COMMUNITIES OF PRACTICE REPORT #3

Documentation of events and achievements

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Abstract	This final report documents the activities of the five local Communities of Practice (CoP) and the DWC project CoP. The first section offers a retrospective of DWC and describes the CoPs operating, including their aims and goals. The second section reports and updates the activities carried out in the five local CoPs (i.e. DWC Berlin, DWC Copenhagen, DWC Milan, DWC Paris and DWC Sofia). Then, the events organized for the Intra-Project CoP throughout the action are documented. A third section presents an evaluation of the co-creation process of DWC and its CoPs. Finally, four annexes provide support information which has been shared with the CoP leaders to facilitate the setting up and operation of the CoPs.

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Dissemination level of the document

X	PU	Public
	PP	Restricted to other programme participants
	RE	Restricted to a group specified by the consortium
	CO	Confidential, only for members of the consortium

Versioning and contribution history

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D2	17/11/2022	I-CATALIST	Formatting and update
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* The version convention of the deliverables is described in the Project Management Handbook (D7.1). *D* for draft, *R* for draft following internal review, *S* for submitted to the EC (under external review) and *V*for approved by the EC.

Note that previous version to *V* are draft since they are not yet approved by the EC.

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Table of contents

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Executive summary

The EU water sector is under pressure, the urban growing population, urbanization, climate change, agricultural and industrial activities, are leading to pollution, overexploitation and modification of water bodies, water scarcity etc. These issues represent challenges for the sector, such as ensuring good policy fit, ensuring regulation standards and boundaries, overcoming institutional limitations, addressing slow innovation rate, overcoming low awareness and engagement of users.

During more than three years, digital-water.city (DWC) attempted to face the challenges of the field of water, by developing 15 innovative digital solutions for water and sanitation infrastructure in five European cities. In order to gather researchers, public and private actors of the water sector, the project implemented a participative approach, through co-creation and Communities of Practice (CoP). These CoPs, articulated at different scales and levels, provided exchange of knowledge between DWC cities. (i.e. with a focus on learning exchange) and between DWC cities and technical work packages (with a focus on cross-fertilization). They were made up of actors from various backgrounds, fields and expertise with the common goal of contributing to the development of digital solutions and facilitating their local adoption. DWC brought together project partners and external stakeholders under a 3-level CoP scheme: i) local level (city scale); ii) intra-project level (mutual learning and knowledge exchange between city actors) and iii) (3) trans-project level.

DWC comes to an end in November 2022. Briefly reminding the objectives of the project and the specific-sector challenges, this report brings a retrospective of the project and the co-creation process within the CoPs. The last intra-project CoPs organized are also presented, as well as an update of the Local CoPs activities, and the evaluation realized with the actors of the project on the co-creation process within the CoPs. This evaluation took place through a multi-case study, like a summary on each city and a survey applied to different actors of the project, followed by a live session of exchanges between the participants. It was the opportunity before the project ends to discuss the contribution of the co-creation within the CoPs, if the objectives in terms of co-creation were achieved, what values have been added to the project, and what possible barriers and successes. Presenting the conclusions on the co-creation process, the report also proposes some recommendations based on the results and feedback of the community of actors DWC created or reinforced.

Information on the document update

This document updates the previous version of the deliverable, due in M30.The following sections have been updated

- Section 2.2 with information related to the last activities of the Local CoPs
- Section 3 with information related to the last Project CoPs organized
- Section 4 with information related to the conclusions of the co-creation process and the CoPs and their added value to the project

Following reviewers' comments, the following sections have been updated

- Section 4 has been totally re-organized with titles, bullet points and rephrasing has been done to better synthesize the information and results regarding co-creation.
- Conclusions have been revised to better highlight achievements, process and format used for the CoPs

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1. CO-CREATION & COMMUNITIES OF PRACTICE WITHIN DWC

1.1. European urban water management: issues and challenges for DWC

The EU water sector is facing increasing issues, such as pollution, overexploitation and modification of water bodies, due to increasing pressures, from growing population, urbanization, climate change, agricultural and industrial activities etc. Water scarcity is due to the increase in water demand and a reduction in availability, which is a serious problem in arid and semi-arid areas of Europe. Too little or too much water can have detrimental effects on water quality, and when water quality is threatened, it can also reduce availability of water. These issues impact the functioning and management of the entire water sector and all the stakeholders involved in it, and these changes represent various challenges for all. In a context where optimizing efficiency, innovation, and awareness of the water management infrastructures is necessary, sector-specific challenges are highlighted, such as: ensuring good policy fit (policy and regulation standards and boundaries), overcoming institutional limitations and improving awareness and engagement of users. The challenges of the aging of infrastructure and shortage (and a long investment cycle) can be an obstacle to innovation, lack of information, communication and technology, for example for the necessary monitoring of water quality and use. Also, users' awareness and engagement are fundamental and can be put in place by raising awareness on the resource management and use, or the uninterrupted access to drinking water and its implications.

To face these challenges, digital solutions can help, but they can also face a low level of maturity concerning the aspects of standardization, interoperability, cybersecurity and governance, and there is a lack of hard evidence of the benefits brought by digital solutions at each level of the water value chain. Some promising innovations often do not reach real applications, due to a lack of an integrated business model, social and technical preparation, and need to include expectations and needs of end-users. An integrated multi-scale management of the water sector involves a complex interaction of agents: political, economic, social, academic actors, and it is necessary to focus on solution integration and governance for successful adoption, integrating multi-scale management of the complex interaction of agents: political, economic, social, academics. Furthermore, long term implementation by utilities can often only be derived from a transparent approach to social communication and co-creation (Stein et al., 2022) as well as from enhanced participation of the various stakeholders.

Through a transversal and participative project across Europe, the digital-water.city project (DWC) developed local technological solutions over three years for five European cities (Berlin, Copenhagen, Sofia, Milan and Paris). Gathering different actors. DWC aimed to strengthen and maximize their collaboration by setting up multi-scale and multi-actor Communities of Practice (CoPs). Within these CoPs, a co-creation process was carried out throughout the whole project. An evaluation of this co-creation process raises the following questions: (1) what are the role and impact of the co-creation process within the CoPs of the DWC project, (2) how may or may not have the co-creation contributed to the achievement of the objectives pursued, and (3) What lessons can be derived to support the success of future co-creation activities in the field of water management. To answer these questions, five case studies are presented and a questionnaire was set up and answered by the cities and some innovators. The results are presented and discussed in this report.

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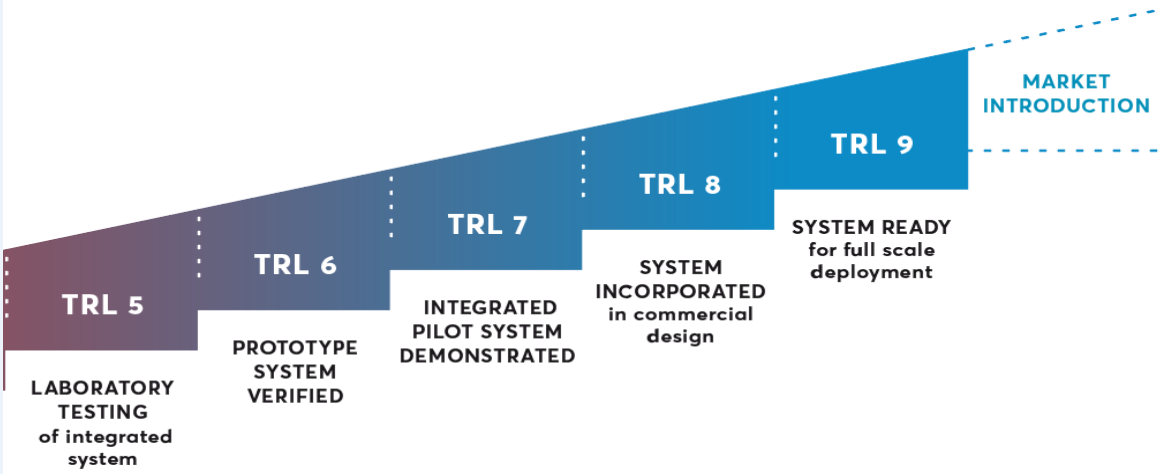
DWC CHALLENGE

European cities face major challenges to achieve the desired level of sustainability in the management of urban water, and innovative (digital) solutions are often needed. However…

- ✔ There is often a low level of maturity of digital solutions regarding standardization, interoperability, cybersecurity and governance aspects
- ✔ There is a lack of tangible evidence of the benefits provided by digital solutions at each management level across the water value chain
- ✔ Promising innovations do often fail to reach the market. (The gap from TRL5-6 – 'tested pilot' to TRL9 – 'market ready'-, is often referred as the 'Valley of Death'). This is often due to a lack of an integrated market, social and technical readiness and misalignment with end-users' concrete expectations and needs.



1.2. Co-Creation & Communities of Practice

A co-creation and engagement process was decided for the project DWC, with the use of Communities of practice as a central tool to help face these issues through collaboration between different actors and overcome barriers from innovation to practice. The aim was to achieve an interdisciplinary and transdisciplinary approach through the integration of outcomes from several disciplines, and from academic and non-academic and non-formalized knowledge. This implies that CoPs participated in both the formulation of objectives and the expected results.

Value co-creation, introduced in the early 2000s by Prahalad and Ramaswamy (Leclercq et al., 2016), is when the actors engage in a process by interacting and exchanging their resources, acknowledging a more constructive role for the customer or end-user in the market value creation process (Galvagno and Dalli, 2014). The community of practice (CoP) can be defined as "a group of large and diverse actors who may be relevant to solving a problem and may be available to share and join experiences, skills, ideas, resources, actions to go further by adopting collective principles and shared societal challenges". The CoPs set a dynamic learning process and a living collective body which in the case of DWC, should evolve by building trust between partners and joint achievements, to the development of digital solutions that could be best adapted to the needs, and facilitate their local adoption. They are built of public, private and academic stakeholders from different backgrounds, fields and expertise,

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with the common goal of contributing to the development of advanced and innovative digital solutions for water and sanitation infrastructure.

The integrated multi scale management of the water sector and its complex interaction of political, economic, social, academic agents are a challenge that DWC had to face. Each of the agents has specific needs, expectations, concerns.

In order to implement the participatory process of exchange learning and face this multi scale and type of actors, the particularity and uniqueness of DWC was the setting of different CoPs across three levels, as presented in the Figure 1 below.

Figure 1.Multi level Communities of Practice of DWC

- Local CoPs (level 1) have been operationalised in four European cities (i.e. Berlin, Copenhagen, Milan and Paris) with a main focus in supporting the potential adoption of new solutions in the local contexts. The role of these CoPs has gone far beyond an approach where non-researchers are given an inactive role, simply seen as 'data providers' and/or 'end users'; Local CoPs for example have aimed to: create during the project a long-term collaborative environment at the city level; increase knowledge exchange among local actors; democratize data access; support the integration of stakeholder knowledge and expectations into the development of solutions; and co-build trust of external stakeholders in the future use of solutions. Local CoPs have provided direct support to innovators to test and/or implement digital solutions in practical contexts, build trust in the usefulness and relevance of the solutions and use, receive specific requirements and specific user needs identified throughout the later stages of development. This is all the more relevant as innovations may tend to focus on technical aspects and partially neglect to take into account problems or difficulties related to the daily routines of end users. In addition, each of the cities had different contextual challenges to face, and had to develop adapted solutions and activities, collaborating with local key actors and populations. In another city, (i.e. Sofia) the local CoP has mainly focused on communication and awareness raising aspects. The general roadmap and the details of each Local CoPs are described in the next section.

- Project CoP (level 2) provided a useful mechanism to facilitate knowledge exchange between DWC cities (mutual learning) and between DWC cities and technical partners (cross-fertilization). In terms of mutual learning, it was the opportunity for the cities to exchange

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their experiences regarding the development of digital solutions, while comparing these innovations to current solutions used to address similar problems. The objective of these activities was to identify drivers and barriers to the adoption of new digital solutions. This work helped highlight key transferability issues for successful adoption of the solutions in a different context. Key aspects to address include reflecting on the results of the local demonstration: what worked well (key factors), what were the implementation issues (main barriers and drawbacks), what could have been done differently, and what that would be considered for reproduction in another setting. In terms of cross-fertilization, this CoP provided a space for discussion around cross-cutting topics addressed by the project (such as cyber-security, interoperability, digital governance etc.), where technical partners and DWC cities met and shared doubts and experiences. The project CoP is facilitated by ICA (as leader of task 5.1) and KWB (as project coordinator). In general, the project CoP meetings took place in coincidence with other project meetings, e.g. General Assembly or WP technical meetings, taking advantage of the organization of a larger meeting where many of the project CoP members were also attending. Project CoP was planned to convene once a year in the initial two years of the project, and at least twice per year in the final two years. The last year of the project (2022), three Project CoP were organized, as described in section 3. of this report.

- Trans-project CoP (level 3) focused on networking and grouping activities with other related projects and actions. This CoP benefitted from an initiative, namely DigitalWater2020, partnering five sister projects funded under H2020 programme to identify synergies and collaboration opportunities on several aspects, i.e., data models and ontology; sensors; market; and communication. DWC has foreseen a specific CoP focusing on networking and clustering activities with other projects and related actions. This was led by KWB (as project coordinator). The goal was to identify and take advantage of synergies and complementarities with five sister projects funded under H2020. This is addressed through four task forces for (1) data models, (2) sensors, (3) market and (4) communication, one of them (market uptake) coordinated by a DWC partner (Ecologic Institute). The active participation of DWC members in this initiative will facilitate the networking activity of DWC local and project CoPs. A series of events were organized to gather all 21 utilities of the sister projects in order to promote DWC solutions to other utilities in Europe and, for DWC utilities, to learn about other promising solutions developed in the other projects and to create awareness of the DWC solutions. The first webinar highlighted digital solutions related to water bodies, sewer network and WWTP. A second webinar focused on drinking water and reuse. DWC will be represented with various presentations of our digital solutions by our utility partners (BWB, SV, BIOFOS, SIAAP for this first session; CAP at the second). The activity of DWC in DigitalWater2020 is reported extensively in a dedicated deliverable[1].

[1] DWC Deliverable 7.5, Synergies inside the portfolio of SC05-11-2018 projects

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2. ACTIVITY OF DWC LOCAL COPs

2.1. General roadmap for the Local CoPs

DWC Local CoPs had a general planning, however it was important to remain flexible and adapt every format to each context, and to the main agreements and points of interest that came up from the activities with stakeholders, as well as to the progress in the development of the digital solutions.

With a initial design of local CoPs (see ANNEX 1. for more details), a general roadmap was agreed with all city leaders, including a timeline and a list of the main actors to be involved[2]. For example, in Berlin and Milan, some stakeholders needed to be engaged from the beginning of the project, and initial development stages of the solutions. Regular local CoPs activities for both cities had been planned. A number of external actors were specifically interested in capturing the benefits that may be provided by the new digital solutions, and in collaborating to increase their potential for adoption. In Copenhagen, water utilities in the larger region were the main actors to be engaged. The project was benefitting from an existing working group involving these utilities. They were regularly met to share experiences and improve coordination of tasks for integrative water management. In Paris there were also several working groups and a broader Community of Practice composed of several actors collaborating to improve water quality in river Seine with the 2024 Olympic Games as reference. DWC activities incorporated on this existing frame. In Sofia, the engagement of external stakeholders was planned to be more important once some results were available. The local CoP activity was initially limited and focused mostly on providing information and communicating about DWC.

2.2. Activities of Local CoPs in each city

As was suggested for local CoP, different types of activities were implemented including an informative phase, an update of all members on project progress and accomplishments, other types of more interactive activities, for example: brainstorming for identification of end-user needs and requirements; participation in testing or demonstration events; presentation of preliminary results or beta versions of prototypes; brainstorming on how to consider transversal issues into the implementation of the digital solutions (interoperability, cybersecurity, public awareness, governance, etc.); communication and networking events (e.g. linking to local initiatives or ongoing projects); etc.

The five cities organized an initial presentation meeting to introduce the DWC project to the key target stakeholders and to identify other stakeholders that could be interested in joining the CoP activities. A supporting guideline for the preparation of this presentation meeting has been drafted, including additional information for the organization of participatory processes (see ANNEX2.). Activities carried out in each of the five DWC cities are described within the following sub-sections. The templates for reporting each event or specific participatory activity are included in ANNEX 3..

A recapitulative of each Local CoPs activity is presented in the next sections, building on the previous Communities of Practice report#2, submitted at M31.

2.2.1. DWC Berlin

[2] This information was included in an internal document called “Guidelines to support DWC local CoPs” produced as means of verification for milestone 5.1.

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The initial activity of DWC Berlin was the organization of a **press conference** (Figure 1) in September 2019. It was aimed to present the DWC project, as well as the main planned activities in Berlin, to key stakeholders and the general public. This press conference was managed by the BWB communication team.

Figure 2. DWC press conference in Berlin on September 2019

Meanwhile, in September 2019, DWC Berlin (name of the Local DWC CoP in Berlin) held their **first meeting**, with attendance of a group of around 20-25 people representing project technical partners (KWB, BWB, Ecologic institute), project innovators (e.g. Vragments), and representatives from several public institutions (Water Authority, Berlin Senate Department for Economics, Energy and Business and Berlin Partner GmbH).

The meeting included a presentation of the DWC project (e.g. project structure and key goals and ambition), a short presentation of the DWC digital solutions being developed and implemented in Berlin, and a participatory workshop.

Attendants were explained the concept of local communities of practice in DWC, describing our goal of considering water management in the city as a whole, and facilitating that local stakeholders benefit from the developed digital solutions. Furthermore, they were also explained the DWC offer to include expectations and requirements of local stakeholders into the development of digital solutions.

As part of the workshop, attendants provided their opinion and feedback (see example in picture below) on a number of specific questions:

- What barriers to digitalization do you encounter in your daily work?
- What is your assessment of the degree of digitalization in your institution?
- What are your expectations of the products developed in DWC Berlin?
- Which DWC digital solutions are more interesting for your institution?
- What synergies do you see between the solutions developed in DWC Berlin and your work?

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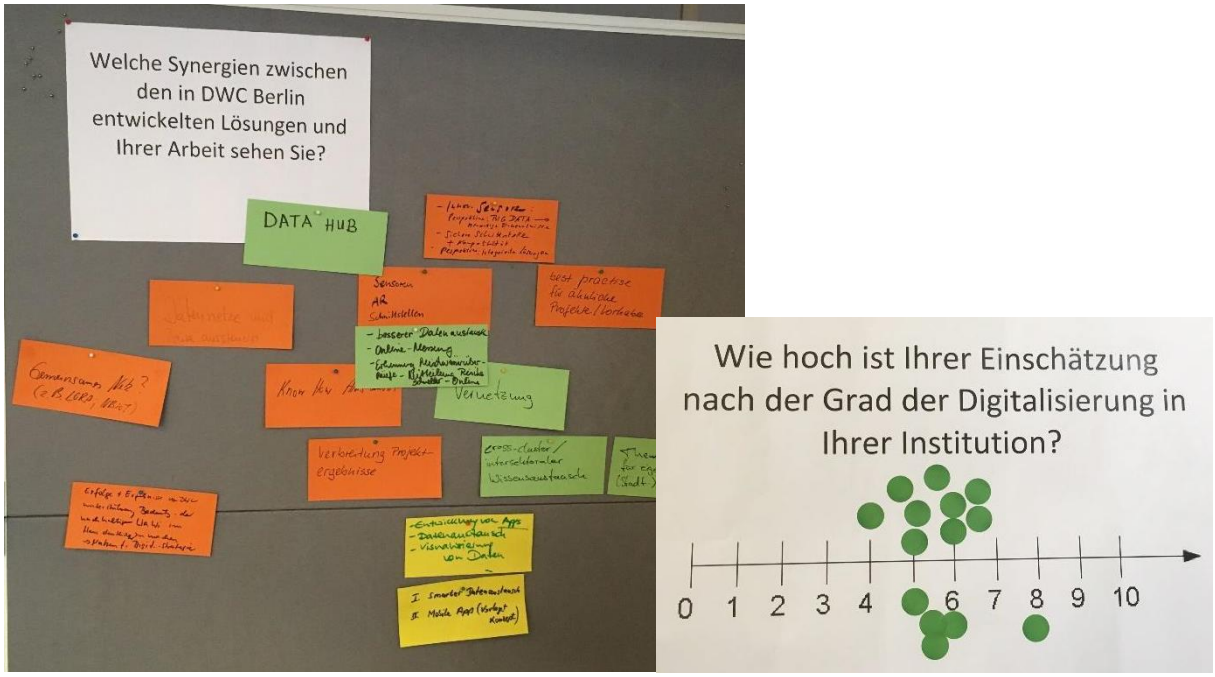

Figure 3. Examples of feedback from the 1st participatory workshop of DWC Berlin

The methods and results obtained in this meeting were presented to the other DWC cities in the first project General assembly (Berlin, September 2019).

The **second DWC Berlin meeting** was organised in June 2020. Prior to this meeting, a newsletter was forwarded to the list of stakeholders included in the local CoP. This is a short online document structured in four sections:

- General project information
- Ongoing activities and outcomes in Berlin
- Feedback from last DWC Berlin
- Agenda of the next DWC Berlin

This second CoP meeting had two main objectives: i) to inform the DWC Berlin partners about the status of the project and ii) to further determine the expectations of the partners in Berlin regarding the digital solutions developed.

