



# SCOREwater

## Smart City Observatories implement REsilient Water Management

### DELIVERABLE D4.2

# INPUT TO IMPLEMENTATION PHASE REGARDING PROTOTYPING TECHNOLOGIES FOR WATER MANAGEMENT

Dissemination level	Public
Type	Other
Issued by	IVL
Contributing project partners	
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Keywords	Evaluation, barriers, enablers
Number of pages	20
Number of annexes	1
Date:	2020-04-27
Version:	V 1
Deliverable number	D4.2
Work Package number:	WP 4
Status:	Delivered
Approved by coordinator (IVL)	2020-04-28

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## REVISION HISTORY

Version	Reason for changes	Name	Date
1	Original release to EU	Hanna Matschke Ekholm	2020-04-27





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## ABBREVIATIONS

Abbreviation	Definition
CKAN	Comprehensive Kerbal Archive Network
ICT	Information and Communications Technology
IoT	Internet of Things
SDG	Sustainable Development Goals
SME	Small and Medium-sized Enterprise





## PROJECT ABSTRACT

SCOREwater focuses on enhancing the resilience of cities against climate change and urbanization by enabling a water smart society that fulfils SDGs 3, 6, 11, 12 and 13 and secures future ecosystem services. We introduce digital services to improve management of wastewater, stormwater and flooding events. These services are provided by an adaptive digital platform, developed and verified by relevant stakeholders (communities, municipalities, businesses, and civil society) in iterative collaboration with developers, thus tailoring to stakeholders' needs. Existing technical platforms and services (e.g. FIWARE, CKAN) are extended to the water domain by integrating relevant standards, ontologies and vocabularies, and provide an interoperable open-source platform for smart water management. Emerging digital technologies such as IoT, Artificial Intelligence, and Big Data is used to provide accurate real-time predictions and refined information.

We implement three large-scale, cross-cutting innovation demonstrators and enable transfer and upscale by providing harmonized data and services. We initiate a new domain “sewage sociology” mining biomarkers of community-wide lifestyle habits from sewage. We develop new water monitoring techniques and data-adaptive storm water treatment and apply to water resource protection and legal compliance for construction projects. We enhance resilience against flooding by sensing and hydrological modelling coupled to urban water engineering. We will identify best practices for developing and using the digital services, thus addressing water stakeholders beyond the project partners. The project will also develop technologies to increase public engagement in water management.

Moreover, SCOREwater will deliver an innovation ecosystem driven by the financial savings in both maintenance and operation of water systems that are offered using the SCOREwater digital services, providing new business opportunities for water and ICT SMEs.





## EXECUTIVE SUMMARY

This deliverable is part of subtask 4.1.2 and is the first in a series of evaluations through the project process. The purpose is to share and bring forward experiences in order to identify issues early and thus improve the implementation of SCORE water. The focus in the evaluation is to identify key factors which may have hindered the process or enabled progress. The evaluation was done through a survey and sent out to partners in the project, mainly involved in WP2, WP3, and WP4.

This first evaluation and input to implementation phase regarding prototyping technologies shows that we are yet early in the project process. However, the input about collaboration, involvement of perspectives and complexity of technical issues need to be analyzed further and taken into consideration as we enter the next phase. For example, identified hinders regarding standardization. Communication and collaboration between partners and between partners and stakeholders are perceived good and essential but can also be improved. From the responses it is also noted that there have not been much involvement or interaction with end users yet, which needs to be addressed further in order to ensure user driven development.



## 1. PURPOSE AND AIM WITH DELIVERABLE

This deliverable is part of subtask 4.1.2 and is the first in a series of evaluations through the project process. The purpose is to share and bring forward experiences from project partners in order to reach improvement in implementing and illustrating the SCORE water platform. The evaluation is carried out through a survey.

The evaluations will together collect lessons learned from participating partners regarding prototyping, implementation and testing of the technologies. The task (4.1.2), when complete, will summarize findings from the implementation and testing phase into the revision phase, as well as summarize findings from the evaluation phase (D4.2-5). This in order to provide useful input for revision, further testing and development (in WP2 and WP3), input regarding barriers and enablers(WP5) as well as to suggest strategies for replication (task 6.3) and for summarizing innovation management challenges (WP8).

