TRANSCEND

Deliverable 2.2: Co-creation Report I

Author(s): Tania Santos, Gustavo Ayala, David Purkey, *Stockholm Environment Institute*

C.Dionisio Pérez-Blanco, *Universidad de Salamanca*

Contributors:

Adria Rubio-Martin, Universitat Politècnica de València; Eulalia Gómez-Martín, Universitat Politècnica de València; Hector Macian-Sorribes, Universitat Politècnica de València; Manuel Pulido-Velazquez, Universitat Politècnica de València; P.N.A. Vaishnavi Institute for Resource Analysis and Policy; Saikat Mandal, Institute for Resource Analysis and Policy; Ambili Ramdas, Institute for Resource Analysis and Policy; Dinesh Kumar, Institute for Resource Analysis and Policy; Maggie Kossida, SEVEN; Klio Monokrousou, SEVEN; Ioannis Tsoukalas, SEVEN; Marinos Kritsotakis, Region of Crete; Maria Kandilogiannaki, Region of Crete; Fotios Pantazoglou, Region of Crete; Chrysoula Avramaki, Region of Crete; Hadi Jaafar, American University of Beirut; Lara Sujud, American University of Beirut; Rim Hazime, American University of Beirut; Zahraa Hamadeh, American University of Beirut; Tania Santos, Stockholm Environment Institute; Gustavo Ayala Stockholm Environment Institute; Róbert Blaško, Slovak Environment Agency; Radoslav Považan, Slovak Environment Agency; Boris Lipták, Slovak Water Management Enterprise; Andrej Šille, Slovak Water Management Enterprise (data collection in living labs); Cinzia Alessandrini ARPAE, Rodica Tomozeiu ARPAE, Vanessa Giorgione ARPAE, Alice Vecchi ARPAE.

Reviewers: Maggie Kossida, *SEVEN;* Róbert Blaško, *Slovak Environment Agency*

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Author(s)	Tania Santos, Gustavo Ayala, David Purkey. Stockholm Environment Institute. C.Dionisio Pérez-Blanco, *Universidad de Salamanca*
Reviewer(s)	Maggie Kossida, *SEVEN* Róbert Blaško, *Slovak Environment Agency*
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Executive summary

In this report, we present the progress in the Co-Creation process that is being developed in TRANSCEND after the first 18 months of project development. In the co-creation process stakeholders and scientists share knowledge and exchange ideas, opportunities, and possible innovations around the design and implementation of TAPs. The three pillars of TRANSCEND provide the scientific and logistical basis for developing the co-creation process: 1) knowledge networks, 2) actionable modeling suite, and 3) monitoring and accounting toolbox.

The co-creation process in Living Labs is carried out following the activities described below:

1. Stakeholders and scientists jointly design relevant scenarios and TAPs, including funding mechanisms and partnerships to create and implement sustainable investments in TAPs and their cost recovery

2. Stakeholders and scientists jointly develop the models.

3. Stakeholders and scientists jointly evaluate the performance of TAPs

4. Stakeholders and scientists jointly identify the TAPs with the highest potential.

5. Stakeholders and scientists collaborate on the implementation of TAPs in the field.

During the period of this report (January 2023 to June 2024) we advanced in the co-creation process around the three pillars: In the knowledge network pillar a. mapping of stakeholders in each of the seven living labs was conducted and an identification of roles and power relations was carried out (Deliverable 1.1.) In each living lab, bilateral and group stakeholder meetings, calls and e-mails have been held to present the project, reach an agreement form the institutions to join the knowledge network, and be part of the co-creation process. In the Deliverable Stakeholders Mapping (D.1.1), the living labs reported a total of 67 organizations with which they started their work to co-create knowledge networks. After the first Scenathon, 87 institutions reported in the Engagement Champions Indicators that are linked to the network. This means that there is an increase in the process of 30% of the total number of institutions that are part of the knowledge network and varies according to each living lab. In addition, we held our first meeting of the network of networks, an event that enables the exchange of information and knowledge between living labs.

The first workshop was held in each of the 7 living labs, with common objectives in all of them. There we achieved the first interaction of all participants of the **knowledge networks** (180 people in all living labs), presented the TRANSCEND project, and explained its scientific foundations and the objective of the co-creation process. We determined with the stakeholders the existing water-related problems in each basin, the gaps in terms of modeling, and the need for follow-up by the stakeholders. In each living lab, we identified the 3 problems and modeling and monitoring gaps that are priorities in the region. It is concluded that many of the problems are related to water governance, as the lack of clear rules and economic instruments affects water resource management.

In the **actionable modeling suite** pillar, this first period identified the existing and available models to be used in each living lab, the modeling gaps in terms of regional needs, the preliminary TAPs that can be adopted by the living labs, and the models should be able to simulate. Each living lab is in a different state of progress in terms of modeling, from living labs that do not have hydrological and economic models for decision-making, and their information is scarce (Nitra), to living labs that already have a significant state of progress in terms of modeling, where they have integrated hydrological and economic models, but need to generate processes of co-creation and interaction with actors that dynamize the adoption of TAPs (Jucar). Most living labs have hydrological models that need to be updated, adjusted, expanded in area, and coupled with economic models that allow the evaluation of TAPs for the co-creation process (Caplina, Mahanadi, Tympaki, Reno). One of the challenges in the living labs has been to obtain information and authorization for the use of existing models for the development of the pillar, a task that has been faced in different ways in each living lab.

In the **monitoring tools** pillar, we have made progress in identifying the information gaps around monitoring in each living lab, which information needs best meet the needs of decision-makers, and which tools can be useful for the co-design, co-development, and evaluation of the TAPs both during and after the implementation of TRANSCEND. In this pillar, actions have been advanced in some basins according to the state of progress. For example, in the Caplina-Mauri-Desaguadero system, a tool is being designed for remote sensor monitoring of quinoa crops in the region, to identify spatial and temporal changes in water consumption.

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1 Introduction

The problem of water scarcity around the world shows that many of the solutions we have used to adapt to extreme climatic conditions have not been sufficient. The planning that has been done for efficient resource management to balance supply and demand does not seem to be sufficient to guarantee enough water for all. *Transformational* solutions that complement biophysical with economic and social factors may generate the required transformations (Boer et al., 2021).

The TRANSCEND ("Transformational and robust adaptation to water scarcity and climate change under deep uncertainty") project seeks to identify and catalyze the adoption of alternative solutions to the problem of water scarcity that generate a transformation, allowing adaptation to changing climate conditions. These Transformational Adaptation Policies (TAPs) to water scarcity, which include innovative allocation systems and economic instruments, should be robust and adaptive to uncertainty and change while achieving equitable and sustainable economic growth and welfare outcomes. To this end, TRANSCEND develops a pioneering innovation ecosystem that combines three key pillars: (i) an inclusive approach to stakeholder engagement and knowledge sharing, **knowledge networks**, (ii) a set of **actionable models** that integrate interdisciplinary socio-ecological science and ensemble forecasting to guide TAP design and selection, and (iii) an **accounting and monitoring toolbox** that supports TAP implementation and compliance in practice (TRANSCEND proposal).

This report consolidates information from the co-creation process carried out in the seven living labs that are part of the project TRANSCEND[1]. In this project, co-creation is conceived as the process between stakeholders and scientists to co-design innovative solutions (TAPs) and scenarios including funding mechanisms and partnerships to implement sustainable investments in TAPs and their cost recovery, co-develop models (hydrological, micro, and macroeconomic), co-evaluate TAPs performance, and identify those with highest potential to co-implement TAPs in the field to address the water scarcity crisis experienced in each of the regions. Therefore, the involvement of stakeholders is essential to ensure, on the one hand, the design of tools that respond to their needs and, on the other, that these tools and the TAPs identified are accepted and internalized in the policy instruments and/or decisions that allow their adoption.

[1] TRANSCEND pilot **7** ***living labs*** in river basins (RB) facing growing water scarcity: Júcar RB (Spain); Reno RB (Italy); Tympaki RB (Crete, Greece); Nitra RB (Slovakia); Caplina-Mauri-Desaguadero System (Peru, Chile and Bolivia); Orontes RB (Lebanon, Syria and Turkey); and Mahanadi RB (Indian states of Chhattisgarh and Odisha).

In this report, we present the results of the first year of co-creation of TAPs and the activities developed for this purpose:

1. We develop the concept of co-creation that allows us to apply the framework in a unified way,

2. We present the co-creation process conducted through the project that articulates the actions of the different workpackages and the development of deliverables, as well as the Scenathons.

3. We analyze the Scenathons developed during the first year concluding about the main problems, modeling gaps, and monitoring needs found in each living lab.

The activities developed are measured using the Engagement Champions Indicators (ECI), defined and used to measure interactions with stakeholders.

For the first 18 months, the objective of the co-creation process was to initiate the co-development of models and the co-design of TAPs and scenarios. The related first Scenathon supported these activities and aimed at jointly identifying the existing problems in each living lab and the current state of models and monitoring. This information made it possible to start defining the models to be co-created (D2.1) and the monitoring tools required to meet stakeholders' needs as part of WP3 and 4, respectively. These tools should enable simulation of the impacts of TAPs that are subsequently jointly co-designed, and assess their impacts, to co-identify and eventually co-implement robust TAPs.

2 Co-creation framework

TAPs in the TRANSCEND co-creation process seek to work together in Knowledge networks to create policies that help adapt to water scarcity in a meaningful way. These solutions are expected to be innovative, built with local stakeholders, and responsive to their needs. The involvement of local stakeholders in planning processes is of great importance as it allows them to have a clear understanding of the problem, define strategies that can be implemented in the territory, and achieve sustainability in the long term (Graversgaard et al., 2017).

These policies not only address the current problem of water scarcity but are also designed to transform the way we think about and manage water in general, including biophysical, ecosystem, economic, and social factors. We are looking to our living labs to identify and evaluate TAPs under deep uncertainty that will make it possible to have sufficient water now and, in the future (Moallemi et al., 2021; Refsgaard et al., 2013; Tudose et al., 2023).

At TRANSCEND, the co-creation process is based on the integration of three key pillars in an innovation environment: 1) the knowledge networks, 2) the actionable modeling suite, and 3) the accounting and monitoring toolbox. In this process, stakeholders and scientists share knowledge and exchange views to identify value-added opportunities, build consensus, and affect decision-making around the design of the TAPs.

To this end, in this co-creation process, models are developed in each of the living labs to evaluate the response of the TAPs in the environment. These tools are coupled biophysical and socioeconomic models, where it is possible to analyze both the impact of TAPs on biophysical variables, mainly related to water coverage in the needs of users (agriculture, population, tourism, hydropower, ecosystems), and the economic impact of these actions. The objective is to have tools to inform decision-making including those variables that trigger transformations, such as the economic and social component.

The tools and models developed may not be accurate and have uncertainty associated with the data used in the models, the simplification of biophysical and economic processes, and the inherent randomness of natural and economic systems. Uncertainty is characterized by its nature, level, and their sources (Refsgaard et al., 2013). In TRANSCEND we seek to make stakeholders aware of this uncertainty when interpreting the results of integrated models and making decisions based on them. Therefore, we include in the interactions, workshops, and tools both an explanation of the sources of uncertainty and the range of possible responses, sensitivity analysis, and a risk management approach to make robust decisions in an uncertain environment (Refsgaard et al., 2013).

In TRANSCEND, we adopted the framework proposed by (Eikebrokk et al., 2021; Moallemi et al., 2021), for the development of **knowledge networks** the first step that gives context to the co-creation process. These networks are fundamental to initiating a co-creation process (see Figure 1. Conceptual Framework of Knowledge Network) The initiation of these networks is usually not an easy task and these guidelines have enabled a successful start in Living Labs. Stakeholder engagement is divided into two stages: Initiation and Management (see Figure 1). These stages

include: 1) contextual understanding and relational competence (D1.1. Map of stakeholders), 2) awareness building, 3) knowledge sharing, 4) rules of engagement and governance (D1.2. Rules of engagement), and 5) adaptive efficiency (Eikebrokk et al., 2021; Moallemi et al., 2021). In the second phase, guidelines for Knowledge Sharing (D.1.3. Guidelines for Scenathons), Governance bodies, and rules of engagement (Deliverable 1.2. Rules of engagement) were proposed.

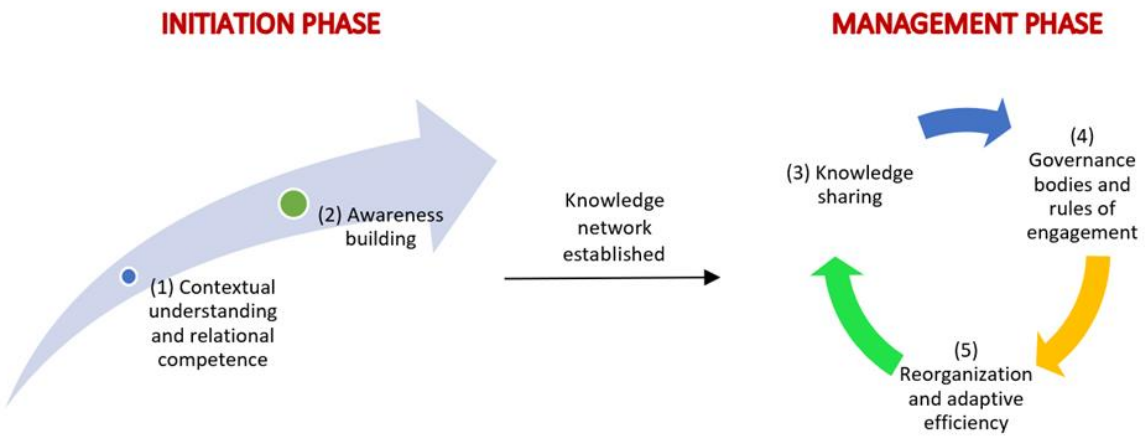


Figure 1. Conceptual Framework of Knowledge Network (TRANSCEND proposal, 2022)

2.1.The co-creation process

The co-creation process is developed in TRANSCEND between scientists and stakeholders following the **iterative stock-taking** process explained in Figure 2. The co-creation process is based on the integration of the three pillars of the project to generate, and innovative space to share knowledge and information: ① The knowledge networks, ② the actionable modeling suite, and ③ the accounting and monitoring toolbox. The process in each living lab includes the following activities: 1) co-design scenarios and TAPs, 2) co-develop modeling efforts, 3) co-evaluate TAP performance, 4) Co-identify TAP with the highest potential, and 5) Co-implement TAPs on the ground.

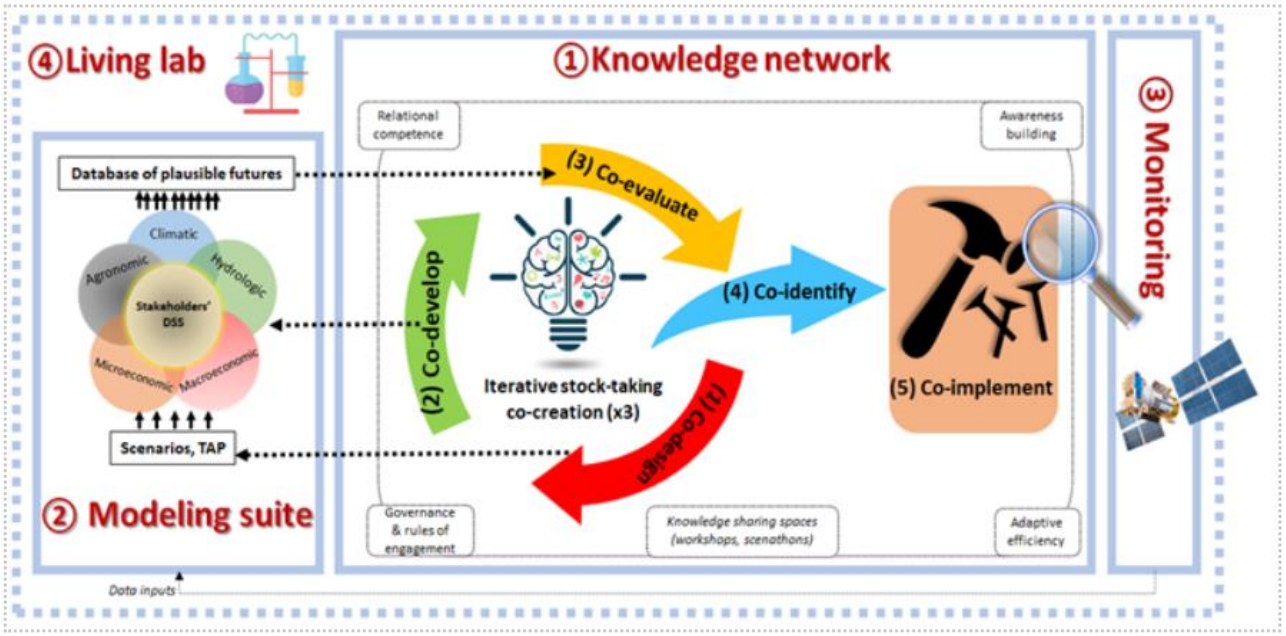


Figure 2. Conceptual Framework Co-Creation process (TRANSCEND proposal, 2022)

The co-creation process of the TAPs in each living lab seeks a continuous exchange of knowledge between researchers and stakeholders. The stakeholders know the regional needs in terms of the problems, the solutions that can be accepted by the institutions, actors, and communities, the existing monitoring and modeling tools that have been accepted and used, and the need for improvement. Scientists are aware of research advances in terms of modeling and monitoring, can develop integrated systems that respond to analysis needs for decision-making, and can develop couplings or extensions of existing tools.

This dialogue of knowledge takes place in each of the living labs on an ongoing basis through different mechanisms: face-to-face and virtual meetings, e-mails, calls, and Scenathons, through a series of exchange, training, and development activities. One of the key instruments proposed in TRANSCEND for the exchange of information, validation of results, and generation of joint outputs are the Scenathons. The Scenathons are the workshops developed in the project, designed as activities that aim to cross the boundaries that usually occur in the participation processes.

Table 1 presents the TAP co-creation process that we are implementing in TRANSCEND. This process was introduced in detail in D1.3. Guidelines for Scenathons. It shows a series of steps that guide the process of defining transformative policies toward adaptation to a changing climate. For each step, an objective is defined, the methodology used to achieve it, and the deliverable where the information and results are consolidated. A list of all the deliverables is presented in the Table, but to date, progress has been made up to step 4.