The second meeting had a workshop format (using a brainstorming/exchange approach) and the main focus was to discuss with several stakeholders about the expectations and potential collaboration in the development of the augmented reality groundwater visualization tool in Berlin, after a presentation of the advances made in this solution and planned next steps. All participants attending the first DWC Berlin meeting were invited and kept informed about further progress in DWC. The atmosphere in the second meeting was already showing confidence and trust from the invited participants that their input was taken seriously. e.g. developing the augmented reality tool.

Other topics for future meetings (e.g. data exchange; use of FIWARE) were also explored.

The **third DWC Berlin** meeting was held as a virtual workshop in February 2021. This time, the status and perspectives for digital data exchange between different public stakeholders in Berlin was discussed. The Federal Department of Environment, Traffic and Climate Protection (SenUVK) presented the functionalities, perspectives and future of the online platform “WasserportalBerlin“ –a

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data share point for ground and surface water quantity and quality specific data (https://wasserportal.berlin.de/). Its functionality is still a compromise between data security, safety and personal data protection. The drawbacks are mentioned due to the fact that the Water Sector is Critical Infrastructure. In a second presentation, Berliner Wasserbetriebe gave an overview on the collection and maintenance of data on groundwater. Within the framework of DWC, data from the groundwater monitoring wells of Berliner Wasserbetriebe are integrated into the "WasserportalBerlin". The requirements for data exchange were discussed considering the fact that the water sector is critical infrastructure. In a final contribution, the Citizen App of the city of Thessaloniki was presented by TasosKarakostas and Yiannis Tsampoulatidis and enabled the Berlin stakeholders to "look beyond their own nose". Although the interaction was limited to a virtual meeting, the 24 experts had an intensive discussion during the three hours meeting and gave their view on the topic.

The COP input is being used to focus the project's work on the identified pain points: balancing open access to public data with security requirements of critical infrastructure - which data should be transparent for the general public.

Figure 4.Screenshot of virtual DWC Berlin meeting#3

For the **fourth COP event in Berlin**, it was decided to present the work of the DWC Berlin group in KWB's public format "Berliner Wasserwerkstatt", an afternoon event for water experts and interested people with an average attendance of 70 – 80 participants. In the 50th edition of the "Berliner Wasserwerkstatt" on October 14, 2021, "Digital-Water.City" was on the agenda to promote the project to a broader public. The participants were informed about the success of the EU-project "DWC" and the following presentations were held:

- Europe-wide investigations into the possible uses of digital applications in the water sector Digital-Water.City: project overview (Dr. Hella Schwarzmüller, Dr. Nicolas Caradot, Kompetenzzentrum Wasser Berlin).
- Searching for false connections in stormwater sewers with mobile sensor technology and data analysis (Michel Gunkel, Berliner Wasserbetriebe)

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- A look into Berlin's groundwater: using augmented reality to visualize invisible processes (Vragments GmbH, Berlin)

In addition, experts from the stakeholder group DWC Berlin (CoP) were invited to reflect on the added value of the project for Berlin in a panel discussion. Dr. Sebastian Hoppe (Berlin State Office for Health and Social Affairs), Dr. Jürgen Varnhorn (Senate Department for Economy, Energy and Education), Matthias Rehfeld-Klein (Senate Department for Environment, Transport and Climate) and Hannes Lebert (Berlin Partner Berlin) discussed with Regina Gnirss (Berliner Wasserbetriebe) how the results of EU projects like DWC are transferred into practice and how which role the communities of practice (CoPs) play. The received feedback clearly showed the importance of the discussed topics and a lack of public awareness.

2.2.2. DWC Copenhagen

The DWC local CoP in Copenhagen (DWC Copenhagen) took advantage of an ongoing operational group for integrated water management involving BIOFOS and other water utilities in the Copenhagen greater region. This group includes the key actors to support the development of the digital solutions being developed and tested in Copenhagen. This operational group consists of a set of stakeholders meeting regularly and sharing expectations which can be used for our product development. In particular, the feedback from other water utilities is very relevant to the development of the "Web platform for integrated sewer and wastewater treatment plant control", which in addition is directly related to other two DWC solutions (i.e. sewer flow forecast toolbox, and the interoperable DSS for stormwater management). This is an interoperable visualisation platform that provides data and analytics to all stakeholders responsible for the integrated management of sewer networks and wastewater treatment plants (WWTPs) in an urban area. The scope and ambition of DWC Copenhagen, as well as the digital solutions, were presented to the group during one of the regular meetings.

As a formal activity, an online workshop was organized on February 4th, 2021 to collect feedback on the use of actual SAMDUS system (i.e. "Web platform for integrated sewer and wastewater treatment plant control") as well as the expectations of key stakeholders on the update of this system. The platform enables the sharing and visualisation of data from a series of sensors, models and decision support systems. It integrates the total system dynamics and facilitates real-time decision-making across all utilities and entities, increasing preparedness for high-flow events.

The workshop was designed as an online exercise using Google Jamboard tool. Attendants replied to six specific questions by sharing boards where their answers were published (organised in clusters containing similar answers) and shared with the other participants.

The workshop was organized by BIOFOS with specific support from ICATALIST in the design and moderation of the activity. Based on the expressed needs from BIOFOS for this workshop, the "**pentagonal problem**" technique was used as a basis for collecting feedback and expectations although a number of changes were introduced in order to put the focus on our need to identify specific features that could be implemented into the web platform. Pentagonal Problem is a visual tool to help teams or a group of stakeholders to nail down a "problem" by identifying its different components and looking for shared and divergent points of view. The final aim is to set a common ground for future actions. In our adaptation of the method, we went one step further by completing the analysis of the problem (in this case by analysing expectations) and then going beyond by identifying useful features and attributes that could be implemented into the tool while considering the information previously generated.

The approach used for the activity is summarised in the figure 5.

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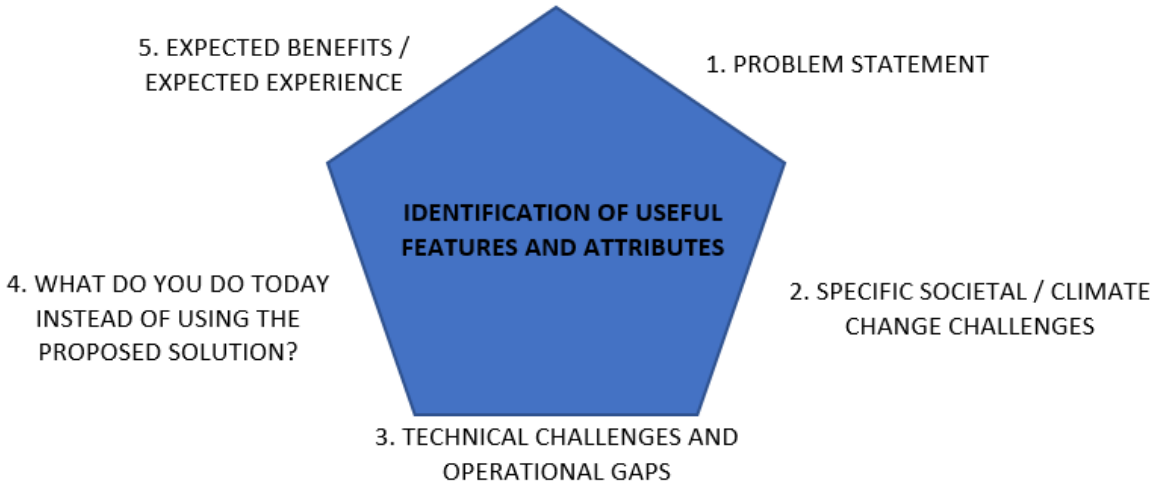

Figure 5. Scheme of the adapted pentagonal problem technique.

The participants provided several answers to six specific questions

- What are you using the current SAMDUS system for?
- Try to describe in a few words your expectations for an updated web platform.
- Societal challenges: what are the key benefits to society, potentially delivered through the implementation of the solution?
- Technical challenges and operational gaps
- What do you do today to get an overview over the catchment instead of using this solution?
- Expected benefits / Expected experience

This information was collected in a systemic way (systemic components related to the expectations from the new solution), allowing to put into common these different views and expectations for the new digital solution and then to diving deeper into the comprehension of the overall context and the specific attributes which may be desirable for these key stakeholders.

An example of the information collected as part of this participatory exercise is shown in figure 6.

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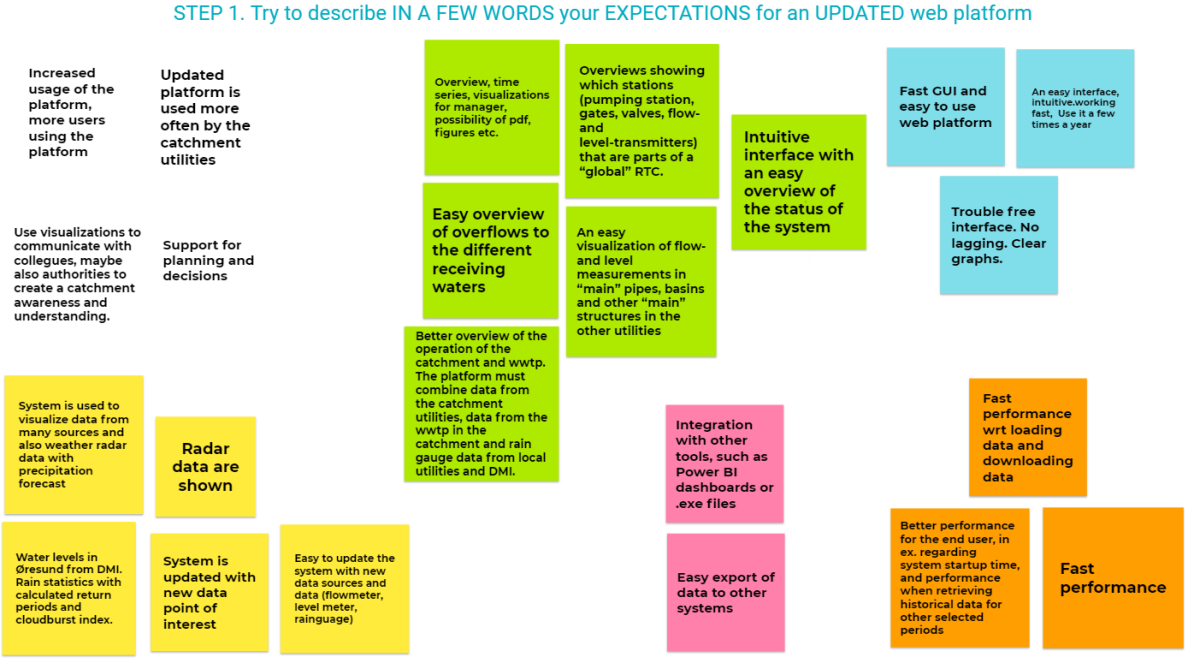

Figure 6. Example of the feedback compiled using the Jamboard tool

Results from the debriefing of this activity were circulated as a report summarizing the key answers: i.e. key information collected through the exercise related to the expectations for the final development of the system. This exercise has facilitated the incorporation of the user needs in the development of the web platform as well as the monitoring of the progress of the tool by DWC Copenhagen CoP members.

2.2.3. DWC Milan

The DWC Milan **presentation meeting** was postponed from early April 2020 to July 2020 due to Covid-19 emergency situation. Although it was originally planned as a face to face meeting (in coincidence with a general WP2 meeting), the event was finally held online a few months later. For this online meeting, it was decided to keep the audience limited to the most relevant stakeholders.

The main objective was to provide an outline of the project as well as a detailed view of the activities implemented in Milan to the most relevant stakeholders forming the local CoP. In particular, the objective was to bring out their expectations regarding the deployment of a reused wastewater network for agricultural irrigation in the Milan area.

The stakeholders were hosted by CAP Holding supported by two DWC partners, (i.e. Università di Milano and UniversitàPolitecnicadelle Marche). They represented three large farmers' associations and public bodies (COLDIRETTI, Confagricoltura, ETC-Villoresi). The meeting agenda included introduction of participants, presentation of the DWC project, explanation of the DWC strategy to implement reuse of reclaimed wastewater in Milan city, concluding with a discussion on this strategy and next actions.

Stakeholders provided valuable feedback on other institutions and local actors which could be part of the reclaimed wastewater value-chain, and on how some potential barriers can be intended to be overcome. This initial interaction was rather dominated by managing representatives of agricultural associations. Therefore, the debate remained quite general and at a political level, rather than

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addressing practical and technical issues. Also, some of the invited stakeholders did not demonstrate yet a full commitment to the reuse of treated water in agriculture (e.g. because of sanitary concerns about water quality). However, this interaction at a higher level was considered necessary to set the ground for more detailed exchanges between DWC partners and farmers, and other stakeholders (e.g. water reclamation managers).

As a follow up activity, an **initial DWC Milan** meeting was organized in November 2020. This was an online meeting with participation of around 40 people including project members and stakeholders representing local (from Lombardy region) farmers' associations, water utilities, irrigation consortia, public bodies and environmentalists (see figure below).

The agenda included presentations of the match-making tool, which links water demand for irrigation and safe water availability (DS5.1), the active unmanned aerial vehicle for analysis of irrigation efficiency (DS5.2), the serious game on the water reuse-carbon-energy-food-climatic nexus (DS6), and the Early Warning System for safe reuse of treated wastewater for agricultural irrigation (DS3).

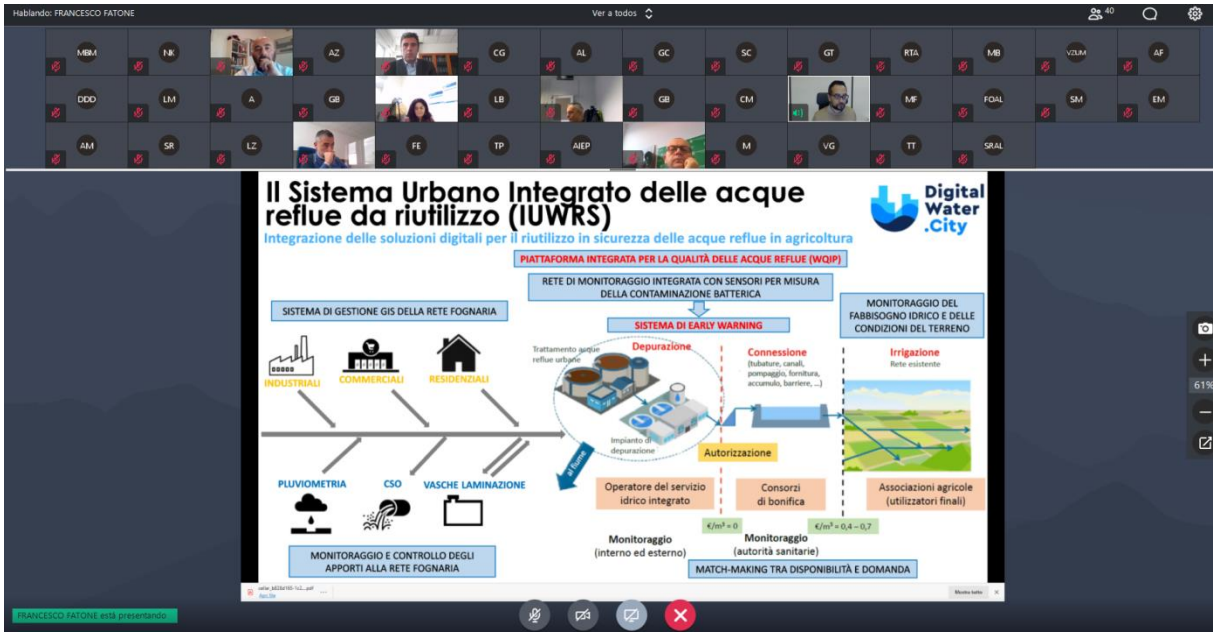

Figure 7. Initial DWC Milan meeting

Initial feedback was collected from the stakeholders using Slido software regarding the settings and relevance of the solutions for the Milan context: e.g. the preferred time-period to receive information about availability of re-used water for its use in irrigation; importance of the consideration of the carbon footprint of water used for irrigation; relevance of solutions for the improvement of agricultural productivity and sustainability; and initial interest from stakeholders to the presented solutions.

As a follow-up of the CoP, several participants got in touch with CAP to clarify some aspects and present some suggestions for the implementation of the project activities that are being discussed among the partners.

The **second DWC Milan** meeting took place at the end of March 2021. This was a two hours online meeting with a broad participation including the core group of stakeholders attending the previous meetings.

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The meeting focused on the presentation of the progress in the development of the digital solutions, including updates on implementation and testing activities for:

- the development of an integrated wastewater management and reuse system- with a particular focus on risk management aspects
- the Early Warning System
- digital tools to support Early Warning at the Peschiera Borromeo wastewater treatment plant
- match-making tool development and next irrigation test campaigns with reused water
- serious game on Water-Energy-Carbon-Climatic nexus

Slido tool was utilized to collect specific feedback of the attendants.

The **third DWC Milan** meeting was on December 17th of 2021. It focused more specifically on one of the digital solutions, i.e. the serious game developed by the Marche Polytechnic University as a tool for communicating and understanding the process of irrigation reuse of purified wastewater and the link between water, energy, food and climate. This activity is planned out as a demo event in order to present the beta version of the solution and collect feedback that can be useful to adjust the tool and guide the final steps on its development and testing, as well as potential additional requirements that may improve the adoption from different stakeholders.

The **fourth DWC Milan** meeting was on April 12th of 2022. This event was exclusively dedicated to students from high schools, with DWC general and Milan city case presentation, and Serious game presentation and play session. The meeting was followed by a visit to the Peschiera Borromeo WWTP.

On November 9th of 2022, the DWC Milan Roadshow and CoP – CAP stood at Ecomondo Fair, Rimini. A presentation was made of all the digital solutions developed within the project, with a hands-on play session of Serious Game.

2.2.4. DWC Paris

In the frame of the activities supporting the organization of the next 2024 Olympic Games, a working group involving a large number of stakeholders and actors (including SIAAP) is collaborating to improve water quality status and monitoring in river Seine. SIAAP is an active member of this “bathing task force” which has been established in order to reach the goal of sufficient water quality for bathing.

In order to involve the citizens and the future bathing site managers in the development of the digital solution for the Parisian region project, a Community of Practice (COP) has been created.

The creation of this COP was a long process and multiple meetings were needed before the first official one. This process has been driven in three steps:

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1. A first step with peer-to-peer preparatory meetings with the relevant members of the task force;

2. A COP prefiguration meeting that gathered all the encountered members in step one. This meeting aimed to report the results of the peer-to-peer interviews and to discuss the goals and the functions of the CoP and its operation rules. By that way, a relevant frame has been raised for the first CoP meeting;

3. The CoP meetings setup and its official launch.

Peer-to-peer preparatory meetings

The first step was to meet individually the institutions that are part of the consortium mentioned above:

- The City of Paris;
- The health and environmental authorities;
- The Seine-Normandy water agency;
- The Direction of the services for water and sewerage of the Val de Marne *département;*
- The Direction of water and sewerage of the Seine Saint Denis *département*;
- The Direction of water of the Haut de Seine *département*
- The *Syndicat Marne Vive* (a local authority that gather municipalities in order to prepare and implement the local Water Development and Management Plan (SDAGE)). This *syndicat* is supporting the opening of bathing place on the Marne River.

These meetings included a presentation of the Digital Water City project and the tools that would be implemented in the Paris region for bathing sites management.

It is important to note that most of these partners are already working on their own tools for the management of bathing sites. Therefore, it was important to make sure that the tools developed in DWC project were not competing with theirs and that ultimately; all the tools could be used together.

Afterwards, the concept of the Community of Practice was introduced by explaining that one of the goal of the DWC project was to involve the future stakeholders (citizens and bathing sites managers) in the development of two specific digital solutions:

- “Expert” application destined to bathing site managers that will regroup all the information needed to decide whether to open or close a bathing site.
- “Public” application destined to inform the citizens of the status of the bathing site of their choice.

Most of these institutions are in contact with the cities that wish to open a bathing site after the Olympic and Paralympic games of 2024. For this reason, it was important to present the DWC project and to discuss its possible consequences these cities in relation with their field knowledge and local stakes. The decision was that these actors would play the role of intermediary between the cities and SIAAP.

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Following these individual meetings, an official invitation was sent asking for a list of individuals that would represent each of these institutions in the future COP meetings.

In parallel, the provider that would develop the applications was hired by SIAAP. After presenting the project and the concept of the COP, it was decided that the provider would participate to all the COP meetings in order for them to develop tools that would fit the need of the future users.

COP prefiguration meeting

This COP prefiguration meeting took place in the beginning of July 2021 virtually and reunited the representatives of each institutions as well as the provider.

Figure 8. Screenshot of the COP prefiguration virtual meeting

Some relevant information was provided at the beginning of the meeting:

- The SIAAP is the responsible for the development of both applications during the DWC project however;
- The institution that would take over after is not known for the moment;
- KWB shared its experience of the bathing situation in Berlin;
- A report of each of the individual meetings was circulated to everyone.

Considering that, some of the people were not present during the individual meetings the DWC project as well as the tool that will be developed for the Paris region has been presented to all the attendees. Working rules for the CoP were proposed and discussed. The work realized by INRAE about the sociological issues linked to the dissemination of water quality information was also presented.