The aim of this deliverable is to provide, if possible, improved conditions for the next phase, enable progress in implementation and thus to support the development, implementation and effective use of smart water management and to identify best practices.

This deliverable is of type “other”. The deliverable presents the first evaluation and the results from the survey sent out.

## 2. THE EVALUATION

In order to collect lesson learned through the project process and between the projects defined phases of development, an evaluation survey have been developed. The questions can be found in section 1.2.

The evaluation has been sent as a survey in Microsoft forms, to seven different partners, between one and three people per organization received the survey, some of these could be counted as both partners and stakeholders. The receiving partners responding to the survey are mainly involved in sensor deployment, collection of data, data analyse, machine learning, platform design etc.

WP5 and the first deliverable (5.1) of the work package of social and organization enablers describes some aspects of evaluation theory and contributes with a framework for WP4. This has been considered when developing this first part of the iterative evaluation. The framework from WP5 state that before carrying out an evaluation its useful to answer a few questions, for example why it's being done and how it should be conducted.

In D5.1 the bottom-up approach or participatory evaluation is described as usable to recognize peoples' diverse perspectives and interests. That is also what these evaluations want to highlight: views and experiences from the partners involved in the project. Project partners will thus be involved in both formulate the questions as well as to answer them. The participatory evaluation can be carried out more frequent and allows development and the iterative process that we want. As partners can be involved at different times in defining the questions to ensure the relevance of the questions at different stages of the process.

The first survey is an essential part of the iterative evaluation which follows the project. It is an important part in identifying positive and negative experiences to be able to improve e.g. platform development and ensure a product based on user needs.

### 2.1. DEVELOPMENT OF THE SURVEY

The focus for the evaluation process is to identify key factors which may have hindered the process or can enable improvement. As well as to identify what already works. The questions have been structured into different types of barriers and/or enablers.

- Organization and planning,
- Technical factors
- Collaboration and communication.

The different types of barriers and enablers are described further in the survey, so the respondents know what context the questions are to be understood.

The choice of the three sections of questions stem from the Strategic objective 5 as well as the KPI:s included. Further the questions were also based on the purpose of the deliverable and the project phase being evaluated. Within these sections, questions have been formulated in order to answer what aspects hinder or enables the project development. Some questions are scale-based which can facilitate comparing results with coming evaluations.

Evaluations will be done a few times in the project. Some questions will remain in order to enable comparison, but some questions will be replaced in order to adapt to the progress of the project and relevant issues that needs to be addressed.

The case leaders have been invited to leave input on the questions before the survey was sent out. The respondents received the survey per email and was given approximately two weeks to answer. After the first mailings, the survey was sent out a second time to more partners within the project. All respondents are anonymous.

## 2.2. EVALUATION

The questions are presented in table 1 below. Note that it's not the design of the survey as they respondents saw it.

Table 1: Evaluation template

Question	Type of answer
Which WP are you mainly involved in?	Open answer
Which demonstration case are you mainly involved in? (if equal in all 3 write "all")	Open answer
<p><b>Organization and planning</b></p> <p><i>This section is about barriers and/or enablers in aspects regarding the organization of the project, among partners and stakeholders as well as planning of project and activities within the project.</i></p>	
<p>How do you perceive the individual motivation and/or know how?</p> <ul style="list-style-type: none"> <li>• From relevant key stakeholders</li> <li>• From partners</li> </ul>	<p>1- Low in motivation</p> <p>2-</p> <p>3-</p> <p>4-</p> <p>5-Highly motivated</p>

