**CSLs**”) and research partners will participate and engage with the user requirements identified in Task 1.2 and (b) hold Community activities in which local stakeholders will be invited to discuss further and exchange their views and experiences.

This report presents the results of co-design workshops held within each pilot Community of Practice (“**CoP**”), to define potential users (stakeholders) of the AquaSPICE applications to be developed in each case study. It should be noted that, currently, each CoP is in the process of being built in congruence with each Case Study’s application development.

The scope of D1.2 is limited to the input of the various partners involved in the respective Case Study. The results collected during T1.2, and subsequently presented in D1.2 should provide valuable knowledge for the development of the AquaSPICE applications. The CSLs, case study stories, and business requirements identified should be considered during the application development stage in order to ensure that the final applications meet the needs and requirements of those that will use the applications.

2.3. Importance of Stakeholder Engagement

In general, stakeholder engagement in research projects, such as AquaSPICE, has many advantages including (i) informing and educating stakeholders; (ii) allowing them the opportunity to voice their opinions and influence decision-making processes; (iii) promoting joint action; (iv) influencing the operational environment, and (vi) enhancing the effectiveness and impact of technologies developed and services to be offered. Depending on the desired end-result or outcomes to be achieved, different stakeholders may be engaged in different stages and different engagement methods to be adopted. Stakeholders can be engaged in the ideation stage, whereby they provide their input and ideas for addressing the problems aimed to be solved via the presented innovations and/or solutions. They can also be a part of the planning stage, referring to strategic planning and prioritization of needed actions. They can complement decision making by providing solution designers with context, evidence and knowledge from a range of sources they have developed. Stakeholder engagement further assists with the design stage by ensuring good, workable and efficient solutions. Stakeholders can provide insights to data repositories, hierarchies (both internal and external) and assist with setting up an implementation plan.

With the implementation of successful strategies, perspectives of all stakeholders can be integrated and opinions of multiple stakeholders can be presented. However, in the business world, organisations have the option to exclude certain stakeholders from their strategy or to prioritise stakeholders in the way they see fit (such as on the basis of economic or political power or relevance to the purpose).

Engaging stakeholders in the project development process not only enhances the quality, scope and the depth of the pilot technologies but also yields findings that are useful, relevant, and credible. Stakeholder engagement also promotes transparency, builds citizens' (service user and customer) trust in the service provider (governmental or private) and strengthens public accountability and responsiveness – in AquaSPICE, that of CSLs.

Considering the above, one of the main objectives of Task 1.2 was to ensure that stakeholder engagement was actively pursued so that stakeholders would be involved and engaged; this would further assist in identifying their individual agendas and demands, promote the development of ideas and the conceptualisation and implementation of the Project solutions.

In this report, the different ways and means to capture stakeholders' needs, feedback and active participation and engagement are described, including methods such as online survey, meetings and technical workshops.

3. Methodology

To meet the aims and purpose of Task 1.2 as described in Section 2.3, ACCELLI has followed the methodology as described below.

Due to the relatively heterogeneous group of stakeholders approached for participation, including a range of high-level decision makers, technical experts and stakeholder representatives from interest groups, it was deemed necessary to consider the social, political, technical, and economic factors of the project for each case study.

In order to be better equipped to engage with the stakeholders involved in the AquaSPICE project, as well as for (i) gathering in-depth information on the different/various stakeholder perceptions, (ii) identifying a common purpose within the stakeholder group, and (iii) providing a framework for addressing the water re-usage target collaboratively, we have utilized an amalgam of methodological approaches¹ to stakeholder engagement.

This enables us to effectively define each business-case and evaluate stakeholder inclusiveness and engagement before the implementation of the pilot technologies in each case study.

3.1. Goal and Method of Co-design Process

The aim of this process was to co-develop water related user stories for the respective case studies. The process included four steps, which are explained in more detail below.

3.1.1. Enumeration of Stakeholder Heterogeneity

In this preliminary step, the goal was to take stock of the stakeholder heterogeneity. This consisted of a Warm-up Call, a Kick-off Meeting (the "KoM") Workshop and a Co-design Meeting. The heterogeneity in case study scenarios was captured during the KoM workshop.

¹ The methodological approaches used in this report have been drawn from, "[Participatory Methods Toolkit](https://archive.unu.edu/hq/library/Collection/PDF_files/CRIS/PMT.pdf)", accessed at https://archive.unu.edu/hq/library/Collection/PDF_files/CRIS/PMT.pdf.

3.1.2. Case Study Workshops

Co-design workshops were organised for every case study between M2 and M8. Relevant partners were invited to comment and provide feedback on the preliminary results of their respective workshop. This allowed for the co-design process to continue after the workshop, and for the resulting data to be more accurate and relevant.

The workshops were facilitated in an online environment, and the group of participants per session consisted of 5-15 people. All CSLs and partners received an invitation to participate in their respective workshop from ACCELI and KWR. A preliminary setup of the focus groups was developed. Based on the feedback, several changes were made to the setup of the other workshops. The general setup of the workshops was as follows:

1. Welcome and Presentation
 - i. At the start of the workshop, participants were welcomed by ACCELI and were provided with a short introductory presentation. Participants were then invited to enter the Google Form used to support the facilitation and for data collection.
2. Familiarity with questionnaires and the Survey.
 - i. Familiarity with the questionnaires and the Survey was cultivated through participation in this activity;
3. Co-creation of business requirements.
 - i. During the first part of the workshop, examples of business requirements were co-created and analysed. ACCELI asked participants to define a specific business requirement and elaborate on the water treatment challenge that is being dealt with. Then, participants were asked to specify the goal of this, as well as the core task that needs to be performed in order to achieve this goal. Contributions of participants were verbal, and ACCELI kept notes in order to adapt accordingly the survey and/or other questionnaires.
4. Application Functionalities
 - i. During this part of the workshop, an inventory of business functionalities was co-created (analysed). In the first part of the workshop, participants were invited to suggest functionalities that users may require to perform their core tasks. Participants had the opportunity to make suggestions and a discussion was facilitated in order to categorise the functionalities as necessary and/or optional.

3.1.3. Feedback on Preliminary Results

ACCELI compiled the results of each workshop in a report. Participants and other relevant partners were invited to provide feedback and suggestions on its content. These were incorporated into the D1.2 Deliverable. The first part of the synthesis consisted of taking the outcomes of the workshops in order to develop concrete business outcomes for every case study. Next, the water treatment challenges, goals and core tasks identified by participants for each case study were interpreted.

3.1.4. Feedback on User Stories

Participants were invited to review the business outcomes developed by ACCELI as part of the synthesis of the outcomes of each workshop. This gave participants the opportunity to provide feedback and suggestions. These were incorporated in the case studies, Survey questions and Questionnaire analysis, as these are presented in this report.

4. Analysis Methods

4.1. Cross-tabulation

Cross-tabulation is the most widely used data analysis method. It uses a basic tabulation framework to make sense of data. This statistical analysis method helps tabulate data into easily understandable rows and columns, and this helps draw parallels between different research parameters. It contains data that are mutually exclusive or have some connection with each other.

4.2. Living Labs

According to the European Network of Living Labs, “living labs are real-life test and experimentation environments, where users and producers co-create innovations, in a trusted, open ecosystem that enables business and societal innovation”². Living Labs (“LLs”) enable the co-creation of user-driven and human-centric research, development and innovation of technologies, products and services. The adoption of Living Labs methods allows for research to be taken “out of the lab”, engage citizens and other stakeholders in the collaborative design of new services.

As also mentioned in section 6 below, there are various methods to engage stakeholders, including the adoption of living labs. Depending on the stakeholder target group, living labs can be a useful method to engage stakeholders since they employ key activities such as:

- a) Co-creation: co-design by users and producers/developers;
- b) Exploration: discovering emerging usages, behaviours and market opportunities;
- c) Experimentation: implementing live scenarios within communities of users; and
- d) Evaluation: assessment of concepts, products and services according to socio-ergonomic, socio-cognitive and socio-economic criteria³.

LLs can frame co-creation for sustainability in two ways: firstly, consulting users and stakeholders allows complementary sets of projects to offer holistic solutions to sustainability challenges; secondly, LLs are able to develop the iterative process of experimenting and learning from year to year. This means that they are able to provide a coherent basis for action over time⁴.

To enable the creation and design of Living Labs for the purposes of the Project, Task 1.2 utilised the online Survey and the Questionnaire, which both included specific questions to help formulate the LLs.

The Survey focused on the engagement and the contributions of users, universities, private stakeholders and governmental authorities both in, and to, the activities and the innovation processes within their individual organisation. For the purposes of LLs, respondents were invited to outline the characteristics of their organisation (Question 7 of the Survey, “*How would you define your organisation?*”), so that the framework of LL uniting them could be identified. Respondents were also asked to describe the governance and management of their organisation (Question 10

² Introducing EnOLL, the European Network of Living Labs, Accessed at: <https://pro.europeana.eu/post/introducing-enoll-the-european-network-of-living-labs#:~:text=Living%20labs%20are%20real%2Dlife, enables%20business%20and%20societal%20innovation>,

Last accessed: October 2021

³ Ibid.

⁴ Evans, Jones, Karvonen, Millard & Wendler, Living Labs and co-production: university campuses as platforms for sustainability science, Current Opinion in Environmental Sustainability, Vol.16, October 2015, Pages 1-6, Accessed at: <https://doi.org/10.1016/j.cosust.2015.06.005>, Last accessed: October 2021

of the Survey, “*Is your organisation required (in its normal course of business) to engage with relevant stakeholders in the process (internal or external)?*”). Stakeholders were also prompted to share their organisation’s views on the key points of effective water management and water re-use to collect individual opinions and viewpoints (Questions 16 – 18, “*In your organisation’s view, which are the key points of effective water management and water re-use in the following area: Waste Water Management, Water Quality and Water Quantity*”).