As mentioned above, during the peer-to-peer meeting it was agreed that the Syndicat Marne Vive will act as intermediary between the SIAAP (and the DWC project) and the municipalities from Marne riverside. Concerning the Seine riverside located upstream of Paris in Val-de-Marne *département,* local political elections results made that the SIAAP had been in charge to contact the cities located on the Seine River upstream of Paris and ask a representative to participate to the COP meetings.

The decision was made beforehand to focus this first meeting on the application that will be developed to communicate with the public. Therefore, the last part of the meeting focused on issues concerning that specific application:

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- Technical issues: What kind of tool would be developed? The provider proposed 3 solutions:
    - A mobile application,
    - A website,
    - A Progressive Web Application (PWA)
- Communication issues: Will the information on the status of a bathing site would only be available on the tool or will it be open or available for other platforms to share?
- Financial issues: In the case of an open information, will it be billed?
- Content of the app: What kind of information would be shared with the public?

Considering that this was not, a true COP meeting, no decision was made about the different issues that were discussed only recommendations.

DWC-Paris meeting#1

The first COP meeting took place in October 2021, virtually and reunited all the institutions mentioned previously as well as the cities that could eventually open up a bathing site in the future:

- Choisy-le-Roi
- Vitry-sur-Seine
- Ivry-sur-Seine
- Orly
- Villeneuve-Saint-Georges
- Villeneuve-le-Roi
- Saint Maur
- Saint Maurice
- Champigny-sur-Marne
- Chelles
- Nogent-sur-Marne
- Paris

The agenda of this first meeting was the same as the prefiguration meeting. The idea was to present the DWC project and the tools that were developed for the Paris region.

It was established at the beginning that the meeting would be about the “public” application.

As introduction, a key information has been delivered: the COP was setup for the construction of the tools and under the responsibility of SIAAP until the end of the project in November 2022.

The second point of this introduction was a discussion about CoP functioning rules in order to have fairness between all the institutions and to insure smooth meetings. The validated rules are the following ones:

- The COP can be joined at any moment of the project by formulating an official demand to the SIAAP;
- There are two status within the COP:
    - As an active member, the person can participate to the meeting and take part in the decision that have to be made.
    - As a passive member, the person can participate to the meeting however do not take part in the decisions.
- The decisions are validated by the 2/3 of the majority;
- One vote per institution.

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The same issues were discussed during this meeting than the prefiguration meeting. However, in this case, the COP was in charge of the decision-making on the different questions.

During the discussion, most of the representative did not have the power to make a decision on the issues discussed, so the opportunity to discuss those issues outside of the COP was asked.

A questionnaire was then prepared and sent out to all the members of the COP. Only the active members could answer it.

A	B	C	D	E
	Site Web	Application Mobile	Progressive Web Application	Ne se prononce pas
Ville de Paris				
Conseil Départemental du Val de Marne				
Conseil Départemental de la Seine Saint Denis				
Syndicat Marne Vive				
Champigny-sur-Marne				
Saint-Maurice				
Chelles				
Nogent-sur-Marne				
Vitry-sur-Seine				
Ivry-sur-Seine				
Orly				
Villeneuve-le-roi				
Villeneuve-Saint-Geoges				
Choisy-le-roi				
EPT 12				
ARS				
AESN				

Type d'application | Ouverture de l'information | Commercialisation de l'infos | Infos tech specific ...

Figure 9. Questionnaire sent out to the COP

Two weeks were given to the members to fill the questionnaire and send it back. Most of the information would be used to create the mock-up of the “public” app.

A projected timetable was presented for the conception phase of the tools and it was decided that one COP meeting per month would take place.

DWC-Paris meeting#2

With the feedback from the questionnaire, specific answers about the different questions concerning the “public” app were available.

The provider could use the information to create a first mock-up of the “public” app.

This second COP took place on November 2021 and was hosted by Nogent-sur-Marne’s town hall and welcomed by the first Deputy Mayor and the Director of the sport department. It was a hybrid meeting with members present in real and the others virtually.

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Figure 10. Second COP meeting at Nogent-sur-Marne's town hall and welcomed by the Deputy Mayor

During this meeting, answers provided by the questionnaire were discussed in order to make sure that everybody agreed on everything.

The provider also presented the mock-up of the “public” app. The home page and bathing site page were prepared and discussed with the COP.

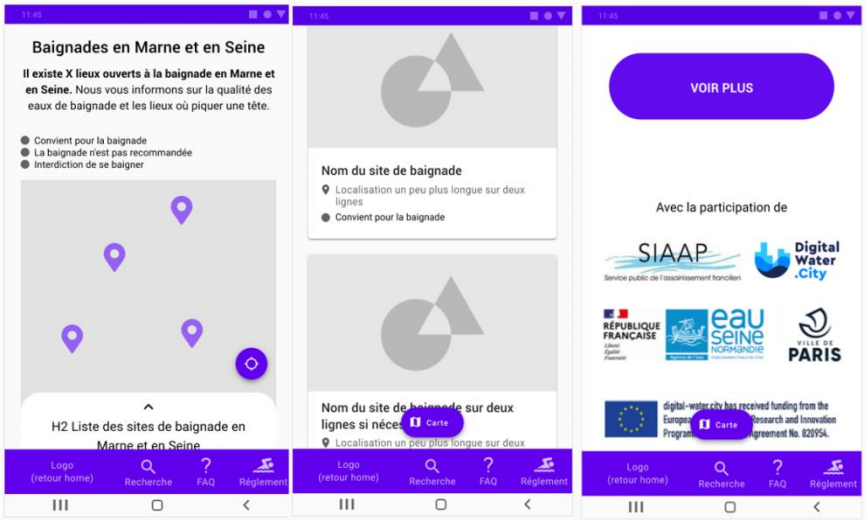

Figure 11. Mock-up of the home page

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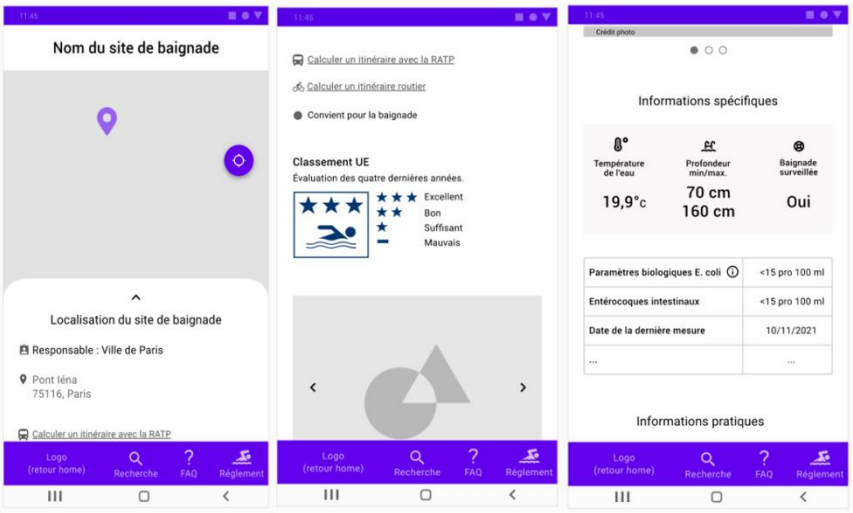

Figure 12. Mock-up of the bathing site page

DWC-Paris meeting#3

The third COP meeting will be taking place virtually on December 2021.

This meeting will be about the "expert" app developed in the project. However, most of the members of the COP do not know what managing a bathing site entails.

We decided to contact bathing site manager all over France and to invite them to the meeting so that they can share their experience in managing a site and hopefully to express what their expectations about numerical tools could be.

A questionnaire was sent out to these managers so that they can prepare themselves and discuss them with the COP during the meeting.

DWC-Paris meeting#4

The fourth COP meeting took place virtually in January 2022. Based on the answer that we collected from the questionnaire sent out to the COP members about the "expert" app, the provider was able to build a first mock up to show how the app would look like. During the meeting, we had the opportunity to discuss this mock-up and get the feedback of the COP about the design and the additional information that might be interesting to have.

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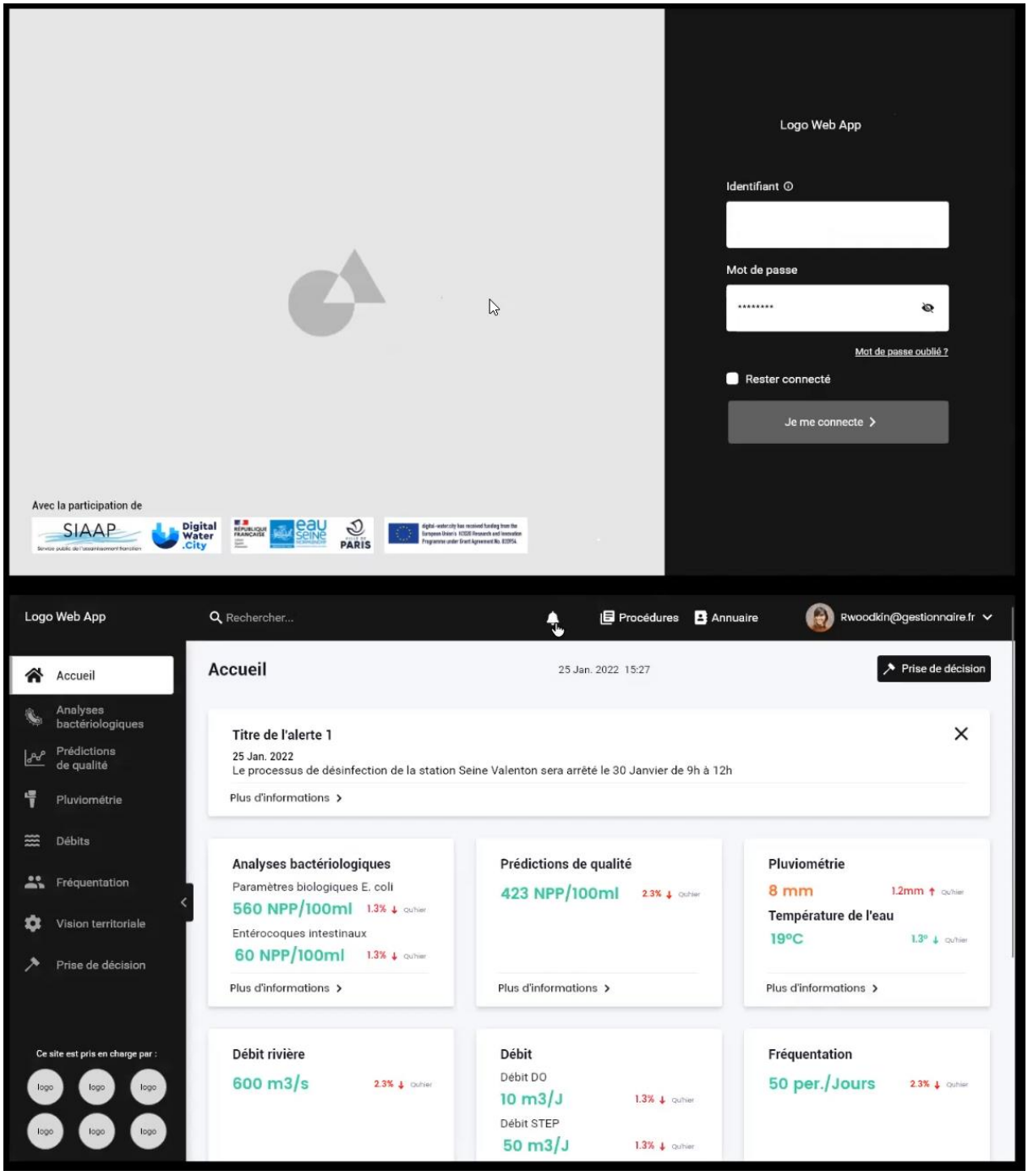

Figure 13. Mock-up of the "expert" app

DWC-Paris meeting#5

The fifth COP meeting took place virtually on February 2022. This meeting was about presenting and exchanging on the different alternative methods that exist to measure the E. coli bacteria.

The first part of the meeting was a concise presentation of the rules about the quality of the water for bathing. Then a brief explanation of the certified method of measurement of the E. coli concentration.

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Finally, we asked public institution to do a feedback on the use of three well-known methods:

- Alert System: Feedback by the City of Paris and SIAAP
- Coliminder: Feedback by the City of Paris
- PCR test: feedback by the city of Biarritz. This method is actually performed in a laboratory but still gives results sooner than the certified technique.

The idea of this meeting was not to promote any tools, but to show the bathing site managers the alternative tools to the laboratory measures that exist for the day-to-day management of a bathing site.

Figure 14. Solutions discussed in the fifth DWC-Paris meeting

DWC-Paris meeting#6 and meeting#7

The sixth meeting took place in March and the seventh in April. Both of those meetings were used to present respectfully the interactive mock-up of the Public app and the expert app.

Those mock-ups gave us the opportunity to show the Community of Practice how the different pages of both applications would look like. The functionalities were not developed (it would be the next phase of the process), but the provider was able to put fake curves and data in order to make sure that it was exactly what everybody agreed on.

Multiple topics were discussed during those sessions.

Public app:

- The name of the status: At the beginning it was “bathing open” but then it was decided that it would be changed to “Bathing authorized” since the opening of the bathing depended of the hours and that the authorized bathing would not especially mean that the site is open and vice versa.
- The “Alert” information about a bathing site: if there is work in progress, or it’s going to be closed for an unusual reason. It was discussed to decide where the information would be available when closed on the main page (purple bell on the picture).

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- One of the main subject that was discussed was the fact that some people might go swimming outside of the bathing site. It was really important to explain that the bathing was authorized and monitored on the indicated points, and that any bathing outside of the site would be at the risk of each individual. This topic, as well as the danger associated with bathing in open water were added on the Vigilance page (top right corner on the picture).
- Finally, the main information that would be shared on the bathing site page were also discussed and validated. Each bathing site manager would choose the information that they want to share; the ones that will not be indicated on the back-end of the app would not appear on the page.

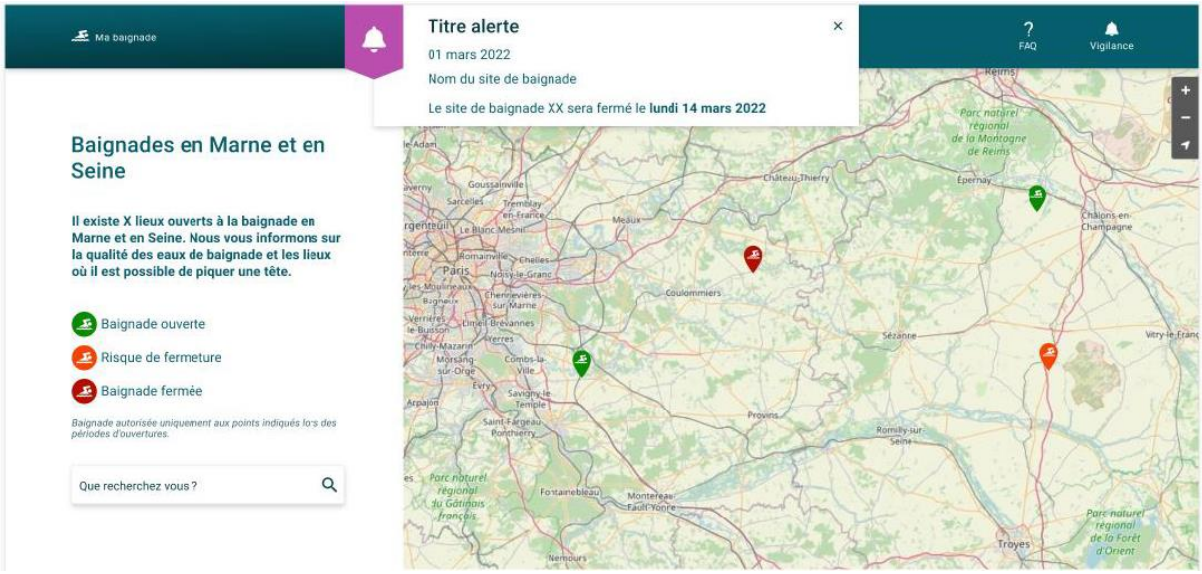

Figure 15. Public app - Welcome page

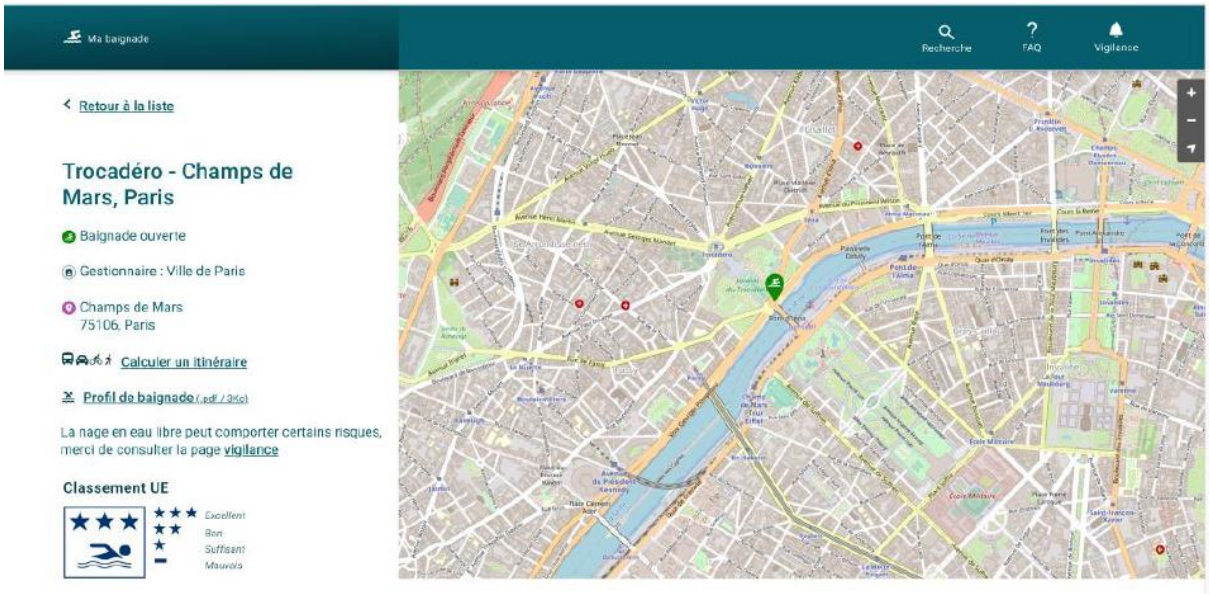

Figure 16. Public app - Bathing site page

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Expert app:

- The main topic discussed during this session was the parameters available on the expert app and their format (curve, point, histogram…)
- The content of the additional page was also discussed such as the phone book and the information it should contain, the protocols page and finally the profile page.

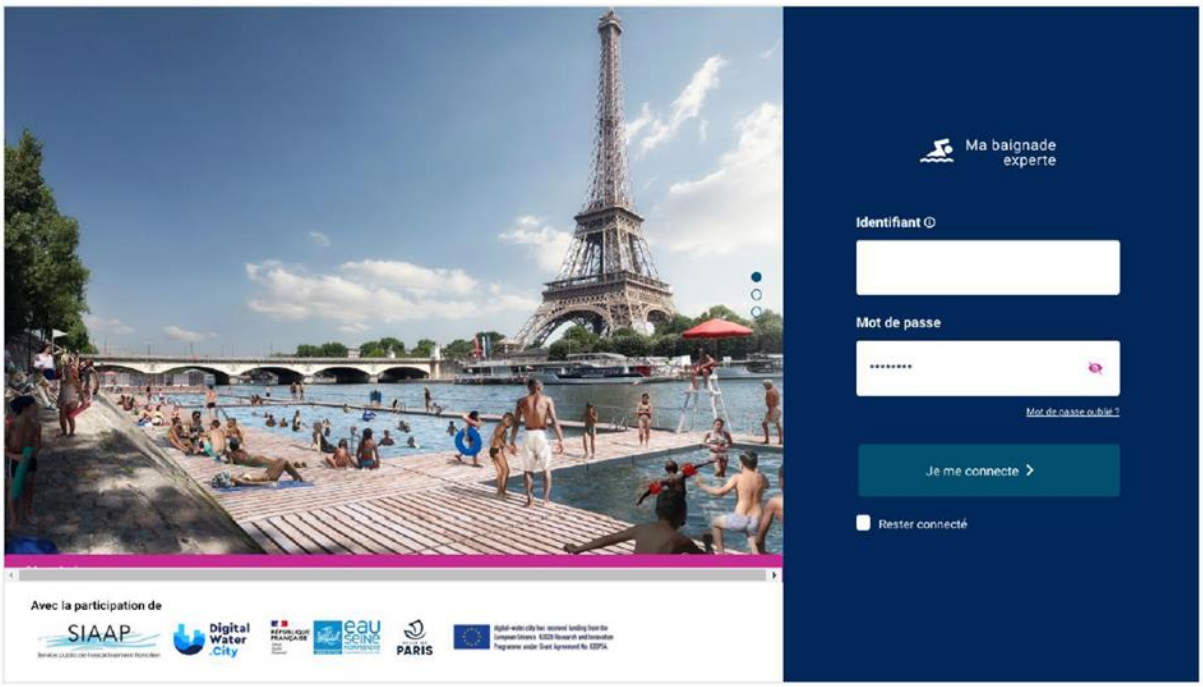

Figure 17. Expert app - Connection page

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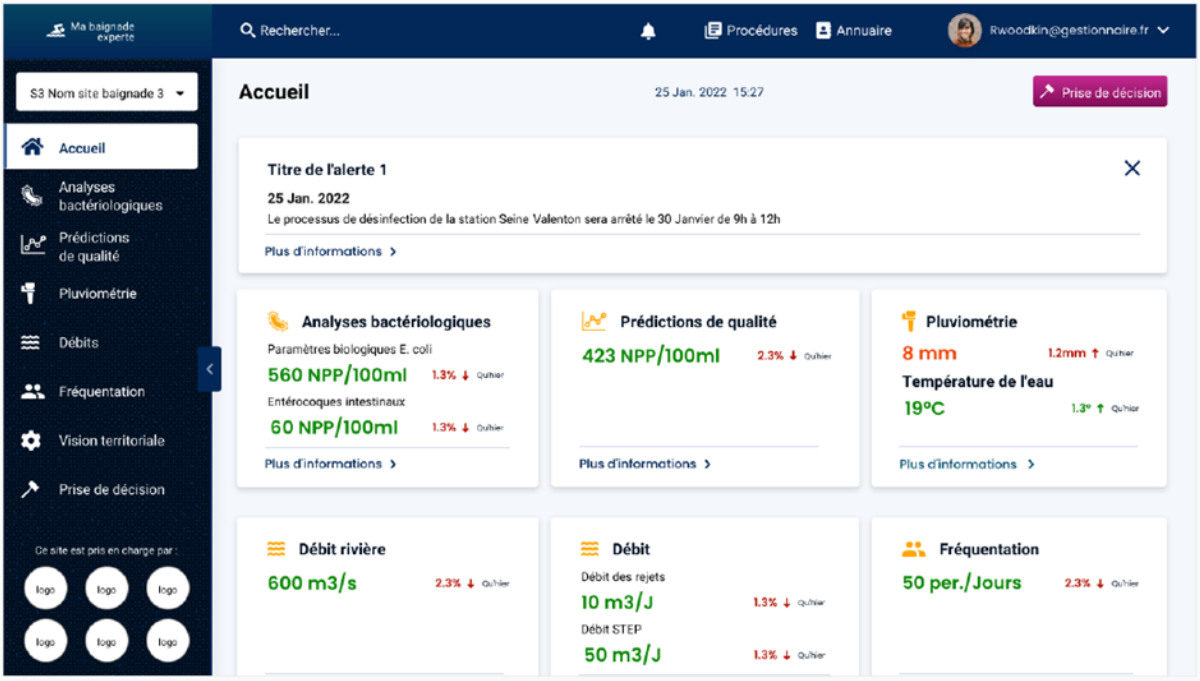

Figure 18. Expert app - Welcome page

The conclusion of both of these meetings is that the public and expert app responded very well at what was asked from the members of the Community of Practice.