Question	Type of answer
<p><b>How do you perceive the partnership arrangements?</b></p> <ul style="list-style-type: none"> <li>• With relevant key stakeholders</li> <li>• With partners</li> </ul>	<p>1-Failed /insufficient 2 - 3- 4- 5- Constructive</p>
<p><b>How do you perceive the technical planning and analysis to determine requirements of the project actions?</b></p> <ul style="list-style-type: none"> <li>• From relevant key stakeholders</li> <li>• From partners</li> </ul>	<p>1- Insufficient 2- 3- 4- 5- Accurate</p>
<p><b>How do you perceive the understanding of user requirements?</b></p> <ul style="list-style-type: none"> <li>• From relevant key stakeholders</li> <li>• From partners</li> </ul>	<p>1- Limited 2- 3- 4- 5- Good</p>
<p><b>Other/comment about organization and planning:</b></p>	<p>Open answer</p>
<p><b>Technical</b></p> <p><i>This section is about barriers and/or enablers in the technical work, activities, know how, problem related questions (e.g., collection of data, type of data, data analyse, machine learning, algorithms, platform design etc.)</i></p>	
<p><b>Have any of the following aspects been hindering progress and/or development:</b></p> <ul style="list-style-type: none"> <li>• Additional technological requirements you didn't expect?</li> <li>• Specific technology not available, or other technical problems?</li> <li>• Complexity of the problems to be solved and lack of shared sense of urgency among key stakeholders.</li> </ul>	<p>Yes/No</p>
<p><b>Have you experienced new technology, or new potentials offered by technology?</b></p>	<p>Yes/No/Unsure</p>
<p><b>Other comments about technical issues or possibilities?</b></p>	<p>Open answer</p>
<p><b>Collaboration/communication</b></p> <p><i>This section is about barriers and/or enablers in collaboration and communication with other partners/stakeholders/end users/experts in the project. etc.</i></p>	

Question	Type of answer
<b>Consultation and involvement have been:</b> <b>Of key stakeholders</b> <b>Of partners</b> <b>Of intended users</b>	1- Insufficient 2- 3- 4- 5- Constructive and open
<b>Have there been (from your organization) any exchange with other relevant initiatives?</b>	Yes, exchange of experiences and lessons learned No, relative isolation of the project
<b>Have you included perspectives and/or involvement from different stakeholders in your work?</b>	Yes/No/Unsure
<b>Have you included perspectives and/or involvement from different end-users in your work?</b>	Yes/No/Unsure
<b>Please elaborate on your answers on question 13 and 14:</b>	Open answer
<b>Other/comment about collaboration and/or communication:</b>	Open answer
<b><i>Concluding questions</i></b>	
<b>Have you identified any other barriers in your work so far?</b>	Yes, standardization barriers Yes, behavioural barriers Yes, legal barriers Yes, other No
<b>If yes, please explain what barriers and how it affected you:</b>	Open answer
<b>Please give an example of what works well in the project:</b>	Open answer
<b>Please give an example of something that can be improved in the project:</b>	Open answer
<b>What is the most important lesson learned so far in the project SCOREwater (until end of prototyping phase, M12)</b>	Open answer

### 3. RESULTS OF SURVEY

The evaluation survey was implemented using Microsoft Forms in order to make it easy for the respondents to answer and explain their experiences. As well as to collect and compile the results.

The survey was sent out to different partners working mainly in WP2 and WP3, but also WP6 and WP4. The representation from the respondents are from all three demonstration cases. Six people responded and their answers are completely anonymous. All figures presented are thus based only on six different answers and cannot stand for any representation nor sufficient to draw conclusions from. The answers are although presented below as an indication of experienced barriers and enablers by the respondents.

Not all questions and answers are presented. However, they will be analyzed in order to develop and revise the next coming evaluation. There are answers that need to be further analyzed and followed up upon as the project proceeds.



1st evaluation from WP4

The prototype phase ends with milestone 2 – Prototype acceptance. This evaluation is one part in assessing the achievement of the milestone. The evaluation is also part of the iterative evaluation in WP4 to identify key factors hindering or enabling the progress as well as experiences from the work so far in order to enable improvements.

#### 3.1. ORGANIZATION AND PLANNING

Regarding organization we asked the partners about motivation, know-how, partnership arrangements and requirements, amongst other partners as well as from key stakeholders. The general opinion seems to be both partners and stakeholders are motivated and that the partnership is fairly good.