Furthermore, respondents were invited to describe, explain and assess their adopted practices in the Questionnaire, in order to foster innovation by first engaging and then increasingly involving users more and more (Section 3.7 of the Questionnaire, “*Desired quality of the stream treated with AquaSPICE solution*”). Stakeholders were also prompted to provide their expected water quality criteria.

Overall, through the inclusion of relevant questions in the Survey and the responses received, it is evident that in all responses, the methods, tools and approaches adopted by each organisation and their business needs towards water re-usage, in order to enhance the innovation process, were the most discussed issues. This confirms the need for further analysis of the methods and practices adopted in each organisation in order to ensure both knowledge sharing and effective interactions between all stakeholders in implementing and adopting a LL and a relevant community.

4.3. Community of Practice

One of the main purposes of stakeholder engagement is to establish and promote a Community of Practice involving relevant stakeholders. A Community of Practice is a dynamic social structure, which connects stakeholders under a shared context, enables dialogue, stimulates learning, captures and diffuses knowledge, introduces collaborative processes, facilitates organization, and generates new knowledge. A Community of Practice can become an organically self-sustained hub of knowledge, innovation, and standardization of industry practices.

The steps taken to design the AquaSPICE Community include utilising:

4.3.1. The Mapping Method

The Mapping Method allows the gathering of descriptive and diagnostic information by collecting baseline data on several indicators and therefore facilitating community ownership of development planning by including diversely interested groups of people in the dialogical process. Mapping encourages a high level of participation, which bridges communication gaps between locals and development planners. As such, Mapping exercises generate discussions on local development priorities and are useful tools in verifying information provided by secondary sources.

4.3.2. The Appreciation-Influence-Control (AIC) Method

The AIC Method aims at formulating action plans by creating a learning-by-doing atmosphere between the multiplicity of heterogeneous stakeholders. This enables the collaborative designing of the solution. By engaging stakeholders, influencing them through discussions and extracting information relevant to their workings, nature and purposes (via questionnaires), we are encouraging social learning, promoting ownership of the outcome, and thus establishing a working relationship between all stakeholders involved in the project.

4.4. New Product Development

When launching new products on the market it is crucial to include, as part of the whole process, new product development (“NPD”) practices, which can enhance and promote a continued business success of the new product. The contribution of NPD practices to the growth of the

companies, their influence on profit performance, and their role as a key factor in business planning have been well documented⁵.

The well-recognized and adopted stages of NPD are: concept, design and production. Currently, and as technology and better human resource management have evolved, the process of NPD consists of several key stages. This ensures that development is not a segregated, fragmented process but is rather a unified procedure, which allows for the modification and improvement of the first product, through meetings, discussions with clients and suppliers and feedback in every stage of the process.

In the development of the pilot solutions in AquaSPICE, and as a target of WP1, we have adopted NPD methods to ensure that the pilot solutions developed for each case study are relevant, customized and addressable to the needs of each case study.

ACCELI's involvement with NPD practices focuses mainly on gathering the strategic business requirements that the pilot technologies should comply with, deriving from the objectives of the stakeholders and the strategies of the CSLs, considered in conjunction with other factors such as social, political, technical, and economic.

It is also relevant to examine the set water quality criteria for each case study and the desired end-result of water quality for the streams to be treated with the AquaSPICE solutions. Relevant KPIs for each case study on water quality have also been defined as part of the Technical Questionnaires shared with the CSLs. Due to the nature of the information provided (confidential) and the dissemination nature of this deliverable (public), the technical criteria, specifications and such other relevant information has not been included in this report.

4.5. Industrial Symbiosis

Industrial symbiosis is the process by which waste or by-products of an industry or industrial process become the raw materials for another. Application of this concept allows materials to be used in a more sustainable way and contributes to the creation of a circular economy. The transition to such an economy is the goal of the European Commission's Circular Economy Action Plan as it will result in the increase of Europe's economic competitiveness, sustainability, resource efficiency and resource security. It also contributes to the reduction of greenhouse gas (GHG) emissions⁶.

The information gathered during the stakeholder engagement process could be further utilized in developing relationships of industrial symbiosis between multiple collaborating businesses, leading to efficient usage of the pilot solutions to be developed for the AquaSPICE Case Studies for water recycling and re-use.

⁵ Karl T. Ulrich & Steven D. Eppinger, Product Design & Development, 2012, Accessed at: https://www.researchgate.net/publication/235700806_Product_Design_and_Development , Last accessed: October 2021

⁶ [Industrial Symbiosis](https://ec.europa.eu/environment/europeangreencapital/wp-content/uploads/2018/05/Industrial_Symbiosis.pdf), European Commission, accessed at https://ec.europa.eu/environment/europeangreencapital/wp-content/uploads/2018/05/Industrial_Symbiosis.pdf

5. Stakeholder Engagement in AquaSPICE

5.1. Preparation for Stakeholder Engagement

To address the targets and aims of Task 1.2 and to ensure the initiation and establishment of a community of practice, it was considered that the most efficient manner in addressing and engaging stakeholders would be to create and provide them with an online survey for completion.

This approach was also adopted while taking into consideration the highly impactful COVID-19 disruptions, which would not allow for in-person meetings, gatherings, focus groups or workshops with CSLs and other stakeholders Actions prior to circulating the Stakeholder Engagement Survey

The first steps of an effective stakeholder engagement process is to identify and understand:

- (i) who the stakeholders are;
- (ii) why they would be interested in the Project; and
- (iii) in what ways they could be involved and/or affected by the Project results,

whilst keeping in mind the Project goals and purpose.

While the question of “who to engage” might seem simple to answer, with including all stakeholders being the first answer that comes to mind, it becomes quickly evident that this question includes many different aspects that need to be considered before commencing stakeholder engagement. One should start with stakeholder identification and analysis and then proceed planning each stakeholder’s engagement and approach. It is also important to consider that, depending on the scope, purpose, timing available, different stakeholders may need to be engaged in different ways and ample time needs to be made available.

To assist CSLs and consortium partners (the “**Partners**”) in identifying the stakeholders that would be relevant in contributing to the stakeholder engagement process, ACCELI lead specific stakeholder engagement workshops from early in the Project, with the CSLs and Partners starting from M3 to M6. Follow-up meetings, discussions and online correspondence and support was provided by ACCELI from the beginning of the task all the way to M10 of the Project (*Figure 2*).

Furthermore, ACCELI contributed to a specific section of the Technical Questionnaire (the “**Questionnaire**”) that was circulated by Partners to CSLs. The Questionnaire, prepared by project partners required CSLs to provide direct contact points of stakeholders that would be appropriate and/or associated to their particular case study. A copy of the template Questionnaire is included herein as Appendix IV.

This included providing contacts from each CSL’s own organization (internal contacts), such as company experts, regional managers and business unit managers, senior management personnel, individuals from other key partner companies of their organization and members of the corporate Social Responsibility Team(s).

It also prompted CSLs to consider partners they work with and/or rely on and/or need to consult before proceeding in taking relevant action, such as public authority personnel, local authority officials and other local or business contacts. Where relevant to their case study, CSLs could include individuals that are involved in policy and decision making in areas relevant to the Project, such as governmental authority representatives and/or relevant Ministry officials.

It was further considered, relevant to include other key players/actors in the area/industry, even including competitors or key business partners that are actively involved and/or engaged with the CSL’s business (considering that such individuals would be facing similar situations as the CSL and would be ideal to provide varying viewpoints on the Project’s research topic).

Following the input provided and as a second step, ACCELI participated in CS specific workshops and worked towards defining and clarifying the requirements of Task 1.2 (to CSLs), as well as highlighting the importance of the Task in designing the pilot technologies of the Project.

Emphasized by the contribution of Task 1.2 in various other tasks (such as Task 1.3 on the user requirements, Task 1.5 for the design of the Water Efficiency Framework (WEF) and Task 6.1 for the creation of further stakeholder engagement environments and co-creation activities at case study level), it was crucial that CSLs understood the importance of their involvement and active contribution to this task.

5.2. Stakeholder Engagement Workshops

Specifically, workshops took place as shown in Table 1.

First Round of Workshops				
Stakeholder Workshops	<ul style="list-style-type: none"> 05 February Workshop 15 March – Case Study 3 16 March – Case Study 2 17 March – Case Study 1 29 March – Case Study 6 30 March – Case Study 5 	Online (Microsoft Teams)	Presentation to all partners on the scope of Task 1.2 and the requirements for stakeholder engagement	All partners + Case study leaders
Follow-up discussions and/or workshops on stakeholder engagement	<ul style="list-style-type: none"> 12 July – Presentation to Partners for Task 1.2 on Stakeholder Engagement Survey 30 July –Case Study 6 10 August –Case Study 3 24 August –Update – Case Study 6 24 August –Case Study 3 	Online (Microsoft Teams)	Presentations to all partners on Stakeholder Engagement Survey, run-through the survey questions and assistance in identifying relevant stakeholders to provide responses.	All partners + Case study leaders

			Follow-up meetings to discuss responses.	
<p>Depending on each CS’s stakeholder responsiveness level, it was discussed with the WP leader, CSLs and Partners whether additional online meetings would be required to engage further with potential stakeholders. It became apparent that some CS required additional efforts and/or guidance in liaising with stakeholders and attract Survey responses, as this was also affected by each CSLs network, their business or other direct connections and relations with such stakeholders as well as the summer holiday season. A learning outcome from the first round of workshops is that to attract high levels of engagement and responsiveness from stakeholders an interactive approach is most suitable and effective (i.e. invitation to physical meeting, presentation of a short-video rather than an explanatory leaflet) as these are methods that have a more impactful engagement with individuals. However, and considering the COVID-19 pandemic limitations it was not possible for all CSLs to meet stakeholders in person and were required to adapt to online/digital outreach.</p>				
Second Round of Workshops				
Case Study Workshops – 2 nd round	04 October – Case Study 3 12 October – Case Study 2 14 October – Case Study 6 15 October – Case Study 5 05 November – Case Study 1 (Dow Böhlen)	Online (Microsoft Teams)	Follow-up discussions and presentations with CSLs on project progress and technical developments.	All partners + Case study leaders

Table 1: Stakeholder Engagement Workshops

It is in general recommended, to include as many stakeholders as possible in the engagement activities, as this will deliver a variety of viewpoints, ensure a robust engagement process and promote acceptability of engagement results⁷. However, “it is not practical and usually not necessary to engage with all stakeholder groups with the same level of intensity all of the time. Being strategic and clear about whom you are engaging with and why, before jumping in, can help

⁷ Alexey Voinov & Francois Bousquet, Modelling with stakeholders, Environmental Modelling & Software, Vol.25, Issue 11, Nov.2010, Pages 1268-1281, <https://doi.org/10.1016/j.envsoft.2010.03.007>, Last accessed: October 2021

save both time and money”⁸. A list of criteria, such as the level of involvement of the particular stakeholder, the information or expertise they may have on the issue that could be helpful, their willingness to engage and any influence they may have, are some of the key points to be considered and can assist with deciding which stakeholders to engage and how.