Table 1. TAP Co-creation process

Phase	SCN	Steps	Objective	Methodology	Del
Preparation and formulation		1. Define decision space	Understand the motivation and rules to make decisions as part of the process of co-development of models.	Description of the current situation as of previous knowledge, interviews, and interaction with Stakeholders	D1.1.
		2. Map Key actors, roles, and power relations.	Describe key actors and the rules and agreements to make decisions. Also conflicts and barriers. Part of the co-identification of TAPs and who could be involved in the implementation	Description of the phase, current situation as of previous knowledge, interviews, and interaction with Stakeholders.	D1.1.
	1	3. Problem formulation.	To identify conflicts collectively around water management, modeling gaps, and monitoring needs. Part of the co-development of models.	**Scenathon:** Round table discussion, surveys, open questions	D 2.2
		4. Tool construction	Co-develop models that describe current and future situations and allow the evaluation of TAPs.	Modeling and Monitoring Blueprint.	D3.1., D4.1., D2.1., D3.2., D4.4
		5. Scenario definition	Co-design scenarios related to climate, population growth, and socioeconomic development, to evaluate the vulnerability of the system	Climate Change, population growth, Trends of economic development and land use. Uncertainty analysis.	D4.2.
	2	6. System vulnerability.	Co-develop models to validate vulnerabilities according to future scenarios and to co-identify TAPs to improve the current and future situation. Explain the uncertainty concept, sources of uncertainty, and how to include uncertainty in making decisions.	**Scenathon:** Modeling suite to inform vulnerabilities. Explore with stakeholders current and future scenarios without any TAP implemented or "business as usual ". Co-identification of possible TAPs according to stakeholders' preferences	D3.3. D2.3
Evaluation and agreement		7. Option analysis	To co-design TAPs, adjust models to simulate TAPs, co-define indicators, and co-design a platform to explore results.	A detailed description of TAPs, including biophysical, and socioeconomic variables. Including TAPs as scenarios in the modeling suite.	D4.5. D3.3.
		8. Indicators definitions	Co-design metrics to compare TAPs performance as part of the process of co-evaluation of TAPs	Co-design metrics that could be compared by Stakeholders. Try to use common and embedded indicators.	D3.3
	3	9. Results exploration	To co-evaluate TAP performance to be implemented using models, simulations, and comparisons between indicators.	**Scenathon:** Simulations of TAPs and comparison with the business-as-usual scenario. Use of indicators to	D4.6. D3.3. D2.4

Phase	SCN	Steps	Objective	Methodology	Del
				compare TAPs. Co-identify TAP with the highest potential	
		10. Decision making	Co-identify TAP with the highest potential to implement in each of the Living Lab	Evaluation among scientists and stakeholders of TAPs that could be implemented. Co-design a roadmap for possible implementation.	D2.5
Implementation and monitoring		11. Monitoring	To co-design a monitoring strategy	Definition of a monitoring strategy including how, when, where, and who will be measuring the indicators.	D4.3, D4.4
		12. Impact quantification	To co-develop the monitoring strategy, measuring impact indicators.	Implementation of a dashboard to present results, and impact indicators in each living lab	D4.6
	4	13. Impacts of TAPs	To co-develop monitoring efforts sharing results of TAPs performance, the impacts of the TAPs, and identifying opportunities to improve	**Scenathon:** Present results of the TAP selected the roadmap for implementation, results, and impacts using dashboards. Scenathon to analysis impacts of TAP	D4.6 D2.5
		14. TAP Improvements	To co-evaluate TAP performance and options to improve.	Co-define actions to improve TAP roadmap and/or implementation, indicators.	D2.3-2.5
Dissemination		15. Publications	To publish partial and final results of each part of the process	Publications of journal papers, conferences, newsletters, Web Pages, feature stories, policy briefs, Jointly with stakeholders.	D6.3-6.6
		16. Lessons learned	To learn from each iteration, step of the process, and effort.	Conversation and feedback with stakeholders to learn from each part of the co-creation process.	D2.2-2.5
	Meet	17. Change/transformation stories	To measure the impacts of the project in a qualitative way	**Interview** stakeholders at different moments of the project to identify transformations in living labs. Use videos and narratives, open dialogue, and feedback	D6.3-6.6, D5.3 D2.6

Legend: SCN: Scenathon, Del: Deliverable

The deliverables in the TRANSCEND project are mentioned in the last column of Table 1. TAP Co-creation processAnd are described below:

D1.1 Stakeholder mapping by lab (CMCC, Month 5)
D1.2 Rules of Engagement (CMCC, Month 7)
D1.3 Guidance for scenathons (SEI, Month 11)
D1.4 Knowledge networks mid-term report (SEI, Month 24)
D1.5 Knowledge networks final report (CMCC, Month 48)

D2.1 *Blueprints* of the modeling suites by lab (UPV, month 8)
D2.2 Co-creation Report I (SEI, month 15)
D2.3 Co-creation Report II (SEI, month 24)

D2.4 Co-creation Report III (SEI, month 37)
D2.5 Co-creation Report IV (SEI, month 44)

D3.1 White paper – methods & models for assessing policy performance under deep uncertainty (USAL, month 7)
D3.2 Modeling suite prototype and sourcebook (UU, month 16).
D3.3 *Database of plausible futures* by lab and sourcebook (UU, month 36).

D4.1 White paper – policy monitoring and enforcement approaches (UoM, month 7)
D4.2 White paper – climate, land use, and socioeconomic scenarios by lab (CMCC, month 7)
D4.3 Database of TAP monitoring and implementation indicators by lab and sourcebook (UoM, month 12).
D4.4 Water accounting and impact assessment toolbox prototype (UoM, month 18)
D4.5 Climate and socioeconomic scenarios database by lab and sourcebook (CMCC, month 36).
D4.6 Populated water accounting and impact assessment toolbox by lab and sourcebook (UoM, month 44)

D5.1 White paper – governance/policy enablers and barriers for TAP adoption (USAL, month 7)
D5.2 White paper – financing mechanisms to support TAP (CMCC, month 18)
D5.3 Policy notebook (USAL, month 48)

D6.1 Detailed and revised PDEC and IPR strategy (USAL, Month 4).
D6.2 Data management plan (UU, Month 6)
D6.3 First 12-month exploitation, dissemination, and communication report (CMCC, month 13).
D6.4 Second 12-month exploitation, dissemination, and communication report (ARPAE, month 25).
D6.5 Third 12-month exploitation, dissemination, and communication report & business plan (ARPAE, month 37).
D6.6 Final 12-month exploitation, dissemination, and communication report & legacy strategy (CMCC, month 48).

At this point of the project, the following deliverables consolidate information on the co-creation process.

D1.1. Stakeholder mapping by lab: This report presents an overview of the water governance arrangements in each living lab. This report provides a preliminary description of the institutions involved in decision-making related to water management, their responsibilities, competencies, skills, and expertise in this area. It also identifies the power relations, the groups affected by the decisions, and the differences in knowledge among stakeholders (technical, territorial, cultural, and practical). This deliverable is fundamental to identify, on the one hand, the actors to be incorporated in the co-creation process, their knowledge, and thus how to incorporate their technical and scientific expertise and regional knowledge. On the other hand, for the formulation of workshops and participatory spaces, the report allows an understanding of the level of language and tools that could be used in participatory spaces to achieve an inclusive space that engages stakeholders. It is fundamental to identify in which decision-making space the TAPs can be inserted in such a way that they have an institutional framework that allows their continuity and maintenance in the long term.

D1.2. Rules of engagement: This deliverable defines the basis for the exchange of information, spaces for co-creation and participation, and the rules for harmonious collaboration with stakeholders. To this end, rules of engagement are defined to enable clear, ethical, professional, and responsible interaction with stakeholders. This document describes how the information gathered through the project will be used, how intellectual property and communications will be handled in the TAP co-creation process, and the ethical considerations of the project.

D1.3. Guidelines for scenathons: This document defines guidelines that guide the TAP co-creation process in the project, defining a series of steps. These steps include participatory spaces called Scenathons, a marathon of scenarios that allow the use of information and models to inform decisions and engage stakeholders in the process. These Scenathons are the key moments of interaction with decision-makers, and as such, require hard work of preparation, design, and innovation.

D2.1. Blueprints of the modeling suite by lab: This document describes the blueprints of the modeling suite for each lab. This initial description of models includes both water management models and hydrological, agricultural, climatic, and economic (micro-macro) models. The purpose of use of the models, their status, and the real possibility of use for the project are described. It also identifies the gaps between existing models and those required to simulate the TAPs that can generate transformations that allow adaptation to current and future climatic conditions.

D5.1. Governance, policy, and financial mechanisms for TAP adoption and upscaling: In this deliverable, each living lab describes for each case study the state of the river, in terms of drivers, pressures, status and prospects, water allocation and economic instruments, natural-based solutions for water storage, and non-conventional water sources. Through open-ended questions, key information is obtained on the current status of each living lab in terms of the current state of the basin and rivers, as well as the progress in economic instruments and alternative solutions to conventional problems. These questions were answered by researchers and institutions related to water management in each basin, thus contributing to the co-creation process of the TAPs.

2.2.Engagement Champions Indicators

The Engagement Champions Indicators (ECI) are intended to measure stakeholder engagement in TRANSCEND, the use of information and priorities defined by stakeholders in the TAP co-creation process, including monitoring models and tools, and the active, inclusive, and egalitarian participation that generates transformations in the living labs. ECIs are designed to report on whether engagement objectives are being met and to measure the various forms of interaction with stakeholders. The results are updated periodically and can be consulted in the dashboard available in the following link.

With the measurements of these indicators, we intend to maintain a constant evaluation of the co-creation process that allows us to react effectively to achieve the proposed objectives.

The ECI are organized in the following categories, and are included in the dashboard in the same structure, given 8 windows to illustrate each category:

1. Mapping Stakeholders in each living lab;
2. Co-creation process: measures of interaction with stakeholders out of scenathons; (
3. Co-creation process: measures of iterations into scenathons;
4. Balance and inclusive involvement;
5. Interactions with Stakeholders;
6. Contributions to co-creation: co-develop of models
7. Contribution to co-creation: co- design of Scenarios and TAP s
8. Contribution to co-creation: monitoring.

The ECIs defined in TRANSCEND and used to explain the results are

Table 2. Engagement Champions Indicators

Number	Indicators on balanced and inclusive involvement
1	**Number and %** of women that are part of the living laboratories (attending, reporting, contributing) and WS
2a	**Number** of gender-related feedback (particularly on adaptation strategies) collected during WS
2b	*Describe gender-related feedback*
3a	**Number** of different categories of organizations (public authorities and regulators, utilities, users, civil society organizations, industry, and scientists) involved in the Laboratories
3b	*List categories of organizations involved (public authorities and regulators, utilities, users, civil society organizations, industry, and scientists)*
	Indicators on interactions with stakeholders
4a	**Number** of stakeholders involved in the workshop (% over total number of members in the knowledge network of that lab)
4b	**%** of stakeholders involved in the workshop (% over the total number of members in the knowledge network of that lab)
5a	**Number** of tools used to collect feedback in the workshops (e.g. questionnaires, Delphi, serious games, scenathons)
5b	*List the tools used to collect feedback.*
6a	**Number** of stakeholder meetings other than workshops (bi- and multi-lateral meetings with specific stakeholders, in person or online) carried out in the laboratory.
6b	*Number of people involved in these meetings*
7a	**Number** of other interactions with stakeholders other than meetings/workshops (such as mail, social media, other)
7b	*List the type of interactions used and the number of interactions per type.*
	Indicators on contributions to co-creation by Stakeholders
8a	**Number** of stakeholder models proposed by stakeholders for their incorporation into the modeling suite
8b	*Number of stakeholder models proposed by stakeholders that are effectively incorporated into the modeling suite*

Number	Indicators on balanced and inclusive involvement
8c	*List the stakeholder models effectively incorporated into the modeling suite (e.g., AQUATOOL)*
9a	**Number** of scenarios co-designed by stakeholders
9b	*Number of scenarios co-designed by stakeholders effectively modeled in the modeling suite.*
9c	*% of scenarios co-designed with stakeholders over total scenarios simulated*
10a	**Number** of Transformational Adaptation Policies (TAP) co-designed by stakeholders
10b	*Number of TAP co-designed by stakeholders effectively modeled in the modeling suite*
10c	*% of TAP co-designed with stakeholders over total TAP simulated*
11a	Number of dashboards (or other tools) to share results and impacts of TAP Implemented
11b	Number of evaluations of stakeholders about the dashboard or other tools, and the utility.
12	Number of publications, change stories, and lessons learned with stakeholders

In the following section, the ECI are used to present the results of the co-creation process.

3. Results of the first-year co-creation process, excluding Scenathons

In this chapter, we present the results of the co-creation process that has been carried out in the TRANSCEND project. The structure follows the co-creation process presented in Table 1 and is described carefully in Deliverable 1.3. Guidelines for Scenathons. This process in the first year covers the following steps:

3.1.Definition of the decision-making space

In the production of Deliverable 1.1, Stakeholder mapping by lab, the living labs analyzed the institutions in charge of making decisions related to water management. They identified the roles of the institutions and their functions. From this, it can be inferred which decision-making spaces can support the implementation of TAPs.

In Figure 3. Dashboard Knowledge Networks, the number of stakeholders in each living lab, roles, and functions are presented.

3.2.Mapping of actors, roles, and power relations

In Deliverable 1.1. the identification of the main actors in each living lab was synthesized, and their functions and power relations were described. Figure 3 presents the list of the mapping of actors in each living lab, the theme they work in, and the description of their role in decision-making. In this deliverable, 67 organizations were identified in all living labs. The organizations were grouped by topic and the graph on the right side of the dashboard shows the number of organizations by topic for each living lab. According to the analysis for each living lab and the groups invited to the knowledge network, the main actors included in the living labs are public institutions on the national or regional scale. In all living labs, these stakeholders oversee the water supply, energy, agriculture, or environmental activities. In 6 of the 7 living labs, one institution oversees the integrated water management in the river basin. Only in one living lab do we have the participation of non-governmental actors and community associations such as fishermen or farmers. This aspect is something to analyze in each living lab, intending to be more inclusive, if it is appropriate.

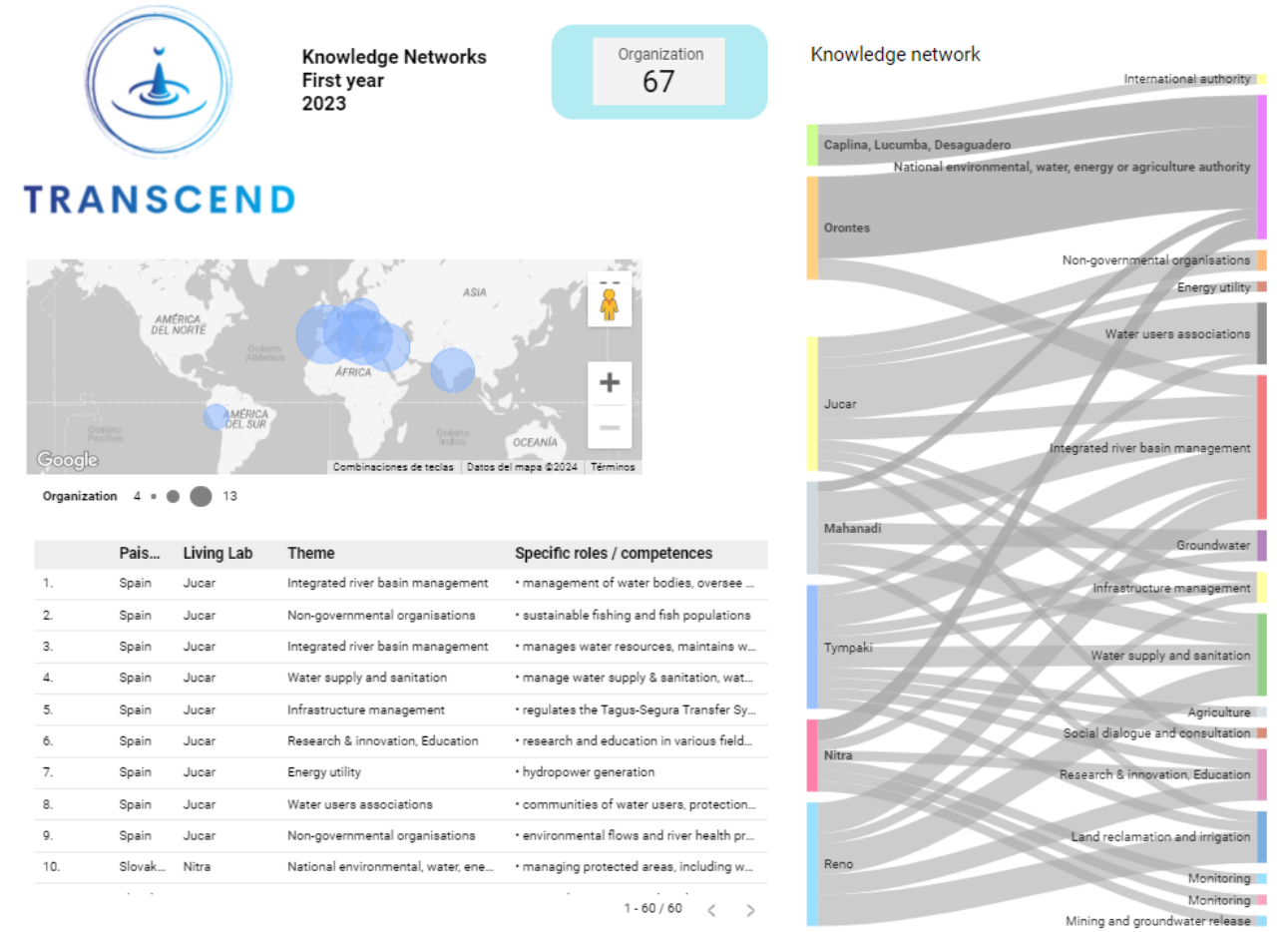


Figure 3. Dashboard Knowledge Networks.

3.3.Interactions with stakeholders, other than scenathons

The identified actors have been contacted through different mechanisms before the workshops (calls, email, in-person and virtual meetings, etc.) and the knowledge networks are being consolidated as the mechanism for information exchange in the living labs.

Figure 4 shows the ECI related to knowledge network consolidation activities calculated at the end of the first year. At this moment, 87 participating organizations have been identified, increasing the number of participating organizations identified in the Deliverable 1.1 by 30%.

During the first year of the TRANSCEND project, 205 people participated in the knowledge networks of the 7 living labs, of which 66 were women (see Figure 4). The percentage of women's participation varies in each living lab, ranging from 53.8% to 12% (Figure 4 a and b). A large number of bilateral meetings, e-mails, telephone, and virtual calls have been held with these institutions.

The objectives of all these interactions varied: strengthening ties with institutions and stakeholders, requesting information, sharing progress on deliverables, validating information, and coordinating the co-design of the first Scenathon. As part of the feedback, we ask stakeholders who additionally should be invited to the knowledge network and Scenathons.

In the dashboard, the list of organizations that are part of each living lab at the end of the first year, and the type and number of organizations can be explored.