For this question below and a number of questions, the respondents were asked to answer on a scale from 1 to 5, where 1 would be negative (low, insufficient etc.) and 5 would be a positive (good, constructive, accurate etc.). Each respondent was to choose one answer for stakeholders (blue) and one answer for partners (orange)

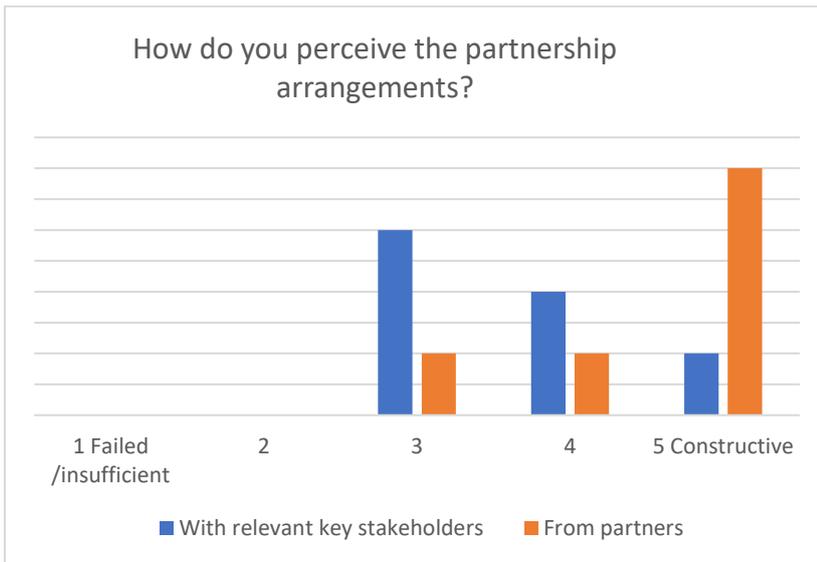


Figure 1: How do you perceive the partnership arrangements?

The planning and analysis to determine requirements of project actions as well as the judgement of understanding of user requirements are seen fairly good to good. The understanding of user requirement is perceived as a bit lower from stakeholders.

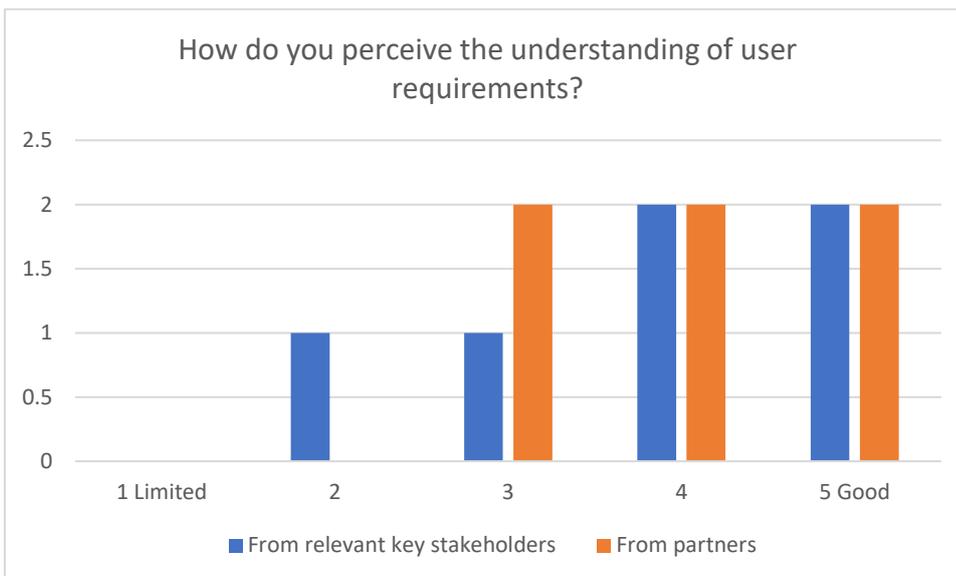


Figure 2: How do you perceive the understanding of user requirements?

### 3.2. TECHNICAL FACTORS

Regarding some technical aspects in the project this far, five people answer that they have experienced new technology or new potential. As example for this is that different AI objectives have been defined for each demonstration case, even if they are not all covered. Further explanation could be needed here and thus worth elaborate on in the next evaluation in order to learn more.