To identifying each CS relevant stakeholders, CSLs were prompted to consider (i) groups of individuals; (ii) entities; (iii) governmental or public authority officials; or (iv) other industrial partners that would assist them and the project partners in:

- (a) identifying their [stakeholder’s] needs, drivers and barriers (from an industrial, technical and regulatory perspective),
- (b) establishing a solid understanding of their relevant environment and individual agenda, and
- (c) their actual needs and requirements.

The same parameters were also considered when preparing the Stakeholder Engagement Survey (the “Survey”) (Appendix I).

5.3. Types of Stakeholders

Depending on their business nature, each case study included and contacted different types of stakeholders.

As can also be seen in the Stakeholder Engagement Survey and Figure 2 below, a wide range of stakeholders was engaged by CSLs. From the forty seven (47) responses we collected, 25% came from Inter-governmental/supra-national organisations (at a local or national level) and another 25% from service providers (such as water management companies, water utilities etc.).

⁸ Morris J. and Baddache F. (2012). Back to Basics: How to Make Stakeholder Engagement Meaningful for Your Company. BSR. Available at: <https://www.bsr.org/en/our-insights/report-view/stakeholder-engagement-five-step-approach-toolkit>, Last accessed: October 2021

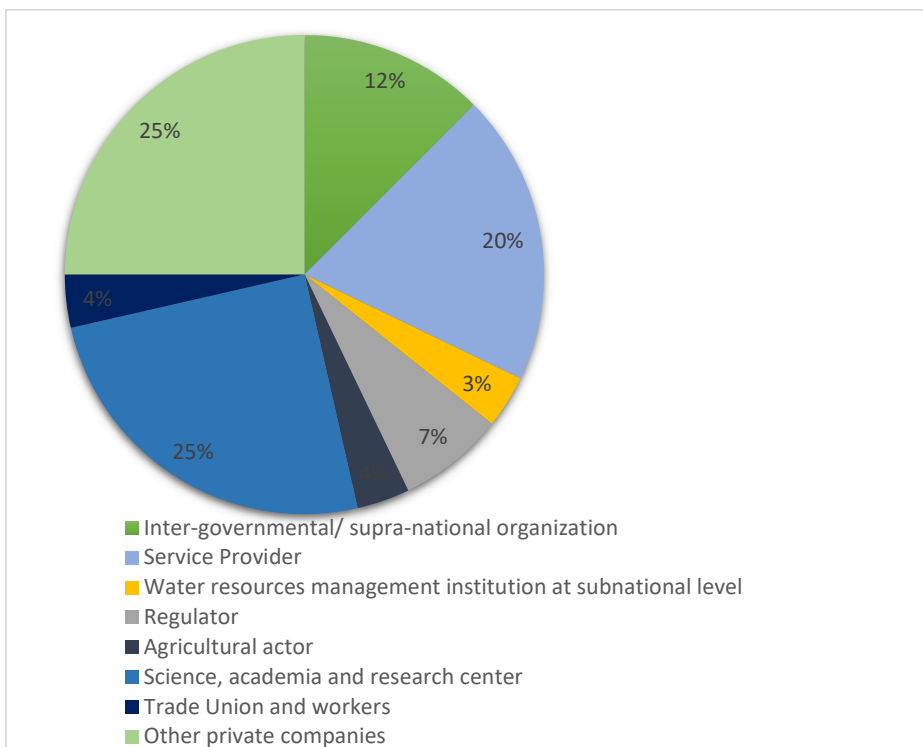


Figure 2: Stakeholder Engagement Survey – Responses per type of organisation

Specifically, the responses received per Case Study were:

Case Study	Number of stakeholder responses
1: Dow Böhlen and Terneuzen	8
2: Solvay, Aretusa	12
3: Port of Antwerp	9
4: void case	-
5: Agricola, Bacau	12
6: Tüpras, Turkey	6

Table 2: Stakeholder Responses per case study

Taking into consideration the wide spectrum of stakeholders that would have an interest and/or be affected by the AquaSPICE technologies, together with the levels of motivation of each stakeholder in participating in the project workings (i.e. by answering the Survey), it early on became evident that the engagement levels per CS will vary significantly.

Stakeholders with the highest motivation to engage tend to be focused on promoting a specific cause, goal or agenda, who might be attracted to innovative solutions and projects such as AquaSPICE (i.e. intra-governmental organisations). Additionally, depending on the urgency of the stakeholder’s interest in the project workings, both in terms of criticality and time-sensitivity of concern, as well as the specific interest in the issue at hand, there is an increased responsiveness level (such as service providers or water management actors).

It is an important finding to note that utilizing methods to understand the motivations and passions as drivers for stakeholder engagement, and understanding the role of each stakeholder within the project focus areas is the main challenge of the first stage of stakeholder engagement.

The in-depth stakeholder engagement and co-design process to follow in the upcoming Tasks will have to initiate discussions with stakeholders early on in the process, so that the views, interests and frames of reference for each stakeholder can be openly explored, as this will serve to identify the most effective engagement strategies going forward.

6. Obstacles faced

There is a wide variety of methods and tools to engage stakeholders, both actively (such as consulting directly with them) and passively (informing them about a topic). Such methods indicatively include:

- Advisory groups;
- Workshops / Meetings;
- Polls, surveys and focus groups;
- Brainstorming;
- Living labs.

Depending on the targeted stakeholder group (i.e. whether these are government officials, employees and managers, industry players et.), the engagement level or the reason for engaging stakeholders (i.e. the desired end result) various methods are applicable.

For the purposes of this Task, and while taking into consideration the limitations faced due to the COVID-19 pandemic outbreak, it was obligatory to follow a joint effort with CSLs to engage with stakeholders. The activities led (these being online meetings, technical workshops and follow-up meetings) meant that the project partners were able to engage with stakeholders only to a passive level. It was required by CSLs to actively engage with stakeholders and were prompted to follow individual consultation methods to reach and engage with stakeholders, also depending on their professional relationship and exposure with such stakeholders.

At first, it became apparent that it was very challenging for CSLs to approach and receive a response from stakeholders in governmental and/or local authority sectors, due to such officials' increased workload and unawareness about the Project. The limitation on face-to-face meetings, formal gatherings and/or participation at organised events of the Project by this group of stakeholders had as a result limited awareness of the purpose of the Project, its overall impact to their relevant community and low levels of engagement by such officials.

To assist in breaking the lack of awareness barrier, an explanatory leaflet (**Appendix II**) was prepared which CSLs could use whilst contacting the stakeholders or even prior to sharing with them the Survey. The leaflet allowed stakeholders to engage further with the Project and get a more sufficient understanding of its purpose, as well as why their involvement and participation was required. A somewhat increase of responses was observed following the dissemination of the Explanatory Leaflet.

Depending on the CS, different consultation methods for stakeholder engagement were followed. The majority of methods included reaching out to stakeholders digitally (via email). The more

personal approaches (such as phone, one-to-one meetings or other formal meetings, public meetings or focus groups) were not pursued in depth by CSLs, which meant that engagement with the stakeholders was at first limited.

To assist in breaking the barriers, ACCELI led CS specific workshops and consultations with CSLs to support them in identifying specific and/or other stakeholders who would be more willing to engage with the Project. Regular conversations and follow-ups were conducted explaining the importance to drive stakeholder engagement whilst also prompting CSLs to utilise more personal methods in approaching stakeholders, such as distribution of project information to government officials (i.e. the Explanatory Leaflet), invite stakeholders to meetings (virtual or physical, to the extent possible), inform stakeholders about the option to engage in consultation meetings or one-to-one discussions. Such methods enabled CSLs to build more personal relations with the stakeholders and present project information directly and with a higher impact.

It also became clear that there is a small and busy number of experts in the field, which made it even more challenging to engage with such individuals in online communities. Furthermore, the diversity of the different community members in terms of professional background, as well as cultural and linguistic specificities, made it necessary for each CSL to focus on national, regional and other sub-groups within their community to obtain responses.

To overcome the language barrier, CSLs worked on translating the Survey into their national language, share it with the stakeholders and translate the responses back in English. This method,



in combination with the personal approach and formal meetings organised proved very efficient, specifically for the purposes of CS#5 (Agricola, Bacau) which enabled a greater number of responses to be collected. In CS#5 case, CSLs also met physically with stakeholders (as this was permitted in accordance with the pandemic measures) in Bacau, Romania in June 2021 (Figure 3) and discussed the questionnaire and the involvement of stakeholders directly. This enabled them to gather a greater interest in participants and more responses.

Figure 3: Stakeholder Workshop held in Bacau, Romania (CS#5)

Furthermore, the lack of visualisation of the incentives for the participation of stakeholders to the Survey had an impact on their engagement; the more specific, individual and direct the incentives are, the better the result in terms of engagement. The approach was very effective where the CLs could meet in person with the stakeholders, present to them the objectives of the Project as a

whole and explain the importance of their engagement. Such an approach was followed by CS#5 and proved to be very effective.