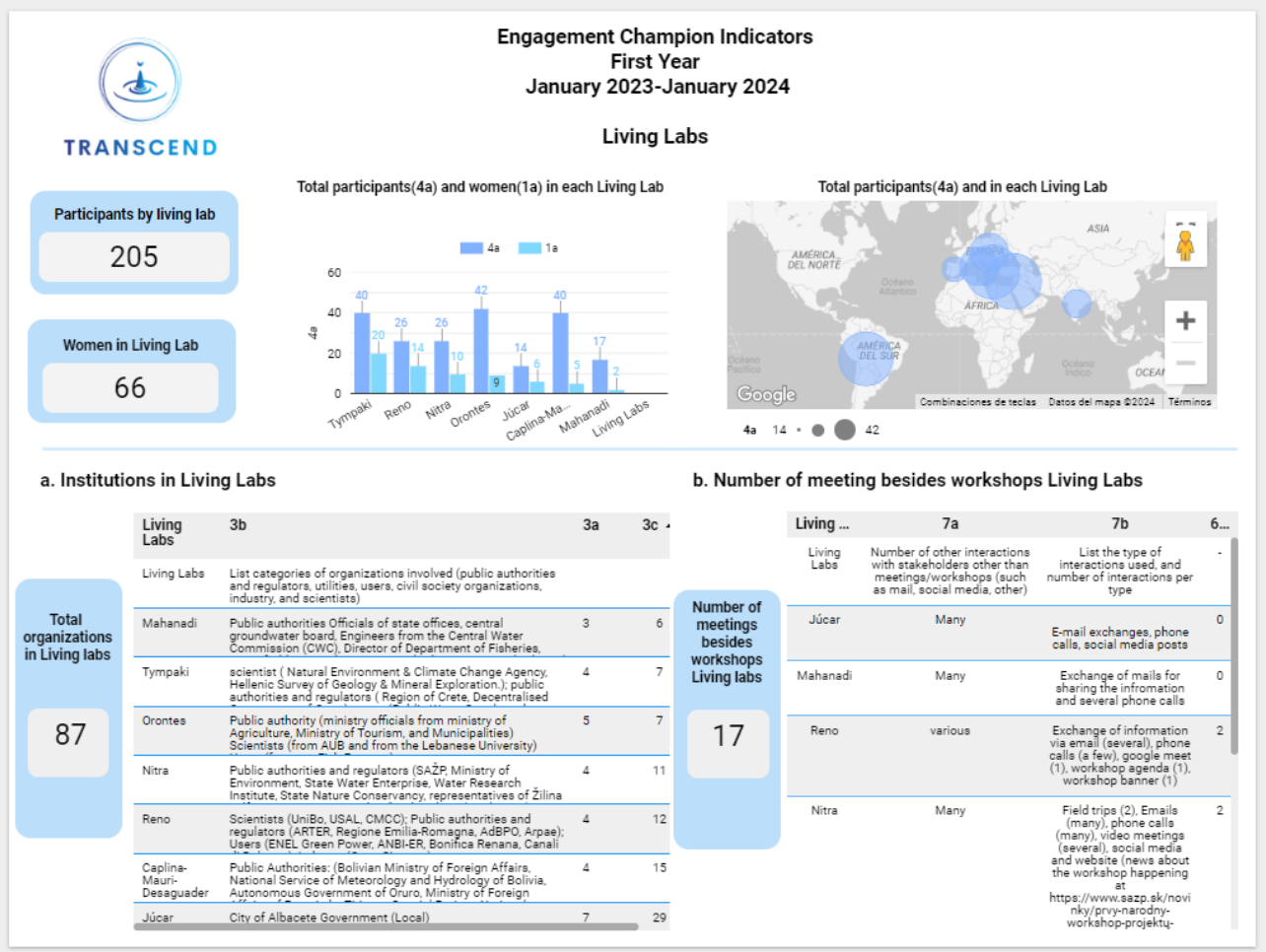


Figure 4. Dashboard Engagement Champion Indicators

Figure 5. Indicators on interaction with stakeholders.

In the co-creation process, we seek to ensure that all stakeholders are included and have a balanced participation in terms of gender, of the groups that are invited, trying to include those most affected by water scarcity and who can adopt TAPs and implement them. Figure 6 (a) shows the number of women (4a) compared with the total participants (1a) in each living lab, and Figure 6 (b) the % of women in each living lab, varying from 12 to 53%. The number of different categories of organization is presented in Figure 6 (c).

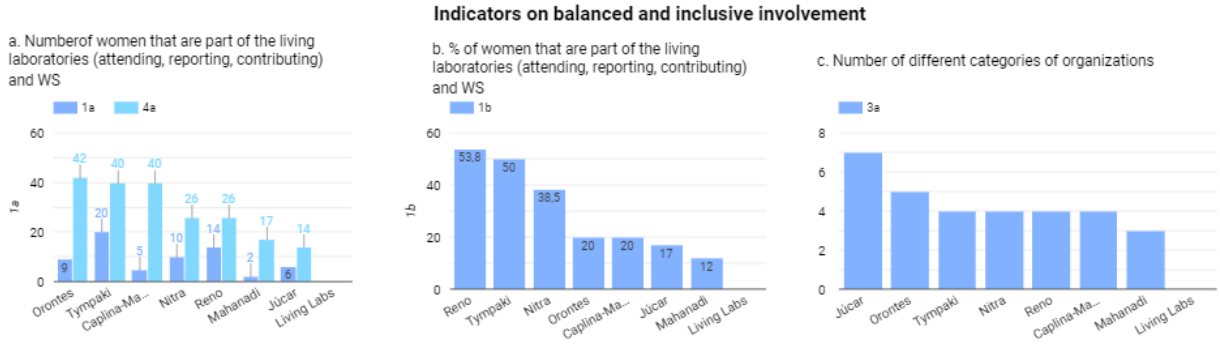


Figure 6. Indicators on balance and inclusive involvement.

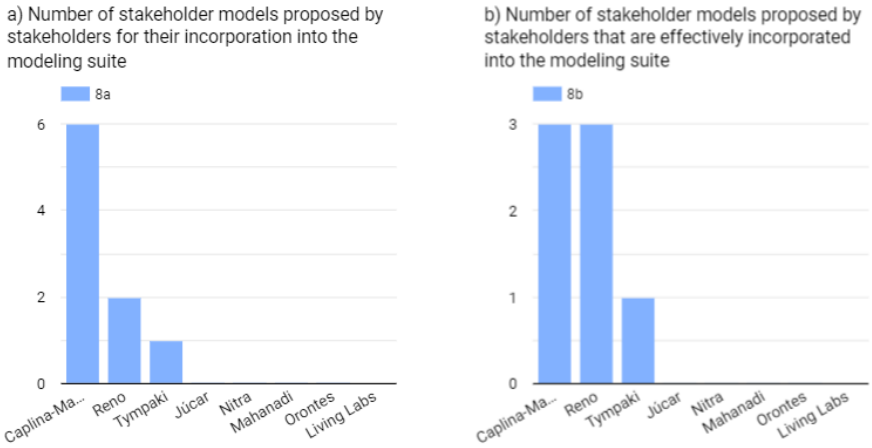


Figure 7. Indicators of contributions to co-creation by stakeholders

3.4.Definition of pressure and challenges by living labs before the Scenathons

The most important issues in each living lab have been defined through the collection of information in previous studies and regional knowledge of stakeholders, answering the questions that have been formulated in the deliverables, mainly in D1.1.

As a result of this first exercise of identifying the pressures and management challenges, pre-identified TAPs for each living lab are presented in Table 3.

Table 3. Challenges and possible TAPs by Living Lab, (Deliverable 1.1.)

Living Lab	**Pressures and management challenges**	**TAP (to be assessed & updated)**
Reno	-Anthropic landscape with large irrigation-dependent ecosystems (wetlands, forests) through return flows;	-Water allocation reform that recognizes return flows, and unbundled rights;
	-Growing drought and scarcity due to climate change;	-PES to irrigators to prevent modernization;
	-Irrigation modernization to mitigate economic losses reduces return flows;	-Irrigation and climate services;
	-Irrigation-dependent ecosystems at risk.	-Insurance against extreme droughts.
Júcar	-Absolute scarcity and climate change are expected to reduce water availability;	-Water pricing and subsidies to improve technical efficiency...
	-Frequency and intensity of drought episodes expected to increase;	allocation reform that recognizes return flows and adjusts water rights to avoid water depletion;
	-Disputes between upper and lower basin farmers;	-Non-conventional water resources;
	-Groundwater depletion, theft.	-PES via markets (buyback);
		-Enhanced monitoring using in-situ and satellite data, penalties for theft.
Nitra	-100+ years of coal and lignite mining under transition as mines (14% of basin area) close in 2023;	- Transition of coal-based economy to an economy based on new and more sustainable industries - protection of wetlands for biodiversity, water & carbon storage;
	-Wetlands created by collapsed underground mines among areas with the highest biodiversity in Slovakia;	-Pricing and subsidies to fund transition and promote nature-based solutions;
	-Wetlands at risk of drying out if water supply from mines (>100 l/s) is not maintained;	-Centralized water allocation register;
	-Climate change will reduce water supply by up to 40% by 2030.	-Water allocation reform that recognizes return flows, and unbundled rights.
Tympaki	-72% of the basin is an agricultural area, irrigation main water user, urban uses growing mainly due to tourism;	-Water pricing;
	-Faneromeni Dam was built to cover irrigation water needs, yet demand still exceeds renewable supply;	-Unbundled rights, recognize return flows;
	-Aquifer overdraft, saltwater intrusion, poor groundwater qualitative and quantitative status.	-Enhanced monitoring using in-situ and satellite data, penalties for theft;
		-Insurance against droughts, explore EU solidarity fund against extreme droughts.
Caplina-Mauri-Desaguadero	-Transboundary system with limited cooperation;	-Inter-regional water allocation agreement, including groundwater;
	-Arid region, sensitive ecosystems to climate change (Poopó Lake in Bolivia);	-Treated wastewater reuse, desalination;
	-Upstream (mining) v. downstream (irrigation, livestock) competition;	-Drought insurance & mutual funds;
	-Inequity (small v. large permit holders).	-Expand nature-based water retention areas and effective cost-recovery.

Living Lab	**Pressures and management challenges**	**TAP (to be assessed & updated)**
Mahanadi	-Growing scarcity and floods (delta) under climate change;	-Inter-state water allocation mechanisms & institutional structure;
	-Irrigation demand exceeds water supply;	-Pricing and cross-subsidization to increase irrigation efficiency and develop water retention areas;
	-Dispute between Chhattisgarh (upstream) and Odisha (downstream) states on water allocation (thermal plants, agriculture).	-Introduce water rights that recognize return flows, and explore trading.
Orontes	-Breadbasket for Lebanon (Beqaa Valley), Syria & Hatay (Turkey);	-Centralized water allocation register using remote sensing;
	-Imbalanced water allocation and use across countries;	-Transboundary water allocation agreement & institutional structure;
	-Conflict, migration (mostly from Syria, including 3.6 million to SE Turkey, 200 000 to Beqaa Valley);	-Quotas and voluntary reallocations for sustainable conjoint use;
	-Growing competition between irrigation and domestic uses.	-Irrigation services, mutual funds.

In addition, during the first workshop, activities were carried out to jointly define the current problems in the basin. Each of the institutions understands the problems from its vision and functions. However, a shared understanding of reality allows awareness of the situation, identifying the cumulative impact of individual actions, and identifying TAPs that concurrently benefit each of the participants. The detailed results of the scenathon conclusions are presented in the following chapter.

3.5.Evaluation of models by living lab before the first Scenathon

Through the collection of secondary information, in this first year, we have identified the models that have been developed in each Living Lab, evaluated whether they can be used, and identified the gaps and new developments required to be able to simulate the current situation and the TAPs that we want to co-create. In deliverable D.2.1., the modeling blueprint of each living lab is described in detail. These analyses are made from the knowledge sourced from the members of the living labs, integrating the existing information and complementing the requested information through meetings with institutions. In Table 4 a summary of the existing models in each living lab, extracted from D2.1 Blueprint for the modeling suite, is presented.

Table 4. Current models in each living lab (Deliverable 2.1.)

	Reno	Jucar	Nitra	Tympaki	Caplina-Desaguadero	Mahanadi	Orontes
Climate change scenarios*		EUROCORDEX, CMIP6	EUROCORDEX, CMIP6			CMIP4, CMIP5	
Landuse scenarios*							
Agronomic models	CRITERIA-1D, Icolt, Irrinet	Aquacrop, Aquacitrus	DAISY, WOFOST				Aquacrop, Ecocrop
Hydrological models	TOPAKI	TETIS	HBV, TUW, Bilan, Frier, MIKE, HEC-RAS	SACRAMENTO, HYMOS	WEAP	WEAP	WMS, HEC-HMS
Water resource management models		GAMS, Vensim		RIBASIM, MODFLOW			WEAP, MODFLOW
Hydro-economic models		GAMS					
Microeconomic models							
Macroeconomic models							

* Refers exclusively to scenarios explicitly mentioned in the deliverable

4. Scenathons

The first round of workshops in the TRANSCEND Project was held in 2023. These workshops had three main objectives: 1) to identify with the stakeholders in each living lab, the common problems that water users have, 2) to identify existing models and gaps in both biophysical and socioeconomic modeling issues, and 3) to identify information and monitoring needs.

To this end, a common workshop structure was proposed for all the living labs to achieve the objectives. The first activity was the presentation of the project and the living lab members. Subsequently, the existing problems were identified using group discussions with open questions and other methodologies. Modeling and monitoring gaps were addressed through a survey and open-ended questions. A report of each living lab workshop is presented in the annex to this document. In this section, we present the consolidated results of the three objectives of the first Scenathon.

In the Jucar living lab (see Annex 1.1.), the same structure was not used because another project is currently being carried out where the identification of problems, gaps in modeling, and monitoring were required similarly to those required in TRANSCEND. In order not to tire the participants with several workshops with the same objective, it was decided to unify the workshops for the two projects. Therefore, the structure was adapted to fulfill the requirements and objectives of both projects.

During the first Scenathon, 180 people participated in all the living labs of which 66 were women (36%). In Figure 8Figure 5, a dashboard visualization of Scenathon indicators is presented, which includes the location of each Scenathon (left) and the number of participants (sizes of the bubble), the relation of Scenathons held to the overall TRANSCEND´s timeline (top-right), and total number of hours spent in all workshops (bottom-right). Figure 9 presents the number of participants per

living lab in each workshop (a.), and the percentage of members of each living lab that participated in the workshop compared with the total members (b.).

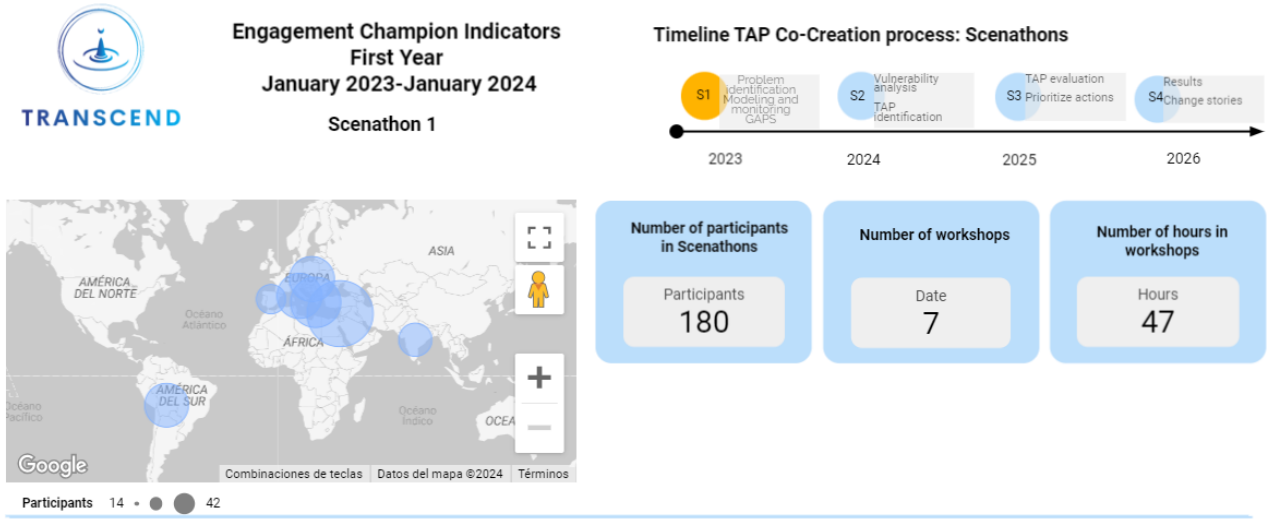


Figure 8. Indicators related to Scenathons

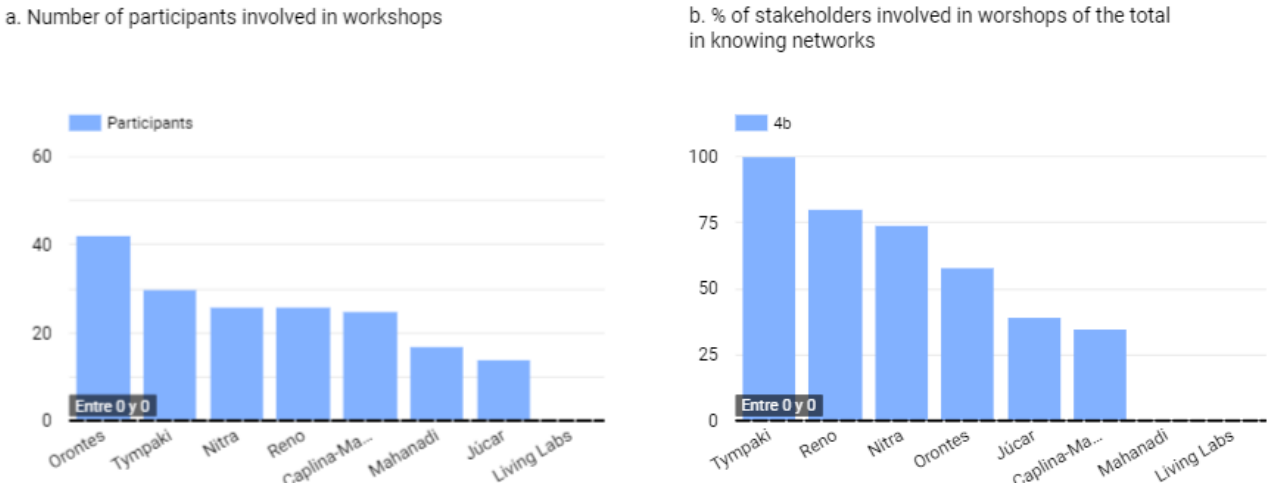


Figure 9. Indicators of Scenathons. a. Number of participants, b. % of stakeholders involved in workshops of the total in knowledge networks (ECI 4b)

4.1.Identification of problems in Scenathons

The first objective of the Scenathon was to jointly define the existing problems in each living lab. Each of the users presents different challenges according to their reality and water use needs. This joint definition of problems seeks to generate a conversation among stakeholders, to understand their differences, but also their commonalities in water management. Concurrent users generate cumulative effects in the system and the exercise seeks to identify possible conflicts that hinder the process of co-creation of TAPs.

Table 5. Main 3 problems identified with stakeholders in Workshop 1 for each Living Lab.Table 5 presents the three main problems identified by each living lab during the workshop.

Table 5. Main 3 problems identified with stakeholders in Workshop 1 for each Living Lab.