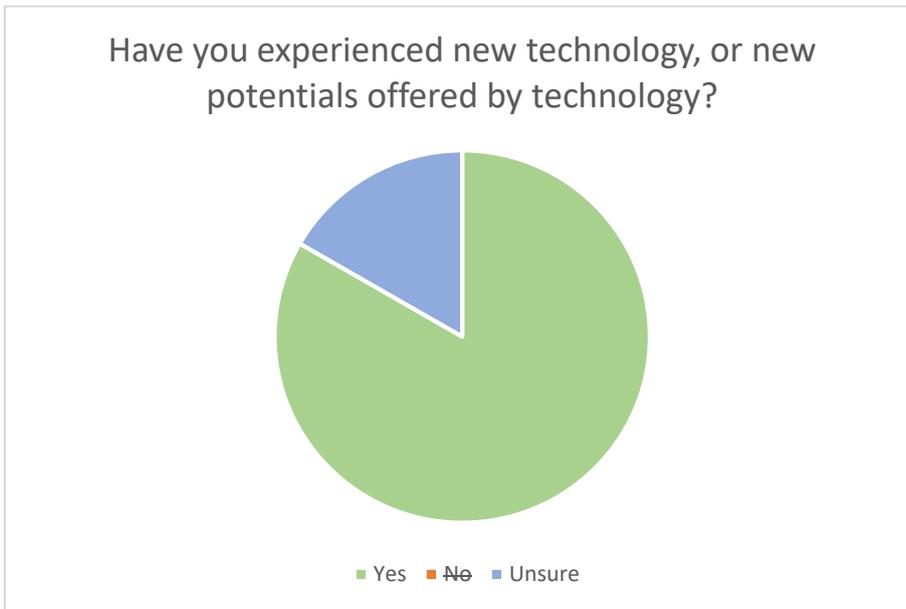


Figure 3: Have you experienced new technology, or new potentials offered by technology?

Regarding hinders in the technical aspects five of six respondents have not experienced any hinders in technological requirements which were not expected or specific technology not available. However - two respondents have experienced complexity to the problems solved and/or lack of shared sense of urgency regarding this among stakeholders.

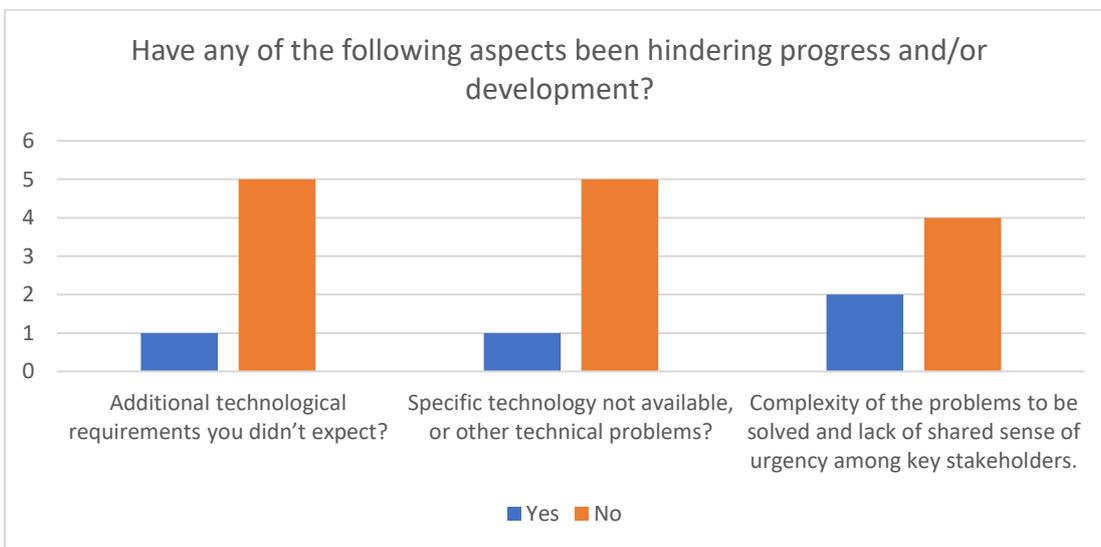


Figure 4: Have any of the following aspects been hindering progress and/or development?

### 3.3. COLLABORATION AND COMMUNICATION

This section is about communication, involvement and collaboration between partners and/or stakeholders. Figure 5 shows that it is experienced positive with both partners and relevant key stakeholders. Marginally lower results for intended users which is likely because of the early stages in the project. However, this is an indicator that needs to be analyzed as the project aims at being user driven to a high extent.