Overall, it is evident that different methods and tactics should be used per stakeholder group. Aspects such as engagement setting, consultation method, personal or indirect approach and offered incentives should be suitably planned. Furthermore, it is also evident that additional time is required to obtain responses when the methods used are mostly digital/virtual, since the response depends heavily on the immediate willingness of the stakeholder to participate to the survey/questionnaire. Thus, additional time must be given when interactions are pursued electronically.

For Task 1.2, the collection of responses coincided with M7 – M10 (June – September) of the Project, which also included the summer season (and by definition people breaking off for summer holidays) for many businesses and organisations, adding a further hurdle to overcome for CSLs.

Nonetheless, and despite the massive interruptions caused by the COVID-19 pandemic outbreak, which has as an effect the limitation to the methods utilised to obtain responses and limiting the approach to a passive (rather than direct or personal) 56 responses were collectively achieved, bringing an average of 9.3 responses per case study.

7. Analysis & Findings

To address the needs of Task 1.2, the engagement method selected to approach stakeholders was that of the survey type. This was done based on the fact that a survey is a research method to gauge views, experiences and behaviours. The benefits of using a survey include that it can be a straightforward collection of information, focused and specific and can gather a large number of opinions. It can also be easily adapted and adjusted to meet the purposes for which the survey is prepared.

The limitations of the survey method, as these were also faced during the circulation of the Stakeholder Engagement Survey, include the fact that it makes it difficult to gather qualitative information and answers may be irrelevant, with the delivery methods (such as open-ended answers) being able to affect results.

Taking the above into consideration, the Survey was made up of a total of 32 mixed open and closed questions, with a Yes or No type answer and short open-text questions on key topics. The sequence of open-ended and closed questions made it possible not only to evaluate the respondents' personal understanding of, and attitude to, the issues dealt with, but also to obtain standardized, hence comparable, answers and opinions from individual stakeholders.

This also assisted in following a cross-tabulation methodology for the purposes of the analysis and draw valuable conclusions from the open-ended answers.

For the purposes of identifying the needs for the creation of a Community of Practice (“CoP”) between stakeholders, questions were specifically included in the Survey to address this point, such as:

“Question 23: “The stakeholders in the water supply/management industry would mutually benefit from creating a community based on shared principles”, followed by a brief explanation answer;”

and

“Question 25: In which areas could stakeholders of the water supply/re-use industry benefit by creating a community based on shared principles?”.

We present herein the key findings deriving from the responses received by stakeholders.

The individual responses to the Stakeholder Engagement Survey are confidential and are only available upon request. Following a request and approval procedure, the responses can be further referred to in detail by interested parties for research and analysis purposes.

For ease of reference, the findings from the Survey are presented in **Table 3**, as per below:

Topic:	Findings/outcomes and comments:	Relevant Survey question(s):
<p>1. Requirement by respondents to engage with relevant stakeholders in their normal course of business</p>	<p>Yes: 31 responses</p> <p>No: 16</p> <p>Some of the main reasons for engaging with stakeholders in their normal course of business included the fact that the stakeholders themselves are required to report their water data and water saving projects to their investors via sustainability reports and indexes.</p> <p>It has also been stated in numerous responses that stakeholders also work closely with ministries (such as Ministry of Environment, Forestry and Water Affairs) as well as local authorities, to which they are required to report their estimated water usage on an annual basis.</p> <p>It has further been stated by stakeholders that they engage with stakeholders via dedicated sustainability programmes or even as part of their corporate social responsibility duties. Frequent communication with governmental authorities, public bodies and other adjacent sites is reported to ensure that (i) relevant concessions and permits are granted prior to using water in their daily processes. It was also highlighted that involvement and interaction with stakeholders was important for the purposes of collaboration to improve the processes currently in place, increase system productivity and ensure compliance with regulatory requirements.</p>	<p>Questions 10 & 11</p>
<p>2. Problems identified in the development of sustainable water solutions in the water treatment process in the European Process Industry</p>	<p>From the responses provided it was highlighted that the biggest problems identified in the development of sustainable water solutions include:</p> <p>a) Lack of Awareness:</p> <ul style="list-style-type: none"> - Lack of understanding across stakeholders on the importance of water as a product, and its significant role in the establishment of a circular economy; - Limited social perception on the need to decrease water consumption and focus on water re-usage, together with lack of information to relevant actors, key players and the public. <p>b) Need for technological innovation:</p> <ul style="list-style-type: none"> - Need to develop more innovative technologies to ensure that water remains in a closed loop and is efficiently re-used, in combination with the development of methodologies and techniques 	<p>Questions 14 & 22</p>

	<p>(such as use of natural systems and new leakage reduction techniques).</p> <p>c) Digitalisation of key players:</p> <ul style="list-style-type: none"> - Slow digitalisation of water management companies and public services managing water resources and/or geographically water-rich areas; - Need for digital management of wastewater treatment; - Urgency in adopting digital tools and solutions to improve water uptake monitoring, diversity and availability control to speed up processes and enhance efficiency. <p>d) Cost efficiency:</p> <ul style="list-style-type: none"> - Technology readiness and cost efficiency of innovative technologies/solutions; - Added costs for maintenance purposes; - Enforcement of new technologies under strict time frameworks without adequate time to adapt to such solutions financially. <p>It was further stated that while there seems to be an increase in awareness on the scarcity of water and a move towards developing technologies in the process, yet the investments by companies towards water reduction are low while companies who choose to make such investments face a low ROI correlated with the low water price.</p> <p>Responses also included the lack of political initiatives and incentives that would benefit in increasing awareness as well as move towards use of sustainable methods and technologies.</p>	
<p>3. Problems identified in the development of sustainable water solutions in particular location or level of governance</p>	<p>The main themes deriving from the answers to this question include the:</p> <ul style="list-style-type: none"> (ii) lack of technological innovation and/or its slow adoption from water utility and management companies, as well as municipalities and local governments, (iii) lack of social and political acceptance and conflicts of interest between stakeholders; (iv) funding problems (that make adoption of new water treatment technologies very financially challenging); (v) water price is on the low end not allowing investors to have a high ROI; and (vi) lack of practical implementation and testing of new technologies which often leads to adoption without 	<p>Question 15 (<i>open-ended question</i>)</p>

	taking into consideration the excessive needs of maintenance.	
4. Need for creation of a Community of Practice	<p>To the question whether stakeholders in the water supply industry would mutually benefit from creating a community based on shared principles (i.e. a Community of Practice), the responses were to their majority positive with Yes: 31, No: 2 and Maybe: 7. Figure 5 (Appendix III) presents the graphic analysis for all stakeholder responses.</p> <p>Stakeholders stated that the creation of a CoP would allow for the creation of a professional network that would develop synergies between them and collaborate to find solutions to technical challenges.</p> <p>A common, shared set of principles would enable all parties, from across industries and backgrounds, to communicate more efficiently and foster cooperation towards a common purpose.</p> <p>In their responses stakeholders also stated that a CoP would boost workings towards establishing a circular economy, sustainable methods and raising environmental awareness.</p> <p>It is, however, important to define the shared principles upon which such CoP would operate and stakeholders suggested “knowledge sharing”, “innovation” and “solution demonstration” as indicative suggestions.</p>	Questions 22, 23 & 25.
5. (a) Main focus points for the design of the AquaSPICE solutions; and (b) end-user requirements that the AquaSPICE solutions should fulfil in order to be accepted and utilized by stakeholders.	<p>(a) The prevailing opinion of stakeholders, when asked which should be the main points the AquaSPICE solutions should consider in their design, was efficient water management.</p> <p>Consortium partners are prompted (by stakeholder opinion) to ensure that they bring forward solutions that promote efficient water management, cost effectiveness and industrial symbiosis. The technologies should aim to improve the entire process of water re-usage across the industry chain rather than in segregated sections.</p> <p>(b) Furthermore, stakeholders identified that the end-user requirements that the solutions should address were cost efficiency, environmental protection and ease of operation. It was further highlighted that it would be beneficial to the industry if the solutions designed were “socially/politically accepted”, without however offering a definition on what this would entail.</p>	Questions 20 & 25

Table 3: Findings/outcomes from Survey

7.1. Conclusion

The stakeholders' primary interests in water, based on the answers provided in Question 9 of the Survey, are mostly reported to be access to water resources and sanitation services, quality of water resources, environmental protection and consideration of water as a consumer product.

All respondents provided at least two of the above four listed interests, highlighting the alignment across the various stakeholders (irrespective of their business background) in their interests towards promoting access to water resources whilst also ensuring quality of water and services. The recognition for the need of considering water as a consumer product should further be highlighted, which responds directly to one of the aims of Task 1.2.

It was further highlighted by stakeholders that, where relevant, they would be keen to utilize the pilot technologies of the Project in the course of their business going forward mainly by (i) adopting the technologies in their everyday workflow of business, (ii) promoting the new technologies to their partner networks, (iii) disseminate knowledge and expertise to the market and (iv) use the AquaSPICE technology results to develop better work practices and lines of business.

Such findings are vital for the purposes of the Project as they indicate the positive reaction of stakeholders to the technologies to be developed, and the Project as a whole, providing further comfort for the stakeholder's participation in further Project tasks.

7.2. Summary of Stakeholder Engagement Workshops

Although the workshops enabled partners to obtain the general technical requirements for each CS – a crucial element of success of the project, the stakeholder engagement workshops further enabled partners to interact with some of the most prominent and key decision makers in their respective CS.

The engagement of stakeholders from the industry, academia, governmental authorities and other directly related sectors, allowed project partners to increase system productivity and ensure compliance with regulatory requirements – as these are understood from the viewpoint of such market participants. Stakeholder engagement complements decision making by providing solution designers with context, evidence and knowledge from a range of sources they have developed.

In these workshops, stakeholders provide insights to data repositories, hierarchies (both internal and external) and assist with setting up an implementation plan.