LL	Problem 1	Problem 2	Problem 3
Reno	Lack of time, manpower, and technical abilities for the stakeholders that use the modeling results but are not able to directly simulate the hydrological/hydraulic aspects of the basin.	Lack of sufficiently precise data to obtain an accurate water balance in the river basin.	Need for closer collaboration between the scientific community, institutions, and stakeholders to increase the accuracy of the hydrological/hydraulic models.
Tympaki	Decision makers-regulators communicate ineffectively their decisions related to water management to the water managers-users. As a result, these decisions are not effectively implemented by the water managers-users.	The Region of Crete River Basin Management Plan adopts the Water Supply Masterplan of Potable Water as a measure that should be applied by the Municipal Water Supply and Sewerage Companies. However, this process was not fully implemented yet. Moreover, it was identified that there is a need to adopt a similar Masterplan process also for the irrigation water, which could be implemented by the Local Land Reclamation Organizations. These Masterplans also need to include Drought and Water Scarcity Response Action Plans.	There is a gap between the scientific community and water managers-users which relates mostly to the fact that there is a lack of expertise.
Orontes	Water Pollution: due to domestic and aquaculture activities.	Access to water: lack of infrastructure, population growth.	Ineffective development and research projects: lack of coordination between efforts, ineffective projects.
Mahanadi	Water availability and use are not looked at the basin level as a whole.	There is no common consensus between the two states (Chhattisgarh and Odisha) concerning data sharing and understanding the Mahanadi River Basin Management.	Odisha stakeholders are under the opinion of building more structures downstream as well.
Júcar	Water quantity: future climate and population scenarios forecast more water availability/scarcity.	Environmental status of Jucar river	Integration between scales, economic assessment of driving forces
Nitra	Conflicting policies: in water management vs. mining laws	Financial stability: Closing of the mines and phasing out the coal power plant by the end of this year presents a large uncertainty with the region´s economy, water use, but for instance, also for the mining company to fund their nature-based solutions projects or to	A prioritization of water users is lacking in Slovakia, which then makes it more difficult for the authorities to decide which water users will be granted permits in times of scarcity. Currently, the regional authority issues permits case by

		maintain the water supply for the wetlands.	case and mostly based on the location of the user.
Caplina-Mauri-Desaguadero	Water Quality in subbasins surrounding lake Titicaca: affected by mining and domestic wastewater discharges	Water stress due to less water store and droughts.	Information at an adequate scale to make decisions. Integration with economic issues, like agriculture and Quinoa crops

Comparing the problems previously identified and summarized in Table 2 from deliverable 1.1 with those obtained in the first workshops and presented in Table 5, different problems are observed in some living labs. These differences may be because the first identification of problems was done with some institutions, from a more technical component and the second depends on the workshop attendees and how the conversation was carried out. These problems identified with stakeholders will be included and possible TAPs will be determined to help transform and improve the conflictive situation.

In several living labs, it was observed that the problem of lack of accurate information, with adequate models to support decisions at the appropriate scale is an issue prioritized by stakeholders. On the other hand, the lack of articulation on policy issues and mechanisms to inform the water management decisions of various institutions as well as how this information is shared is another relevant problem. The current and future water scarcity crisis, according to climate scenarios and population growth, is compounded by the growing water pollution and governance problems that complicate the search for solutions to transform the territory.

4.2.Modelling gap

Through the questions developed in the stakeholder workshops and the survey, the living labs identified the three priority gaps in modeling issues presented in Table 6. In the co-creation process, the gaps identified in the workshop will be used to define the models to be implemented.

This information obtained in this workshop was used to develop the model blueprint (Deliverable 2.1.) and after the Modeling suite prototype (D3.2.)

From the deliverable 2.1 and Table 4 we realized that living labs have models and information that could be used in the project as a starting point to develop the modeling suite from prior efforts. However, some challenges we face in living labs are that the information is not available, models are not open to be used in the project and some of them require expansion, upgrading, and adjustments. According to the workshops and priorities consolidated in Table 6, each living lab faces different challenges about the use of models to make decisions. Some of them don't have or don't use models to make decisions. They identify a lack of technical capacity internally in the institutions to manage models and depend on external support for this task. Other ones have models but identify a lack of coupled hydrological – economic model to make decisions evaluating the economic implications of water scarcity.

Table 6. Main 3 modeling gaps identified with stakeholders in the first workshop

LL	Modeling 1	Modeling 2	Modeling 3
Reno	Integrated model: biophysical and socio-economical	Model Calibration	Quality and accessibility
Tympaki	Currently, the water managers-users of the living lab don't apply a specific model and it was identified that there is a need to use a water demand-supply model and a groundwater model at a local scale.		
Orontes	Not identified in the workshop		
Mahanadi	Extending the WEAP model for the entire basin area, covering Odisha	Integrating the model with a sound groundwater flow model to understand the impacts of intensive or modified groundwater use on the lean season flows.	Carrying out an economic evaluation of the water management alternatives identified to deal with floods and droughts to choose the cost-effective water management alternatives
Júcar	Integrate Hydrology + economic	Scenathon interaction	
Nitra	In general, water-management stakeholders expressed a lack of capacities and competent staff for modeling, and no resources to train people. Modeling is used for specific situations (e.g. flood management), but mostly they rely on external help. However, some modeling outputs would be welcome.	VÚVH also stressed that while about 80% of the drinking water comes from groundwater resources, there are no models to predict the availability of these resources in the future, as well as no models for the interaction of groundwater and mining water (?)	VÚVH would also appreciate a model for predicting ecological water flows (e.g. accounting for climate change, and drought) or a model for predicting the water pollution spread in case of some ecological catastrophes. For the mining company, it would be useful to have some kind of model to predict the progress of mines´ flooding.
Caplina-Mauri-Desaguadero	**Integral Modelling gap**. Lack of comprehensive models of the entire system that have information from both countries.	**Lack of hydro-economic models**. There is no precise information on the application of agricultural insurance, and emergency protocols established in the current plans of water resources in cases of events that reduce profitability in economic sectors.	**Lack of water quality models**. A transversal problem throughout the TDP system is water quality, which has relevance in the appropriate sizing of treatment for wastewater.

4.3.Monitoring gap

In each living lab, monitoring needs were prioritized according to the conversation that took place in the workshop among stakeholders. These jointly identified priorities are considered in the co-creation process to identify the monitoring tools to be developed.

In Table 7, the main monitoring gaps for each living lab are presented. Information about water demand for different users seems to be the more critical issue in all living labs. In addition, monitoring hydrology, groundwater, water quality, and economic information appears as priorities in the seven living labs. Another topic is how this information is managed because is not available, or the quality of the monitoring system seems not precise, and the institutions that manage information need technical training to improve the use of the information.

Table 7. Main 3 monitoring gaps identified with stakeholders in the first workshop

LL	Monitoring 1	Monitoring 2	Monitoring 3
Reno	Monitoring tools for scarcity	A lack of monitoring data concerning water use has been observed, mainly related to withdrawals and releases (return flows)	Developing a more precise quality monitoring system would enable a better comprehension of the basin conditions and better management of its waters.
Tympaki	Currently, the water managers-users monitor the water level/volume of the main reservoir existing in the Messara Plain (Phaneromeni Dam), the groundwater level of the aquifer, and the water consumption and water quality.	Groundwater level of the aquifer	Water consumption and water quality.
Orontes	Establishing of Asi River Authority: improve coordination and centralize the planning process.	Activating law enforcement: ensure better allocation of water	Monitoring wells and well digging: to control informal use of water and wastewater discharges.
Mahanadi	No monitoring points at strategic locations - may be automized. In the case of groundwater availability, it is always overestimated. However, in the case of surface water, this problem did not arise.	It is understood from the discussions with stakeholders that fixing limits to the usage of water will bring positive impacts, especially in the case of surface water.	Water regulating authority should be formed within the existing departments.
Júcar			
Nitra	The hydrological monitoring network is, in general, insufficient for better water management and the network needs to be denser.	Several stakeholders agreed that the water withdrawal monitoring system is not objective in general.	Existing information is not available to all stakeholders and some decision makers suggest that a database should be consolidated to share

				information from existing monitoring.
Caplina-Mauri-Desaguadero	Demand Monitoring: agriculture, mining, and domestic use.		Water Quality monitoring, mainly in lakes	Information on markets and economics driven by water use.

5 Conclusions and Recommendations

This report presents the results of the TAP co-creation process carried out in the TRANSCEND project, after the first year of activities. The co-creation process aims to bring together scientists and stakeholders through knowledge networks to identify TAPs applicable in each living lab and evaluate them using models integrating biophysical and socioeconomic variables and monitoring tools.

For the implementation of the TAPs co-creation process, a series of steps have been defined that seek to generate a logical sequence, easy to follow in all living labs. This report presents the results of the steps taken during the first year of the co-creation process: identification of the decision-making space, mapping stakeholders, problem formulation, identification of modeling, and monitoring gaps.

As a result, the living labs advanced in the consolidation of knowledge networks, increasing the number of members in the network by 30%, exchanging information, knowledge, and tools. At this moment we have 87 institutions that are part of the knowledge network, 205 participants of which 66 are women. In some living labs, the participation of women is low, and it should be analyzed if it is possible to increase the participation of women. It was also observed that in most of the living labs, there is no participation of communities, farmers' or fishermen's associations, or/ non-governmental organizations. It is recommended that the living labs evaluate whether it is pertinent to invite other community-based and/or non-governmental organizations to the network that can support the process of co-creation of TAPs and their subsequent adoption.

Regarding the Scenathons, 7 workshops were held in the first year, with the participation of 180 participants, 47 hours in total of interaction spaces. As this was the first space for co-creation in the living labs, the space for the presentation of the project and interaction among the actors was important, allowing in some cases to get to know each other, understand other actors with similar needs, and identify barriers and challenges for the adoption of TAPs.

All living labs achieved the three objectives of this first Scenathon: 1. Identify the main issues, 2. Identify modeling gaps and 3. Monitoring needs. This output from the first Scenathon will be used for the co-development of models and co-design of monitoring tools that will be used to evaluate TAPs in future Scenathons. The living labs are recommended to keep the needs identified by the stakeholders for the development of models and monitoring tools as a priority. They should also analyze the ability of models to simulate TAPs and compare them for the following Scenathons.

We compared the problems identified in the deliverables developed before the workshop and those identified in each living lab in the first scenathon. We note that governance issues such as lack of clear policies, water allocation systems, and lack of institutional capacities for integrated water management are presented as issues that need to be improved to overcome the water scarcity crisis in the regions.

Regarding modeling, some challenges that have been identified in the project are that in some laboratories the models that were previously identified cannot be used due to restrictions of the

institutions or lack of finding editable files that allow their use. In others the models need to be expanded to cover larger areas, they need to be updated according to the demands and climate and they need to be coupled with other models to simulate TAPs. In general, stakeholders identify that the officials of the institutions need technical training for the use of models in decision-making.

Regarding the monitoring pillar, the need for monitoring the water demands for different types of users is identified. Other monitoring priorities for each living lab are hydrological monitoring, groundwater monitoring, water quality, and information on economic factors affecting water management. The living labs also highlighted the need to improve how information is managed in a way that is easy to consult and accessible, with greater accuracy. In addition, it was highlighted in several living labs that technical training is required for the use of the information by the institutions.

These results show the progress in the three pillars that integrate the co-creation process at TRANSCEND and some recommendations according to the first 18 months of experience: (i) an inclusive approach to stakeholder engagement and knowledge sharing, knowledge networks, (ii) a set of actionable models that integrate interdisciplinary socio-ecological science and ensemble forecasting to guide TAP design and selection, and (iii) an accounting and monitoring toolbox that supports TAP implementation and compliance in practice.

6 References

Graversgaard, M., Jacobsen, B. H., Kjeldsen, C., & Dalgaard, T. (2017). Stakeholder engagement and knowledge co-creation in water planning: Can public participation increase cost-effectiveness? *Water (Switzerland)*, *9*(3), 1–29. https://doi.org/10.3390/w9030191

Boer, M. M., Bowman, D. M. J. S., Murphy, B. P., Deubelli◎, T. M., & Mechler◎, R. (2021). To cite this article: Teresa Maria Deubelli and Reinhard Mechler. *Environ. Res. Lett*, *16*, 53002. https://doi.org/10.1088/1748-9326/abd42d

Eikebrokk, T. R., Garmann-Johnsen, N. F., & Olsen, D. H. (2021). Co-creation in networks of SMEs: A conceptual model of the cocreation process. *Procedia Computer Science*, *181*(2019), 360–366. https://doi.org/10.1016/j.procs.2021.01.179

Moallemi, E. A., de Haan, F. J., Hadjikakou, M., Khatami, S., Malekpour, S., Smajgl, A., Smith, M. S., Voinov, A., Bandari, R., Lamichhane, P., Miller, K. K., Nicholson, E., Novalia, W., Ritchie, E. G., Rojas, A. M., Shaikh, M. A., Szetey, K., & Bryan, B. A. (2021). Evaluating Participatory Modeling Methods for Co-creating Pathways to Sustainability. *Earth's Future*, *9*(3). https://doi.org/10.1029/2020EF001843

Refsgaard, J. C., Arnbjerg-Nielsen, K., Drews, M., Halsnæs, K., Jeppesen, E., Madsen, H., Markandya, A., Olesen, J. E., Porter, J. R., & Christensen, J. H. (2013). The role of uncertainty in climate change adaptation strategies-A Danish water management example. *Mitigation and Adaptation Strategies for Global Change*, *18*(3), 337–359. https://doi.org/10.1007/s11027-012-9366-6

Tudose, N. C., Marin, M., Cheval, S., Mitter, H., Broekman, A., Sanchez-Plaza, A., Ungurean, C., & Davidescu, S. (2023). Challenges and opportunities of knowledge co-creation for the water-energy-land nexus. *Climate Services*, *30*(February), 100340. https://doi.org/10.1016/j.cliser.2023.100340

7 Annex 1. Living Labs Reports. Scenathon 1.

7.1 Júcar River Basin, Spain

7.1.1 General Information

Scenathon Objective	To identify problems, modeling, and monitoring gaps
Living Lab name	Jucar River Basin
Place	Albacete (first day) and Valencia (second day)
Number of participants	14
Date (s)	11-12 January 2024

7.1.2 Agenda (CET)

	DAY 1 (ALBACETE)
9:00 – 9:15	Registration of participants
9:15 – 9:45	Welcome and introduction
9:45 – 10:45	Presentation and discussion on local scenarios
10:45 – 11:15	Coffee break
11:15 – 12:15	Analysis of trade-offs between water, food, energy, and ecosystems for each scenario
12:15 – 14:00	Identification and debate on innovative measures and Transformational Adaptation Policies (TAPs) based on the scenarios and trade-offs indicated
14:00 – 14:15	Closure
	DAY 2 (VALENCIA)
9:00 – 9:15	Registration of participants
9:15 – 9:45	Welcome and introduction
9:45 – 10:45	Presentation and discussion on local scenarios
10:45 – 11:15	Coffee break
11:15 – 12:15	Analysis of trade-offs between water, food, energy, and ecosystems for each scenario
12:15 – 14:00	Identification and debate on innovative measures and Transformational Adaptation Policies (TAPs) based on the scenarios and trade-offs indicated
14:00 – 14:15	Closure

7.1.3 Summary of the discussion on each point in the agenda.

This case study used information from a workshop that was held with the GoNEXUS Project. This workshop had the same objective as the TRANSCEND project: problem, modeling, and monitoring gaps identification. However, to avoid overwhelming stakeholders with more workshops, it was decided to use the results of the first workshop in TRANSCEND.

Issue 1

Overview:

Climate change is expected to decrease water resources in the Jucar River Basin. Depending on the source, they could be curtailed up to 40-50% of the level shown in the late 20th century in some areas. The largest reductions are expected to happen in the headwaters of the basin, where most of the reservoirs are placed, which could reduce the over-the-year storage needed to deal with the interannual droughts.

Although the uncertainty in the percentage of decrease is large, most of the CMIP5 projections agreed on pointing at a reduction, so the degree of confidence is high. Furthermore, future projections of drought indices indicate an increase in the frequency and severity of droughts, further challenging the sustainability of water use in the system.

This expected decrease will drive impacts on all water uses: urban supply, agriculture, hydropower, and environmental status. Among them, impacts on agriculture and the environment are expected to be the most important. With an 80% share of total water use and lower priority than urban supply, agriculture will suffer the largest curtailment in water deliveries among consumptive uses. On the other hand, the environmental status of water and dependent ecosystems will be challenged by decreasing streamflows and the competition against agriculture. Hydropower production may suffer a significant decrease as well, but it is expected to be lower than the equivalent in the sectors previously mentioned.

Trade-offs

The main adaptation options, based either on increasing the available resources by marginal sources (reuse of treated wastewater, desalination) or by enhancing water use efficiency in agriculture (use of drip irrigation) result in an increase of energy demand, which with the current Spanish energy mix would drive an increase in water demand for hydropower production (non-consumptive but with significant impacts on the flow regime) or in fossil-fuel based energy production (with an increase in GHG emissions and energy prices).

Furthermore, adaptation options for agriculture may cause negative impacts on environmental status. The adoption of drip irrigation will lower the surface and groundwater returns from agriculture, which play a distinct role in the maintenance of one of the most important ecosystems of the Jucar River Basin: the Albufera-protected wetland. On the other hand, adaptation measures focusing on changes in water governance or reservoir operation may modify streamflow regimes and challenge the environmental status of water bodies. Counterwise, changing dam operations towards improving environmental status may harm both agricultural and hydropower.

Policies

Achieving the good status of water bodies as foreseen by the Water Framework Directive (WFD) would agree with the Green Deal (GND) but may be in conflict with the Common Agricultural Policy (CAP) and the Renewable Energy Directive (RED) due to adding constraints to hydropower operation and the consumptive water use from agriculture.

Some objectives of the CAP may be achieved due to increasing energy consumption, which will challenge the RED. It is expected that the CAP reform (a greener CAP,

https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/key_policies/documents/factsheet-newcap-environment-fairness_en.pdf) will be better aligned with the rest of the EU directives, although the current version of the CAP collides with the WFD and the RED.

A new Energy Efficiency Directive (EED) has been recently proposed (https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-directive_en), as well as a Renewable Energy Directive (https://ec.europa.eu/energy/topics/renewable-energy/directive-targets-and-rules/renewable-energy-directive_es), at the light of the Green Deal. However, pushing towards an increase in renewable energy generation from hydropower may enter into conflict with achieving a good status on water bodies.

Synergies/solutions

- Change to less water-demanding crops (by farmer's choice or by law instruments – incentives, CAP)
- Combination of solar panels and irrigation modernization (in areas in which it could be implemented), wastewater reuse or desalination
- Building renewable energy sources not depending on water to reduce the dependency on water-generated energy
- Change the operation of the dams to better reconcile environmental needs with economic uses.
- Use economic instruments (water markets, water prices, crop insurance) to change the current water use towards a more sustainable one.
- Implement climate-sensitive reservoir operation (depending on seasonal forecasts, climate change scenarios, etc.)