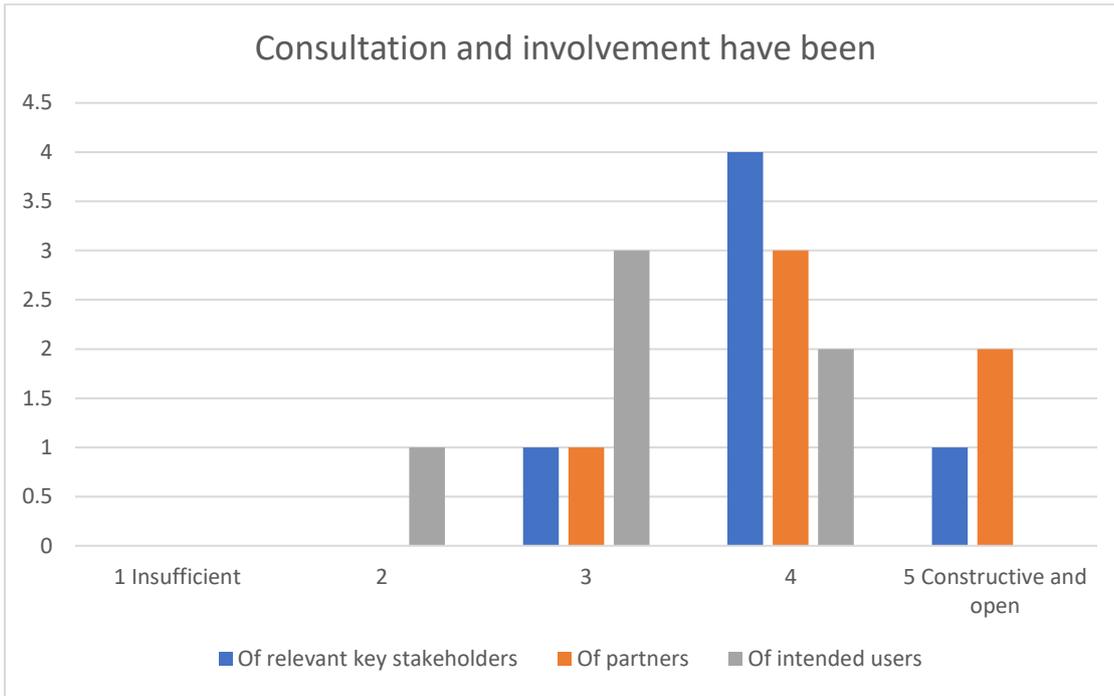


Figure 5: Shows result of how the respondents experience the consultation and involvement of other actors.

### 3.3.1. HAVE YOU INCLUDED PERSPECTIVES AND OR INVOLVEMENT FROM STAKEHOLDER /FROM END USERS?

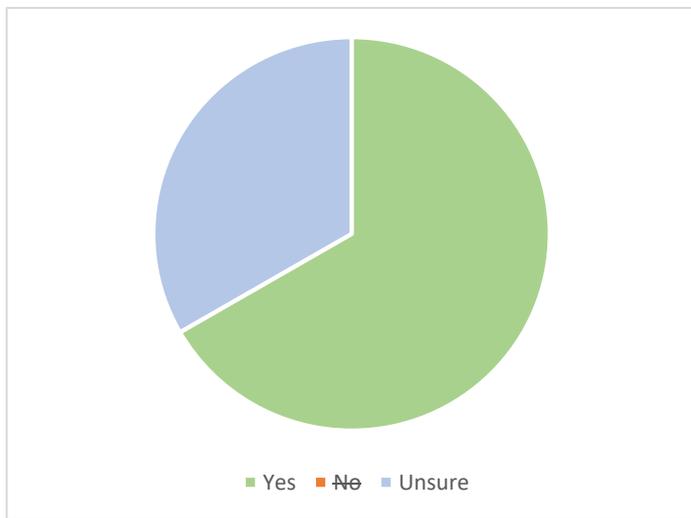
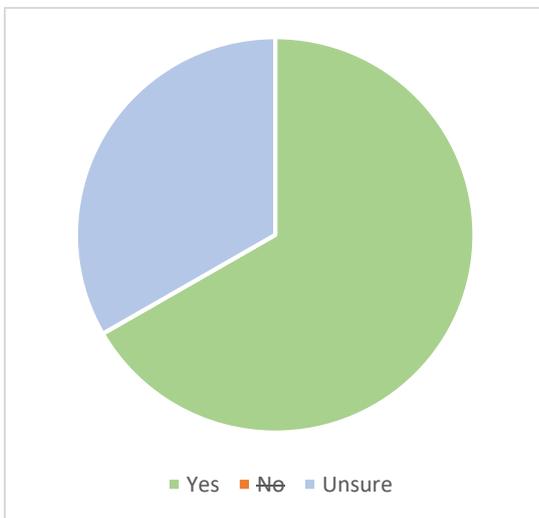