By performing effective stakeholder management (via direct or indirect communication and/or hosting of workshops) partners individually created their ability to maintain positive relationships through the appropriate management of individual needs, wants and expectations.

Via their respective stakeholder engagement activities, partners managed to identify the key project stakeholders, determine their importance and establish a communication management plan.

They key messages arising from stakeholder engagement workshops include:

1. **Need to increase awareness in the regions.** Stakeholders largely commented on the lack of information in their respective regions for the importance of water as a product; thus, limiting potential “political” pressure being put into changing the people's perspectives on water.

2. **Lack of innovative technologies.** Most stakeholders stated the lack of innovation in technologies in their respective areas of interaction with water resources which leaves gaps in closed water cycle looks.
3. **Old-fashioned methodologies.** From their survey responses and other comments, it is understood that stakeholders support the imminent need for digitalization of water management companies and public services managing water so they can utilize newer technologies for water management. The digitalization does not only relate to water management but their operational systems as a whole. It was also greatly commented that there is an urgent need to adopt digital tools and solutions to improve water uptake monitoring to speed up processes and enhance efficiency.
4. **Cost efficiency.** In presenting their views stakeholders frequently noted the importance of developing cost efficient solutions in meeting the purposes for each CS. This relates further to other attempts completed in the past to adopt technologies but as such actions were rushed and implemented/enforced without adequate time for correct implementation, it only left stakeholders with the bitter feeling of nonachievement. As such, it is considered one of the main priorities for industry parties to be offered a cost-efficient solution to their ongoing considerations.
5. **Political pressure and public consensus.** As it is often the case, adoption of new solutions arises when an unprecedented change in time occurs (see consequences of the COVID era in industries) or when a new regulatory piece forces this to happen. As a result, it is not unprecedented for stakeholders to comment on the need for new legislative pieces to be introduced on regional, national and/or European level to enhance the adoption of new solutions for water management, battling water scarcity and water re-use.

The summary of the stakeholder workshops may serve as new potential functions for partners in the duration of the project, including:

- (i) Serving as a tangible document concerning the state of the issue (per CS) that can then be utilized to clarify necessary next steps. In particular, they can help identify tough choices, common ground, key questions to explore more fully, and a broad sense of the potential stakeholders on the issue.
- (ii) Serving to bridge gaps between different stakeholders, as each can respond to the work done by the partners and use that as a point of reference;
- (iii) Serve as a catalyst for action and a reminder of the promises or suggestions made during workshops; and
- (iv) Develop a record of collaborative work that can be used to increase understanding on the issue across the cadre.

7.3. Critical review of Engagement workshops

Summarizing the feedback and indicators provided by both, the participants (local stakeholder community per CS) and facilitators, creates a basis for improvement of the future operation and knowledge gathering/sharing within the local and pan-european CoPs.

7.3.1. Water Quality Requirements

From the various technical workshops and consultations performed with the CSLs, the water quality envelope of each case study was developed. This includes the water quality requirements for each Case Study, their individual desired quality of water streams to be treated with the AquaSPICE

solution and relevant KPIs. The information was provided as part of the (i) Questionnaires that were circulated to all CSLs at the beginning of the Project; and (ii) through technical workshops, consultations and meetings organised with the project partners and CSLs

7.3.1.1 CS#1

For the DOW Case Study, CS#1, and the **Böhlen** location, the main objectives are to create (a) an optimized sourcing (by smart monitoring and control) of fresh raw water streams to produce customized water qualities for different downstream applications, and (b) the treatment and direct reuse of the cooling tower blowdown water, and slightly polluted process water streams.

For the **Terneuzen** site, the main priorities are to reduce their fresh water intake intensity by (a) enhancing the internal recycle of various process water streams – these comprise (but are not limited to) cooling tower blowdown and dilution steam blowdown streams, and (b) creating a next level of site water management by using smart monitoring, algorithms and control on raw water, discharge and recycle streams.

7.3.1.2 CS#2

In CS#2, the objective is to optimize the industrial water cycles towards increased energy and carbon efficient water re-use. In this context a pilot-scale technology will be validated for the treatment of the industrial used water (water from hydrogen peroxide and peracetic acid production) up to the limits for discharge in municipal sewers. In this way, the flow can be further treated in the ARETUSA reclamation plant and be re-used for cooling processes back in the Solvay chemical plant.

7.3.1.3 CS#3

Sub-Case 1: Antwerp Canal

In CS#3, the streams to be utilised for the purposes of the AquaSPICE project include surface waters from the Albert Canal, that connect to the Antwerp harbour. The Albert Canal on its turn takes its water from the river Meuse. Drinking water company Water-link abstracts water from the Albert Canal for drinking water production.

Due to climate change, there is increasing salinization of the dock waters in the port, as well as of the River Scheldt and the Albert Canal. The available amount of freshwater is declining. The area is facing increased problems of managing freshwater resources – for drinking water, industry and transport (inland shipping) – in terms of both water quantity and water quality.

The stakeholders in the area need to develop strategies that ensure that water quality and scarcity are factored into decisions that protect current operations and support business growth.

The water quality is monitored by the Flemish environmental agency through sampling at several locations. The water quality criteria are not applicable for this Case Study, since the objectives to be investigated within AquaSPICE include, among others, installing sufficient online monitoring devices to monitor the required geographical area of the streams and develop mid-term early warning system to support operational decisions to prevent salination at raw water intake points

Sub-Case 2: BASF Site

In Sub-Case 2 of CS#3 (the BASF site), the main objective is to evaluate the effects of an enhanced recirculation of cooling water at the site and examine possible future process conditions (scaling, fouling, corrosion).

The desired quality of the stream treated with the AquaSPICE solution is for:

COOLING WATER: No performance reduction of heat exchangers due to higher degree of CoC.

REUSE WATER:

- Improved water quality for (partial) reuse purposes like process (raw water for demineralization process) or demineralized water and condensate return or water spraying for air coolers.
- Salt solution with required quality for softener regeneration or acid/base for mixed bed regeneration

7.3.1.4 CS#4

Due to the non-existence of the SynDi plant in CS#4, this CS is considered as void case and no work related to this CS is reported in this deliverable.

7.3.1.5 CS#5

For CS#5, the desired quality of the stream treated with the AquaSPICE solution would be suitable for reuse in the slaughterhouse. AGRICOLA suggested that the parameters that have to be checked are provided in *Ordonanța Guvernului pentru modificarea și completarea Legii nr. 458/2002 privind calitatea apei potabile*⁹, that has transposed EC Directive 98/83 into local (Romanian) legislation.

7.3.1.6 CS#6

For CS#6 the needs and areas of improvement within the AquaSPICE innovation include taking significant steps towards near-zero discharge; the outlet stream of ballast water treatment system **will be tried to be recycled and reused** in the refinery.

In its current situation, the treatment system is solely used to achieve standards for discharge. Although the ballast water system has a connection with **biological treatment system, it is not utilized**. The reason for that decision is to prevent any upsets that may take place in biological treatment caused from the characteristics of the two incoming streams of ballast system (Stream 1; highly conductive, Stream 2; high level of contamination COD, NH₄-N+, S-2). Two streams are blended as neither of them can be treated in existing biological treatment and used to dilute each other to feed the ballast system. The **blending operation** is also not a perfectly controlled and optimized operation.

7.3.2. AquaSPICE New Business Requirements

In regions where water is already a scarce resource and where water quality issues have been problematic, there are good examples of more circular approaches to water and wastewater management.

These are 4 common objectives of such projects:

- Use alternative, non-traditional water sources to relieve the demand of current water sources
- Reduce demand on water supply through water use reduction measures

⁹ EUR-Lex, National Transposition measures communicated by the Member States concerning Council Directive 98/83/EC of 03 November 1998 on the quality of water intended for human consumption, <https://eur-lex.europa.eu/legal-content/EN/NIM/?uri=celex:31998L0083> , Last accessed October 2021

- Treat used water to enable its use for other purposes thereby replacing fresh water supplies
- Improve the water quality in receiving waters

The concept of different business models has been a strong feature of moving to a circular economy, as the solutions are limited and even blocked by traditional linear economic patterns (take, make, use, dispose).

Increasing the circularity of resources within the economy requires a number of different actions: reducing resources use and waste; requiring reuse and prolonging product use; ensuring biological resources are returned to natural cycles; recovering and recycling of nonbiological materials. Enabling these activities and having them as the foundations of our economies requires changes to occur within our products and how money is made. The linear economy is well established.

Traditional business models have not typically found value in circular approaches – but the legal, social and business context is changing. The need to manage risks and the potential to create economic gain in other ways will challenge the linear economy – although the speed of change might be challenged.

The Key Performance Indicators (KPI's) set vs the impact of the AquaSPICE are defined in the following table:

KPI	Impact within the AquaSPICE project	Relative priority
Amount of reclaimed and reused water (m3/year)	AquaSPICE solution will increase the reuse of reclaimed water at Solvay plant	High
Energy footprint in wastewater treatment (kWh/m3 or kWh/COD removed or kWh/H2O2 removed or kWh/pollution load removed)	Energy for water reclamation will be compared with the energy required for freshwater intake from the local aquifer Calculation will be accomplished for the three reuse options.	High
Carbon footprint of wastewater treatment (Kg CO2 eq/m3)	Carbon footprint for water reclamation will be compared with Carbon footprint related to freshwater intake from local aquifer Calculation will be accomplished for the three reuse options.	medium
Amount of produced waste / m3	The amount of produced waste and its specific disposal will affect the environmental impact of the solution.	High
Cost of treated wastewater (€/m3)	AquaSPICE solution will optimize the cost of wastewater treatment	High

8. Lessons learned

In general, we learned from the workshops that we should plan our project solutions with a technological flexibility, considering the specific needs and requirements of local ecosystems (stakeholder community of AquaSPICE end users) and on the other hand to easily change the experimental set-up in order to conduct different kind of trials which might even simulate a critical state of the investigated processes and which allow the project participants to follow novel services and operations.