DWC-Paris meeting#8

The eighth COP meeting took place in May online and the main topic of discussion was the feedback on the focus groups and interviews that INRAE has been conducting from the beginning of this process.

Our colleagues explained their role in the French case of the DWC project and the process of organizing the interviews and focus group.

There were two kind of exchanges with the public that were realized:

- Interviews conducted with bathers in Berlin: this was done as part of a comparison study between Paris and Berlin
- Focus groups for the DWC project: This kind of exchange cannot be managed like a meeting. Once the main topic is launched, the discussion is led by the group. The main topics that were discussed were the opinion of the public in opening bathing sites after the Olympic and Paralympic games and what kind of information were they expecting from the public app

The focus groups were organized with:

- Inhabitants living next to the Marne river
- Inhabitants living next to the Seine river but not in Paris
- Swimmers in open water
- Innovations specialists

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Essentially, people would say that it was really early to discuss such a subject and that basically, they trusted the information about the status that would be shared with them, however they wanted a wider type of information and not only the quality of the water. It is important to note that for these first focus groups, the Berlin public app was presented as an example. Nonetheless, it was really productive and we were able to retrieve a list of information/ parameters that the public would be interested in having.

The last version of the French public app was presented on focus groups that were organized after this COP meeting. In brief, the app was well received by the public.

DWC-Paris meeting#9

The ninth COP meeting took place in October. It was a hybrid exchange that took place at the headquarters of SIAAP and online.

The occasion to summarize everything done for the development of the apps.

This meeting was also a part of the Paris roadshow and used it to present other digital solutions developed in other cities partners of the Digital Water City project:

- WWTP management in Copenhagen and bathing management
- Serious game in Milan
- Monitoring bad connection in Berlin

The first part of this meeting was the presentation by the provider of the prototypes of the two applications. For both of them, most of the design and functionalities were developed. It was the occasion to confirm that those tools really responded to the demand by the COP members.

We also realized some issue, particularly in the expert app where some of the data did not appear correctly, which would be very unsettling for the bathing site managers.

In general, the feedback that we got from the COP members was positive because the apps that were presented matched everything that was asked.

2.2.5. DWC Sofia

The main groups of stakeholders to be involved in DWC Sofia are on one hand, the municipalities and, on the other hand, other Bulgarian water utilities, representatives of the scientific community in Sofia (University of Architecture, Civil Engineering and Geodesy in Sofia and others), and representatives of commercial companies carrying out digital installations on the territory of the country. However, the involvement of both these groups was more relevant once some results can be shown and discussed in detail. Input from the stakeholders was not required for the initial development of the digital solutions.

Therefore, it has been decided to create awareness in these target audiences about the project objectives and progress. The initial plan was to initiate DWC Sofia through a press conference in March 2020 to present DWC and the digital solutions tested in Sofia. The conference had to be cancelled due to COVID restrictions. This event was rescheduled over the year in coincidence with some relevant events (e.g. planned DWC General Assembly in Sofia, conference on innovative water management

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and circular economy) but unfortunately, it had to be cancelled each time due to the health situation in Bulgaria.

Finally, **Digital Water City project and local Sofia CoP** were presented as part of an online event on the occasion of the World Water Day on the **23rd of March in Sofia.** SofiyskaVoda, stood behind the organization of the event and together with the Clean &amp- Circle Competence Center presented five effective scientific solutions for water and its conservation, including the work of DWC in Sofia. There was an audience of more than 100 people and the event was communicated internally on the website of SofiyskaVoda AD, part of the Veolia group, and also in other communication channels, e.g. Social Media, of the company (see an example here).

Moreover, since the 2020, SofiyskaVoda has been spreading information about DWC project, both among its employees and among the Bulgarian public, e.g. recording a video with the first results from the field work and creating several media publications, e.g. link1, link2, link3, link4, link5, link6. The DWC project was also presented to the young audience – high school students from the Sofia High School of Construction, Architecture and Geodesy “HristoBotev”.

From 2020 to 2022, dissemination of information about DWC was carried out, by SofiyskaVoda, with several media publications. Presentation also to young audiences - high school students from the construction, architecture and geodesy high school in Sofia "HristoBotev".

On March 22-23 of 2022, a RoadShow event for World Water day was organized as a two day event. Disseminated in SV facebook page, also, innside the company site. Videos made on the two Digital solutions, demonstrated in Sofia.

On the 8th of July 2022, an Open "Sewer" classes day in front of the high school students from the construction, architecture and geodesy high school in Sofia "HristoBotev". One of the main topics was the "DWC" project.

3. ACTIVITY OF THE DWC PROJECT COP

3.1. Project CoP#1 (World Café)

The main aim of the World Café exercise was to gather information regarding: i) any potential interaction of local CoPs in each city with the development of the digital solutions and ii) the importance of transversal topics (cybersecurity, interoperability, ICT governance and policy uptake) for the deployment of the solutions.

A set of guidelines were prepared and circulated prior to this activity comprising the following:

- An introduction to the World Café method
- Instructions for the preparation of the World Café exercise (e.g. organization of World-Café tables and visiting rounds). Three tables were hosted by WP leaders, grouped as WP1 + WP2 (table 1); WP3 and WP5 (table 2); and WP4 (table 3).
- Definition of key objectives for each World Café table, e.g.to map the potential interactions between Digital Solutions and Local CoPs; to identify how important the transversal topics of WP4 (e.g. cybersecurity, interoperability) are in each of the cities; and to think about potential transferability of DSs to other cities (with different contexts).
- A list of tentative questions for each table. Discussions followed a “semi-guided” approach, i.e. the same general questions were to be asked to all the City Leaders, although the focus of each

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conversation differed between the cities, depending on which topics are more relevant for them.

Examples of questions addressed to the cities were:

- How relevant is the involvement of external stakeholders (not participating as partners) to facilitate and improve the development of the DS and increase the benefits from these DSs to the end-users?
- How could the work to be done in WP3.1 be facilitated by activities at Local CoP level / Intra-Project CoP level?
- Are the cities interested in transferring the solutions being demonstrated to other cities?

The results obtained from this exercise are described in ANNEX 1. of this document.These provided a starting point for setting up the local CoPs.

3.2. Project CoP#2

This project CoP was held as an online meeting, being part of the second DWC General Assembly meeting, and was attended by 40-50 people. -The meeting was open to the city partners, the WP leaders and potentially interested project partners. Two main topics were raised:

Topic 1: Cybersecurity. Which are the threats and reduction measures? This topic was led by SINTEF within the frame of the activities in cybersecurity in DWC.

This meeting focused on risk identification in the context of the DWC project. The profiles of invited participants comprised risk managers, IT experts from the water utilities as well as technology developers.

The main goals were: i) to create awareness among water professionals from the five DWC cities on the importance of appropriate risk management related to cyber security; ii) to present the approach and the action plan to create a DWC cyber-related risk events registry as part of the activities of T4.2; and iii) to run a preliminary and assisted brainstorming exercise to train the attendants on how to populate the RIDB (Risk Identification database).

These goals were addressed through four presentations: 1) Cyber Threats and Water - why should we care?; 2) Definition of a risk event; 3) The Risk Identification database (RIDB) developed in the H2020 STOP-IT project; 4) Reflection on the DWC RIDB as extension of the STOP-IT RIDB) and the realization of a training exercise with the direct involvement of representatives from the five DWC cities. In this exercise, the cities identified cyber threats related to the DWC solutions/systems under implementation in each city, and then elaborated consequences of incidents realizing identified cyber threats. As a result, the representatives from water utilities started to populate the DWC RIDB by identifying risk events and consequences.

Topic 2: Real-time control (RTC) of sewers and WWTP with modelling uncertainty: communication and decision making.

In this session, four DWC cities, i.e. Berlin, Copenhagen, Milan and Paris, presented their local solutions related to RTC of sewer system and WWTP, also addressing integrated systems. The presentations included the description of existing or under-development systems and the architecture of these solutions. A focus was also set on the use of RTC for decision making and the consideration of uncertainties.

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- Berlin presented the existing first generation of their overall model for monitoring the combined sewer system and minimizing CSO volume. A river quality model is also integrated in this overall model. A second-generation model (SmartLISA) is currently under development, including simulation of the pumping system, a sewer simulator (including near-real time network performance and an alert system). In the exchange of the CoP, it was discussed if the SmartLISA model could also be extended for modelling the load management in sewer and integrated with the WWTP.
- Copenhagen presented its system for integrated control of sewers and WWTP (see figure below). The city has implemented a stormwater control system, including filling and emptying of basins, a bypass of the WWTP biological step (with restrictions by the authorities), and Qbiomax aeration tanks. The system also produces flow predictions into WWTP using radar measurements over the region. As for visualizations, Copenhagen has implemented the SAMDUS web platform, to be improved in the frame of DWC.
- Milan presented their under-development flow monitoring system. This is including the implantation and testing of several inflow and infiltration detection methods (i.e. interferences between sewer system and surface/groundwater; periscope and CCTV inspections; electrical conductivity analysis and temperature analysis using sensors and optic fiber).
- Paris introduced their RTC system named MAGES. As elements for discussion, SIAAP identified the biggest challenges and benefits related to the implementation of this RTC system and explained the most important control mechanisms and their aim. The presentation also dealt with the visualisation tools included in the system and explained how MAGES system supports or influences decisions. As for the latter, although MAGES is a sound base for decision-making, the experience and skills of operators and technicians are also a key part of this decision-making. Finally, SIAAP explained how uncertainty in RTC is considered.

During the presentations, questions from attendants were gathered using Slido software. These questions were answered by the different cities also establishing an open dialogue that allowed to identify some shared interests and potential future lines of mutual learning and collaboration. These include the following: i) cost-evaluation analysis of conductivity and temperature methods to detect CSO and infiltration; ii) comparison of results between managing overflow with aeration tanks or equalizing the flow using sedimentation tanks to overload; iii) methods for emptying the storage tanks in the sewer system in case of potential overflow and capacity to manage flows in WWTP; and iv) reporting and communication tools. A main discussion point was to evaluate the robustness of the simulation results and the possibility to gain the correct “calibration data”. During the meeting, a separated workshop for all utilities was proposed to exchange on introducing Artificial Intelligence (AI) processes for calibration.

3.3. Project CoP#3

DWC Project CoP#3 followed up with the topic of Real Time Control in sewer systems and WWTP (discussed in Project CoP#2), although with a more specific focus on monitoring and the use of sensors. More specifically, some identified potential topics for discussion on monitoring and sensors for Real Time control (RTC) were:

- Which kind of monitoring programs are you deploying for RTC?

- Return on experience on sensor operation and validation

- Return on experience on data management

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The meeting included three presentations, an open discussion between the attendants and some additional sessions related to the DWC CoP management.

ANDO, a partner in DWC developing digital solutions related to network monitoring, provide the first presentation. Here, they introduced their solution and explained how "your data can show you what you cannot see". In other words, they showed how by using new integrated methods supported by the use of Artificial Intelligence, Machine Learning and Deep Leaning algorithms they can provide a very precise view on what is going on a the network in terms of pollution, i.e. how pollution behaves, when is going to impact and what that impact is going to look like, going beyond traditional solutions.

The second presentation dealt with the web platform for integrated sewer and wastewater treatment plant control. This solution is being developed and tested in the Copenhagen region by DHI supported by our partner BIOFOS. The system is producing inflow forecast for better management of the network and treatment plants, i.e. allowing to change the control strategy of the plants when significant changes in the flow are anticipated, and thus operate more efficiently. Currently two different approaches are implemented: i) a machine learning routine is being trained; ii) a high fidelity model (hydrodynamic detailed model) is being produced, both building on numerical weather data models and radar data. The web system interface that is being prepared to communicate with the operators and users was shown, e.g. allowing to make queries and retrieve time series data and depicting clear maps with critical points in the infrastructure (e.g. critical spill points, flow meters, rain gauges), and showing how the system is working and anticipating problems in how it is expected to work.

A third presentation focused on RTC of sewer systems and WWTP in Sofia. In this session, our partner SV presented the advancements achieved in Sofia towards implementing real time control processes with a focus on the sewer system network monitoring. Challenges and advances in the topics of GIS design and operation, measurements (e.g. online monitoring of the sewer system through sewer water quality and sewer water level measurements monitoring sites; temperature sensors), modelling (moving from a strategic model to a detailed model) and finally RTC systems implementation were presented. Also, the aims for improving in the water management digitalization in Sofia were shared.

The main topic of the open discussion focused on the monitoring of the sewer system, e,g. required maintenance effort, common problems, available devices, problems in sampling, maintenance on the flow meter monitoring stations, CSO monitoring, equipment being used for sewer monitoring.

Final topics were the identification of next discussion topics (by ICATALIST), the presentation of the joint initiative to match water sector needs with new digital solutions in the frame of DWC2020 (by Ecologic) and the discussion of the next DWC CoP as part of the next General Assembly (by KWB).

3.4. Project CoP#4

The DWC Project CoP#4 dealt with the topic of `Sewer water quality monitoring: experience with sensors and sampling'. Most of the DWC cities (i.e. Berlin, Copenhagen, Paris and Sofia) made a presentation on their experiences in this topic, which followed with questions and discussion.

The initial presentation showed BIOFOS experience in Copenhagen with nutrient online sensors in water treatment plants using the advanced control system, called STAR. This presentation was focused specially in the Damhusaen wastewater treatment plant experience, which is the one involved in the DWC project. BIOFOS has more than 25 years of experience in online sensors and more than 17 years with the STAR advanced control system.

In the second presentation, SIAAP explained how the public service of Paris sewer system deals with the data acquisition, transmission and validation for sewer systems. An explanation of the global sewer

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system was provided, describing how SIAAP covers a populated area with more than 9 million inhabitants. The system has more than 15,000 pipes, 667 CSOs (401 monitored) and 6 Wastewater treatment plants. It was explained how the sewer control system is structured. Different kind of sensors are spread through this net (hydraulic, position, gas sensors, experimental quality sensors…). Their SCADA data are collected into a system called EDEN, that transmits it to their online decision-making tool called MAGES. An offline database (EVE'M) also collects data from SCADA, EDEN and MAGES.

Next presentation (by SV) focused on the sewer water quality monitoring of Sofia and their experience since 2015. In this year, SV started monitoring 15 sites for measuring hydraulic parameters and water quality, such as temperature, PH, etc. The objectives, achievements and disadvantages of this experience were shown. The sewer net and the monitoring points developed were described. The future expectations were also presented, such as improving the quality measurements, performing measurements in rain sewers, developing online and detailed monitoring, and the integration of a software to collect all sewer measurements.

Next presentation was the sewer water experience with sensors in Berlin (by BWB). Some experiences of sensors in the sewers and some of the microbiological test that have been done were shown. The presentation explained the development and test of a two-steps methodology to identify illicit connections in storm sewer networks. More than a thousand visual inspections have been performed without solving the odour problems in the lake since 2000. Thus, the best way to detect the illicit connections was to perform 24h inspections with sensors in strategic points, where already some issues were detected.

Several questions were raised after each of the presentations on e.g. false alarms, data certification, cyber security, data quality control, forecasting systems, problems with blockages,

3.5. Project CoP#5

The topic for DWC Project CoP#5 was `Big data and machine learning: experiences and challenges'. Milan, Berlin and DHI made presentations on the topic followed by some questions and discussion. The event was held for the first time as a hybrid session during the project's General Assembly.

The presentation from Milan (by CAP) dealt with the challenges the utility has found in relation with big data and machine learning. Remote monitoring is being used to save time in control of the systems and to reduce the number of dataanalysed in laboratory. Nowadays they are measuring 5 parameters in the effluents and are starting to measure in the influents as well. CAP has different suppliers of sensors technology using different type of sensors and present different limits. In 2017, 40% of wastewater treatment plants effluents were monitored. This percentage was raised to 80% in 2018 and it is expected to be 95% in 2023. The main issue they are facing is the quality of data, which is not enough to gain accreditation. Thus, gaining accreditation is their first objective now.

BWB presented the experience from Berlin, starting with a short introduction showing the main figures of Berlin's water cycle and its sustainable management principles. The inner part of the city has combined sewers (1,900km) while other parts have separate sewers and local infiltration of stormwater. Wastewater is pumped over long distances. It was explained that there is an ongoing automation of processes and its control which aims at improving the infrastructure's operation using sensor data. BWB has the goal of reaching carbon neutrality in 2030. In order to accomplish these objectives and achieve real time control, BWB is developing an intelligent process control with artificial neural networks (ANN). A need for balance was detected between the load reduction and the effluent values. BWB announced that the kick-off of a prototype for commercial solutions will be launched in

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December 2021. The next step will be the deployment of a commercial ANN in activated sludge basin of one WWTP.

Final presentation was from DHI, focusing on the best practices of modelling and machine learning developed in Copenhagen. DHI outlined the main topics: generalizability of machine learning models and the reproduction of results. Then, the different choices in order to obtain the best pre-processing, regularization, model, and features were explained. The presentation went through avoiding over-optimistic evaluation and the common pitfalls in their experience, i.e. feature selection via filter methods using test data, reporting validation performance metrics, standardization and cross validation using random sampling on time series data. Finally, DHI commented on the versioning for reproducibility (code, data and model versioning).

As usual, some time was devoted to an open discussion and dialogue between all the attendants.

3.6. Project CoP#6

The CoP #6 took place on 2th of May 2022, on **FIWARE**. The project CoPs aim to provide mutual learning and knowledge exchange between the cities' stakeholders regarding the digital solutions or common issues of digitalization. In the DWC Project CoP#6, it was decided to introduce to all the DWC team, FIWARE, and present the return on experience in the case of Paris and Milan.

The Agenda of the CoP was: an introductory presentation, followed by an introduction on FIWARE, a Return of experience Paris, a Return of experience Milan, followed by Questions/Exchange on FIWARE, and finally a Discussion about the last meetings: decide all together the subjects for CoP#7 and CoP#8 and the General Assembly/Last meeting.

The CoP#6 meeting was an online event, taking place in the Zoom Platform. The online participants joined using their own computer. The three presentations were prepared by several members of the project and shared with the group. After the presentations the questions and answers sections were held between the participants. The CoP#6 had good participation with interactions, exchanges between the assistants. There were 29 online participants.

- Introduction FIWARE - AudunVennesland (SINTEF):

The goal of bringing highlights of FIWARE was to introduce FIWARE essentials and present the approach from digital-water.city in the WP4 of the project. FIWARE offers a framework that has two fundamental values: open standards (which are very critical in interoperability) and open-source software components for smart solutions.

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FIWARE - What is it?

→ FIWARE offers a framework of open standards and open-source software components for smart solutions.

(Source: https://www.fiware.org/foundation/)

Figure 19: Screenshot of the introduction on FIWARE framework

The presentation showed some statistics of the developers and community, offering the technology but also consultancy and guidance. For example, there are 26 FIWARE iHubs, with innovative tools for technology supports and business advices.