Stakeholders

Major stakeholders concerned	Stakeholder interest	Potential conflict with other stakeholders
Jucar Basin Agency (CHJ)	Achieve sustainable water use, fulfill the WFD, reconcile all the water users and interests, and ensure that dams are adequately operated.	No perennial conflicts with anybody, it acts as a referee for user conflicts. May enter into conflict with users in case of droughts demanding though decisions
Jucar Users Union (USUJ)	Downstream farmers with elder rights and Iberdrola. Want to ensure the sustainability of their activities and preserve the elder-right position they currently hold. Legal owners of the main reservoir (Alarcon).	They watch over any decision made to ensure it is in line with the current water share and right system, and with the Alarcon Agreement (agreement setting constraints on the management of the Alarcon reservoir). May oppose any change threatening the current position their users hold, in particular anything that collides with the Alarcon Agreement. They have sued the CHJ and other Jucar users for breaking this agreement in the past.
Acequia Real Del Júcar (ARJ)	The most important farmer association among USUJ members. Want to ensure the sustainability of their farming activities and	They have a good relationship with the rest. Open to implementing irrigation modernization or to cope with some temporary degree of surface curtailment during droughts (although being compensated as

	preserve the elder rights that they currently hold.	the Alarcon Agreement states). They would oppose any change in the water-sharing system threatening the elder rights they possess.
Canal Jucar-Turia (CJT)	Farmers without elder rights from the lower Jucar. They use surface and groundwater, and during droughts, they are not allowed to use surface water unless they pay financial compensation to USUJ. They want to ensure the sustainability of their farming activities and achieve a more equitable share of surface water.	They have a good relationship with the rest but complain about energy prices rising since they directly affect their revenues. They would like to change the current water share to ensure fairer access to surface water (cheaper), but would not enter into open conflict with anybody.
Junta Central de Regantes de la Mancha Oriental (JCRMO)	Farmers without Elder rights from the middle Jucar. They use mostly groundwater, although lately they have been entitled to a small share of surface water. Due to the overexploitation of the aquifer from which they pump (Mancha Oriental), they are being pushed to reduce their pumping rates. They want to ensure the sustainability of their farming activities, stop or at least reduce the pace of groundwater pumping curtailments, and increase the share of surface water they currently have	They had conflicts with USUJ and the CHJ in the past, but now their relationship is not bad. They would oppose any curtailment (or even the lack of increase) of the current surface water share, and oppose any further reduction in their current groundwater pumping cap.
Iberdrola (energy company responsible for hydropower production)	Member of USUJ and the owner of all the main hydropower facilities in the basin. They also own the hydropower reservoirs in the middle Jucar, which can be freely operated subject to some restrictions on their minimum and maximum storage levels, as well as environmental flows. They want to preserve the *status quo* in terms of managing their reservoirs.	Blamed in the past by increases in energy prices that affect users relying on groundwater. They are opposed by the environmental NGOs and in some cases by small riverine towns due to the disruptions that hydropower generation causes on streamflows, in particular for small hydropower plants whose disruption tends to be high compared to the amount of energy generated.
City of Valencia	75% of the water used by Valencia comes from the Jucar. Urban supply has priority over agriculture according to the Spanish law, so they do not expect curtailments. However, an expansion of their current share to cope with population increase is unclear. They are also worried about water quality issues.	They do not have any conflict with any other user. It has access to surface water, its rights have the top priority by law, and climate change expectations are well below a level in which they could be challenged, so they are not expected to take the lead in any measure.
City of Albacete	It used groundwater until it switched to surface water due to quality issues. During droughts, it has to pay financial compensation to USUJ. It would like to preserve and expand its surface use and avoid as much as possible the payment of financial compensations.	It had a bad relationship with USUJ and the users in the lower basin, but it has improved recently. It was sued by USUJ due to unpaid financial compensation, lost the trial, and refused to pay for some years (now the debt is paid). It would team up with Mancha Oriental in demanding access to surface water.
Government of the Valencian Region	The Jucar water supplies water to the main urban area of the region, some of the main farming sectors, and the most known protected area in the region. It wants to preserve and improve, if possible, the economic activity of the farming districts and the ecological status of the protected areas.	They fluctuate depending on the government of Castille – La Mancha and the government of Spain. Now they are from the same party, so no strong conflict is expected.
Government of Castille – La Mancha	It would like to increase the share of the surface water of the Jucar, which is currently allocated mostly to the lower basin, as surface water is cheaper and cleaner than the groundwater from the Mancha Oriental aquifer.	They fluctuate depending on the government of Valencia and the government of Spain. Now they are from the same party, so no strong conflict is expected.
Xúqer Viu (environmental NGO)	Platform made up of several environmental NGOs, municipalities, and other public and private entities. They would like to improve the environmental status of the river, particularly by increasing the minimum environmental flows and preventing water transfers from the Jucar to other basins (e.g. the Jucar – Vinalopó transfer)	They have a bad relationship with the users pumping from the Mancha Oriental. Its relationship with the CHJ and the hydropower company goes back and forth.

AEMS Ríos con Vida (environmental NGO)	Nationwide NGO founded by fishermen pursuing a sustainable fish population and fishing activity. They would like to improve the environmental status of the Jucar to enable a healthy habitat in its streams, favoring native species.	They do not have a bad relationship with any user *per se* and try to keep a good relationship with the rest unless they find a strong opposition (e.g. users not respecting minimum environmental flows)-

Scientific relevance

There are three main scientific contributions.

- Definition of the trade-offs between water allocation to agriculture, energy production, and environmental status, as well as their economic assessment.
- Impacts of climate change and value of adaptation measures for levering those trade-offs
- Assessment of the interaction between large-scale and local-scale driving forces (e.g. impact of energy prices on hydropower production, impact of crop prices on crop choice and farmers' revenues)

Modeling considerations

[Can the models capture the WEFE nexus challenge? If not, how could the case be addressed otherwise? Who is working on this case study? Please remember to check if you added all people from your team to this list.]

The current Jucar River models can estimate water deliveries, energy production, farmers' revenues, and environmental habitat, although they would only be able to optimize the economic uses (without environmental status).

The assessment of the trade-offs among the WEFE nexus and the optimization of their management would require the development of a multi-objective algorithm, expected in the project and with which UPV has previous experience.

Issue 2

Overview:

According to the River Basin Management Plan of the Jucar RB district, 53% of their natural river reaches will not reach a good status before 2027 as required by the WFD. Similarly, all heavily modified or artificial reaches will not reach a good status. The situation improves in the case of reservoirs, with 86% expected to show a good status by 2027, but it drops for the case of natural lakes (63%) and even further for the case of heavily modified or artificial lakes (50%). The overall evaluation of surface bodies altogether shows that 52% will not reach the good status by 2027 required by the WFD. The situation of groundwater bodies is similar since 46% will not reach a good status before the original deadline of the WFD. This situation is combined with a heavily-committed basin concerning water resources since consumptive water demands account for 95% of the average surface water resources.

Improving the environmental status of the JucarRiver to meet the standards of the WFD would necessarily imply a modification in the operation of the river combined with a reduction (and/or substitution by non-conventional water resources) in the amount of water abstracted by consumptive uses in both surface and groundwater.

Trade-offs

The main options for increasing the available resources (treated wastewater reuse, desalination), and increasing energy demand, which with the current Spanish energy mix would drive an increase in the water demand for hydropower production (non-consumptive but with significant impacts on the flow regime) or fossil fuel production (with an increase in GHG emissions and energy prices). A change in the energy mix towards renewable energy sources other than hydropower would facilitate adaptation. The main options for reducing the amount of water used imply the change from gravity to drip irrigation in the areas in which it is not implemented yet (which implies an increase in energy demand); the substitution by crops with lower water requirements (with impacts in crop prices and thus in the regional economy); or the reduction of the irrigated areas (with impacts in the farmers' revenues and thus in the regional economy). Furthermore, the adoption of drip irrigation will lower the surface and groundwater returns from agriculture, which play a distinct role in the maintenance of one of the most important ecosystems of the Jucar River Basin: the Albufera protected wetland.

Policies

Given the similarities between this issue and the previous one (the main difference between both is that the current issue addresses the present status of the basin while the previous one deals with the future), the same policy interactions apply. Fulfilling the WFD would be aligned with the GND but might conflict with the CAP and the RED. On the other hand, reforms on either the CAP or the RED would distinctly impact (in particular the CAP) the achievement of the WFD goals.

Synergies/solutions

Since both issues deal with balancing water resources and water demands, the proposed solutions are the same:

Change to less water-demanding crops (by farmers' choice or by law instruments – incentives, CAP)

Combination of solar panels and irrigation modernization (in areas in which it could be implemented), wastewater reuse or desalination

Building renewable energy sources not depending on water to reduce the dependency on water-generated energy

Change the operation of the dams to better reconcile environmental needs with economic uses

Use economic instruments (water markets, water prices, crop insurance) to change the current water use towards a more sustainable one

Implement climate-sensitive reservoir operation (depending on seasonal forecasts)

7.2 Reno River Basin, Italy

7.2.1 General Information

Scenathon Objective	To identify problems, modeling, and monitoring gaps
Living Lab name	Reno River Basin
Place	Emilia-Romagna Region Headquarters Tower, Bologna, Italy
Number of participants	26
Date (s)	24 July 2023

7.2.2 Agenda

10.00 - 10.15	Registration of participants
10.15 – 11.00	Welcome and introduction
	Formal welcome - Arpae general director - Giuseppe Bortone TRANSCEND project presentation - Dionisio Pérez-Blanco USAL Life Climax Po project presentation - Selena Ziccardi, Adb Po Workshop presentation - Jaroslav Mysiak CMCC RENO case study presentation - Cinzia Alessandrini
11.00-12.40	Round table
11.00-11.15	Brief presentation of the stakeholders
11.15-11.50	1° theme - CRITICALITIES of the Reno RB: brainstorming + discussion
11-50-12-10	2° theme - MODEL STATUS: brainstorming + discussion
12.10-12-30	3° theme - MONITORING STATUS: brainstorming + discussion
12.40-12.50	Wrap-up and Next Steps
	Discussion on the main criticalities, problem formulation, scenario formulation, and identification of potential TAPs • Questionnaire (T5.1), participants were asked to fill out the questionnaire online.
12.50-13.00	Conclusion and goodbyes

7.2.3 Summary of the discussion on each point in the agenda.

7.2.3.1 Welcome and introduction

The day opened with greetings from Giuseppe Bortone, general director of *Arpae Emilia-Romagna*, giving information about the project overview and its importance and correlation with the Reno River Basin. In particular, it was pointed out how TRANSCEND will have a major impact on our case study, reflecting on the year 2023 and extreme events that affected the Emilia-Romagna region, especially flood phenomena, and water shortage. The speech concluded with this premise, stressing that uncertainty poses a major challenge for those who must design adaptive models, planning, and programs and it is something that needs to be addressed through projects like this one aimed at supporting the path to climate change mitigation and adaptation.

Then, Dionisio Pérez-Blanco, associate professor at the University of Salamanca (*USAL*) and project leader, introduced the TRANSCEND project.

Next, Selena Ziccardi from the Po River District Basin Authority (*AdB Po*), remotely connected, presented the Climax Po strategic integrated LIFE project, which focuses on similar issues as TRANSCEND and with which it will be important to network.

Afterward, specific interventions related to the conduct of the workshop led by the event organizers and project partners: Jaroslav Mysiak from the Euro-Mediterranean Center on Climate Change (*CMCC*) explained the objectives and operation of the workshop, and finally, Cinzia Alessandrini (*Arpae, Climate Observatory*) presented the case study of the project, the Reno River Basin, and introduced the main topics of the workshop discussions, particularly modeling and monitoring.

With these presentations, the aim of the workshop was explained, emphasizing the participation of all stakeholders through the creation of a welcoming and collaborative atmosphere.

7.2.3.2 Round table

In the second part of the meeting, organizers and participants animated a panel discussion to share their perspectives and perceptions and focus on gaps and challenges to be addressed within the project.

From the fruitful participation of all invitees, in the room and remotely, it emerged that a great part is only end-users of model outputs climatological, meteorological, hydrological, agronomic, and only a few employ socioeconomic without having their own.

They underlined that these are essential tools for supporting their decision-making processes.

Despite the good performance of the models currently in use, some shortcomings have been identified that partially or entirely affect the stakeholder decisions.

7.2.3.3 Wrap-up and Next Steps

The session was held with a discussion on the main criticalities, problem and scenario formulation, and identification of potential TAPs.

A series of major points emerged ranging from issues related to modeling, socio-economic data, transparency and accessibility to data, monitoring tools, and so on.

All of these will be further explored under item *3. Conclusions.*

The round table concluded with a questionnaire, whereby participants were asked to answer some questions to validate the information presented in Deliverable D5.1. However, this failed due to display errors and was sent to recipients at a later time.

7.2.4 Conclusions

7.2.4.1 Common identification of problems

Problem 1

Lack of time, manpower, and technical abilities for the stakeholders that use the modeling results but are not able to directly simulate the hydrological/hydraulic aspects of the basin.

Problem 2

Lack of sufficiently precise data to obtain an accurate water balance in the river basin.

Problem 3

Need for closer collaboration between the scientific community, institutions, and stakeholders to increase the accuracy of the hydrological/hydraulic models.

Do you identify the main barriers to implement TAPs?

Do you identify enablers to implement TAPs?

Neither barriers nor enablers in TAPs implementation were identified during this first workshop, surely, they will or might come up in future meetings when TAPs will be discussed and further explored.

7.2.4.2 Modelling gaps

Model gap 1

Socio-economic model. The first and most shared need identified by the majority of stakeholders concerns the development of an integrated model that considers both the technical and socio-economic aspects. Socio-economic data is considered to be essential for the decision-making processes, in particular by public institutions, in the following areas: legislation, planning, programming, and licensing.

Model gap 2

Model calibration. Another gap highlighted concerns the need for a better calibration of the existing models to the specific context. The Reno River basin is particular because of its extension, from the mountain to the Adriatic Sea, and is a highly anthropized territory with a complex artificial and strongly interconnected system. A better use of the existing data would enable a better calibration of the models and therefore a more accurate use, based on more realistic and detailed scenarios.

Model gap 3

Quality and accessibility of data. According to many stakeholders, there are gaps concerning modeling data: first, the need for higher transparency and sharing of different kinds of data during technical tables to ensure a better and more operational decision-making process and the creation of protocols for the replication of decisions; second, the necessity for sharing input data, possibly hindered by conflicts of interests; third, the need for a major effort in model validation through higher-quality observed data.

Are the existing models used to make decisions in the living lab?

Yes, the existing models are currently used by most stakeholders.

Please explain what decisions are made with the current models.

The available models are currently used by stakeholders to make the following decisions: planning based on the hydrological balance (RER); management of summer releases from reservoirs (RER); models on meteoric contribution are used for hydro-electrical production to both optimizing the resource and avoid wasting it and for security management in case of river floods (Enel); irrigation management during summer season based on ICOLT climate service (Bonifica Renana); water distribution to users, administrative concessions, the definition of the value and cost of water (Arpae, state property area); use of the agro-hydrological model (Criteria) for climate change impacts evaluation on crops water requirement (Arpae, OC); agronomic and hydrologic integrated models for the imminent use of water (Anbi);

Monitoring Systems and Data

Monitoring Priority 1

Monitoring tools for scarcity. Historically, in the Reno River basin, monitoring has always been calibrated on abundance, for Civil Protection purposes; the tools that monitor hydraulic safety in case of flood, measure propagation times of a few hours while scarcity tools work on a completely different scale, therefore, for correct monitoring, it would be necessary to have tools calibrated on scarcity.

Monitoring Priority 2

Improvement of data. A lack of monitoring data concerning water use has been observed, mainly related to withdrawals and releases (return flows) with negative consequences on the precision of the hydrological balance; withdrawals are high in number and strongly differentiated, and often only the license limit data but not the exact extraction data is available; data about releases are rarely available. In a highly anthropized basin, with a great number of withdrawals and return flows mainly due to agricultural use, this monitoring aspect would be a priority.

Monitoring Priority 3

Quality monitoring. Developing a more precise quality monitoring system would enable a better comprehension of the basin conditions and better management of its waters. Quality data would be relevant both because of the natural protected sites that lie in the river basin and are interested in the Reno waters and because along the river, many factors, such as changes in quantity and speed propagation, solar irradiance, releases, etc. affect the quality of water.

7.2.4.3 Lessons learned.

Related to the participation process, please provide some answers to the following questions.

1. *How do you perceive the communication between stakeholders?*

Stakeholders were not hesitant to share their opinions. Particularly, during the round table, the dialogue among participants was very active and successful. Communication took place through the passage of a microphone, increasing the debate.

2. *What additional stakeholders should be invited for the next meetings?*

In addition to stakeholders already present during the workshop, the participation of other important invitees is welcome, for various reasons could not be present, such as representatives from the regional Water Protection and Management area and the agricultural sector, academia, other reclamation consortiums, regional Civil Protection Agency, associations, and river contracts and finally hydrologists from Arpae.

The attendance of territorial agencies and people with expertise in modeling and monitoring is fundamental, along the way we may find other potential participants and interested parties.

3. *Please describe the participant's engagement in the first workshop, they were active throughout the three topics covered? Do you identify active and passive participants?*

It is clear that in these contexts there may be some people more proactive and dominant than others, depending also on their area of expertise. All stakeholders introduced themselves by giving information about their working field and the involvement of their Institution in the living lab.
In general, notes were taken, some asked focused questions and others added their experiences in planning, monitoring, and decision-making.

4. *How were the time, space, and logistics in your workshop? Do you need any additional resources to plan and develop your workshop?*

The workshop was held in a small but intimate conference room, in the Emilia-Romagna Region headquarters, with a good connection also for online participants. The transition between speakers was smooth, and overall, the meeting was condensed into three hours. Maybe it could have been developed with a little more time for debating.

As for the 2nd workshop, we plan and hope to distribute the presentations and activities over a longer period to have more time for networking and involving stakeholders, such as through breaks between sessions and possibly a field trip to the Reno River Basin. Finally, as an additional resource, we would need preparatory support given the use of serious games to enliven and make the workshop dynamic.

5. *Do you perceive conflicts among decision-makers that need to be handled carefully at the next workshop?*

No conflicts among decision-makers were perceived.

6. *Did you manage to Kickstart /implement a constructive debate, devoid of blame, along the lines of the Talanoa Dialogue that TRANSCEND seeks to implement?*

The sharing of ideas, opinions, and expertise among stakeholders went off without a hitch. A general review of the situation in the Italian case study was made, thanks to an approach of understanding, empathy, and constructive debate.

7. *Do you identify an institutional framework that allows a coordinated management of water resources?*

Water resources management in the Emilia Romagna Region is coordinated by the Po River Basin District Authority which develops River Basin Management Plans (RBMPs) that outline how water bodies within the district will achieve the WFD's environmental objectives.

National laws and policies often set the framework for water resource management. They define the roles and responsibilities of different levels of government, as well as the rights and obligations of water users.

In this framework, Emilia Romagna region develops the regional Water Management Plan following Po River Basin District Authority guidelines and detailing them based on the specific structure and processes.