In terms of the potential co-creation activities in AquaSPICE, we identified the most important success factor to be the commitment and willingness to act together to “make it happen”. Therefore, a common goal is necessary, success stories as motivation to act together and an idea facilitator serving as an initiator to spread and start ideas among the partners. Another important success factor is an open and evidence-based communication to convince people and to gain their trust.

Based on the knowledge, how important an open and evidence-based communication is in order to materialise circular water use, we conclude that this is also true for a project consortium involving multiple circular water solutions. Hence, the continuation of AquaSPICE workshops in WP2, which focus mainly on the development and optimisation of our technologies, is seen as a crucial step towards the successful project execution to inform and involve all project partners even those, who are not directly involved case study specific tasks.

9. Conclusion

Overall, it is evident that in projects such as AquaSPICE, where the pilot technologies presented affect an array of stakeholders (not just industry partners but also local groups, entities and authorities) whilst addressing a commodity that affects all (water), stakeholder engagement is an essential element to be performed prior to implementation actions taking place.

Through the engagement with stakeholders, via the various workshops, focus groups, technical meetings and consultations, the key elements and guidance on how best to continue with stakeholder engagement in later Tasks have been identified.

Via the Survey it has become apparent that there is an imminent need for technological innovation to enable water closed loops and efficient water re-usage across industries. The lack of awareness across sectors on the importance of water as a product makes matter even more difficult, whilst highlighting the need to enhance dissemination of the Project goal and purpose, in an effort to raise social awareness on the need to decrease water consumption.

The key factors for the adoption of new technologies being introduced to provide solutions to the problem at hand include the fact that such solutions should be cost efficient for the industry and market players – including having lower maintenance costs. Furthermore, and while stakeholders would be keen to consider and adapt such solutions, it is key that the Project targets the correct audience and presents well-tested and sustainable solutions.

Furthermore, the findings and outcomes deriving from this Task include the fact that stakeholders have specific concerns that can act as barriers preventing them to engage in activities such as the ones promoted by the Project. These include either local laws or regulations, lack of awareness and/or engagement with the cause (i.e. water re-usage) as well as lack of funding, innovation programmes and implementation methodologies that would allow them to adopt new solutions. It should also be considered that institutional stakeholders have a limited time to devote to such activities and it may also be the case that they have had bad prior experiences in engaging with innovative technologies (i.e. engagement results that remained unused, rushed implementation of new technologies that proved very costly).

Nonetheless, the workings for this Task showed increased willingness by stakeholders to participate in the Project workings and engage with technology partners to design efficient solutions to address their needs. The same willingness has been shown by external stakeholders that have actively participated and engaged with the activities promoted by this Task. It is considered that such willingness can be maintained by sharing the results, showing what has been achieved and then expanding to get further engagement can be a winning strategy to keep stakeholders involved in the process. Actual results can further convince the hesitant respondents/participants to engage as well.

Another key finding that should be considered is that interaction with the stakeholder community has shown that culture is an important factor to keep in mind; cultural differences mean that different methods need to be adopted to engage with people. It is therefore advised to partners due to utilize the results and findings of this Task to consider the local and cultural circumstances of each case study in their future workings.

The beneficiaries of these results are the CSLs and Project partners who are working on the pilot technology developments as well as external stakeholders that can utilise the findings and outcomes in later policy-making and decision-making. Stakeholders, such as governmental authorities, civil society organisations and policy makers, who have an impact on water treatment (and its consideration as a consumer product), together with their powers in influencing public opinion, can be successfully engaged in the implementation of the technologies and drive further impact beyond the completion of the Project.

10. References

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11. Appendix I

Stakeholder Engagement Survey: Questions

AquaSPICE - Task 1.2 - Stakeholder Engagement Survey

This survey is aimed at the stakeholders impacted and/or affected by the AquaSPICE project.

For more information on the AquaSPICE project, please visit the website at:

<https://aquaspice.eu/>

The purpose of the survey is to gather as much information on the organizational profile of the different stakeholders participating in the AquaSPICE project.

Acquiring in-depth knowledge and understanding of the requirements and expectations of the relevant stakeholders will allow the AquaSPICE partners to customize the solutions and pilot technologies to meet end-user specifications; tailoring each solution to match the needs of each business-case and its key actors.

We are always available to discuss further should you wish, to clarify any particulars of this survey or the wider AquaSPICE project. For more information, please feel free to contact the case-study partners via the AquaSPICE website, or us directly at: mikaela.kantor@accelligence.tech

Thank you for taking the time to complete this survey.

***Required**

1. **Email ***

1. **Name ***

Please state your name and relevant title.

2. **Organization ***

Please write the name of your organization.

3. **Referral ***

Please state the name of the person/organization that referred you to this survey.

4. **Country ***

Where is your organization located?

5. **Case-Study Stakeholders ***

To which group of stakeholders of the different AquaSPICE case-studies does your organization relate to?

- DOW, Böhlen, Germany
- DOW, I-Parc Dow Terneuzen, The Netherlands
- SOLVAY, ARETUSA, Tuscany and Marche, Italy
- BASF, WL, Port of Antwerp, Belgium
- AGRICOLA, BACAU County North East Region, Romania
- TUPRAS, Izmit, Turkey
- Other:

6. If you have selected "Other" in the above question, please briefly provide an explanation on how the AquaSPICE project affects your organization as a stakeholder in water management/re-use.

7. How would you define your organization? *

- Inter-governmental/supra-national organization (National/federal/regional/local/other)
- Service Provider (public utility/private operator/other)
- Water resources management institution at subnational level (state water resource management authority, regional water authority, other)
- Regulator (Economic/environmental/other)
- Agricultural actor (farmer/relation association/network/other)
- Civil Society (NGO/community-based organization/Association/other)
- Financial Actor (Financial institution/investor/other)
- Science, academia and research center (please specify)
- Trade Union and workers (engineering/consulting firm/other)
- Other:

8. What are your organization's views on water? *

- Consumer product
- Environmental issue with social/political impact
- Key component for the functioning of the organization
- Material by-product of the functioning of the organization
- Other:

9. What are your organization's primary areas of interest in water? *

- Access to water and sanitation services
- Access to water resources

- Quality of water and sanitation services
 - Quality of water resources Environmental protection
 - Water as a consumer product
 - Other
10. **Is your organization required (in its normal course of business) to engage relevant stakeholders in the process (internal or external)? ***
- Yes (and if so, please explain in question below)
 - No
 - Other:
11. **If you have answered "Yes" on the above question, please provide a brief explanation of such requirements.**
-
-

12. **At which level of governance does your organization participate? ***

- European Union level
- National/Federal level
- Regional/provincial/state level
- Local authority/community level
- Global/International level
- Other:

13. **How does your organization contribute to better water governance? ***

- Supporting effective implementation of a policy, reform or project
Ensuring proper enforcement of regulations and norms
- Raising awareness on water availability, risks, quality, costs etc.
Building/Operating/Maintaining water infrastructure
- Ensuring value for money (i.e. better quality of services/resources at lower costs)
Increasing the willingness to pay of water users
- Contributing to the financial sustainability of water management
- Fostering capacity building, qualifications, training
- Providing funds for investment
- Sharing information on issues and processes of interest to stakeholders
Supporting consensus building (across policy areas, between water users, etc.)
- Developing technical and non-technical innovation (e.g. to protect water resources, prevent risks, deliver services in challenging contexts etc.)
- Fostering corporate social responsibility and codes of conduct
Building trust and confidence
- Building political acceptability (for specific ownership models, delivery options, new technologies, etc.)

- Helping opinion forming and development of preferences
- Other:

14. What problems do you identify in the development of sustainable water solutions in the water treatment process of the European Process Industry, overall? *

Definition of Process Industry: an industry, such as the chemical or petrochemical industry, that is concerned with the processing of bulk resources into other products. For more information on the European Process Industry, please visit: <https://www.spire2030.eu/spire/the-association>

15. What problems do you identify in the development of sustainable watersolutions in your particular location or level of governance? *

For example, you might be facing funding problems, or environmental problems, or lack of technological innovation, or lack of social/political acceptance

16. In your organization's view, which are they key points of effective water management and water re-use in the following area: WASTE WATER MANAGEMENT *

17. In your organization's view, which are they key points of effective water management and water re-use in the following area: WATER QUALITY *

18. In your organization's view, which are they key points of effective water management and water re-use in the following area: WATER QUANTITY *

19. In your organization's view, which of the following indicators is the most important in measuring the success or failure of the AquaSPICE project? *

- Profit margins from selling AquaSPICE solutions
- Effectiveness/efficiency of innovative solution in water management and re-use
- Amount of businesses/organizations adopting AquaSPICE solutions
- Environmental/Social impact
- Success/Failure to establish a community of best practice in the industry
- Other:

20. In your view, which main points should the AquaSPICE project focus on in designing innovative water solutions? Please elaborate on your answer. *

For example: environmental protection, efficient water management, industrial symbiosis, waste water re-use.