The presentation showed what kinds of open-source components are being offered. It also presented how FIWARE contributes to Smart Data Models (in different domains like Smart Water, Smart Agrifood, etc.), as the initiative aiming to develop standards for how data are represented and enabling interoperability between context brokers. The presentation also developed the benefits of FIWARE specifically for the DWC project and WP4.

Development approach used in Digital-water.city

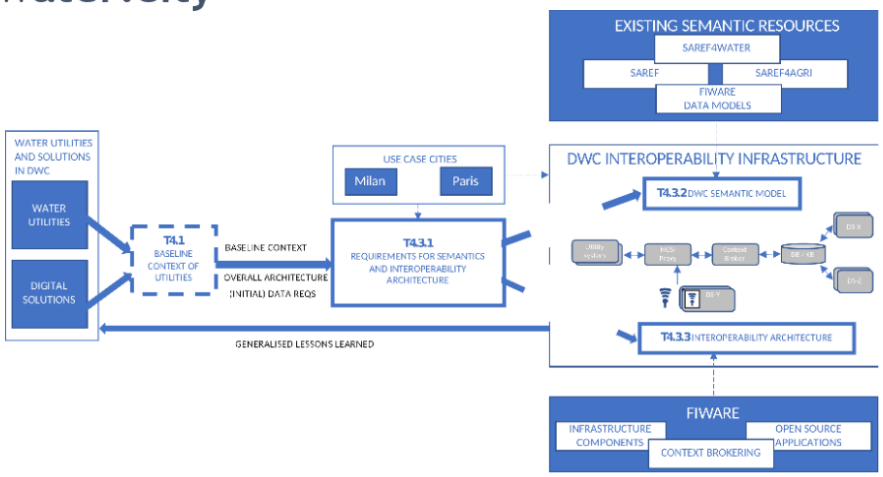

Figure 20: Screenshot of FIWARE presentation and the development approach used in DWC

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The contributions from project developments to smartdatamodels.org were specifically on Water Quality Observed, Water Observed, Water Quality Prediction, Agrisoil.

➢ Development of an Early Warning System for bathing water management – Paris Case (Sofia Housni - SIAAP)

A presentation was made about the French case and the use of FIWARE.

For the French case, the deliverables of the DWC project were the Measurement tool ALERT, the Prediction tool, the “Expert” app and the “Public” app.

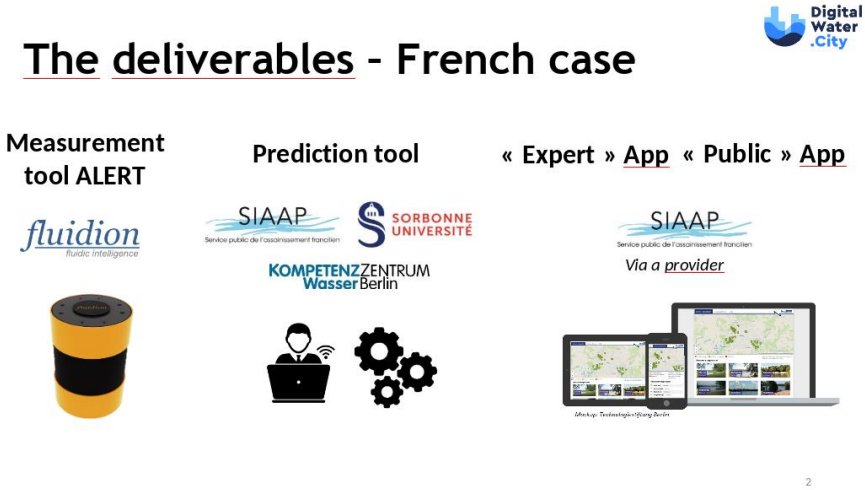

Figure 21: Screenshot of the presentation of FIWARE in the Paris case and the different tools

During the presentation, the General concept FIWARE environment was presented, as well as the Data models, the “Expert” app and the “Public” app.

It was also the opportunity to explain how the apps are going to be connected, technically and for the end-users. For example, the “Expert” app was presented how it will be set up and what will be the information available, with also the button of “Decision” if bathing is authorized or not. And then this information will go back to the Context Broker and be available for the “Public” app, showing us the welcome page of the “Public” app with the map of authorized bathing sites, with useful information for the end-users.

➢ Return of Experience Milan (Adriano Mancini - UNIVPM)

The presentation focused on the tools and solutions developed. The Early Warning System (EWS) for safe reuse of treated wastewater for agricultural irrigation is a risk-based decision support tool that integrates real data and modeled data, to assess water reuse related risks and forecasting analysis, using data sources in-situ real-time data from multi-parameter sensor network, offline data, and generated data from machine learning / statistical correlation. The EWS wants to improve, control, monitor and share with stakeholders and users health risks with the reuse of treated by maximizing the benefits of effective water reuse in productive agriculture.

The Match Making Tool is a new tool to best match water demand for the peri-urban irrigation and water availability from the wastewater treatment plant (WWTP). The data sources (mainly time-series data) are similar as previous solutions + agricultural field data: WWTP data, Agronomic data. The Match Making Tool makes easier the interaction between farmers, irrigation consortia and WWTP to

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re-use water for irrigation finding the match between demand (from farmers) and offer (WWTP and irrigation consortia).

The Footprint (also for serious game) is a real-time carbon and energy footprinting and assessment at WWTP. It assesses the Water-Energy-Food-Ecosystem (WEFE) nexus implementing WWTP data with modelling tools. The data sources (mainly time-series data) are the WWTP data and the modelled data. The Footprint assesses and monitor footprints related to water reuse and analyses the connected impacts, share with stakeholders the benefits of effective water agricultural reuse in reduce environmental impacts.

It was also explained how the applications are connected: how the Early Warning System (EWS) informs Match Making Tool (MMT). For the return on experience, it was explained how the integration with WWTP was complex and there are still open issues (some tags are not available for a long time; requested additional tags; still not available). Two separated processing pipeline to manage ingested data were created: Custom pipeline based on cloud computing services and FIWARE (NGSIv2) with Quantum Leap to manage time-series is under progress and within the end of the project the integration will be completed.

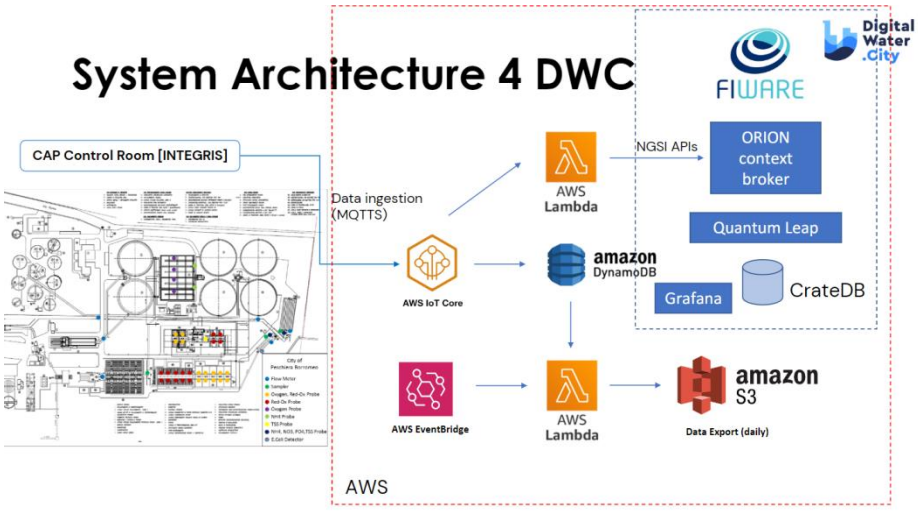

Figure 22: Screenshot of the Milan Experience and System Architecture 4 DWC

3.7. Project CoP#7

The CoP#7 took place on June, 27th of 2022, on Sewer monitoring on CSO emissions and illicit connection. The project CoPs aims to provide mutual learning and knowledge exchange between the cities' stakeholders regarding the digital solutions or common issues of digitalization. In the DWC Project CoP#7, it was decided to discuss with the DWC team the topic of **Sewer monitoring on CSO emissions and illicit connection,** sharing experiences with DWC solutions for sewer monitoring in Berlin and sharing details on some solutions developed.

The agenda of the meeting was: Presentation CoP#7 – Sewer monitoring on CSO emissions and illicit connection, Experiences with DWC solutions for sewer monitoring in Berlin, followed by Questions/Exchange, Solutions developed and experiences in sewer monitoring.

The CoP#7 was an online meeting, through the Zoom Platform. The online participants joined using their own computer. The three presentations were prepared by the participants and shared with the

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group. After the presentations the questions and answers sections were held between the assistants. The CoP#7 had a good participation with 23-25 online participants.

➢ Experiences with DWC solutions for sewer monitoring in Berlin - Michel Gunkel (BWB)

Michel presented an overview of the solutions tested in Berlin: the sensors and analytics for tracking illicit sewer connections (DS 9: EC sensors and multi-parameter sensors for hotspot screening and DS 8: DTS distributed temperature sensing for tracking exact locations), the Smart sewer cleaning Xpection (DS 15: Smart sewer cleaning system with HD camera and wireless communication), the Smart sensors for CSO monitoring (DS 14: Low-cost temperature sensors for real-time CSO and flood monitoring). The presentation was the opportunity to discuss with the participants the experiences made on the solutions developed.

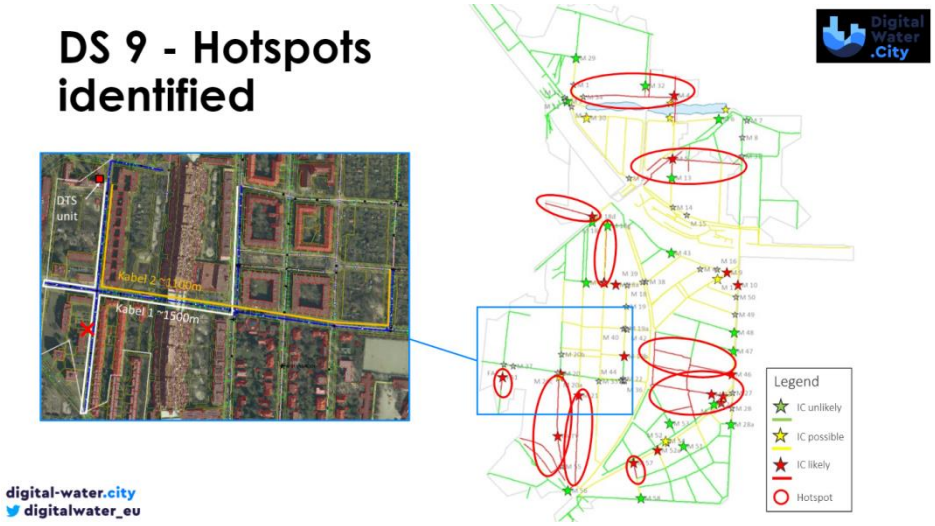

Figure 23. Screenshot of the presentation of DWC solutions for sewer monitoring in Berlin

➢ Solutions developed and experiences in sewer monitoring - Oriol Gutierrez (ICRA)

Oriol presented to the DWC team the Context of Combined Sewer Overflows, a focus on the development of DS14 within DWC, and the return of experience. For context, 3 billion liters per year of untreated wastewater is being discharged from over 650,000 overflow structures. (Estimations reported by 19 EU member states), most of the CSO events are not monitored in Europe and there is a lack of affordable technologies-solutions for such a widespread environmental, social and economic problem. DS14 Solution is based on temperature sensor for CSO's. The DS14 provides extensive CSO information at low costs. Data can be used for: Real-time control (only online version); Reporting and allocation of measures; Hydraulic model calibration –increase predictions accuracy. The return of experience showed that it identified new scenarios-situations-limitations. Delays were observed due to lockdowns-travel restrictions: Algorithm CSO detection required upgrades and improvement. The solution is currently TRL7, and TRL9 was not achieved, delaying spin-off creation as well. Finally it was concluded that it was a great learning experience, with strong foundations.

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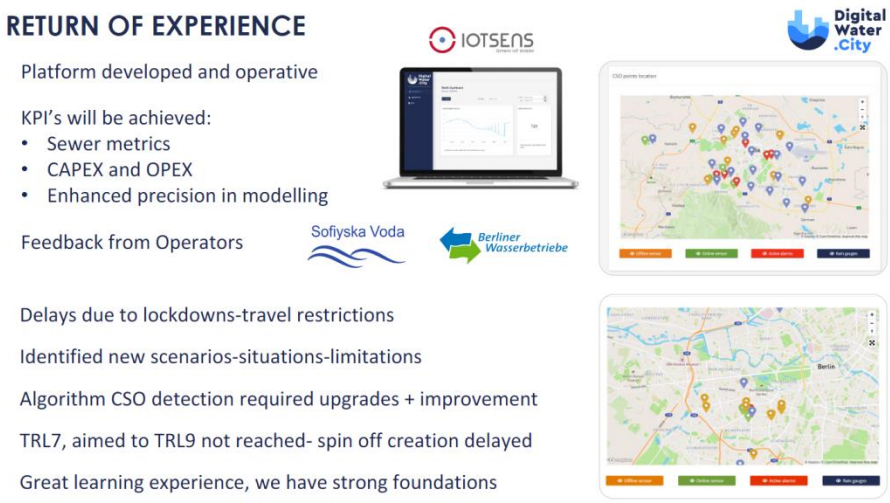

Figure 24. Screenshot of the presentation of ICRA and the solutions developed in sewer monitoring

3.8. Project CoP#8

The CoP#8 on Cybersecurity was held on the 14th of October 2022.This was a special session for all the DWC team, organized, presented and facilitated by the WP4 cybersecurity-team from SINTEF, with the support of the WP5 team.

This CoP aims to increase cybersecurity awareness for the DWC solutions developers and users. During the session, participants used a digital role game called TORC (Training for Operational Resilience Capabilities). The basic aim of the TORC game is to address and develop skills, competences, resources, collaborative strategies and practices that allow the trainees to cope resiliently with surprise and disturbance that bring them at or beyond their limits of preparation.

The approach of the game session was: "Being prepared to be surprised" with a focus on creating awareness and reflect on possible solutions to increase resilience of critical infrastructure during crisis situations (e.g., due to a cyber attack). This was achieved by engaging on a role game moderated by a facilitator guiding the players through different steps of brainstorming.

The participants could explore and decide on strategies and resources to be adopted under unexpected situations related to a proposed scenario Actions in the short term (crisis management) and longer term (increase preparedness) can be both considered.

The following expertise was invited to attend this special CoP#8: risk manager, IT responsible and persons responsible for IT devices, especially devices developed in the project. Around 12-15 participants attended the session.

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Figure 25. Screenshot of the presentation on Cybersecurity and the presentation of the TORC game

4. EVALUATION OF CO-CREATION OF THE COPS

4.1. Lessons learned: why do we need co-creation?

DWC team is producing a paper under the title: "Evaluation of the co-creation process in communities of practice for urban water management" to summarise the main insights, lessons learned and added value of the use of the CoPs as a tool to support the development of the digital solutions. The Horizon Europe Innovation Journal (https://open-research-europe.ec.europa.eu/) was identified as the main candidate journal to host this publication. So far, we did not find any specific publication in this Journal related to stakeholder engagement or Communities of Practice. Thus, this opens a valuable opportunity to share our experience with other projects and initiatives and amplify the impact of our action. The content of the paper is included into the core part of this final deliverable (next section on the results and previous section on conceptual framework of co-creation and Communities of practice) by reflecting on how our joint effort has contributed to increase the impact of DWC in terms of enhancement of product development, trust-building of potential end users of the digital solutions, and increased market outreach of these solutions.

4.2. Co-creation process evaluation session

The aim of reflecting on co-creation with the practical case and application of DWC was to get a standardised and comprehensive feedback building on the direct feedback collected from the cities and project leaders.

■ 4.2.1 Methodology

As a first step, a survey was circulated to the pilot leaders to document the scope of co-creation activities within the local COPs. In most of the cases, a follow-up interview was conducted to complete the information and discuss potential improvements in the participatory work plan that could better support co-creation within the COPs.

The survey produced as a questionnaire was divided into six parts: Objectives (Co-development of solutions to overcome barriers from innovation to practice; Collect user requirements; Business

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development and contribution to value; Collaboration in co-creation); Process; Unexpected results. For each category, the details of the questions are presented in the table n°1 below.

Table 1. Questions to collect feedback on co-creation process

Objectives	**Questions**
Co-development of solutions to overcome barriers from innovation to practice	*Has co-creation been achieved? If yes, at what level (project activities/between cities/within the city)?*
	Has this co-creation process contributed in any way to improving the development of digital innovations?
	Did the goals set were achieved?
Collect user requirements	*Have the needs of all users been collected? Yes/No. If yes, in what way? If not, why?*
	Who were the actors most involved in this co-creation? (Please explain)
Business development and contribution to value	*How does co-creation contribute beyond what the economy offers? Possible answers: Specific solutions to a specific problem based on the development of existing generic solutions / Solutions more adapted to the operating process / New solutions not yet considered by the market / Other*
Collaboration in co-creation	*Does co-creation in CoPs offer new opportunities for cooperation with other stakeholders? Possible answers: Definitely yes/somewhat/not really (You can find space below to expand on your answer if you wish)*
	In case the co-creation did not achieve the objectives, could you explain why?
	If the expected co-creation is not produced, what do you think are the main causes or barriers? Possible answers: Technologies are not developed/ Lack of stakeholders/ The design of the participatory process is not adequate/ Lack of communication/adequate dialogue/ Online communication barriers/ Other
Process	*Was the co-creation process (format, activities, actors, etc.) implemented adequate to achieve the objectives? Yes/No (You can find space below to expand on your answer if you wish)*
	How did this co-creation process go? Possible answers: During COPs/ Individual interaction/ Information sharing/ Other
	How could this process be improved?
	Why would co-creation be considered fundamental/necessary?
Unexpected results	*What unexpected results co-creation brought? (You can find space below to expand on your answer if you wish)*

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A special online meeting was organized on the 9th of September 2022 and was the opportunity to let an informal space where participants expressed and exchanged on co-creation and their experiences.

During the session, the questionnaire was revisited, and Sofia Housni (SIAAP) presented the methodology, experiences and feedback of the co-creation process in the region of Paris, followed by a roundtable with all attendants in order to collectively discuss and debate the process

The questionnaire was applied to 13 participants (Figure 26) To answer the survey and participate in the exchange session around CoPs and co-creation, the organizers ensured the involvement of at least one representative of the different cities, and of each category of project actors (cities, researchers, innovators, WP leader, etc.). The participants who participated in the survey, interviews and workshop are in general those DWC actors who were most active throughout the CoPs and the co-creation process of the project, so they are the core group for a robust analysis of the added-value brought by the co-creation processes.

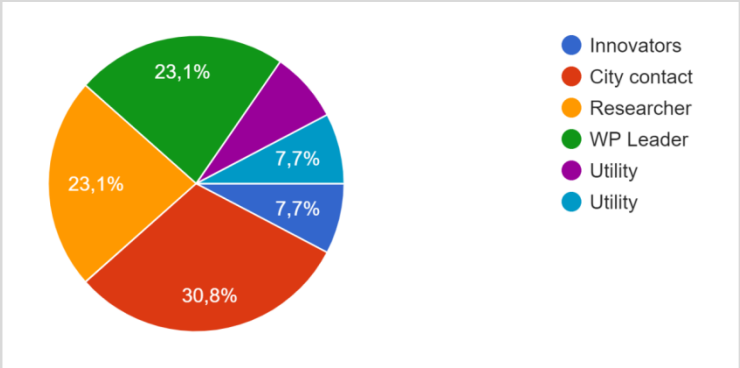

Figure 26. Participants of the survey

4.2.2 Results

The results of the questionnaire are presented in this section whereas the detailed answers to the survey are included in the ANNEX4.

4.2.2.1 Achievements

The co-creation in the DWC project and the establishment of Communities of Practice have presented several achievements and successes. The majority of respondents indicate in particular that this co-creation process contributed to improving the development of digital innovation through different aspects:

- Cooperation:

As explained by the participants, co-creation allowed more cooperation, in bringing together different actors, public, private and research. It allows stakeholders to be “heard beyond the commercial approach of assessing the application's ergonomics or the accuracy of the technical information” Co-creation brought more communication and “cooperation between the different actors (those who had a better understanding of the tools and the situation and those who didn't)” and cooperation with outside participants Co-creation was fundamental because it made work “different sectors” from “different backgrounds and competencies”, and allowed to establish between the actors a “joint

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learning culture". Generally, Communities of Practice offered new opportunities for cooperation with other stakeholders,

- End-users' needs:

One of the main achievements of co-creation is that the needs of users have been collected.and better addressed, as agreed by all the participants. One participant precised that "probably not the needs of all users, but quite a few needs were collected and addressed" and another explained that the DWC co-creation process has been able to make understand that it is not possible to represent the points of view of all users of the digital solutions developed, although a co-creation approach helps to involve most concerned actors.