7.2.4.4 Other information

- *Link to the survey Survey_RB_IT*

7.3 Tympaki Basin, Greece

7.3.1 General Information

Objective	To identify problems, modeling, and monitoring gaps
Living Lab name	Tympaki river basin, Crete, Greece
Place	Zaros, Crete, Greece
Number of participants	40
Date (s)	26-09-2023

7.3.2 Agenda

09.30 – 10:00	Εγγραφές	Registration
10:00-10:20	Καλωσόρισμα – Χαιρετισμοί	Welcome – Opening greetings
	Ξυλούρης Νικόλαος Αντιπεριφερειάρχης στον τομέα Περιβάλλοντος	Xylouris Nikolaos Vice Regional Governor of Environment / Region of Crete
	Χουδετσανάκη – Γιακουμάκη Ειρήνη Αντιπεριφερειάρχης στον Πρωτογενή τομέα	Choudetsanaki – Giakoumaki Eirini Vice Regional Governor of Primary Sector / Region of Crete
	Αλεξάκης Γεώργιος	Alexakis Georgios Commisioned Regional Consultant on European and International Affairs /

	Εντεταλμένος Περιφερειακός Σύμβουλος στον τομέα Ευρωπαϊκών και Διεθνών Σχέσεων	Region of Crete
10:20 – 10:40	Εισαγωγή για το πρόγραμμα TRANSCEND Εισαγωγή της 1ης Συνάντησης Χρηστών νερού Λεκάνης Τυμπακίου Δρ. Μαρίνος Κριτσωτάκης Δρ. Μάγκυ Κοσίδα	Introduction to TRANSCEND project Introduction to 1st LAB of Tympaki Dr. Marinos Kritsotakis Dr. Maggie Kosida
10:40 – 10:55	Παρουσίαση των Χρηστών της 1ης συνάντησης	Presentation of Stakeholders
10:55 – 12.00	Συζήτηση & συμπλήρωση ερωτηματολογίου ανά ομάδα χρηστών Συντονιστές/τραπέζι: Δρ. Μαρία Κανδηλογιαννάκη κ. Φώτης Πανταζόγλου κα Χρυσούλα Αβραμάκη κα Μαρία Στειακάκη κα Βάσω Μαδούλκα	Discussion in each group of stakeholders Moderators: Dr. Maria Kandilogiannaki Mr. Fotios Pantazoglou Mrs. Chrysoula Avramaki Mrs Maria Stiakaki Mrs Vaso Madoulka
12.00 – 12.15	Διάλλειμα καφέ	Coffee break
12.15 – 14.00	Παρουσίαση της συζήτησης των ομάδων χρηστών / Γενική Συζήτηση (Ολομέλεια)	Presentation of the outcomes of each group of stakeholders / Overall discussion (All)
14.00 – 14.15	Αξιολόγηση συνάντησης	Evaluation of the workshop
14.15 -	Γεύμα	Lunch

7.3.3 Summary of the discussion on each point in your agenda.

At the start of the workshop, Region of Crete's political representatives addressed greetings to the plenary and the coordinator of the project on behalf of the Region of Crete partner team presented the main aspects of TRANSCEND as well as the scope of the workshop. The stakeholders were

divided into 4 groups according mainly to the water use (agricultural use, domestic and tourism use, environmental use, and decision-making group) and moderators from the Region of Crete partner team explained the questionnaire completion process and managed the discussion among the stakeholders' members of each group. The responses of the different groups were collected and discussed in the assembly.

Finally, to evaluate the effectiveness of the workshop, the attendees filled up an evaluation questionnaire.

7.3.4 Conclusions

7.3.4.1 Common identification of problems

Problem 1: Decision makers-regulators communicate ineffectively their decisions related to water management to the water managers-users. As a result, these decisions are not effectively implemented by the water managers-users.

Problem 2: The Region of Crete River Basin Management Plan adopts the Water Supply Masterplan of Potable Water as a measure that should be applied by the Municipal Water Supply and Sewerage Companies. However, this process was not fully implemented yet. Moreover, it was identified that there is a need to adopt a similar process of Masterplan for the irrigation water which could be implemented by the Local Land Reclamation Organizations. These Masterplans also need to include Drought and Water Scarcity Response Action Plans.

Problem 3: There is a gap between the scientific community and water managers-users which relates mostly to the fact that there is a lack of expertise in the latter.

7.3.4.2 Modelling gaps

Currently, the water managers-users of the living lab don't apply a specific model and it was identified that there is a need to use a local-scale water demand-supply model and a groundwater model.

7.3.4.3 Monitoring Systems and Data

Currently, the water managers-users monitor the water level/volume of the main reservoir existed in the Messara plain (Phaneromeni Dam), the groundwater level of the aquifer, and the water consumption and water quality.

7.3.4.4 Lessons Learned.

There was fruitful communication between stakeholders and it was mentioned that European projects contribute towards this direction. All participants were actively engaged during the 1st workshop. The resources available for the organization of the workshop were satisfying. Twenty-seven attendees filled up the workshop evaluation questionnaire which included a five-point rating

scale evaluation from "Not at all=1" to "very much=5". The content and the results of the responses have been included in the original report sent.

In Greece, River Basin Management Plans have been developed and implemented at the River Basin level in accordance το Directive 2000/60/EC (Water Framework Directive) to achieve good water status. The River Basin Management Plan of Crete was approved in 2015 (Government Gazette 570 B 8-04-2015) and was revised for the first time in 2017 (Government Gazette 46666 B 29-12-2027). However, these Management Plans are revised on a six-yearly basis and we are currently in the phase of the 2nd Revision.

7.3.4.5 Other information

Summary of the survey's main messages.

There were no changes to the original questionnaire which has been provided both in English and Greek language.

7.4 Nitra basin in Slovakia

7.4.1 General Information

Objective	To identify problems, modeling, and monitoring gaps in each living lab
Living Lab name	Nitra river basin
Place	SAŽP headquarters, Banská Bystrica, Slovakia
Number of participants	26
Date (s)	20 July 2023

Agenda

09.30 – 10.00	Registration and coffee
10.00 – 10.45	Welcome and introduction of TRANSCEND (SAŽP) *- Welcome note* *- round the table introduction* *- opening and aim of the workshop*
10.45 – 11.15	Project coordinator and special guest speeches: transformative change in water resources management *Carlos Dionisio Pérez Blanco (USAL – University of Salamanca)* *Jaroslav Myšiak (CMCC)*
11.15 – 12.30	Water resources management in the region undergoing transformation and in the context of climate change: the need for transformative changes to address these challenges (SAŽP, all participants) • living lab introduction and identification of the issues *(region in transformation, coal-mining phaseout, shifts in groundwater regime, shifts in surface water use)* • *short presentations and perspectives of stakeholders (both regional and national level) and their views on the issues in Nitra RB about climate change and water scarcity (5 – 10 min per presenter)*
12.30 – 13.30	Lunch and group photo
13.30 – 14.00	Introduction to the group discussions (SAŽP) *- Project roadmap and plan for achieving the goals*
14.00 – 15.30	Group discussions *Moderated discussions (3 groups, each 45 min):* 1. *Water resources monitoring* 2. *Modelling in water management* 3. *Monitoring and modelling (30, respectively 15 min)* *- analytical framework and solutions (measures), identification of the main issues, gaps, and strengths in the Nitra RB* *- knowledge, analytical skills, and the steps needed to achieve the goals of the living lab*
15.30 – 15.45	Questionnaire (T5.1) *- participants were asked to fill out the questionnaire online*

15.45 – 16.00	Summary and next steps. *- summary of the main outputs of the workshop and next steps* *- closing the workshop, coffee, refreshments, and informal talks with participants*

21 July 2023, informal and voluntary field day in the Nitra RB

08.00 – 17.00	Field trip to study area in the Nitra RB (Upper Nitra) *- mining areas: visiting former mining areas that present an opportunity for water retention, mining company (HBP) representatives* *- presentation of the accumulation water reservoir Nováky/Rudno at the Nitra River by the project partner SVP* *- visiting the two of the largest wetlands (Košské mokrade a mokrade Ťakov) and a presentation by S. Harvančík on the wetlands´ biodiversity, from the State Nature Conservancy, regional headquarters CHKO Ponitrie)*

7.4.2 Summary of the discussion on each point in your agenda.

7.4.2.1 Welcome and introduction of TRANSCEND (SAŽP)

We used PowerPoint presentations to briefly introduce the work of SAŽP and the project – the budget and partners. Then we introduced the aim and objectives of the project as well as the living labs around the world and the role of stakeholders in the living labs. We followed by setting the scene for the later presentations and discussions by pointing out the issues of the living lab that we identified in the proposal.

7.4.2.2 Project coordinator and special guest speeches

Dioni recorded a video, in which he also introduced the project and provided some more insights, details, and aims of the project. Jaro held a brief oral presentation without slides to engage and inspire the stakeholders, in which he talked about opportunities and the importance of a collaborative setting like this that can serve as a working group and be a foundation for other projects and activities in the future.

7.4.2.3 Water resources management in the region

Participants could choose the way of presenting in this part of the meeting.

The mining company (**HBP**) used a PowerPoint presentation to provide a history of the company, the projects they proposed incl. water retention projects, and the challenges for implementation of the projects. The HBP was transparent about the environmental impacts of the mining. However, they also stressed that the company was state-owned before 1996 and acted on the assignment of the government. Now, the company is held responsible for all the environmental impacts throughout the history of mining, which they found unfair, especially because it was the state who ordered so

and the mining industry has played a significant role in the development of the region and industrialization of Slovakia.

HBP has been working on different projects incl. water retention measures, however, the company is under time constraints as Dec 2023 will mark the final phase of the mining activities, and the mines will lose their main income from the 1st Jan 2024. Only a small liquidation team of about 100 people will remain. Although the region of Horná Nitra was chosen for financial support within the Just Transition fund, HBP has not received any **funding** due to the terms for receiving financial support from the Just Transition. As a private company, HBP would have to contribute 50% of its budget, which it cannot afford now when the mining is phasing out and mines will be closed soon. They think the state should take some responsibility as well and support them, given the company has existed only since 1996 and is not responsible for all the impacts.

HBP presented several plans for water retention and adaptation measures. The former surface mine near Lehota village is now restored and offers the possibility of creating a water reservoir of about 13 – 15 ha large and 10 m deep. Technically speaking, the creation of the lake would be rather straightforward, as there is a water source nearby and a short outflow channel could eventuate into Lehotský stream. Similarly, former settling ponds in the Cigeľ mine with an area of 12 – 13 ha could serve as adaptation measures and for recreation. The dams of these ponds are functional and certified as water dams and could be fed by the mining water from the Cigeľ mine nearby, while the lower pond holds some water already. The sediment has been certified as inert. There is also an uncertainty associated with the source of water for the wetlands, which were created by the extensive mining activity (an area of around 10 – 40 km^2 is undermined and the ground has collapsed already in several places) in the future if the mining water will decrease or cease.

From the point of view of HBP, the main barrier to proceeding with the restoration plans are **conflicting policies and laws** (mining, and nature protection laws), as well as potential EIA obligations. Other issues are **land ownership** and different classification of the ponds in the cadastre. After the mines have closed, some other institute – probably the regional authority (on behalf of the Ministry of Interior), will have to take over the responsibility and compensate landowners. Sometimes, the company has to face cross-border disputes, with institutions from Romania, Hungary, and Austria requesting assessments that the mining is not affecting negatively water regimes in the lower and upper Danube regions.

State Water Enterprise, SVP š.p., presented the water works and the system of water dams for water users in the study area in their ppt presentation. Other SVP representatives also mentioned **policy conflicts** in water management and water bodies´ maintenance. Besides water management and maintenance, adaptation to climate change is in their competence as well. Coal power plant closure at the end of 2023, is currently the highest **uncertainty** for the SVP and the water management in Horná Nitra region because the coal power plant is the main water user in the RB.

The rest of the participants/institutions chose to briefly present their standpoints orally without ppt presentations.

The wetland ecosystems created by mining activity harbor rich biodiversity life, retain water in the landscape, and store carbon. The **State Nature Conservancy** (ŠOP SR, CHKO Ponitrie office), has recorded about 181 bird species in the wetlands, of which 70 species were nesting, while 17 species were likely nesting. Wetland ecosystems are home to other protected species such as beavers, otters, amphibians (*Pelobates fuscus*), and insects (*Euplagia quadripunctaria*). ŠOP SR also stressed the **issue of conflicting policies**: according to the mining law, the mines were supposed to be restored and filled with soil, which conflicts with the nature protection law stating that habitats rich in biodiversity should be protected. The regional authority acknowledged the high value of the wetlands and did not approve of following the mining law. A high number (can be several thousand) of landowners with small fractions of land and an uncertain water supply for the wetlands are the main barriers to creating **protected areas or nature reserves**. According to the ŠOP SR (personal opinion of the representative), it is less likely that the wetlands should dry out completely and the habitats would still support rich biodiversity even at lower water levels. In the case of Ťakov wetland, the water could be redirected from the Handlovka River into the old Nitra River channel. This would, however, require building a dam, which meets the policy barrier again.

The Water Research Institute (VÚVH)´s main task is to contribute to water management strategies such as the *Water Policy Concept of the Slovak Republic for 2030 with an outlook to 2050, and the Water Plan of the Slovak Republic (2009, 2015, 2022).* VÚVH coordinates the implementation of the Water Framework Directive (WFD) and the 3rd RBMP now includes a separate chapter on climate change impacts on water management. Drought and water scarcity is another important topic, and VÚVH, in collaboration with the Ministry of Environment, also works on bridging two strategic documents: the *Water Plan* and the *Action Plan for Droughts*. In addition, VÚVH prepares outlooks for water balance in the surface waters. These water-use outlooks account for the climate change and drought impacts on water ecosystems and water resources and are based on the water balance of surface and groundwater bodies published by SHMÚ (Hydrometeorological Institute) annually. The withdrawal register managed by SHMÚ is a crucial information base for the outlooks and the water balance estimates, although it needs some improvements. Currently, they are working on a methodology for estimating minimum water flows, so-called ecological flows, which are minimum flows that ensure a sufficient amount of water in times of drought for the functioning of the aquatic ecosystems (anchored in the Water Policy Concept). They mentioned the importance of **defining the needs and monitoring the resources** to cover all the user demands in times of water scarcity. VÚVH is also involved in the assessment of construction projects under the exception of the WFD, namely Article 4 (7) (and § 16a 364/2004 of the Water Act).

Ministry of the Environment. Many strategies and strategic documents that the Ministry of Environment has coordinated and prepared include goals accounting for the aspects of climate change and water scarcity issues in water management.

WWF Slovakia works on several projects in the context of water resources management. Currently, it is mainly the LIFE project Living Rivers, which is being implemented in the Danube, Ipeľ, Hron,

and Belá rivers. Some activities are planned in Nitra RB in the future as well. They also mentioned **issues of conflicting policies and bureaucracy**.

7.4.2.4 Introduction to the group discussions

In this block, we presented the roadmap for the project and for adopting TAPs in the living lab. We mentioned again some of the main issues within the living lab to be remembered in the discussions. Originally, we planned to split participants into 2-3 groups, and each group would discuss both modeling and monitoring subsequently for 45 min each. However, because we had a slight delay and to speed things up, we changed the plan on the go and split the participants into 3 groups; 1st group discussed the monitoring of the water resources moderated by Rado, 2nd group used models in water management moderated by Jaro, and the 3rd group discussing the monitoring for 30 mins and modeling for 15 mins moderated by Róbert. We stressed that the discussions should be respectful, and participatory, and the participants should listen to each other. We then presented the particular questions (which we discussed in the meeting with Tania, Dioni, and Tim before the workshop).

7.4.2.5 Questions for group discussions

We used the suggested guiding questions to lead the discussions. For monitoring, the questions were:

1. Monitoring of water use and availability is critical/important for the sustainable and equitable use of water resources.
2. Improved monitoring of the water resources should be the priority for more sustainable and equitable water management.

For the modeling discussion, the questions were:

1. How often do you use models (e.g. GLOBAL, Hydrus, WEAP, AQUATOOL, Aquacrop, MIKE, RIBASIM, LISFLOOD….) for water management in the Nitra RB in your daily work/at your institution?
2. Do you know about any models, whether it would be climatic, hydrologic, or socio-economic, used in the Nitra RB?

After discussions, we reserved some time for answering the questionnaire, which, however, didn´t work and we had to send it out after the workshop in an email.

We summarized the meeting, presented the next steps, and closed the meeting. The next day, we organized an optional field trip to the study area for the participants who signed up. Three representatives from the mining company who participated in the workshop guided us and showed us some of their water retention and restoration projects. We also stopped by at the wetlands, and finally at the water dam Nováky, where the water management enterprise representative talked about the water works and withdrawals.

7.4.3 Conclusions

7.4.3.1 Common identification of problems

Problem 1

One of the main problems repetitively identified and shared by the stakeholders is the **conflicting policies** and bureaucracy of the impact assessment processes. For example in the case of the wetlands, the mining law requires land restoration after the mining is finished. However, the nature protection law states that areas of high biodiversity need to be protected. There was less of an agreement regarding the impact assessment processes. The mining company claimed that they would need to undergo a rigorous EIA process for some of their water retention projects situated in the area of mines or actually in the former surface mine, while they hesitate to invest time and resources into this when they want to improve degraded areas. For example, in the case of the former sedimentary pool, the sediments are certified as inert and they would supply the pool with the water from mines, which already flows out into the stream anyway. Yet, they think they would need to undergo EIA. However, some other stakeholders (VÚVH, SAŽP) didn´t think that this would necessarily be the case. SVP also mentioned policy conflicts in water management and water bodies´ maintenance.

Problem 2

Closing of the mines and phasing out the coal power plant by the end of this year presents a large uncertainty for the **financial stability** of both, the HBV and SVP. From 1st Jan 2024, only a small liquidation team of about 100 people will remain, which presents a time constraint for HBP to continue with their activities and water-retention projects. Although this region was chosen for financial support within the Just Transition fund, HBP stressed that the terms for receiving financial support from the Just Transition are set in a way that prevents them from applying for the funds. As a private company, HBP would have to contribute 50% of its budget, which it cannot afford now when the mining is phasing out and mines will be closed soon.

The coal power plant is the largest water user for the SVP and it is still uncertain how this will affect the SVP, because they will probably have to increase the costs for water withdrawals for the other users.

Problem 3

A prioritization of water users is lacking in Slovakia, which then makes it more difficult for the authorities to decide which water users will be granted permits in times of scarcity. Currently, the regional authority issues permits case by case and mostly based on the location of the user, i.e., the users higher upstream are given preference and the users downstream may consequently not be given permits when the water levels are too low. Partly, it is an issue of competencies as well.

Do you identify the main barriers to implement TAPs?

Conflicting laws, scattered governance, and no integrated management. Lack of integrated database and a better monitoring network. Poor monitoring and control of the water withdrawals. Large investment debt for the water infrastructure causing large troubles for the SVP.

Do you identify enablers to implement TAPs?

Finances and stability in political situations are conducive to implementing The Water Policy concept.

Modelling gaps

Please describe the three main modeling needs identified in the workshop by stakeholders.

Do they know the available tools in the living lab?

Model gap 1

SVP does use models like MIKE and HEC-RAS in their work for modeling the water flow and flood prevention. SVP is partly self-sufficient in the use of in-house models, but in some cases, it also depends heavily on externally commissioned models.

Water Research Institute (VÚVH) does not have capacities and competent staff for modeling, in general, and they do not have resources to train people, however, they would welcome some modeling outputs. VÚVH prepares some scenarios for water use/demand, whereby they use climate scenarios prepared by SHMÚ (hydro-meteorological institute). Models may be used for local and specific situations. For example, VÚVH uses rainfall-topography models to estimate surface water distribution and associated risks. A rainfall-runoff model has been developed for the Rajčianka River, and runoff is influenced by various interventions on the ground, such as forest clearings and roads (unclear which stakeholder has done so).

VÚVH also stressed that while about 80% of the drinking water comes from groundwater resources, there are no models to predict the availability of these resources in the future. VÚVH would also appreciate a model for predicting ecological water flows (e.g. accounting for climate change, and drought) or a model for predicting water pollution spread in case of some ecological catastrophes.

Model gap 2

Model outputs require proper interpretation, and this task must be carried out by someone who understands the issues. The barriers to using models and modeling outputs are mainly: a lack of finances, capacities, competent experts, and also time.