21. **How does the current water (re-)use by the European Process Industry affect you (as a stakeholder, per case-study)? ***
- Financially Environmental Social
Political
 - Spatial (land use)
 - Other:
22. **Opinion: "The stakeholders in the water supply/management industry would mutually benefit from creating a community based on shared principles." ***
- Yes
 - No
 - Maybe
23. **Please briefly elaborate on your choice to the above question. ***
-
24. **In which areas could stakeholders of the water supply/re-use industry benefit by creating a community based on shared principles? ***
- Sharing of ideas/innovations
 - Lobbying/leverage in local/national/international authorities and regulators
Industry symbiosis/synergy
 - Inclusive dialogue with all stakeholders
 - Standardization of industry practices
 - Other:
25. **Which end-user requirements should AquaSPICE solutions fulfill in order to be accepted and utilized by your organization? ***
- Environmental protection
 - Socially/politically accepted
 - Ease of operation and access to the solution
 - Cost-efficiency of solution
 - Other:
26. **How do you intend to utilize the pilot technologies of the AquaSPICE project in the course of your business going forward? ***
- Adopt the technology in the everyday workflow of our business
Promote the new technology to our network of partners

- Upgrade our service offering by integrating the technology in our existing services -Added Value
 - Disseminate knowledge and expertise on the pilot technology to the marketSupport other businesses in adopting the pilot technology
 - Use AquaSPICE pilot technology results to develop better work practices and lines of business
 - Other
27. Are you planning on utilizing the technologies in your workstreams? If so, please briefly explain in what ways you will be utilizing the technologies. *
-
28. Briefly provide a list of 2-3 stakeholders or groups of stakeholders you believe would benefit from the AquaSPICE technologies.
-
29. What possible risks does your organization identify in the execution of the AquaSPICE project? *
- For example: financial, social/political acceptance, environmental impact
-
30. What obstacles could the AquaSPICE project face in disseminating information on its technologies and innovations? *
- Provide a brief description of any obstacles you believe could hinder the dissemination of AquaSPICE solutions.
-
31. Which strategy should the AquaSPICE project follow in order to disseminate its solutions? *
- National funding EU/International funding
 - Incentivizing businesses/organizations
 - Lobbying for legislative regulations
 - Other:
32. How can recognition of the AquaSPICE project be effectively increased? *
- Lectures / Seminars
 - Social Media presence
 - Participation in Expos
 - Lobbying in local/national/international levels
 - Other:

Thank you for completing the survey! - AquaSPICE Consortium

12. Appendix II

Stakeholder Engagement – Explanatory Leaflet (Template)

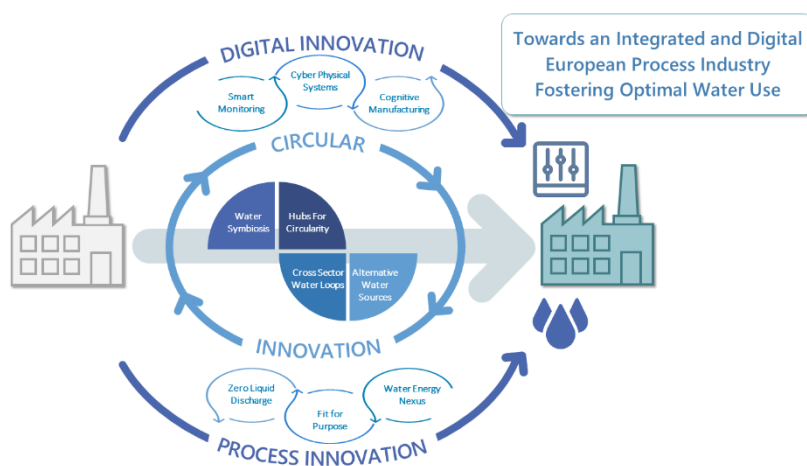
1. Short description

Dear all,

Firstly, thank you for taking the time to participate in the Stakeholder Engagement Survey of the AquaSPICE project (“AquaSPICE”). Your contribution towards the purposes of the project is greatly appreciated and your input will enable us to design our solutions in the most suitable and beneficial manner for the entire water industry, to which you are also a key player.

AquaSPICE is a **Horizon 2020 SPIRE** project and kicked-off its workings in December 2020. The aim of the project is to materialise circular water use in the European Process Industries and foster awareness in resource-efficiency. It delivers compact solutions for industrial applications, including water treatment and reuse technologies and closed-loop water recycling practices. The project will also deliver

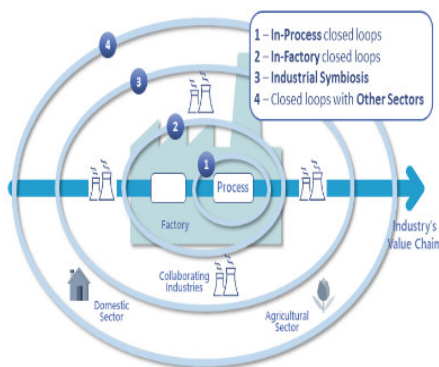
an innovative cyber-physical-system (WaterCPS) including a system for real-time monitoring, assessment and optimisation of water use and reuse at different interconnected levels.



The AquaSPICE project has further recently joined the ICT4WATER cluster. We plan to contribute to relevant activities of the Action Groups. Due to the strong IT/IoT content of the project, we are mainly considering a particular contribution to the Smart Water AG and collaboration with the DW2020 synergy group.

The project follows a systemic approach in water management where optimal efficiency can be achieved through an adaptation of appropriate technologies and practices in different levels, from a single industrial process (unit operation), to an entire factory, to other collaborating industries (industrial symbiosis) or other sectors (e.g. domestic and/or agriculture).





You can find more information on AquaSPICE on our website or LinkedIn channels at: <https://aquaspice.eu/> & [LinkedIn](#).

2. Stakeholder Engagement Survey

Please follow this link to complete the Survey: <https://forms.gle/a2h6brKdN6Fv3xDE8>

The purpose of stakeholder engagement in AquaSPICE is to create, from the onset of the project, a business-case oriented approach to the pilot technologies and solutions to be designed and developed.

Through the [Survey](#) we aim to collect information from stakeholders who are actively engaged and/or affected by AquaSPICE, so as to **identify their specific user requirements** with regards to water and water re-usage. Our purpose is to initiate a **consideration in the industry of “water as a product”** and enable us to lead outreach activities to potential external water users in industrial and other sectors.

This enables us to effectively **define each business-case** and **evaluate stakeholder inclusiveness** and engagement before the implementation of the pilot technologies in each case study.

Further, an important element of our task is the establishment of a **co-creation environment** whereby all relevant stakeholders will be encouraged to utilize the AquaSPICE technologies in their respective markets post-project.

You can find out more information about the particular Case Study to which you are mostly related to below.

3. Case Study Details – [NAME OF CASE STUDY, LOCATION]

Case Study #:

Description of the Partner:

Problems faced:

Stakeholders:

Objectives to be achieved via AquaSPICE:

13. Appendix III

Summaries of Responses - in charts –

What are your organization's views on water?

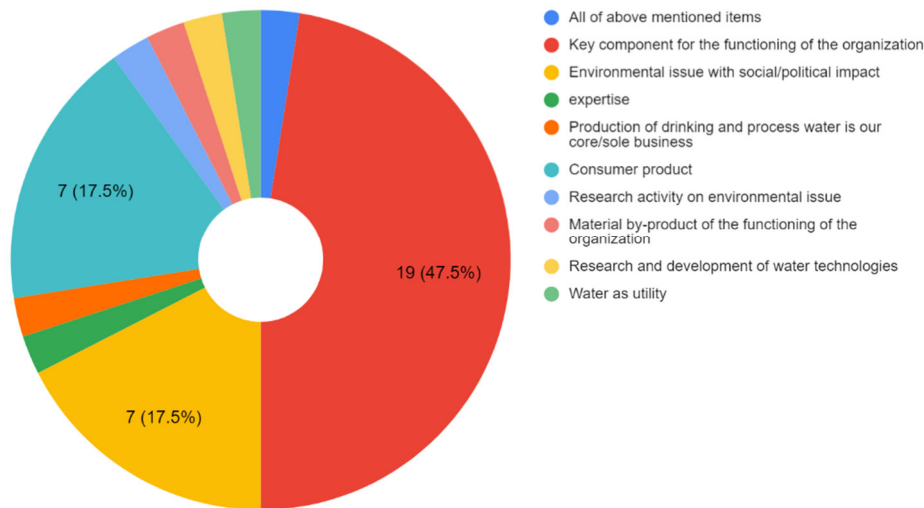


Figure 4: Answers to Question 8 "What are your organization's views on water?"

Opinion: "The stakeholders in the water supply/management industry would mutually benefit from creating a community based on shared principles."

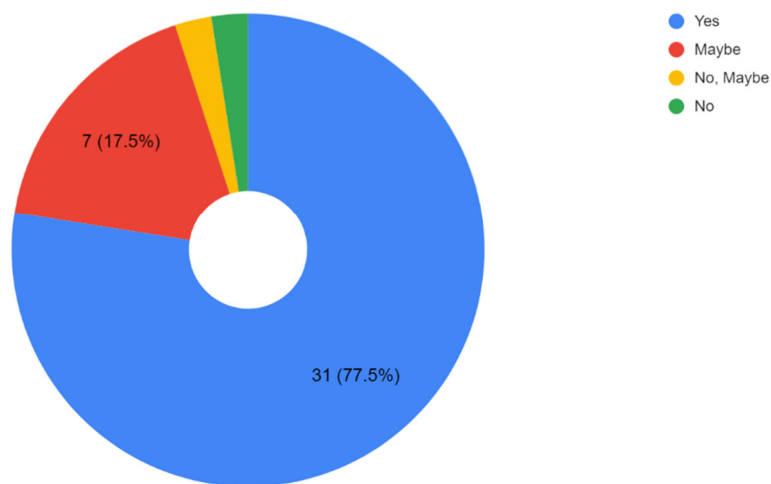


Figure 5: Answers to Question 23 "The stakeholders in the water supply/management industry would mutually benefit from creating a community based on shared principles".

In which areas could stakeholders of the water supply/re-use industry benefit by creating a community based on shared principles?