User feedback was mainly used to drive an scenario approach that is useful for even inexperienced users to broaden potential spread of the solutions. Including end-users' feedback allowed to "develop solutions people want to use", and was considered a necessary asset "because the assumptions made by developers about users' need are often biased", as mentioned by some participants. Co-creation enables to gain an in-depth understanding of the needs and requirements of the future users, for example in the case of Berlin user's: fear of information overflow, the lack of staff and resources to maintain and operate the digital solutions after a pilot phase and also the trade-off between the the need of easily available data and the need of secure data to protect critical infrastructure. Some participants highlighted the high specificity of the solutions developed "to a specific problem based on the development of existing generic solutions" (for example some aspects that have been improved to being able to add new scenarios with few additional development input."). It was also concluded that co-creation could reduce failure rate of a product since the solutions are better adapted to end-users' needs. For example, the co-creation process in Copenhagen supported the identification of several key aspects leading to an enhanced product development and detecting some barriers (e.g., why water utilities are either not regularly using current systems for data sharing or either limiting their use to specific issues like the analysis of rain events). Also, participants in the DWC Copenhagen CoP recognized a number of expected benefits (e.g. increased cooperation, improved internal and external communication and savings in operation costs) and expected experience in the use of the system (e.g. easy data visualization and download). In Milan, an important lesson learned is that although the institutional stakeholders provided a very valuable feedback, in particular in the initial development stages, it was concluded that a greater involvement of final end-users into this exercise can help to better tune-up and refine the tools. In Paris, the end-users' feedback has been fully incorporated into the applications. In Sofia, The co-creation has focused on communication of results (i.e. how to regularly report on the collected data and generated information to the stakeholders) as well as in promoting the use and further adoption of the digital solutions and the information generated through their use.

- Trust:

As a clear benefit from the co-creation process, it helped to build trust in the solutions developed, i.e., as explained one participant: "we believe that if they participated in the development process they would be more willing to use the tool afterwards and trust in it!" It was important to maintain the "involvement of the participants and make it effective (one must be ready to see the initial plan bifurcate by listening to the actors' concerns and constraints)" and that listening and responding to their concerns was key to maintain the "confidence and involvement in the co-creation process". Co-creation was necessary because it helps to increase confidence in the solutions, as said one participant "involving the future users in the development of the tool allowed us to create something that

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perfectly answers their demands and we were able to build trust in the tool so that they could use it with a lot of confidence".

- Governance:

Co-creation raised also challenges: first in terms of communication because of the importance of raising awareness among users and populations, e.g., concerning swimming in open waters, and second about the utilization of technical data to make decisions, e.g., on the status of a bathing site. The co-creation approach allowed rising "new questions of governance" and faced political questions.

4.2.2.2. Format and process

The participants agreed that the implemented co-creation process (format, activities, actors, etc.) has been adequate to achieve the objectives. The workshop format was often used to facilitate deliberation and feedback collection from different actors, e.g., opinions on potential barriers to implementation of digital solutions, synergies with their work and their expectations of the DWC project. For example in the Berlin case, dedicated workshops with future end-users were held to specify user requirements and test prototypes. This included the ideation of features of the well diary as well as UX and UI design. This has been essential to support development of the digital solution and has enabled the DS provider to tailor these products to actual users' needs. In Milan, the third CoP meeting had an important focus on co-creation. In this case, a demo version of the serious game on the water, energy, food and climate nexus was presented and discussed with a group of stakeholders. Some educational workshops were also organized as a follow-up activity. In a similar manner, the DWC Milan leaders have approached several farmers (in collaboration with some of the stakeholders participating in previous CoPs) to directly involve them in the demonstration activities of the matchmaking-tool and the related innovations. Again, reception of this initiative has been very positive.

In the Paris region case, INRAE conducted a series of focus groups in order to collect feedback from the citizens, organizing a feedback session on all the interviews and focus group conducted during the project, which were very effective. Several exchange meetings were also organized, e.g., bathing site managers in France sharing their experiences, or a meeting including return of experience on alternative measurement tools of E.coli by several institutions.

Some webinars were also organized to generate new constructive exchanges, like said by one participant "great exchange webinar as follow up action of the CoPs, discussing different techniques and strategies to deal with illicit connections". Cross-fertilization processes were also perceived as a clear benefit from the Local CoPs, e.g., "through the intervention of "practitioners" with a broad experience", in order to be able to share daily experiences, difficulties and how to better adapt or overcome these

The CoP events required prior preparations to understand what kind of format could be the most adequate. As an example, a participant in the DWC Paris CoP said that a key step that enabled the effective calibration of the CoPs was the preliminary individual interviews with the representatives of the invited institutions in order to explain the approach and find out about the institution's position on the subject. Another fundamental step was to agree on the mode of deliberation for collective decision-making. Digital tools were effectively used to this end to survey participants' opinions". For the format, participants also indicate that it was important "participate without blocking too much of their time so we decided to fix one meeting per month and exchange information via emails".

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In terms of composition of actors, for some CoPs, public authorities have been most involved, for other CoPs, it is innovators, private sector actors and/or researchers. One participant specified that the actors' involvement also depended on their "motivation" in the face of the subject, concerning them more or less.

Co-creation process occurred during the CoPs, and through individual interaction and information sharing, as shown the Figure 27.

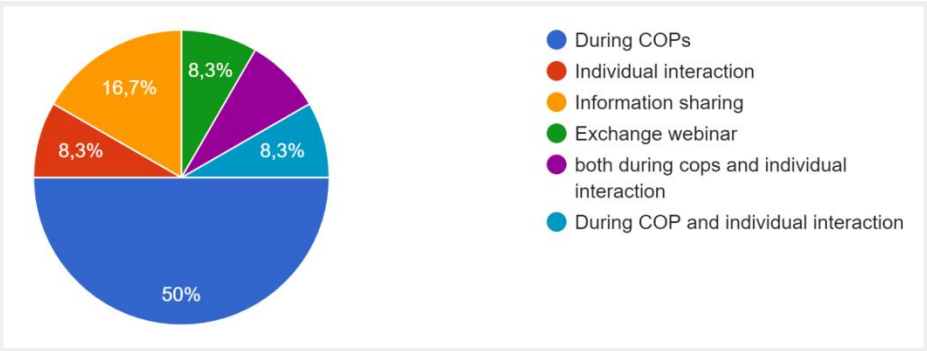

Figure 27. Answers on how the co-creation process occurred.

In the Berlin case, the local CoP raised the topic of data exchange between the cities' stakeholders, e.g., exchanges about groundwater, surface water and rain data. This discussion contributed to setting up a common ground in order to work on a secure and centralized data hub for water infrastructure and environmental data will provide a very important foundation for future expansion of the developed digital solutions. In Copenhagen, the results from the dedicated workshop on SAMDUS tool organized have allowed to integrate key aspects in the solution development roadmap, BIOFOS and DHI have embraced an Agile approach for the progress of the SAMDUS web platform. Requirements were identified in the workshop and been directly addressed and beyond this, used as criteria for the definition of targets in the development sprints included in the process. In Milan, a strategy developed during the process was the identification of key "intermediaries" to get in touch with them, and also a collaboration with the Milan municipality to engage with some high schools in the area to organize a number of educational activities to present the serious game tool and collect some final feedback as a direct input for completing the app. In the Paris case the fully participatory conception of both applications brought together all the actors working on the bathing situation in the Paris area as well as representatives of all the cities that might open up a bathing site.4.2.2.3 Difficulties and limitations:

Some limitations mentioned were that the process of co-creation is challenging and needs time, e.g. the co-creation process put in place "took time to set up" and there was also "time lack for the procedure". Also, some participants indicated that "more results" could be shared on a platform. Another limitation mentioned was that the process could be "closer to the user needs", and that the format could integrate "more physical meetings".

A usual difficulty was that "stakeholders in COP did not have capacity and funding for more involvement in the co-creation". Some other difficulties were also mentioned, specifically during the online interactive session, where some participants debated on communication and political issues or sensibility, and that sometimes it was necessary to decide "not open too much" the process to keep it effective.

Another aspect was the importance of "prioritizing", i.e., as one participant indicated, it is important to select those features that give value to many, and be aware of benefits and co-benefits".

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The main barriers limiting the full production of the expected co-creation are summarized in Figure 28 below.

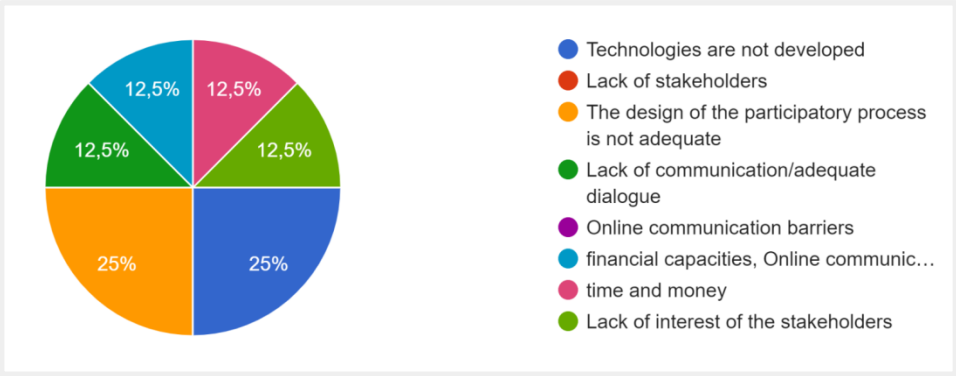

Figure 28. Main causes of barriers when the expected co-creation was not produced

Conclusions and recommendations:

The methodology proposed by the DWC project for co-creation put in place a process aiming to interact and exchange different actors and share their knowledge and resources. Their regular interactions made them share "their own resources, integrate resources offered by other actors, and potentially develop new resources through a learning process", as suggested by the definitions on co-creation in the literature (Leclercq et al., 2016, p6).

The survey on co-creation within the COPs and the case studies on the Local CoPs showed that one of the objectives of this co-creation was, if the context allowed it, to include end-users' needs in the development of the digital solutions, which is congruent with the literature on co-creation, acknowledging a more constructive role for the customer or end-user in the market value creation process (Galvagno and Dalli, 2014). The necessity of integrating into the processes, among end-users, other stakeholders like suppliers, public institutions, collaborators, competitors have been underlined (Prahalad and Ramaswamy, 2004a) as an added value in the DWC project and the CoPs. Furthermore, The participative approach of the co-creation process also allows increasing trust of the solutions developed as the needs and expectations of end-users were collected. Collecting end-users' feedback allowed to build trust and buy-in on the solutions because these can be better adapted to the needs and context specificities.

The issue of time and effort was not seen in the same way by all participants. Some actors of the DWC project highlighted that the process and setting up interactions was taking a lot of time, although for other participants they express that implementing a co-creation process would cost less time and less money because the solutions would be more adapted to the needs.

Regularity was highlighted as a central element of the process, as well as adaptability, i.e., to adapt to the needs of the different actors joining the process.

Regarding generally the DWC CoPs, the interest and relevance for the topics discussedhas been a key issue, and is one of the foundations of the creation of a community of practice where actors must share a concern or a common subject to constitute the community. Furthermore, as the concept of Communities of practice suggested (Wenger-Trayner, 2015), the "process of collective learning" and sharing mutual knowledge were highlighted by the participants. During the online debate session, it was indicated that one of the central points in constituting the communities was the "sense of

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commitment". The fact that several groups of people deliberately choose to engage in regular interactions, common activities and meetings, sharing information and developing skills and solutions together, making them members of a community, as the literature on Communities of practice highlighted (Wenger, 2010).

Finally, another important added value of the co-creation process within the CoPs, is that, as explained by some actors during the online session, this would allow them to raise news questions and to create new partnerships.

Co-creation was a whole process to set up, in order "to establish a culture of co-creation", adapting the objectives, expectations and format. The role of the co-creation process was different depending on the cases and needs. For some Local CoPs, the co-creation was established through a whole participatory process between private actors, public institutions and researchers. For some other CoPs, the co-creation occurred more directly at a company level integrating interactions with end-users.

Co-creation was beneficial to face some of the sector-specific challenges mentioned before, such as addressing slow innovation rate, low awareness and engagement of users. As several actors mentioned, the DWC co-creation process and the methodologies of cross-levels and cross-sectors Communities of practice raised governance questions, and allowed reflection on policy fit and regulation standards and boundaries.

It could be recommended to add stakeholders and end-users' feedback once the solutions are fully implemented and after some time operating. It can be also beneficial to include more perspectives and insights during the whole co-creation process, from the very beginning. Including the reflection on how integrating their subjective experience can improve the effectiveness of companies looking to integrate customers (and their employees) into their value processes, as mentioned in the co-creation literature (Galvagno and Dalli, 2014).

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ANNEX 1. DESCRIPTION OF THE MAIN AIMS AND PROFILES OF THE DWC LOCAL COP'S

This annex summarizes the main results from a World Café exercise that was part of the General Assembly meeting held in Berlin in September 2019. City leaders and WP leaders participated in this exercise, facilitated by ICA. The participants in the exercise were separated into two groups, i.e. the "table hosts" (WP leaders) and the "table visitors" (City leaders). There were three rounds, and after each of these the "visitors" rotated to a different table. The key objectives were:

a) To map the potential interactions between Digital Solutions and Local CoPs with the final objective of defining the topics and stakeholders of the local CoPs.
b) To identify how important are the transversal topics of WP4 (e.g. cybersecurity, interoperability) in each of the cities.
c) To think about potential transferability of DSs to other cities (with different contexts) building on the planned analysis on existing governance frameworks, policies and stakeholders within WP3.

The results are summarized in this section in terms of commonalities and differences among DWC cities and specific characterization for each city.

Commonalities

Based on the discussions, a number of common points among several DWC cities have been identified[3]:

1. Cities are in general very interested in **exchanging experiences** with other cities, e.g. learning how other cities are implementing a specific Digital Solution or which kind of barriers or limitations have been identified.

   [This mutual learning could be fostered through specific activities conducted by the Intra-Project CoP. Moreover, the knowledge exchange could also be extended to other cities currently not involved in DWC, i.e. through the organization of workshops.]

2. Some of the cities (i.e. Copenhagen, Milan) envisage potential **collaborations with ongoing projects** at the local scale. This kind of networking activities provide opportunities for improved adoption and/or dissemination of the expected results.

3. A crucial aspect to be decided is **when to engage with the relevant stakeholders** (e.g. from the beginning, once initial results are available, when digital solutions are sufficiently tested, at the end of the project for communication and dissemination purposes, etc.).

4. One of the key reasons for involving stakeholders into the project activities is **building trust**. This social capital is considered as an important driver for the adoption of the digital solutions. Related to this point, the involvement of operational teams may be particularly remarkable in order to improve the usability of some solutions.

5. **Data exchange** is considered a significant challenge for many of the cities. There is a need to better understand which data exchange is needed, and which data can be exchanged, i.e. open data / critical data.

[3]For some of these common points, some follow-up ideas were suggested. These are written [between brackets]

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6. There is no common understanding yet on **what is meant by ICT governance** in the water sector.

   [Our analysis related to innovative modes of ICT governance will be based on interviews with relevant stakeholders in the demo cities. These interviews could be complemented with other activities at Intra-Project level (e.g. a workshop with all city leaders and relevant stakeholders)]

7. The discussions on **cyber-security and interoperability** lacked time to get into the details, although this was expected. The general scope and right contacts were identified for all cities and follow-up activities will be organized to deepen into these two topics.

   [These are considered as very relevant topics for joint discussion at Intra-Project level.]

Differences

In addition to the common points, a number of differences have been recognized:

1. There are different needs as regards to **stakeholder involvement**, i.e. ranging from a strong interest by stakeholders to cooperate in the co-development of some solutions to cases where the need of stakeholder involvement is very limited (e.g. Sofia). This must be taken into account for the design of the activities of Local Communities of Practice.
2. The required **stakeholder involvement** is related to different stages in the solutions development, namely:
   - contribution for the specification of **technical characteristics**
   - consideration of **expectations from end-users** throughout the design and development of the solution
   - **convincing** end-users and stakeholders **about the benefits** from the implementation of the solution
   - increase of **communication and dissemination** of the results
3. There are differences in **problem awareness** by public authorities. For some DSs, there is a clear willingness of public authorities to cooperate to reduce existing problems (e.g. bathing quality) whereas it is not fully clear whether public authorities have a real interest in strongly contributing to sort out other problems (e.g. detection of illegal sewer connections). As for the latter case, it is acknowledged the need to make an effort to involve authorities so as to motivate them to work on the topic.
4. The discussions showed that in the different cities, **digitalization has been integrated quite differently.** Often, technical aspects of implementing new technologies and making them work prevail over ICT governance and policy aspects.
5. While Copenhagen, Paris and Milan were already quite clear on the **sensor integration and needs concerning WP4**, for Sofia IT department needs to be involved and for Berlin, expectations on strategic and tactical level need to be further sharpened.

All these points will be considered for the identification of activities and topics to be addressed by the DWC Local CoPs.

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City-specific issues

The city-specific issues regarding i) the planned level of involvement of stakeholders in the implementation of the digital solutions; ii) ICT governance; and iii) cyber-security and interoperability, are presented in this subsection:

- BERLIN

Implementation of Digital Solutions

A total of seven DSs will be implemented in Berlin mainly dealing with improved groundwater management and sewer system management.

List of Digital Solutions to be implemented in Berlin

CITY	DEMO ACTIVITIES IN CITIES	RELATED DIGITAL SOLUTIONS (DSs)
BERLIN	Improved operation and predictive maintenance of water wells [WP2]	DS7. Mobile application for predictive maintenance of drinking water wells
		DS8. Forecasting tool for strategic rehabilitation planning of drinking water wells
	Public awareness (groundwater management) [WP3]	DS16. Augmented Reality (AR) mobile application for groundwater visualization
	Bathing quality online monitoring [WP1]	DS1. Sensors for real-time in-situ E.coli and enterococci measurements
	Identification of illicit connections in the stormwater network [WP2]	DS9. DTS sensor for tracking illicit sewer connections
		DS10. Sensors and smart analytics for tracking illicit sewer connections hotspots
	Smart sensors and analytics for real-time stormwater management [WP2]	DS14. Low-cost temperature sensors and analytics for real-time CSO and flooding monitoring

(*) The DSs highlighted in blue are those being implemented in several DWC cities

A summary of the discussion about the needs, benefits and potential limitations of stakeholder involvement for each solution is hereafter provided:

- **DS1:** The main interest is in exchanging experiences with other cities. Other stakeholders in Berlin do not need to be included.
- **DS7, DS8 and DS16:** The Water Authority (WA) operates its own wells and is very interested in these solutions on groundwater management.

  Since BWB is the intended main final user of DS7 and DS8, the suggested strategy is to foster discussion at DWC Berlin level on some key issues, (e.g. secure data exchange, sharing sensitive information) and to get these topics back into the company level.

  This is seen as a good opportunity to improve efficiency of data exchange between Berlin stakeholders (e.g. WA, SenUVK) and the Water Utility (BWB). Lots of data are being collected and there is a need to share these data to improve knowledge generation.

  A decision to be made is whether is it useful enough to get them on board now (i.e. to improve transferability from the beginning), or whether this involvement should occur later since now

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they could they bring their own problems on board and hinder the development of the solutions.

The involvement of the operational team of BWB will benefit these solutions.

- **DS9:** Water Authority is in charge of closing illegal sewer connections. Municipalities have responsibility in detecting and communicating about these connections, but they were not in the DWC Berlin initial meeting. A challenge is to involve authorities to motivate them to work on this topic.

  The involvement of the operational team of BWB will benefit these solutions.

- **DS10:** This solution raised a lot of interest from stakeholders attending the first DWC Berlin meeting. Water Authority is a key actor, since some of the data they are collecting are required for the effective implementation of the solution. The Water Authority is interested in the demonstration of the solution but not in participating in its development. They could be involved in communication of results.

- **DS14:** This solution was very interesting for many stakeholders in Berlin (W.A., H.A.). This is considered as a cost-effective alternative to gather a large amount of useful data. There is an interest in exchanging data between stakeholders in Berlin. Furthermore, there is an interest in exchanging experiences with other cities where these sensors are also going to be deployed.

Planned stakeholder involvement in Berlin for the co-development of solutions

DS	Relevance of stakeholder involvement	Stakeholders to be involved and benefits	When to be involved?
DS1	No need	-	-
DS7	Data exchange	WA, SenUVK / Secure data exchange and enhanced info for GW management.	TO BE DECIDED Now vs Once the solution is more advanced
DS8	Data exchange	WA, SenUVK / Secure data exchange and better info for GW management	Limited involvement now through DWC Berlin
DS9	High	WA, municipalities / Improved detection of illicit sewer connection	From the beginning (building trust and motivating them to work on this topic)
DS10	Very High – data from WA are needed	High interest from many stakeholders (more in demonstration than in co-developing)	Once preliminary results can be shared
DS14	Data exchange	High interest from many stakeholders (WA, HA,…) / Data collection and data exchange	Once preliminary results can be shared

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DS16	End-users expectations for the mobile app	End-users of the app	To be coordinated with WP3 (public awareness)

ICT governance

- It is largely undefined what digital transformation in the water sector means.
- Data exchange within BWB is a challenge
- Discussions on ICT-security of relevant infrastructure is still not really kicking off.
- A quality check protocol exists for laboratory data before publishing it, however, for other data, this is still missing.
- At the very end of the session, the question was raised about the actual benefit of digitalization.

Cyber-security and interoperability

The system in Berlin is already well-known to Sintef from Stop-it project, thus there was a broader discussion on expectations and tasks. Sintef is interested in working on strategic and tactical levels of cybersecurity with BWB, e.g. impacts of misfunctional or corruptive sensors.

BWB has not decided yet how sensor integration will be developed. IT department will be involved and they are expected to set standards that solution providers have to fulfil. BWB is interested in undertaking an approach to up-scale integration of (many) sensors and their data in data transmission procedures.