Figure 6: Have you included perspectives and/or involvement from different stakeholders in your work?

Figure 7: Have you included perspectives and/or involvement from different end-users in your work?

The respondents were asked to elaborate on their answers about including perspectives from others. There are a few partners in the project who are both partners, stakeholders and end-user. Why it can be difficult to separate them. One respondent makes the distinction: “stakeholders: platform owner, data owner, municipality, water authority, citizens, end users: municipality, water authority, citizens”

It is clear that it varies somewhat but most respondents take stakeholders and end users perspectives into account during stakeholders meeting and they also present their work in order to get feedback.

“We do have close contact with stakeholders and we also present our activities to potential end-users we work or aim to work with”.

One answers they have limited contact to stakeholders and or end-users in the project because it is not part of their role.

#### 4. CONCLUDING QUESTIONS AND LESSONS LEARNED

This first evaluation and input to implementation phase regarding prototyping technologies shows that we are yet early in the project process. However, the input about collaboration, involvement of perspectives and complexity of technical issues need to be analyzed further and taken into consideration as we enter the next phase.

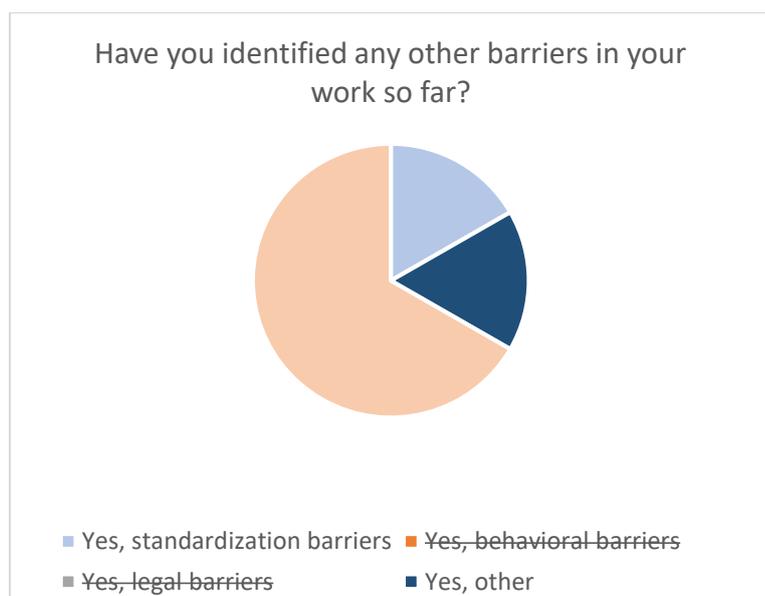


Figure 8: Have you identified any other barriers in your work so far?

The identified barriers are standardization barriers with the FIWARE platform and new standards for exchanging information. Also, some barriers with the IT infrastructure supplier are mentioned which cause problems for deployment of the score water platform.

What has worked well in the project so far, according to the respondents are communication, coordination, and collaboration within the project. For example, coordination of demonstration sites activities, the coordination and communication between partners are perceived to work well and have good structures in place. At the same time, more frequent communication is requested by some respondents when the project develops. It is also clear that the distinction between partners and stakeholders as well as users are sometimes unclear.

Most important lessons according to some of the respondents are the importance of engaging stakeholders, but also notes that its time consuming and requires flexibility to involve for example citizens. Further, to define on-site technical specifications are of high importance and that its relevant to share information about the demonstration cases.