Model gap 3

For the mining company, it would be useful to have some kind of model to predict the progress of mines´ flooding. The drainage system is, in large part, unregulated, which presents a large uncertainty regarding how fast the mines will be flooded. And may have consequences for the water outflow from the mines feeding some of the wetlands.

Are the existing models used to make decisions in the living lab?

No systemic use of models to support water management decisions in the lab is in place.

Please explain what decisions are made with the current models.

In general, models are used for flood prevention mostly.

7.4.3.2 Monitoring Systems and Data

Please provide a summary of the three main priorities for improving monitoring of water use and/or availability in your river basin. For each priority, please state what aspect of water use or availability requires improved or greater monitoring. Justify why regarding existing monitoring infrastructure and water management pressures in your basin. These priorities should be identified based on the information gained from the 1st stakeholder workshop and your own knowledge about monitoring needs in the basin from wider discussions and work with relevant stakeholders.

1. *Monitoring Priority 1*

The hydrological monitoring network is, in general, insufficient for better water management and the network needs to be denser. For instance, the water balance outlooks that VÚVH issues are based on data from 137 hydrological profiles within the whole Slovakia, however, there is only one profile (Chalmová) available in the upper Nitra RB.

HBP thinks that the monitoring should be improved especially in the SE part of the river basin along the Vtáčnik Mts., because this is the area of the highest mining activity (and inherent geological instability).

Groundwater is monitored by the SHMÚ in general, while the HBP monitor the groundwater within the mining area. There is a risk that HBP will not be able to continue monitoring this network due to financial reasons after the mines are closed and it is unclear, whether other organization or authority will take over. In addition, the landscape is expected to further change due to the mining, and more ground collapses and pinge creation is expected in the future. This presents a question of whose competence will it be to restore the pinges.

2. *Monitoring Priority 2*

Several stakeholders agreed that the water withdrawal monitoring system is not objective in general. According to the Water Act, the water withdrawals are supposed to be measured by certified devices and checked by authorized personnel, however, there are cases when the water users set their devices incorrectly. Known as a case of Bojnice Spa Resort setting an upper limit for their device and thus higher withdrawals were not recorded, e.g., the device recorded 20 l/s even if the amount withdrawn was higher. In the case of Horná Nitra region and the main water users, SVP has a good overview of the water amounts withdrawn: the withdrawals are recorded and reported monthly by the water users and they´re then charged by SVP at the beginning of a year. In other cases, however,

the withdrawals are reported only once a year. Another issue is that the water users pay for the permitted amount rather than the actual amount withdrawn. Thus, water users often apply for higher amounts of water to have a margin (it doesn´t cost them anything), while in reality, they need/consume less water. The data that SHMÚ collects is, thus, often not good and accurate, which is then reflected in unrealistic water balance estimates (SHMÚ, VÚVH). In addition, VÚVH thinks that the permits should be based on the so-called ecological flows, and not on the volume flows (l/s).

Illegal/unaccounted withdrawals are an issue as well and law enforcement is insufficient. In general, illegal extractions concern small water users in villages, who extract water from the rivers/streams (for watering their gardens for instance). Often these withdrawals may be within the legal limit of 1 250 l s^{-1} $month^{-1}$ or 15 000 l s^{-1} $year^{-1}$ for permit-free extraction. However, these withdrawals altogether can represent a significant amount and severe consequences for the water courses downstream, especially in times of water scarcity. Illegal withdrawals (and constructions) are reported to the regional authority – SVP does not get any feedback on how these cases end. The law enforceability is thus rather limited, especially in the case of illegal constructions.

In summary, there is a need for a unified methodology for granting permits and also for water withdrawal reporting.

3. *Monitoring Priority 3*

VÚVH is in charge of monitoring for WFD, Nitrate directive, etc, and manages several databases. While, for example, representatives of VÚVH in one group didn´t see problems acquiring the data from the institutions subordinate to the Ministry of Environment (available on request), stakeholders in another group expressed that they have to pay for the data, e.g. SHMÚ even though they fall under the same Ministry. Ministry representative agreed that the data obtained from the national monitoring system run by the SHMÚ should be available and free to use, especially for the institutions subordinate to the same ministry, which the representative will convey at the Ministry. VÚVH is currently running a project to bridge various databases, and thus, improve online data sharing. WWF supports that a more complex and overarching information system should be created as it is also one of the objectives of the *Water Policy Blueprint 2030* (IS Voda).

In case of commercial purposes, the regional county boards request information through the relevant ministries, and the first contact is always useful. Flood flows are monitored, and reports are accessible.

7.4.3.3 Lessons learned.

Related to the participation process, please provide some answers to the following questions.

1. *How do you perceive the communication between stakeholders?*

The communication was respectful and factual.

2. *What additional stakeholders should be invited for the next meetings?*

The mining authority did not participate, nor did anyone from the concerned region´s county board. However, we have information that they might be interested in the future. Also, depending on the modeling suite outputs, we might invite more people from academia and governmental organizations with experience in modeling.

3. *Please describe the participants' engagement in the first workshop, they were active throughout the three topics covered? Do you identify active and passive participants?*

Some stakeholders were more active and dominant than others, in particular, the HBP who held a long presentation about the history of the mines, their activities, and projects they´re working on. They provided a lot of useful information and insights, although mostly focused on the mining and not on the climate change impacts on water resources. Other stakeholders presented themselves shortly orally without ppt presentations. In the group discussions, pretty much all stakeholders engaged actively, some a little bit more than others perhaps.

4. *How were the time, space, and logistics in your workshop? Do you need any additional resources to plan and develop your workshop?*

I think it worked out fairly well, it worked also for the group discussions, although better premises with separate rooms for discussions would have been better perhaps. We chose to organize it in-house, as we do not need to do public procurement for conference premises. The technique worked well, except for a bit of technical difficulties with the survey. The participants could not sign up for some reason with their work emails, they would have needed a Gmail account. We tried to troubleshoot it, but in the end, we skipped it so as not to delay the participants any longer than scheduled. For the next workshop, we should also have better equipment for, e.g., recording or playing videos, providing a hybrid option.

5. *Do you perceive conflicts among decision-makers that need to be handled carefully at the next workshop?*

It didn´t appear that there were some conflicts among the decision-makers in our stakeholder group.

6. *Did you manage to Kickstart /implement a constructive debate, devoid of blame, along the lines of the Talanoa Dialogue that TRANSCEND seeks to implement?*

I think we created a good and respectful atmosphere. It is worth mentioning that the mining company pointed out that the current company has existed only since 1996, but the environmental impacts since the beginning of the mining are ascribed to them. Moreover, it was the state, who decided to mine for coal there, while the whole region and country profited from the mining. Therefore, they think the state should take some responsibility as well. Now, they cannot even afford to participate in the Just Transition Fund, because as a private company, the co-financing is 50%, which they view as unjust.

7. *Do you identify an institutional framework that allows a coordinated management of water resources?*

The Ministry of Environment coordinates legislation and strategies implementation by the national and EU law. The Ministry also coordinates the regional and local authorities.

Slovak Water Management Enterprise (SVP) is the authority appointed by the Ministry of Environment and responsible for water management and planning in the six main river basin districts in Slovakia including the Nitra River that belongs to the Lower Váh RB authority. SVP works with the national, regional, and local authorities and other stakeholders to develop a water management plan in each of the six RBs. SVP is mainly responsible for the management and protection of the rivers and other water bodies within the basins, and hydroplants, protection of the drinking water reservoirs as well as the water supply from these reservoirs and other water courses. SVP works to maintain the sufficient water level in the ecosystems and works to restore and protect important biotops such as wetlands, old river channels, etc. SVP is partially responsible for monitoring the surface water quality, and protection of the areas of natural water accumulation according to the Act 305/2018 Coll. Another important responsibility is flood prevention.

Please add some suggestions about the indicators here.

I think the indicators could be explained in more detail, i.e., what exactly are you looking for, because it was a bit of a guessing game. For example, the number of gender-related feedback: what exactly counts, how does it count, and what all you consider gender-related feedback in adaptation policy? Number and % of the stakeholders involved: is it out of the total number of stakeholders we invited or that we think should be involved? We might even expand the network in the future, how to account for that? It was unclear how to count, but I tried my best. Number of meetings, and interactions: how to count? Is one email one interaction, or one thread of emails is one interaction?

4.4.Caplina-Mauri-Desaguadero transboundary basin in Peru, Chile, and Bolivia

7.4.4 General Information

Objective	To identify problems, modeling, and monitoring gaps in each living lab
Living Lab name	Titicaca Lake, Desaguadero River, Poopo Lake (TDP)
Place	Bolivia, Peru [La Paz, Bolivia]
Number of participants	25
Date (s)	October 5th, 2023

7.4.5 Agenda

Time	Section
08:00	Welcomes from the ALT President, Juan Jose Ocola Salazar Introduction from the Head of Transboundary Waters of the Embassy of Peru, Daniel Fernandez Wilson, Introduction from the Minister of Foreign Affairs, Rogelio Mayta Mayta
08:30	Welcomes from David Purkey, Center Director SEI – LA Memorandum of Understanding SEI - ALT
08:40	Presentation of TRANSCEND Project by Dionisio Perez – Salamanca University [Project Lider]
09:00	Introduction of Stakeholder
09:10	Problem Identification [Participatory cartography delimitation, Lead - Tania Santos SEI]
10:00	Coffee break
10:15	Presentation of Findings for Problem Identification
10:45	Stakeholders' presentation about monitoring and modeling in the study area
11:45	Survey TAPs for TRANSCEND and evaluation of the workshop
12:05	Final Remarks by Tania Santos SEI - LA

7.4.6 Summary of the discussion on each point in your agenda.

7.4.6.1 Welcome from the authorities of Peru and Bolivia

The organization of the workshop was coordinated by the Binational Authority of Titicaca Lake, Desaguadero, Mauri, and Poopo Basins (ALT), they notified both ministries of foreign affairs about the workshop, consequently both entities appointed correspondent authorities. Since there are some diplomatic agendas behind the analysis of the transboundary water resources of the study area it was of great interest to understand the scope of the project and the possibilities to move forward with some technical evaluations, that local stakeholders are interested in.

7.4.6.2 Introduction of Stakeholders

We asked each participant to introduce him/herself and the entity/institution represented. This is very important for the stakeholder mapping. In total 13 stakeholders gathered in the initial workshop, 54% from Bolivia and 46% from Peru, which is an important and even representation of each country of the transboundary study area.

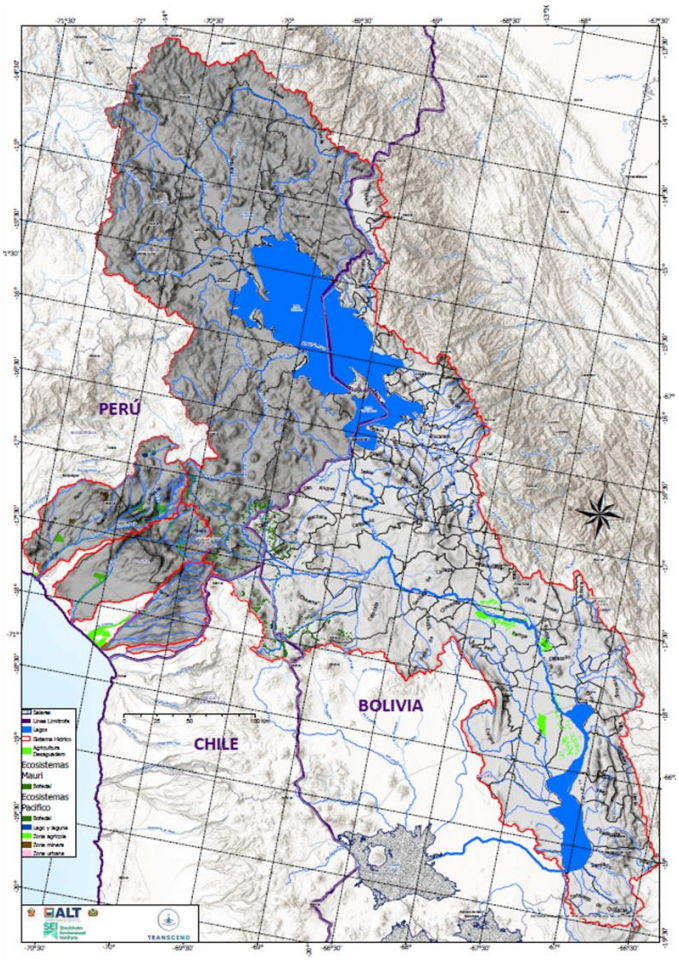
Entity	**Country**
Bolivian Ministry of Foreign Affairs	Bolivia
Ministry of Environment and Water of Bolivia	Bolivia
National Service of Meteorology and Hydrology of Bolivia	Bolivia
Bolivian Operational Unit	Bolivia
Autonomous Government of Oruro	Bolivia
University of San Andres	Bolivia
Technical University of Oruro	Bolivia
Ministry of Foreign Affairs of Peru	Peru
AAA Titicaca Water Management Authority	Peru
Titicaca Water Resources Council	Peru
Caplina Water Resources Council - Locumba	Peru
Lake Titicaca Special Project	Peru
National Service of Meteorology and Hydrology of Peru	Peru

7.4.6.3 Problem Identification

We developed a methodology to work in the identification of problems in the transboundary area, based on group discussions [four groups in the workshop] and geographical maps to guide and make understandable; location, scale, interaction, and type of problem. Therefore, the main resource for the discussion was to have a leader to guide in the type of problem and a GIS map of the transboundary area, we attached the map and type of problems for the discussions:

Type of Problems for the discussion

a) Water Quality issues
b) Water Quantity issues
c) Ecosystem Conservation issues
d) Water related Social/Economic issues
e) Water Monitoring issues



7.4.6.4 Presentation of identified problems

After the discussion in groups, we asked one person in each group to present to all participants the findings with the help of GIS maps to receive feedback, suggestions, and clarifications considering every person in the meeting knows the general context of the transboundary area of study. In the following figure, we attached a scan of the GIS maps with the ideas and suggestions of the participants:

As can be seen in the previous figure, the discussions were guided through a set of questions to identify some features of the problems. One important characteristic in the settings of the groups we organized is the point of view representation, which means to preserve the proportionality of entities of both countries we mention in general, applied in the groups as a criterion to the organization. This characteristic allows us to compare the GIS maps after the workshop to identify some discrepancies and similarities we can identify in the problems. This is an important index for further steps in the project related to agreements and consensus we can find with our stakeholders. This feature allows us to prepare a strategy to acknowledge these potential differences in opinion in the next workshops of the project for the living lab.

7.4.6.5 Presentation of state of monitoring and modeling

To understand the current state of monitoring networks about hydrology, water use, and climate among other key sets of data related to water resource management, we asked some specific

stakeholder to comment in this section of the meeting about their efforts to install, maintain, and manage the datasets. There is not a binational network, every country monitors its area independently. In the case of Peru, the National Service of Meteorology and Hydrology (SENAMHI its acronym in Spanish) has the largest network of climate and hydrological stations, all this data is available on the website of SENAMHI, for a certain period from the present to the past (5 years behind). In the case of SENAMHI from Bolivia, the network is smaller despite the area being bigger and the availability of data is recognized as an issue to be solved.

People from local universities explain the studies about hydrology and water resource management. In general, there are local studies about specific subbasins in the upper site of TDP system however, there is not a produced and published complete model for the system which stakeholders can refer to yet. It was mentioned that some integral studies have been produced by the countries under the Integrated Water Resource Management for TDP system (GIRH-TDPS by its acronym in Spanish), but there is no clear procedure to get the information or models for this project, some coordination through ALT can be done in the next phases of the project, for the living lab.

7.4.7 Conclusions

7.4.7.1 Common identification of problems

There is a considerable set of ideas about the main issues of water resources and their influence on the social and economic development of the municipalities around the TDP system. We can aggregate them into specific topics and also geographical areas as follows:

Problem 1

Water pollution is used for human consumption with no knowledge about heavy metal content in their water sources. The second issue in this region is the critical water quality of Titicaca Lake due to the water sewages of cities like Puno, Copacabana, Desaguadero, and especially El Alto. There is a lack of both Peruvian and Bolivian policies to treat these water returns because of not regulated growth of the cities and the rapid transition from rural to urban land near these urban centers. These are effects of the fast economic development of activities such as agriculture, commerce, and mining.

Problem 2

The sub-basin around the upper side at the west-southern part of the TDP system (Mauri, Lauca) focuses the challenges on the effect of climate changes and the increase of the severity of events such as droughts and floods which impose extremely dangerous effects in the communities and the economic development of the municipalities. The main concerns are about the reduction of the potential quantities stored in the current water sources, especially about agriculture which is not

located in the system but is near the surrounding areas in the Pacifico region of Peru and in the altiplano flatlands in Bolivia. Water Stress is a key problem that also has a deep ecosystem impact in the small ecosystems of high altitudes like Andean wetlands which are not of so much interest to the governments because of the small economic impact over the region.

Problem 3

The sub-basins are located in the region of the Bolivian flatlands surrounding the Desaguadero River and Lake Poopo. During the beginning of the 2000s, high prices of Andean cereals such as quinoa promoted growth in their agricultural production, which increased the economic capacity of the communities and exerted considerable pressure on the soil in terms of agriculture. To support local livestock, also due to the generation of solid waste and the need for sanitary landfills which have not been adequately sized in the case of large urban centers such as the city of Oruro, and above all the increase in mining and generation of wastewater from mineral treatment processes. All this has imposed severe environmental pressure on the Desaguadero River, Uru Uru, and Poopo Lakes. The absence of regulation and exact knowledge of the scale of water use are pending tasks in monitoring issues and data necessary to know the proportionality of the impacts and sources of these impacts.

7.4.7.2 Modelling gaps

Model gap 1

Integral Modelling gap. The first challenge in terms of modeling is the lack of comprehensive models of the entire system that have information from both countries. There are specific basin models in terms of hydrology, but non-existent water balance models with primary information on the most relevant uses such as agriculture for quantity issues and mining for water quality concerns. The project through SEI-LA has access to local models, the challenge of TRANSCEND's next steps is the permissions to use them in an integrated way.

Model gap 2

Lack of hydro-economic models. Although the actors recognize the need to have economic tools that allow them to efficiently regulate users and support them in cases of climate emergencies such as drought, there is no precise information on the application of agricultural insurance, emergency protocols established in the current plans of water resources in cases of events that reduce profitability in economic sectors. There is an absence of economic models to respond to these problems in general in the living lab.

Model gap 3

Lack of water quality models. As described in the problems discussed in the workshop, a transversal problem throughout the TDP system is water quality, which has relevance in the appropriate sizing of treatment for wastewater. However, there are no quality models at the basin level that allow the identification of areas of intervention and severity of the degree of contamination. Currently, in general cities, both in Peru and Bolivia, the water treatment procedures are undersized. In the case of Puno and El Alto, for example, despite the treatment, the effects on

the surrounding bodies (Titicaca) are visible. Using satellite images is possible to see the impact without the need for false color filters from remote sensors.

7.4.7.3 Monitoring Systems and Data

1. *Monitoring Priority 1*

Strategic water use in the system implies water transfers to other regions. This information is important for a correct representation of the current state of the basins. The problem in this regard is the accessibility of this data for modeling purposes for integrated management. Although these are available, the rest of the water use in the TDP system is not monitored and therefore there is no total value of the volume of water measured for agricultural, mining, or domestic use.