Some questions will be shared with IT departments and a workshop is to be planned between Sintef and BWB (involving IT) on topics within WP4.

■ COPENHAGEN

Implementation of Digital Solutions

The DSs to be implemented in Copenhagen are all related to sewer and WWTP management.

List of Digital Solutions to be implemented in Copenhagen

CITY	DEMO ACTIVITIES IN CITIES	RELATED DIGITAL SOLUTIONS (DSs)
COPENHAGEN	Sewer and WWTP management [WP2]	DS11. Sewer flow forecast toolbox
		DS12. Interoperable DSS and real-time control algorithms for stormwater management
		DS13. Web platform for integrated sewer and WWTP control

At first stage of development, external stakeholders are not important.

The key goal is to develop the solutions to improve quality of forecast. As a result, BIOFOS aims to share these results with other utilities operating sewer systems in neighbor municipalities. There is an ongoing project at operational level with utilities which provides a valid channel to replicate (platform to exchange best practices). The ultimate goal is to reduce risk of flooding through an improved system operated in a larger area.

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Planned stakeholder involvement in Copenhagen for the co-development of solutions

DS	Relevance of stakeholder involvement	Stakeholders to be involved and benefits	When to be involved?
DS11, DS12 & DS13	Not important for the development. The key goal is adoption of the solutions in municipalities not currently operated by BIOFOS	Water utilities / the key benefit is reduction of flooding risk	Demonstration activities

ICT governance

- Guideline by Danna exists.
- In the Copenhagen area no standardized protocol exists. Instead, 7 utilities have to agree on the numbers to be communicated.
- Municipalities are mostly perceived as stakeholders that lack the technical knowledge to understand particular aspects of the innovations.
- Local authorities are afraid of data misuse.
- Utilities decide on innovation (not authority)

Cyber-security and interoperability

BIOFOS was already quite specific and able to answer most of the questions. These will be shared with IT departments and a follow-up meeting is to be organized.

- MILAN

Implementation of Digital Solutions

Six DSs are being implemented in Milan area, all of them related to safe water use for irrigation

List of Digital Solutions to be implemented in Milan

CITY	DEMO ACTIVITIES IN CITIES	RELATED DIGITAL SOLUTIONS (DSs)
MILAN	Safe water reuse for irrigation [WP2]	DS1. Sensors for real-time in-situ E.coli and enterococci measurements
		DS3. Near real-time Early Warning System for safe water reuse
		DS4. WebGIS platform for improved management and decision making in water reuse
		DS5. Match-making ICT tool between water demand for irrigation and safe water availability
		DS6. Active unmanned aerial vehicle for analysis of irrigation efficiency
		DS17. Web-based serious game for the water reuse – carbon – energy – food – climatic nexus

(*) The DSs highlighted in blue are those being implemented in several DWC cities

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A summary of the discussion about the needs, benefits and potential limitations of stakeholder involvement for each solution is hereafter provided:

- **DS1:** The solution will be tested for estimating bacterial use in water use for irrigation. No relevant need for stakeholder involvement since sensors will be installed in CAP facilities.
- **DS3, DS5, DS6:** The primary stakeholder is the national Farmers Association. This is particularly important for the early phase of development and they have shown a solid commitment.

  Other stakeholders (consumers, actors in the food value chain) need to be involved in later stages, in particular to better understand potential reactions and acceptance of consumption of food irrigated with wastewater.

  There are other stakeholders to be considered:

  - Irrigation Communities: responsible of water quality delivered to the farmers (they "sell" the water to the farmers).

  - Water Authority: interested in supporting water bodies recuperation

  - Farmers (to be engaged later in the process, since the Early Warning system is mainly addressing ICs

  - Environmental NGO's (e.g. Legambiente)
- **DS4**: There is a fellow company interested in applying same methodology
- **DS17**: The aim of the tool is awareness raising. Interest of citizens is crucial. There is an ongoing LIFE project devoted to raising awareness on Climate Change (collaboration opportunity). Legambiente to be involved but also smaller NGO's. Engagement could happen once a preliminary version of the game is produced (i.e. sharing initial data).

Planned stakeholder involvement In Milan for the co-development of solutions

DS	Relevance of stakeholder involvement	Stakeholders to be involved and benefits	When to be involved?
DS1	No need	-	-
DS3, DS5	High	Farmers Association (key stakeholder); consumers, food value chain; Irrigation Communities; Farmers; Water Authority; Environmental NGOs	Farmers Association to be engaged at an early stage. Other stakeholders will be involved later in the process.
DS4	Not a strong need – possibility of replication		
DS6	Data provision	Farmers Association Irrigation Communities; Farmers	Support to development and demonstration
DS17	High	Citizens; Environmental NGOs; Water Authority	Once a preliminary version of the game is prepared

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ICT governance

- Web GIS application has been published, however, without the framework of overarching policy and rather based on a single initiative.
- Data protection and IPR are open questions and could motivate the creation of new policies.
- Fear of misinterpretation hinders data publication.
- It is yet unclear who is taking responsibility for data validity and quality. Data should meet end-user needs. Thus, instead of making raw data accessible, data communication becomes key here to cater end-user needs and make it understandable to them.

Cyber-security and interoperability

CAP was already quite specific in addressing the questions.

An online meeting is to be set up between CAP and Sintef to go into further detail of the solutions.

- PARIS

Implementation of Digital Solutions

Three DSs related to bathing quality are being developed for Paris.

List of Digital Solutions to be implemented in Paris

CITY	DEMO ACTIVITIES IN CITIES	RELATED DIGITAL SOLUTIONS (DSs)
PARIS	Bathing quality [WP1]	DS1. Sensors for «near» real-time (**) in-situ E.coli and enterococci measurements
		DS2. Machine-learning based Early Warning System for bathing water quality
		DS18. Mobile app to communicate bathing water quality to citizens

(*) The DSs highlighted in blue are those being implemented in several DWC cities

(**) Near real time means that a few hours are needed to get the result but in-situ sensors help to save a lot of time

As for **DS1**, no relevant involvement from end-users is required. Feedback from other cities is interesting, i.e. how other cities are implementing this and barriers or constraints for implementation.

For **DS2**, the Health Authority is the key stakeholder. An important activity is to decide on the acceptable reliability of the forecast. This will have a direct effect on how much resources need to be invested. Data exchange to feed the model is also required.

Regarding **DS18**, the solution retained in the grant agreement is the mobile app dedicated to communicate water quality to the citizens that we called “Public” app. However, it is important to note that an “expert” app will also be developed. This app is for the bathing site managers and will contain the results of the Early Warning system (DS2).

For DS2 and DS18, expectations from end-users need to be taken into account. Hidden social aspects will be analysed as part of WP3.

Planned stakeholder involvement In Paris for the co-development of solutions

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DS	Relevance of stakeholder involvement	Stakeholders to be involved and benefits	When to be involved?
DS1	No need	-	-
DS2	High	Health Authority / Agreement between forecast reliability and resources to be invested; Data exchange for solution development	From the beginning
DS18	High	Citizens and Authorities (decision-makers) / Consideration of end-users' expectations and requirements	Coordinate with WP3

ICT governance

- There is no major discussion evolving around ICT governance yet.
- Questions have been raised on the process of making data accessible.
  - ☐ National law requires making data accessible; however, this has not happened yet.
  - ☐ What kind of data, for what destination and which kind of end user, in which delay? Raw data? Validated data?
- Different levels of ICT governance were brought up:
  - ☐ Internal (authority)
  - ☐ between authorities
  - ☐ between authorities and end users
- In Paris exists an exchange between authorities and innovators as data from sensor monitoring is being sent to authorities
- In France, formalised data exchanges procedures already exist concerning WWTP self-monitoring and natural water quality monitoring. This data exchange process is managed by the SANDRE.

Cyber-security and interoperability

SIAAP was already quite specific in answering the WP4 questions. However, implementation of sensors is not defined, yet. An internal steering committee is currently involved in this decision (with IT and neighbour utilities). An open issue is data transmission.

- SOFIA

Implementation of Digital Solutions

Two solutions are being implemented, both related to improved sewer and storm-water system management.

List of Digital Solutions to be implemented in Sofia

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CITY	DEMO ACTIVITIES IN CITIES	RELATED DIGITAL SOLUTIONS (DSs)
SOFIA	Sewer and stormwater management [WP2]	DS14. Low-cost temperature sensors and analytics for real-time CSO and flooding monitoring
		DS15. Smart sewer cleaning system with HD camera and wireless communication

(*) The DSs highlighted in blue are those being implemented in several DWC cities

The need of stakeholder involvement is low for both solutions.

For **DS14**, the final aim is to provide an evidence to municipalities in Sofia area (consisting of 24 municipalities) about the need to construct drainage pipes to improve sewer system. Currently, 10% of CSOs are without outfall to river. The information gathered through the network of sensors also is expected to be useful for communication issues (i.e. reporting).Involvement of municipalities will happen at a later stage of the action, after getting data that can be trusted.

As for **DS15**, no involvement required from external stakeholders, since the main objective is for promotion of the company (i.e. demonstration of benefits obtained by an increase of the efficiency in the cleaning works, e.g. reduction of traffic jams).

Planned stakeholder involvement In Sofia for the co-development of solutions

DS	Relevance of stakeholder involvement	Stakeholders to be involved and benefits	When to be involved?
DS14	No need for operation of the solution	Municipalities / to proof the need of an improved drainage system	Later, after getting data that can be trusted
DS15	No need	Other water utilities	-

ICT governance

- Only a limited amount of data is being shared and only within utilities for operational issues.
- Data protection is not a major issue yet.

Cyber-security and interoperability

SofiyskiaVoda was quite specific on the objectives and number of sensors to be installed, although not aware of IT details. However, IT division should be able to answer questions. These questions will be shared with and an online meeting will be prepared.

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ANNEX2. ADDITIONAL INFORMATION INCLUDED IN THE GUIDELINES TO SUPPORT ACTIVITY OF LOCAL COPS

As part of the guidelines to start operating and support activity of local CoPs (M5.1), some annexes were included with some useful information for CoP managers:

a) Description of general steps in participative processes;
b) A catalogue of methodologies and event formats for facilitation of workshops;
c) Suggested messages to be included in the invitation for the presentation meeting of local DWC meeting;
d) A detailed guidelines for the organization of the DWC presentation meeting of local CoPs.

A) GENERAL STEPS IN PARTICIPATIVE PROCESSES

First of all, the organization and conduction of participatory processes for interaction and co-development with stakeholders should follow a series of key principles.

1. Objectives should be clearly stated;
2. Methods should be adapted to the local cultural / institutional / context;
3. There should be a broad range of interested parties / individuals;
4. Transparency in using the information: it is key to make clear how stakeholders' views will be used and what the information resulting from the workshop will serve for;
5. Allocate sufficient time to carry out the activities without overloading the participants. Some time for breaks and networking is necessary and helps creating connection and engagement between the participants;
6. Stakeholders should receive intermediate feedback and summary of results and conclusions from their contributions during the course of the process;
7. The results of the process should have an impact on the decision to be made or the process in which they are to be involved;
8. We should search for evidence of enhanced stakeholder understanding – i.e. social learning.

Having these keys in mind, structuring the organization of stakeholder engagement participatory processes can be done in a series of sequential steps. These steps describe the methodological backbone and logic to develop a coherent and fruitful participatory workshop or session, as well as the elements and aspects to be prepared and taken account of. However, on a broader sense the methodological logic can also be applied to structure the whole participatory process composed of several iterative workshops, where stakeholders are embarked in several phases of the process with bilateral information exchanges: stakeholders provide information and insights and receive feedback and results from previous phases.

Steps for the organization of a participatory workshop:

STEP 1.Define the objectives. You should define the main and secondary objectives of the workshop. The following questions can help identify both categories objectives.

- *What do we need to get (outcomes) from the participation process: information (quantitative, qualitative, perceptions, awareness…?*
- *In which format do we need the information: numbers, causal relations, concrete data, general knowledge, perceptions, spatial representations...?*

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- *Are we seeking any additional effects besides our main inputs: e.g. building sense of community, raising awareness, promoting networking and communication between the actors, foster/show transparency, educate on something/disseminate information…?*

STEP 2.Define the best methodology to obtain the required outcomes. Depending on the type of outcome and the format required, a different methodology or set of methodologies will be more convenient. A set of examples of methodologies suited for obtaining different types of outcomes is provided in this annex. Once the methodology has been selected, the most logical and efficient sequence of steps should be defined, looking at optimizing time and resources while ensuring the achievement of results.

STEP 3. Materials and resources needed: once the exercises and dynamics have been designed, a list of required materials and resources should be prepared to make sure everything needed can be available. In case some critical element cannot be accessed, an alternative should be searched for (alternative material, adapted exercise or an alternative method). Examples of useful materials are PPTs, post its, board charts, blackboards, stickers, etc.

STEP 4. Define the agenda and prepare a dissemination and an internal working agenda: Once the agenda has been closed, it is useful to prepare two versions:

- Dissemination agenda: should include the title, logistics and main schedule of the workshop activities. It is aimed for sharing with the participants to provide them with the essential information and attract their interest.
- Internal working agenda: it should contain the same items as the external agenda, completed with the distribution of tasks among the organizing team and the preparation details, as a sort of a script for the organization and conduction of the workshop. Possible tasks include overall moderation, facilitation of groups, note taking, generation of visual material (pictures, videos), etc.

STEP 5. Pilot workshop

Carry out a pilot test of the workshop to make sure the exercises can be done within the allocated time, to foresee any possible unexpected situations (questions, polemics) and prepare responses, and make the organizing team get hold of their tasks. Make any adjustments as required.

STEP 6. Define the list of actors to be invited

Make sure that all the interested groups are represented, and there is a certain balance, unless the objective of the workshop is especially focused on one or two specific groups.

STEP 7. Logistics

- Prepare logistics: book a place for the venue, book the catering/drinks, prepare and buy the materials with time.
- Send the invitations to the participants via email and make any personal contacts (by phone or in person) for those stakeholders potentially more difficult to reach via email (i.e. farmers, old people, etc.).
- Ask for confirmation of assistance and send reminders when the event gets closer. Some additional phone calls may help get further responses if the response rate has been low.
- Prepare attendance list and consent forms for the use of images, data protection, possible sharing of email among participants, attendance forms.
- Organize and manage reimbursement of travel costs if applicable.

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- Prepare accreditation tags.

STEP 8. Process evaluation

Undertaking some kind of process evaluation is important in order to assess: 1) the quality of the process, 2) the satisfaction of participants / Suggestions for improvement, 3) to gather additional individual based information or feedback, 4) assess the perception of usefulness, learning from the process. This can be done through forms or surveys at the end of the day, or through an evaluation email submitted one or two days after the workshop. Generally, any feedback gathering method onsite will gather more responses than ex-post via email.

STEP 9. Post workshop processing tasks

- Send a thanking email to the attendees.
- Gather and digitalize the information co-produced with stakeholders during the workshop.
- Analyze the information and turn it into usable results for the project/process' aims. Draw out a few conclusions of the session.
- Prepare a summary note of the workshop, including the results and conclusions achieved, and disseminate it among participants.
- Proceed to the reimbursement of travel expenses if applicable.

Final specific keys or recommendations to ensure the success of a participatory workshop or session include the following:

- Make sure to explain very well the objective of the workshop and how it fits within the broader project/process, and if there will be future follow up/next phase sessions.
- Explain how the inputs from the participants will be included.
- Explain carefully what the role of the participants is and what they will be asked to do during the session.
- Send a summary of results and conclusions 2 or 3 weeks after the workshop and another final summary by the end of the process/project.
- Provide information that may be useful/interesting for the participants.
- Ensure a good moderation so all the participants feel equally encouraged to contribute and there is an atmosphere of respect, order and equality.
- Try to integrate the stakeholders' interests in the discussion topics/exercises to ensure a balance between their concerns and needs and the specific objectives of the process.
- Make always sure that stakeholders end up with a feeling that their opinions have been listened to and taken into account.

B) CATALOGUE OF METHODOLOGIES AND EVENT FORMATS FOR DINAMISATION OF WORKSHOPS

There are a wide range of methodologies that can be used to dynamize workshops and ensure the achievement of objectives in a smooth and interactive manner.

Most of the techniques can be classified according to their function within the workshop and the objectives it pursues (Geissler and Löffter, 2007)[4].

[4]Geissler and Löffter (2007) Multi-stakeholder management: Tools for Stakeholder Analysis: 10 building blocks for designing participatory systems of cooperation. GTZ, Germany.

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A) Presentation and activation techniques. These are aimed at introducing the participants among themselves, attracting their attention, breaking the ice and fostering a participative and dynamic environment.
B) Analysis and data gathering techniques. These are aimed at reflecting about a topic, raise awareness about the importance of a topic, transfer or communication of knowledge and results to participants or gathering data.
C) Evaluation techniques. These are aimed at evaluating the performance through a selection of indicators that can cover participation, interest, utility, understanding, etc.

The following boxes present a series of examples of techniques within each category.

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A) PRESENTATION AND ACTIVATION TECHNIQUES	
4. SCHOOL BUS	
Objective	Make participants aware of the common features (stakeholder group, origin, interests) and interests of the other participants.
Suitability	Big groups with insufficient time for individual introductions and a great variety of profiles and sectors.
Method	- List of strategic questions (origin, sector, interest, objective) - The organising team members hold labels with the answers distributed throughout the room - Participants need to go the "stop" with the answer that suits them best

5. WRITTEN NAMES	
Objective	Make participants introduce to each other
Suitability	Small groups (<20) where interaction will be important and a networking effect is sought.
Method	- Place participants in a circle holding a card with their name - The participants should try to memorize all names within 5 minutes - The cards are gathered, mixed and distributed again randomly - Each participant should find the owner of the name in his assigned card

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6. SPIDER NETWORK	
Objective	Make participants introduce to each other and break the ice
Suitability	Small groups (<15) where strong interactions are expected and time available is of 20-30 minutes
Method	- Place participants in a circle. - The first participant receives a thread ball and briefly introduces himself. Holding the thread edge, he/she passes the ball to a random person in the circle, who holds the next bit and repeats the process until all the participants have spoken and are holding a piece of thread, building together a spider network. - The last participant receiving the ball starts an inverse round rolling it back and repeating the information from the participant holding the next stretch of thread.

B) ANALYSIS AND DATA GATHERING TECHNIQUES

7. BRAINSTORM	
Objective	Gather unbiased perceptions/ideas from participants on a topic
Suitability	When there is a need to gather unbiased opinions, perceptions or proposals from the participants
Method	- Make small groups with a balanced representation of actors - Write the target question in a board chart and ask participants to think of ideas, write them down on post-its and paste them around the question. - The facilitator should classify them

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8. WORLD CAFÉ	
Objective	Carry out good dialogue and exchange of knowledge on a specified topic
Suitability	Any group with space to move chairs.
Method	- Make small groups of 8 to 10 people to discuss the topic, while seated around individual tables. - The composition of the group can change because everybody moves on to other tables after a short period of time. - One person always remains at the table as the host and, by doing that, ensures that the exchange of knowledge is fast and saved. - The results of all the discussions are presented at the end of the session.

9. PRO ACTION CAFÉ	
Objective	Host conversations about questions and projects that matter to the people that attend.
Suitability	Small groups (<15) where strong interactions are expected and time available is of 20-30 minutes
Method	- Opening circle to connect to the purpose of the session - Ask participants to consider a question they would like to explore for the session and if so, they will be called on to share it and invite others to work with them. - Three rounds of conversation (20-30 minutes each) with a specific focusing question to move the conversation through an evolving process. - Feedback in circle: the host of each table shares what was discussed.

10. FISH BOWLS	
Objective	Facilitate discussion in large groups by having just 3-6 people talk at any one time.
Suitability	Big groups that should have discussions

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Method	- People who should speak are seated in the centre of the room while the rest of the participants (maximum of 50 people) sit around the outside and observe without interrupting. - You can have "closed" or "open" fishbowls, meaning that the discussion is either exclusive to the selected participants or one or more of the chairs is open to members of the audience who want to ask questions or make comments. -Although largely self-organising once the discussion gets underway, the fishbowl process usually has a facilitator or moderator.

11. GRAPHIC VISUAL RECORDINGS	
Objective	Make visual representations of the ideas presented by speakers or introducers facilitating understanding to stakeholders
Suitability	Sessions with many presentations and the need to explain multiple concepts and ideas.
Method	- Graphic recording artists work hand-in hand with the speakers to visually depict the key points and messages of your session. - These artists can either draw live onstage on a board or they can draw on a tablet/digital device which is shown on a screen.

12. SAMOA CIRCLE	
Objective	Promote debate within a central group of stakeholders open to contributions from other participants.
Suitability	Debate with a small target group as the centre
Method	- Place target participants in a circle in the centre - Sit in bigger surrounding circle all the participants that can contribute to the discussion - Explain the rules and start the debate with the small group - When someone in the big circle wants to speak they should make a sign previously agreed (e.g. stand up).

C) EVALUATION TECHNIQUES

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13. SATISFACTION FORM	
Objective	Evaluate participant satisfaction with the workshop
Suitability	Any group
Method	- Prepare a form with a few closed questions (ideally tick or yes/no) and a space to write suggestions of comments for improvement - Hand it out the last hour before the end or before lunch and pick them up at the exit.