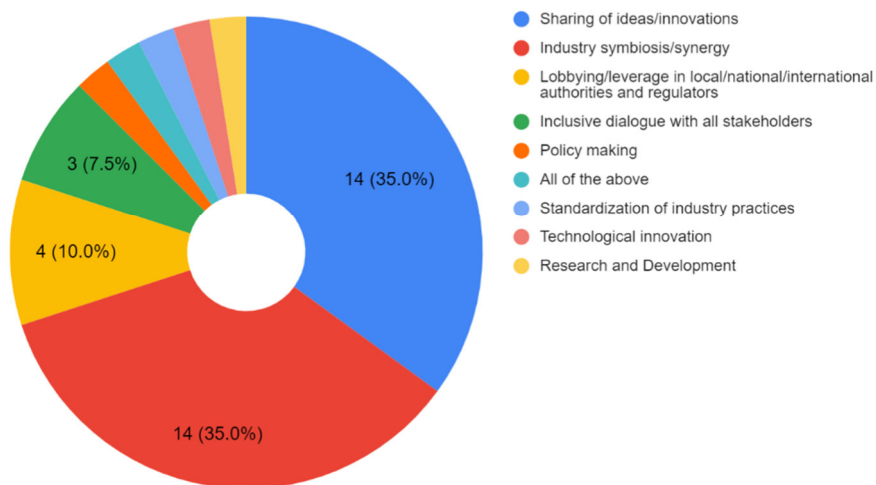


Figure 6: Answers to Question 24 “In which areas could stakeholders of the water supply/re-use industry benefit by creating a community based on shared principles?”.

Which end-user requirements should AquaSPICE solutions fulfill in order to be accepted and utilized by your organisation?

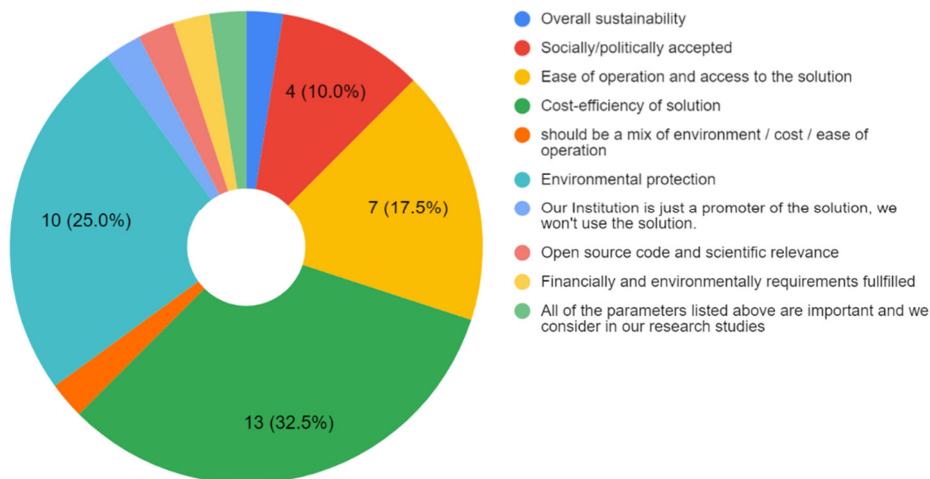


Figure 7: Answers to Question 25 “Which end-user requirements should AquaSPICE solutions fulfill in order to be accepted and utilized by your organization?”

14. Appendix IV

Technical Questionnaire (Template)

Questionnaire #1

Template

Case Study X	[TITLE]
1. OVERVIEW	
<p>1.1. Value chain and involved actors (if in the scope of AquaSPICE)</p> <p>1.1.1 Overview of the value chain</p> <p>1.1.2 Actors (roles and machines) and contributions in the value chain</p> <hr/> <p>1.2. Major Stakeholders that need to be involved in project consultations</p> <ul style="list-style-type: none"> • <u>CS company experts / Regional Managers / Business Unit Managers:</u> • <u>Other management personnel / senior management company personnel/ key partner companies:</u> <p>Name: Contact Details:</p> <ul style="list-style-type: none"> • <u>Corporate Social Responsibility Team(s):</u> <p>Name: Contact Details:</p> <ul style="list-style-type: none"> • <u>Public Authority Personnel / Local Authority Officials:</u> <p>Name: Contact Details:</p> <ul style="list-style-type: none"> • <u>Governmental Authority Representatives/ relevant Ministry Officials:</u> <p>Name: Contact Details: <u>Other key players/actors in the area/industry</u></p>	
1.3. Description of the raw water or wastewater stream(s) relevant for AquaSPICE	

<p>1.3.1. Indicate the raw water/ wastewater streams with a short description (related to AquaSPICE):</p> <p>1.3.2. How is the stream generated?</p> <p>1.3.3. If applicable, provide current final disposal or (re)use of the stream & related effluent quality guidelines/limits imposed by the Environmental regulator/agency</p> <p>1.3.4. Describe seasonal effects (if applicable and relevant for the project):</p> <p>1.3.5. Characterization of the stream to be treated by AquaSPICE solution</p>
1.4. Additional information
2. AS-IS SITUATION (current scenario without AquaSPICE)
2.1. Description of current treatment scheme(s) of the (raw) water or wastewater stream(s) relevant for AquaSPICE
2.2. Existing closed loops (intra-factory or across the value chain)
2.3. Process flow diagram(s) of current treatment scheme(s)
2.4. Characterization of the stream after current treatment (only necessary if different from data provided in 1.3.5)
<p>2.5. Existing ICT infrastructure (ICT systems, sensors, ...)</p> <p>2.5.1. Are there any sensor networks deployed to control the process? Which sensors are deployed and what data are they collecting? What is their purpose? What communication technologies are used? What are the control units (SCADA, PLC, etc..)?</p> <p>2.5.2. Are there any other software elements, different from sensor networks, being used to control the process (e.g.: ERP, CRM, etc..)?? What is their purpose? How the information they hold can contribute to the project?</p>
2.6. Additional information
3. TO-BE SITUATION with AquaSPICE (Objective and treatment scheme(s) to be investigated within AquaSPICE)
3.1. Needs and areas of improvement (Main parameter(s) to be improved within AquaSPICE; If there is a current treatment scheme, why does it need to be improved?)
<p>3.2. Brief optimization request (related to parameters indicated in 3.1). Please provide a:</p> <p>a) Short verbal description of the problem we want to solve, in terms of an objective (what is to be optimised)</p> <p>b) Set of decisions (what can be the different options to solve the problem)</p> <p>c) Set of constraints (what parameters govern sets of feasible options)</p>

3.3. Key performance indicators (KPI)

KPI	Impact within the AquaSPICE project	Relative priority

3.4. Treatment scheme to be investigated within AquaSPICE

3.4.1. Short description of the sequence of treatment units to be investigated within AquaSPICE

3.4.2. Treatment capacity of the units to be tested within AquaSPICE and its related wastewater stream

3.5. Closed loop practices to be tested (intra-factory or across the value chain)

3.6. Process flow diagram of treatment scheme(s) to be investigated within AquaSPICE

3.7. Desired quality of the stream treated with AquaSPICE solution

3.8. Use of the treated or recycled water

3.8.1. Expected use of the treated or recycled water

3.8.2. Related regulations to be fulfilled (for example for recycled water reuse or intended use)

3.9 Water Efficiency Problem Detection, Route-Cause Analysis and Remedial Action

Please provide examples of data that can be analysed in order to detect or predict water efficiency problems and find the route-causes. Possibly also data that can be used to identify remedial actions to these problems. Please send a sample file for each row in the table below.

ID	Data Source	Frequency	Data Format	Availability	Realtime	Historical	Type

Key: ID: An identified of the data source; Data Source: The data source may be a sensor, an industrial automation or enterprise system (e.g. PI, SAP, etc.) or other systems/databases; Frequency: The average frequency of measurements/records for each data source (e.g. 1 minute, 1 day, 1 week, etc.); Data Format: The format in which the data are currently available (e.g. CSC, JSON etc.); Availability: How the data will be available to the project (e.g. through API, MySQL, Excel sheets, etc.); Realtime: Real time or near real time data availability (Y/N); Historical: Availability of historical data (Y/N); Type (sensor/other e.g., lab data, quality-related, enterprise data, etc.)

3.10 Additional information

4. PERMITS & ETHIC REQUIREMENTS IN RELATION TO AquaSPICE PILOT STUDIES

4.1. Permits

- 4.1.1. General permits
- 4.1.2. Permits to enter the industrial site

4.2. Requirements

- 4.2.1. Insurance requirements
- 4.2.2. Export requirements
- 4.2.3. Environmental requirements
- 4.2.4. Ethics requirements - Contact person for information sheet and informed consent from case study users

4.3. Additional information

Table 1. (If there are several streams to be treated, please copy this table, and fill it for every stream)

Stream nr: 1	Current situation									Desired situation	
	Please fill with "x" if the parameter is measured online (i.e. sensor connected with PLC)	Characteristics of the stream to be treated within AquaSPICE solution				Characteristics of the stream after current treatment				Please fill with "M" if the parameter needs to be monitored. Add also an "*" if it needs to be monitored online	Desired characteristics of the stream treated with AquaSPICE solution
Min		Av.	Max	Data range available	Min	Av.	Max	Data range available			
Flowrate (m ³ /day)											
Temperature (°C)											
COD (mg O ₂ /l)											
TOC (mg/l)											
BOD ₅ (mg O ₂ /l)											
pH											
Alkalinity (mg/l)											
TDS (mg/l)											
Conductivity (µS/cm)											
TSS (mg/l)											
Turbidity (NTU)											
VSS (mg/l)											
PO ₄ ³⁻ (mg/l)											
Total phosphorus (mg P/l)											
TKN (mg N/l)											
N- NH ₄ ⁺ (mg N/l)											
N- NO ₃ ⁻ (mg N/l)											
Total nitrogen (mg N/l)											
S ₂ - (mg/l)											

<i>E.coli</i> (CFU/100 ml)											
<i>Legionella</i> <i>spp.</i> (CFU/l)											
<i>Please introduce more rows to add other compounds to be monitored (ions, metals, contaminants etc.)</i>											
<p>Where: COD: chemical oxygen demand; TOC: total organic carbon; BOD₅: biochemical oxygen demand; TSS: total suspended solids; TDS: total dissolved solids, VSS: volatile suspended solids, TKN: Total Kjeldahl nitrogen N.D.: not determined, N.A.: not applied.</p>											