Recommendations for the continued work and the next evaluation:

- Follow up on identified issues and barriers and further evaluate how these can be reduced
- More open questions in the next round to allow for more detailed data, for example add questions related to customer and user needs as well as potential customer market.
- Include identified risks in the evaluations in order to contribute to risk work and mitigating work.
- Send the survey to a larger number of respondents to include a better data base.

# ANNEX 1 – STOCKTAKING

A final Annex of stocktaking was included in all Deliverables of SCOREwater produced after the first half-year of the project. It provides an easy follow-up of how the work leading up to the Deliverable has addressed and contributed to four important project aspects:

1. Strategic Objectives
2. Project KPI
3. Ethical aspects
4. Risk management

## STRATEGIC OBJECTIVES

Table 2 lists those strategic objectives of SCOREwater that are relevant for this Deliverable and gives a brief explanation on the specific contribution of this Deliverable.

Table 2. Stocktaking on Deliverable’s contribution to reaching the SCOREwater strategic objectives.

Project Strategic Objective	Contribution by this Deliverable
<b>SO5</b> Identify and mitigate key barriers to implementation of smart, resilient water management	This deliverable has been a first step to provide better conditions for coming work, enable progress in implementation and thus to support the development by aiming towards sharing and bring forward experiences in order to reach improvement in implementing and illustrating the SCORE water platform. It is therefore contributing to SO5 to identify and mitigate barriers for implementation.

## PROJECT KPI

Table 3 lists the project KPI that are relevant for this Deliverable and gives a brief explanation on the specific contribution of this Deliverable.

Table 3. Stocktaking on Deliverable’s contribution to SCOREwater project KPI’s.

Project KPI	Contribution by this deliverable
<b>10</b>	KPI 10 to 14 are the different barriers identified in order to reach SO5. This first evaluation aims to identify barriers and can therefore contribute in the work of mitigating barriers. KPI10 is on Standardization barriers
<b>11</b>	See above KPI11 is on Behavioural barriers
<b>12</b>	See above KPI12 is on Technological barriers

Project KPI	Contribution by this deliverable
13	See above KPI13 is on Organizational barriers
14	See above KPI14 is on Legal barriers

## ETHICAL ASPECTS

Table 4 lists the project’s Ethical aspects and gives a brief explanation on the specific treatment in the work leading up to this Deliverable. Ethical aspects are not relevant for all Deliverables. Table 4 indicates “N/A” for aspects that are irrelevant for this Deliverable.

Table 4. Stocktaking on Deliverable’s treatment of Ethical aspects.

Ethical aspect	Treatment in the work on this Deliverable
Justification of ethics data used in project	Not relevant
Procedures and criteria for identifying research participants	Not relevant
Informed consent procedures	Not relevant
Informed consent procedure in case of legal guardians	Not relevant
Filing of ethics committee’s opinions/approval	Not relevant
Technical and organizational measures taken to safeguard data subjects’ rights and freedoms	Not relevant
Implemented security measures to prevent unauthorized access to ethics data	No personal information has been handled
Describe anonymization techniques	The survey was sent out by hyperlink to partners within the project and there have been no questions of names or organization or ability to track back answers
Interaction with the SCOREwater Ethics Advisor	None, not relevant

## RISK MANAGEMENT

Table 5 lists the risks, from the project’s risk log, that have been identified as relevant for the work on this Deliverable and gives a brief explanation on the specific treatment in the work leading up to this Deliverable.

Table 5. Stocktaking on Deliverable’s treatment of Risks.

Associated risk	Treatment in the work on this Deliverable
<b>1 Failure on installing sensors on demo-sites</b>	This deliverable has identified some aspects that could be affecting risks and possibilities to mitigate risks. This will be considered in next evaluations and might also be investigated further to assess if mitigation actions are needed.
<b>6 Communicate effectively in the consortium</b>	See above
<b>13 Failure architecture implementation and modules integration</b>	See above
<b>15 Stakeholders outside the project are not interested</b>	See above
<b>20 Lack of mature standards and data models might influence the uptake of services, replicability and scalability.</b>	See above



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