14. FORM OF PERCEPTION	
Objective	Identify or evaluate perception changes in the participants as a result of the workshop-exercise
Suitability	Any group.
Method	- Hand out a form with a few questions about the topic of discussion at the beginning of the day to record the pre-workshop perception. - Give each participant a number and ask them to write in the form and remember it until the end. - Hand out the same form again at the end of the day asking to answer the questions again and write down their assigned number. - Pair the forms by number and check any changes in perception.

15. EVALUATION EMAIL	
Objective	Check the perception of participants through an online survey
Suitability	Useful when statistical analyses of the answers are needed
Method	- Design an evaluation survey and introduce it in an online survey platform - Send the survey by email to the participants to ask for their evaluation of the workshop. - Make sure to keep the survey brief and no longer than 10 minutes.

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■ C) SUGGESTED MESSAGES TO BE INCLUDED IN THE INVITATION FOR THE PRESENTATION MEETING OF LOCAL DWC COMMUNITY OF PRACTICE

A number of short messages is suggested to be included into the invitation letter (to be prepared in your native language):

- digital-water.city (DWC) is an innovation project funded by the European Union under the H2020 programme.

- The project will develop and demonstrate several digital solutions for urban water management, covering the most innovative technologies.

- These solutions are being implemented in five large cities across Europe: Berlin, Copenhagen, Milan, Paris and Sofia.

- DWC is creating communities of practice in each city to help to overcome the barriers from innovation to practice by involving key actors in each city and facilitate that their actual needs are appropriately considered.

- A presentation activity is being organized to inform about the project and the digital solutions being implemented in [add your city name]. Moreover, an active participation from attendants will be encouraged to identify your interest in contributing to the co-development of the solutions as well as better shape the benefits that your organization could get from these new solutions.

■ D) GUIDELINES FOR THE ORGANISATION OF THE FIRST PRESENTATION MEETING OF LOCAL COPs (WORKSHOP FORMAT)

The goals of this meeting are:

i) to inform the relevant stakeholders in each city about the project and the digital solutions to be implemented in each city

ii) to identify which benefits can these solutions provide to several stakeholders and

iii) which actual particular requirements of the potential final users should be addressed and on the other hand,

iv) analyze how these stakeholders can support the development of the solutions.

On top of this, this initial meeting will help to build trust on the DWC project and to create an interest in the collaboration for the co-development of solutions better fitted to the actual needs of the end-users.

The presentation meetings are expected to last for 90 minutes, although these could be extended to 120 minutes. These will be moderated by a city leader representative.

The topics suggested to be included as specific items in the agenda are:

- Presentation of DWC
- Overview of Digital Solutions to be implemented in the city
- Concept of Community of Practice
- Setting objectives for the local CoP
- Stakeholder mapping and brainstorming for the validation of the stakeholders map

Based on this list of topics, the following tentative agenda is suggested:

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Presentations	Content	Extent
Presentation 1 (P1): Welcome from Project Coordinator / City Leader	Welcome and overall presentation of DWC	(5-10 min)
P2: Presentation by the session moderator	Agenda and main aims for the meeting	(5-10 min)
P3: Overview of Digital Solutions to be implemented in Berlin	Focus on DSs dealing with groundwater management	(10 min)
P4: Concept of CoP and Berlin DWC management	What is a CoP? How we intend to manage the Local CoP at Berlin?	(10-15 min)
ROUNDTABLE	**Description**	**Extent**
Topic 1 (T1): 'Tour de table'	Short presentation of all participants, including main expectations for DWC	(5 min)
T2: Setting objectives	What can DWC do for me? What can I do for DWC?	(10-15 min)
T3: Stakeholder mapping	Mapping key stakeholders for each solution (Who do you miss in this room?)	(10-15 min)
T4: Mapping relationships	How do stakeholders relate among them?	(10-15 min)

Hereafter, some suggestions are provided for the content of slides to include in the PowerPoint presentations as well as for the moderation of the discussions in the roundtable.

PRESENTATIONS

P1.- WELCOME FROM NATIONAL ORGANIZER

5-10 minutes. Presentation given by Project Coordinator / DWC City Leader

- Appreciation for coming
- Introduce the project
- Importance of the DWC project
- Importance of stakeholder involvement for DWC
- How we will be using the results
- Hopes for consultation

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- *Appreciation for coming*

  Welcome participants and thank them for coming to take part in this activity, part of DWC project. Present shortly the partner organisation, the institution you come from, and explain that DWC is conducted by a group of 24 partners, from 10 countries across Europe with demo activities in five cities, i.e. Copenhagen, Milan, Paris, Sofia and Berlin.

- *Introduction to DWC and importance of the project*

  Short overview of DWC (brief description of the project key challenges and goals)

  Why is this project important for the European Commission? (short remark)

- *Importance of stakeholder involvement*

  There is a large number of digital innovations improving water management and enhancing water sustainability although the number of solutions reaching the market and adequately addressing the needs of end-users in terms of interoperability, cybersecurity, governance or increase of public awareness, etc., is in comparison, very reduced.

  DWC aims to overcome this barrier (from innovation to practice) by involving stakeholders in the co-development of solutions and increase the learning on how this co-development can be facilitated and consolidated.

- *Use of results*

  The feedback collected from the meetings or activities conducted by Berlin DWC will exclusively be used to support the progress of the project.

  This feedback may be communicated to

  i) other project partners, i.e. partners developing digital solutions in Berlin, and partners leading the technical work packages supporting the development of innovations

  ii) the European Commission, as part of two internal documents that we are entitled to deliver by the middle and end of the project to report on the work done by the DWC communities of Practice.

  The feedback will be attributed to the organisations participating in the activities and not to individual persons.

  Specific permission will be asked for the external dissemination of any images or specific information related to DWC Berlin meetings or activities.

- *Hopes for the local DWC CoP*

  "It is our sincere hope that you will have a very nice time at this meeting.

  "We hope that "DWC ******" contribute to expand the dialogue about how to successfully implement new digital solutions in cities and that everybody will leave with a good sense of how we aim to cooperate and help each other to improve the innovations and increase their benefit for the end-users."

P2.- WELCOME FROM MODERATOR

5-10 minutes. Presentation given by Session moderator

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- Agenda
- Ground rules for the meeting

- *Agenda*

Present agenda for the meeting: general presentations about the project and communities of practice + roundtable with a focus on identifying objectives for Berlin DWC and mapping actors and stakeholders to be engaged

- *Ground rule for the meeting (rules for dialogue)*

We have a common understanding about:

- There are no right or wrong answers – there are many possible realities all contributions and perspectives are appreciated.
- Our goal is to build a "win-win" collaboration between research and practical knowledge. This implies a two-way collaboration.

  Stakeholders are asked to:

  i) Provide support to innovators
  ii) Identify how DWC can provide support to them
  iii) We are ready to let go of our own determinations and find a broad consensus

P3.- OVERVIEW OF DIGITAL SOLUTIONS TO BE IMPLEMENTED IN THE CITY

10 minutes. Presentation given by DWC City Leader

- Brief description of the innovations to be implemented in the city
- Planning for implementation of each digital solution: schedule, sites, testing plan, targets…

P4.- CONCEPT OF COMMUNITIES OF PRACTICE IN DWC

5-10 minutes. Presentation given by Session moderator

- Concept of local CoPs in DWC
- IP CoP and TP CoP
- Next steps

- *The concept of Local Community of Practice in DWC*

Definition of CoP.

Main aim of local CoPs is to provide a space for facilitating the co-development of digital solutions. Co-development should increase the chances of producing innovations readiness and their adoption by end-users. Co-development is based on a collaboration:

- where innovators benefit from data and information and testing and development in practical contexts and
- end-users benefits by getting their needs and requirements (general and related to specific routines linked to daily work) incorporated into the development of solutions.

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- *Other CoPs in DWC*

- Another 4 Local CoPs in Copenhagen, Milan, Paris and Sofia

- 1 Intra-project CoP: where Local CoPs leaders are represented (transferability and transversal topics)

- 1 Trans-project CoP: represented by Project Coordinator will organise a limited number of networking activities with other projects and initiatives.

- *Next steps*

- Tentative vision of the CoP roadmap

- Feedback from participants

ROUNDTABLE

Topic 1 (T1): 'Tour de table'	Short presentation of all participants, including main expectations for DWC	(5 min)
T2: Setting objectives	What can DWC do for me? What can I do for DWC?	(15 -25 min)
T3: Stakeholder mapping	Mapping key stakeholders for each solution (Who do you miss in this room?)	(15 min)
T4: Mapping relationships	How do stakeholders relate among them?	(10 min)

TOPIC 1 (T1).- 'TOUR DE TABLE'

5 minutes. All

Short presentation of all attendees, institution they represent and main aim for engaging into Berlin DWC and with DWC project.

T2.- SETTING GENERAL OBJECTIVES FOR DWC BERLIN

15 minutes. All

One idea is to hand out two papers to each participants for them to write as bullet points:

- ✔ How do I think DWC can directly benefit to my organisation?

  (not limited to co-development of digital solutions, e.g. an organisation may be interested because it increases its visibility)

- ✔ How do I think my organisation can support the development of the innovations?

  (only as data/information providers? or is there anything else that can be done?)

Then, we can collect the answers, read them in loud voice and discuss with all the group. The answers will be later summarised and the overall perception of the group shared with all participants.

T3.- STAKEHOLDER MAPPING

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15 minutes. All

A preliminary stakeholder mapping has been already prepared by BWB as part of the preparatory work for the organisation of the meeting.

Our suggestion is that you prepare 3 slides (i.e. one slide per each of the 3 innovations dealing with groundwater management) with the following information:

- List of the stakeholders already identified (highlighting in a different colour those participating in the meeting)
- Potential role of each organisation in the co-development of the solutions

Then all the participants can help to complete the list and identify roles for other participants, or indeed, extend their own potential role in Berlin DWC.

T4.- MAPPING RELATIONSHIPS

10-minutes. All

[NOTE: This part could be skipped in case that time is running out or the moderator feels the participants are starting to get tired or losing a good spirit.]

The idea is to ask the participants to identify (for each of the 3 solutions dealing with groundwater management) which stakeholders they think they can collaborate with and which with aim.

In order to make this exercise easier to the participants, a list of possibilities can be displayed on screen (also linking to the transversal topics of DWC). As an initial suggestion these topics could be:

- Sharing data/information
- Improving data interoperability
- Provide support to testing activities
- Enhancing cyber-security
- Increasing public awareness about involvement of the organization in enhancing water sustainability
- Adopting the solution once these are validated in operational environment
- Others…

For example, one organization may be interested in collaborating with another one in terms of improving data interoperability between both of them, benefitting at the same time the development of the innovation.

Again, we would ask the participants to write their answers in paper. Probably there will be not a long time for sharing, but we can prepare a summary graph with all suggested interactions. This graph will provide useful information about the most central actors in terms of suggested interactions [ICA can take care of preparing the graphs].

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ANNEX 3. TEMPLATE FOR REPORTING ON LOCAL COP ACTIVITIES

Name for the activity	(e.g. Presentation meeting for Berlin DWC)

Date	**/**/20**	Place	

General description of the activity: main aims and objectives

Agenda

Attendance (just add the names of the organizations participating)

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Key outcomes of the activity (please describe here the most relevant points expressed by the participants throughout the activity. Also lessons learned and important action points for next activities should be added here)

Particular feedback from the participants about the process (if any) (e.g. perception of usefulness of the activity, feedback about organisation, satisfaction)

Feedback from the organising team (what worked well, what did not work so well)

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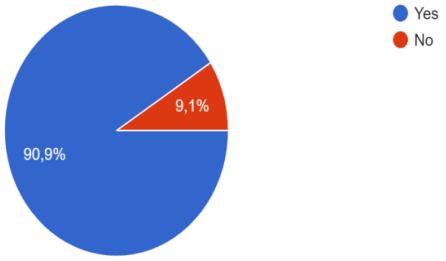
ANNEX4. DETAILED RESULTS OF THE SURVEY ON CO-CREATION

Objectives	Questions	Answers
Co-development of solutions to overcome barriers from innovation to practice	*Has co-creation been achieved? If yes, at what level (project activities/between cities/within the city)?*	Yes, at the city level
		Yes, project activities
		Yes, project activities and exchanges between cities
		Project activities
		Local level
		Yes, on project activities
		Yes, in the city and between Paris and Berlin
		Not at the local level, at the project level
		Co-creation at local/city level as well as at project level has been achieved
		From our point of view (with a lack of visibility on the co-creation process of applications), co-creation has been particularly effective at the city level where the opinions gathered during communities of practice and focus groups have been incorporated into the development of applications.
	Has this co-creation process contributed in any way to improving the development of digital innovations?	

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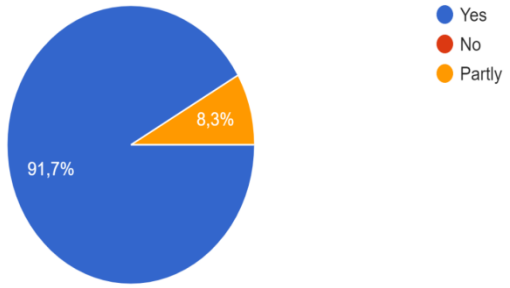
	Did the goals set were achieved?	
Collect user requirements	*Have the needs of all users been collected? Yes/No. If yes, in what way? If not, why?*	Yes, through COP and involvement in product development.
		Yes, during multiple meeting organized (once a month) and email exchange with tables to fill in
		Yes, we arranged meetings with utilities to know thier needs
		Difficult to say in our developments. Probably not the needs of all users, but quite a few needs were collected and addressed.
		Depends on cities
		Yes. but not all is implemented.
		Yes. But for the public app, we had to take into account the digital divide, the fact that many water users are not app users. So app users are a smaller population than what we initially thought
		I think so.
		Requirements for digital solutions, potential features have been collected during workshops and COP actions.
		It would be illusory to try to represent the views of all future users of the applications - this is also one of the points that the project has helped us to understand. Enrolment in the co-creation process can only involve motivated individuals/organisations (e.g. swimmers who already practice open water

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		bathing or residents living close to future bathing sites who feel concerned by the issue and/or for whom the question of legitimacy to express themselves on the topic is less of a barrier).
	Who were the actors most involved in this co-creation? (Please explain)	Corresponding authorities.
		Stakeholders and public.
		ICRA, BWB and Sofiyskavoda.
		Researchers & operators.
		BWB, P4uw, SIAPP, Amsterdam.
		Researchers, WWTPs, software developers.
		City leader + innovators.
		Innovator and BIOFOS as a user... Stakeholders partly via 2 workshops. BIOFOS on a regular basis.
		Wastewater managers and future bathing site managers
		Intra project partners.
		Utility and city representatives in local COP; technology providers for digital solutions discussed
		It is more relevant and easier to answer this question from the example of the communities of practice because the focus groups only brought people together once. All our attempts to reproduce the experience failed, which testifies to the difficulty of maintaining the involvement of people expressing themselves in an individual capacity in a process of co-creation of an application - all the more so as the participants in these focus groups were systematically critical of the temporality of this co-creation process: how can we build an application aimed at providing information on bathing sites when these do not exist? The participants in the communities of practice were more likely to maintain their participation over the

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		months. It can be noted, however, that the most consistent participants were the institutions that were best informed and "motivated" by bathing, while the representatives of municipalities that were still hesitant about their desire to create sites participated in a fluctuating way (absence from meetings and lack of intervention during them).
Business development and contribution to value	*How does co-creation contribute beyond what the economy offers? Possible answers: Specific solutions to a specific problem based on the development of existing generic solutions / Solutions more adapted to the operating process / New solutions not yet considered by the market / Other*	Specific solutions to a specific problem based on the development of existing generic solutions/Solutions more adapted to the user needs
		The idea was to use a co-creation process so that the tools developed correctly match the demand of the stakeholders and the public. The stakeholders contributed in building the tools by specifying the content. We believe that if they participated in the development process they would be more willing to use the tool afterwards: they would have trust in it!
		Solutions more adapted to the operating process
		Better feedback to new solutions - reducing failure rate of products
		Solutions more adapted to the operating process
		Specific solutions to a specific problem based on the development of existing generic solutions/Solutions more adapted to the operation process
		Specific solutions to specific needs expressed by users : alerts for the expert app, additional information for the public app.
		Solutions more adapted to the operating process.
		Agile development of digital solution made , solutions more adapted to the operating process

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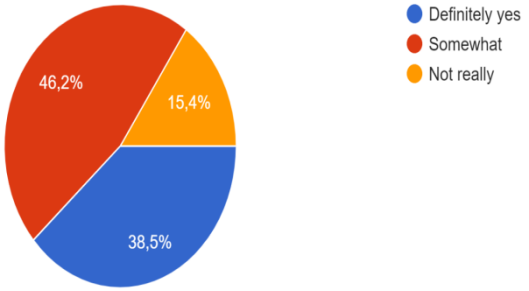
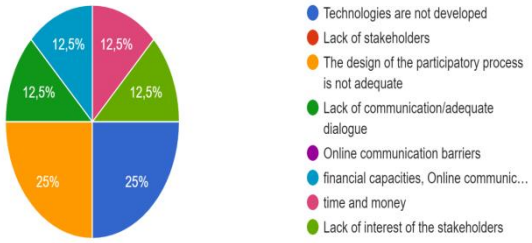
		I don't know.
Collaboration in co-creation	*Does co-creation in CoPs offer new opportunities for cooperation with other stakeholders? Possible answers: Definitely yes/somewhat/not really (You can find space below to expand on your answer if you wish)*	
	In case the co-creation did not achieve the objectives, could you explain why?	The co-creation process is quite time expensive. There was no establish culture of co-creating. Thus, the learning curve was steep for all actors involved.
		Time lack for the procedure
		Hard to involve external partners in new processes without funding
	If the expected co-creation is not produced, what do you think are the main causes or barriers? Possible answers: Technologies are not developed/ Lack of stakeholders/ The design of the participatory process is not adequate/ Lack of communication/adequate dialogue/ Online communication barriers/ Other	
Process	*Was the co-creation process (format, activities, actors, etc.) implemented adequate to achieve the objectives? Yes/No (You can find space below to expand on your answer if you wish)*	Yes
		Yes! We wanted them to participate without blocking too much of their time so we decided to fix one meeting per month and exchange information via emails.
		It was a starting point
		About illicit connections (DS9) we had a great exchange webinar as follow up action of the

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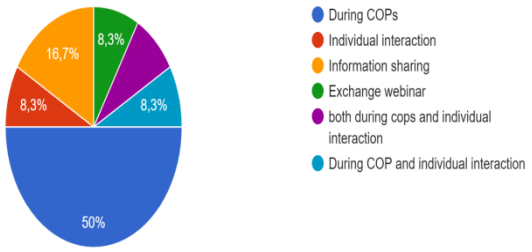
		CoPs. Discussed different techniques and strategies to deal with illicit connections
		Yes.
		Yes.
		Yes. But can be done better.
		The co-creation process that was put in place took time to set up; it required prior preparation work to find the format most likely to attract the participants (work carried out by Sofia Housni). The institutional stakes were high in Paris with a diversity of actors and territories represented in the CoPs, with a divergent level of knowledge and involvement in the bathing issue. The key step that enabled the effective calibration of the CoPs was the preliminary individual interviews with the representatives of the invited institutions in order to explain the approach and find out about the institution's position on the subject. Another fundamental step was to agree on the mode of deliberation for collective decision-making. Digital tools were effectively used to this end to survey participants' opinions.
	How did this co-creation process go? Possible answers: During COPs/ Individual interaction/ Information sharing/ Other	
	How could this process be improved?	Align the co-creation process closer to the user needs.
		We believe that it went really good considering the amount of people involved and we offered different options so that everybody had a say such as specific individual meetings outside of COPs meeting
		More physical meetings

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		Design of the event, better highlight the needs and added value of the co-creation
		Smaller ambitions.
		More structured results from the CoPs
		Hard to do. Stakeholders in COP do not have capacity and budget for more involvement in the co creation
		An important lesson from the process of co-creation that we invite reflection on is that of the embeddedness of this practice in other wider practices and concerns. Sensitivity to this point must be kept in mind in order to maintain the involvement of the participants and make it effective (one must be ready to see the initial plan bifurcate by listening to the actors' concerns and constraints). In the case of bathing, participants needed to be informed of the implication of future site management beyond the sole issue of water quality. Their confidence and involvement in the co-creation process was maintained by listening and responding to these concerns.
	Why would co-creation be considered fundamental/necessary?	Because, it establishes a joint learning culture.
		Involving the future users in the development of the tool allowed us to create something that perfectly answers their demands and we were able to build trust in the tool so that they could use it with a lot of confidence
		For us, because we were able to know the specific needs of our partners
		Different sectors - different backgrounds and competencies
		To develop solutions people want to use.
		Because the assumptions made by developers about users' need are often biased
		It is a platform for sharing.

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		The case of the development of the "general public" application in Paris demonstrates the importance of the co-creation process, which allows stakeholders to be heard beyond the commercial approach of assessing the application's ergonomics or the accuracy of the technical information on water quality. It has thus made it possible to identify the need to integrate awareness and prevention pages on the risks associated with swimming (linked to navigation, the presence of dangerous objects in the water).
Unexpected results	*What unexpected results co-creation brought? (You can find space below to expand on your answer if you wish)*	Cooperation between the different actors (those who had a better understanding of the tools and the situation and those who didn't), cooperation with outside participants
		Communication
		Prioritizing. Only select those features that give values to many. Be aware of benefits such as performance.- This was more important than the feature itself here in Copenhagen.
		New questions of governance.
		(see previous answer on the need for information beyond the sole water quality issue).

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