2. *Monitoring Priority 2*

There is a very large difference in the availability of water quality data compared to quantity data. This information and monitoring gap restricts knowledge of the environmental state of rivers and especially lakes, which present visible signs of deterioration which generate news on social media at a local and international level from time to time, without imposing any pressure to improve monitoring that allows understanding scales and proposing gradual measures in the medium and long term.

3. *Monitoring Priority 3*

There is no information on the markets and economics driven by the water use of the TDP system. There is a monitoring gap on the economic implications of water use, as well as policies for its regulation on the different economic sectors that use this resource. There is a diversity of economic scales that play a relevant role not only for the geographically close region but for the two countries as a whole, such is the case of mining and agriculture.

7.4.7.4 Lessons learned.

Related to the participation process, please provide some answers to the following questions.

1. *How do you perceive the communication between stakeholders?*

The project with the first workshop in the living lab provided a space for interaction between stakeholders outside the conventional diplomatic procedure. The actors who are focused on guiding transboundary basin policies have requested more information about the scope of the project and since it aims to analyze strategies in an academic context, a certain reservation is perceived to take the next steps, especially in regions of high conflicts, such as the tri-national cross-border zone between Bolivia, Peru and Chile. The first workshop allowed us to clarify that both Peru and Bolivia do not plan to start conversations at any technical level on transboundary basins with Chile in the short term. This has been suggested in some meetings after the workshop and has implications for an adjustment in the originally proposed study area.

2. *What additional stakeholders should be invited for the next meetings?*

The next meeting will have more specific participation, in which the presence of representation from the ministries of foreign affairs of Peru and Bolivia must be guaranteed. It will focus on the call for academic entities that study the hydraulic system of Lake Titicaca, Rio Desaguadero, and Lake Poopo, in the same way, the participation of institutions that carry out productive monitoring will be sought both in Puno in Peru and in La Paz and Oruro in Bolivia.

3. *Please describe the participants' engagement in the first workshop, they were active throughout the three topics covered? Do you identify active and passive participants?*

The participants have been very active in the discussions of the first workshop, regarding issues of prioritizing areas for analysis, as well as defining problems that should be analyzed in the context of transboundary water resources management.

4. *How were the time, space, and logistics in your workshop? Do you need any additional resources to plan and develop your workshop?*

The logistics of the organization for the first workshop were carried out through coordination with the bilateral entity ALT, which was in charge of inviting stakeholders from Bolivia and Peru. The following meetings will be held under this same coordination, thanks to the MoU that SEI signed with ALT for the development of the project in the living lab.

5. *Do you perceive conflicts among decision-makers that need to be handled carefully at the next workshop?*

There are many conflicts of interest over the use of water in the study area, not only at the national level between Bolivia and Peru but also at the local internal level of the countries. Relating local and national actors in the project must be carefully analyzed for subsequent meetings to avoid the project from becoming involved in socially sensitive discussions.

6. *Did you manage to Kickstart /implement a constructive debate, devoid of blame, along the lines of the Talanoa Dialogue that TRANSCEND seeks to implement?*

In the first workshop, the discussion was very productive and positive terms, however, the bilateral entities between Peru and Bolivia after the workshop requested meetings to clarify and clearly define the scope of the evaluation of strategies as well as omit specific study areas with high social and political conflict.

7. *Do you identify an institutional framework that allows a coordinated management of water resources?*

Since the preparation of the study proposal, ALT was identified as the bilateral entity between Bolivia and Peru that can articulate the different strategies and studies of the project in planning actions in a context of joint management of the basins of Lake Titicaca, Desaguadero River, and Poopo Lake. An attempt was made to incorporate actors from the basins in a tri-national context; however, it was recommended to omit these regions to avoid conflicts of use that have not yet been resolved between the countries.

7.4.8 Other information

- *List of participants*

Ministerio de Relaciones Exteriores	**Participants**
Ministerio de relaciones exteriores de Bolivia	Marissa Castro
Ministerio de relaciones exteriores de Bolivia	David Rada
Ministerio de Medio Ambiente y Agua	Juan Godoy
Servicio Nacional de Meteorología e Hidrología	Hugo Mamani
Servicio Nacional de Meteorología e Hidrología	Hugo Cutile
Unidad Operativa Boliviana	Ernesto Mercado Gutierrez
Gobierno Autónomo Departamental de Oruro	Pablo Pacheco
GAD Oruro	Andro Villegas Chino
Gobierno Autónomo Departamental de La Paz	José Luis Astilla
IRD en Bolivia	Frederich Satge
Universidad Mayor de San Andrés (IHH)	José Antonio Luna
Universidad Técnica de Oruro	Willy Choque Marca
Embajada Peru en Bolivia	Daniel Férnandez Wilson
Autoridad Nacional del Agua	Ana Cecilia Torres Uriarte
Autoridad Administrativa del Agua AAA Titicaca	Ronald Isidro Alcos Pacheco
Concejo de Recursos Hídricos Titicaca	Elvis Condori Condori
Concejo de Recursos Hídricos Caplina - Locumba	César Huanacuni Lupaca
Proyecto Especial del Lago Titicaca	Edson Pizarro Rojas
Servicio Nacional de Meteorología e Hidrología - Zonal 13 Puno	Emily Milagros Quispe Salazar
SEI	David Purkey
ALT	Lic Ocola
SEI	Gustavo Ayala
SEI	Tania Santos
ALT	Julio Cesar Miranda
ALT	Patricia Sullcata


Agenda

7.5 Orontes transboundary basin in Lebanon, Syria, and Turkey

7.5.1 General Information

Objective	To identify problems, modeling, and monitoring gaps in the Orontes River Basin
Living Lab name	Orontes Living Lab
Place	Hermel, Lazord Hotel and Restaurant
Number of participants	42
Date (s)	September 26, 2023

7.5.2 Agenda

Hour	Activity
09:45 – 10:00	Registration
10:00 – 10:10	Speech by His Excellency the Minister of Environment, Dr. Nasser Yassin Welcome remarks and opening of the workshop
10:10 – 10:30	Presentation of the TRANSCEND project
	Dr. Hadi Jaafar, Associate Professor and Chairperson of the Department of Agriculture, American University of Beirut (AUB) Lara Sujud, Department of Agriculture, AUB
10:30 – 11:00	Coffee Break
11:00 – 11:45	**Round 1:** Discussion in focus groups Feedback from each group Main problems and challenges faced in the basin - stakeholder objectives and watershed management issues
11:45 – 12:00	Q&A on discussion
12:00 – 13:00	**Round 2:** Survey: The main barriers to Transformational Adaptation Policies (TAP)
	Lara Sujud, Rim Hazimeh, and Zahraa Hamadeh, AUB
13:00 – 13:30	**Round 3:**
	Focus group discussion: evaluation of monitoring and modeling in the basin Feedback from each group
13:30 – 14:30	Lunch
14:30 – 14:45	Debriefing session on workshop outcomes: Reflection and Evaluation
14:45 – 14:50	Closure of workshop

7.5.3 Summary of the discussion on each point in your agenda.

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7.5.3.1 Section 1 – Welcome Remarks and Introduction.

During the welcoming remarks and introduction, we created a welcoming atmosphere allowing stakeholders to interact and familiarize themselves with Dr. Hadi Jaafar and the team. To set the

stage for stakeholders' engagement, we asked them to introduce their roles and involvement. Later, Dr. Jaafar initiated the workshop with a presentation outlining the TRANSCEND project's objectives, the workshop's objectives and expected outcomes, and the impact of climate change on the Orontes River Basin highlighting the need to adapt to these changes. Following the discussion of the challenges at hand, participants were invited to share their practical knowledge of the challenges they face in their day-to-day activities.

7.5.3.2 Section 2 – Discussion and Q&A: Main problems and challenges faced in the basin.

We encouraged stakeholders to raise questions and initiate discussions. As soon as Dr. Jaafar's introduction ended, a café owner posed a question about the immediate impact of the project which prompted honest and open discussions. This spontaneous question set the atmosphere for the coming discussions, allowing stakeholders to share their concerns and discuss the potential and existing challenges. Afterward, focus groups conferred together to produce a list of "problems and challenges faced in the basin". Each focus group shared their list among the other groups for open discussion. This approach encouraged active participation, allowing for collaboration among stakeholders to identify challenges. As focus groups shared their concerns and challenges (depending on stakeholder type), cross-group discussions were facilitated highlighting the shared concerns in the basin.

The key points in this discussion centered around:

1. Prevalent corruption among both state and non-governmental organizations.
2. Biased resource allocation in development projects (favoring a few sectors over others).
3. The need for awareness of climate change impacts in educational institutions.
4. Concerns regarding water temperature fluctuations in the Orontes River impacting fish farmers.
5. Fragmented research efforts.
6. The presence of waste dumps next to a major spring near Ras Baalbek.
7. River pollution from using chicken intestines as fish feed.
8. The Assi Dam Project.

The challenges addressed in this section were not only those encountered by stakeholders but also included institutional and structural obstacles arising in attempts to shift the status quo. Hence, they reflect potential challenges that can be faced when adopting transformational adaptation policies in the future.

7.5.3.3 Section 3 - Survey

Stakeholders filled out a survey assessing the potential challenges of adopting transformational adaptation policies (TAPs). The survey served as a structured method to gather knowledge and

observations from stakeholders. The team provided individual clarifications related to the survey to ensure a thorough understanding of stakeholders' viewpoints and perceptions on TAP.

7.5.3.4 Section 4 – Discussion: Monitoring & proposing solutions.

Focus groups were formed to evaluate the monitoring of water use in the basin, proposing urgent solutions. Stakeholders participated in discussions on monitoring and collaboratively suggested solutions. These solutions were shared across groups which ensured a diverse range of perspectives. The formation of small focus groups (5-6 people) ensured more detailed and in-depth discussion of ideas and proposed solutions.

The key points in this discussion centered around:

1. Implementing ecological restoration and nature-based solutions to address Orontes River pollution.
2. Advocating for self-regulation and formation of informal institutions to enforce laws and regulations that protect the river basin considering climate change impacts.
3. Implementing regulations to address intrusions on the Orontes River water from Baalbek.
4. Promoting reforestation and environmental protection methods to reduce the impact of climate change on decreased water flow and quality.
5. Enforcing regulations on well digging and groundwater pumping.
6. Establishing a basin authority of the Orontes River.
7. Reactivating the enforcement of environmental laws.
8. Construct a feasibility study for the construction of the Assi Dam.
9. Mitigate pollution in the Orontes River due to the presence of sewage and chicken intestine waste (used as fish feed).

7.5.3.5 Section 5 – Closure of Workshop and Lunch

The workshop concluded with a summary of the proposed solutions, where key points were recapped. Lunch was served and informal discussions and networking continued.

7.5.4 Conclusions

7.5.4.1 Common identification of problems

*Problem 1***:** *Water pollution*

The primary issue facing the Orontes River is water pollution, endangering the unique environment that sustains Rainbow Trout farming - a key economic activity in the river. Pollution, mainly in the

form of chicken intestines used as fish feed and waste from restaurants and cafes along the riverbanks, poses a severe threat to fish farmers and greatly influences the livelihoods of people relying on the river for irrigation purposes. In addition to direct pollution to the river from nearby sources, a landfill located near the main spring in the Baalbek area contaminates the groundwater, compounding the pollution issue. The impacts of pollution do not only affect the economic sector, but also tourism, household use, and downstream countries like Syria and Turkey.

Problem 2: Access to water.

Access to water is a significant problem with inadequate physical access being a major concern. The existing water network, managed by the municipality, supplies drinking water to households. However, not all residences have access to water, and those that do may face insufficient supply due to the growing population. Additionally, agricultural projects rely on pumping groundwater through wells due to the absence of infrastructure for surface irrigation usage. The long-pending Assi Dam Project, delayed by various factors, could reduce these issues by providing water for irrigation and household use.

Problem 3: Ineffective Development and Research Projects

Stakeholders voiced their dissatisfaction with the abundance of development and research projects in the region, noting the limited positive impact on both their livelihoods and the basin. There is a call for projects that address stakeholders' needs without bias, instead of providing benefits to specific groups. Another issue with previous research and development projects is the scattering of efforts and lack of collaboration among projects which is inefficient and wastes a lot of resources. Specifically, there is a need for a coordinated and organized approach to such projects, building on existing research instead of repeating the same work and addressing structural needs to avoid repetition of efforts. Additionally, stakeholders shed light on corruption in the non-governmental sector, due to misuse of funds in inefficient projects.

Do you identify the main barriers to implement TAPs?

1. **Scattered authority**

The main barrier to implementing TAPs is that the legal authority on the Orontes River is divided among 3 ministries in the Lebanese government:

i. The Ministry of Agriculture (including multiple departments each having a distinct role or authority concerning the Orontes River).

ii. The Ministry of Energy and Water (through the Beqaa Water Establishment - Department of Northern Beqaa).

iii. The Ministry of Environment.

These entities, along with their respective departments, often overlap. For example, the Ministry of Environment with the Department of Woodlands and fish stock (from the Ministry of Agriculture) oversees the protection of the Orontes River. Sometimes, they make opposing decisions and actions, resulting in interdepartmental or inter-ministerial problems, hence, creating an opportunity for inaction. Additionally, most governmental departments are underfunded which further exacerbates this problem.

2. **Lack of decrees**

Although water laws exist, however, no judicial decrees have been issued which hinders their effective implementation and enforcement.

3. **No law enforcement**

Law enforcement is an important barrier to implementing TAPS. Unfortunately, the absence of accountability for lawbreakers in the region has resulted in a lack of law enforcement. Municipalities struggle to monitor water use because powerful water users will use their connections to resist restrictions. Ministries, on the other hand, have a hard time preventing illegal activities, such as the usage of chicken intestines as fish feed or encroachments on public property along the riverbanks, because there are people with connections to higher authorities benefiting from these activities.

Do you identify enablers to implement TAPs?

Yes, however, implementing policies and enforcing regulations remains a challenge in the Upper Orontes Basin. Enablers for implementing TAPs include an a) existing effort in research and development projects, b) the availability of adequate funding, and c) ensuring the interest and engagement of stakeholders. However, the challenge lies in the scattered projects or reports. Organizing and managing this existing knowledge is essential to establish a foundation for future projects.

7.5.4.2 Modelling gaps

Please describe the three main modeling needs identified in the workshop by stakeholders.

Do they know the available tools in the living lab?

Most stakeholders are not modelers or model users; hence we did not identify modelling needs in this workshop.

7.5.4.3 Monitoring Systems and Data

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1. *Monitoring Priority 1:* Establishment of Asi River Authority

The stakeholder focus groups unanimously expressed the need for the establishment of an "Asi River Authority" similar to the existing Litani River Authority. This authority will be responsible

for water governance and planning, and land use in the river basin. Its scope will include sustainable irrigation, protection of the river basin and the river pathway, ecological restoration of the basin to combat climate change, and planning restorative and sustainable uses for publicly owned properties in the river basin.

This authority will ensure improved coordination since it will centralize the planning process in the river basin and substitute the authority of the varying and opposing ministerial departments. It will also act as an anchor for all research and development projects for better coordination and efficiency between the varying different initiatives. Most importantly, it will make the governing of the river basin independent of changes in ministerial and governmental bodies which will ensure the continuity of work cohesively and efficiently.

2. *Monitoring Priority 2:* Activating law enforcement

For any kind of monitoring to be upheld and access assured, law enforcement must be activated. A serious decision needs to be made for the laws to be implemented in tandem with the installment of infrastructure to ensure unbiased and fair allocation of water resources for households and farmers. This includes separating farmers' water shares for irrigation purposes from those designated got household use, securing the sustainability of the river pathway and its flora and fauna, as well as the livelihoods of those dependent on it.

3. *Monitoring Priority 3:* Monitoring of wells and well digging

According to the Lebanese-Syrian agreement on sharing the Orontes River water, drilling of new wells is restricted in the Lebanese section of the basin. Despite this legal restriction, drilling of unauthorized new wells continues to occur. Due to lawlessness, insufficient water network infrastructure for household users, and the absence of irrigation infrastructure for farming, new wells are being drilled, however, they are not reported or monitored. Stakeholders, though some were hesitant, recognize the urgent need for monitoring of (new and old) water wells and river discharge. Water well monitoring is important to prevent over-extraction, especially considering the future implications of climate change on water availability in the region.

7.5.4.4 Lessons learned.

1. *How do you perceive the communication between stakeholders?*

Most stakeholder openly shared their opinions with Dr. Hadi Jaafar during the welcoming section. Subsequently, when focus group discussions were held, the communication was beneficial, particularly in groups containing diverse stakeholders. However, some groups lacked diversity which affected the depth of the discussion. Stakeholders from the same ministry were seated together at one table, likewise some farmers grouped at another table. The seating was voluntary and not predetermined. Overall, the discussions between the different focus groups were opinionated and lively as well.

2. *What additional stakeholders should be invited for the next meetings?*

It would be beneficial to invite experts in modeling and representatives from NGOs or research institutes working on river basin management.

3. *Please describe the participant's engagement in the first workshop, they were active throughout the three topics covered? Do you identify active and passive participants?*

In general, the discussions were dynamic, with active participation from various stakeholders. Members of municipalities were the most engaged, followed by MoA representatives, aqua-culturists, and NGO representatives. While farmers were initially passive, when asked to discuss their challenges and propose solutions, they were responsive and contributed to the discussion.

Active participation was encouraged across all sections of the workshop, and stakeholders who were actively participating in one topic maintained their engagement throughout all topics.

4. *How were the time, space, and logistics in your workshop? Do you need any additional resources to plan and develop your workshop?*

Time was sufficient, but due to the absence of modeling experts among stakeholders and their unfamiliarity with modeling, this topic was omitted from the agenda.

The venue faced technical issues, such as echoing and lighting issues. The venue has a track record of hosting workshops and the staff promptly responded to all our needs. The catering provided good coffee breaks and lunch during the workshop.

Informal and formal invitations were effective, through phone calls, emails, texts, and reminders. However, a more structured invitation process in future workshops will ensure optimal participation and effectiveness.

5. *Do you perceive conflicts among decision-makers that need to be handled carefully at the next workshop?*

Potential conflicts among decision-makers are anticipated in future workshops, since some stakeholders hold influential positions in the region, and their actions, negligence, and/or personal gains have contributed to the existing challenges. In addition to that, some stakeholders play an active role in governance, and as such are less receptive to criticism or correction. Furthermore, the majority of stakeholders have participated in past workshops and have already established different or conflicting opinions. Stakeholders' priorities differ, with certain stakeholders prioritizing economic growth (for example café and restaurant owners), while others prioritizing sustainability practices. However, despite these differences, all stakeholders are committed to addressing the pollution issue in the river.

6. *Did you manage to Kickstart /implement a constructive debate, devoid of blame, along the lines of the Talanoa Dialogue that TRANSCEND seeks to implement?*

We would assess that the debate was constructive and civil, and this success goes largely to the professionalism of the people present, although some were not as vocal as others or as active in the

debate. But the debate was not one-sided. It showed varied points of view and opinions were consolidated, especially after the focus group discussions, resembling the inclusive approach encouraged by Talanoa dialogue sought by TRANSCEND.

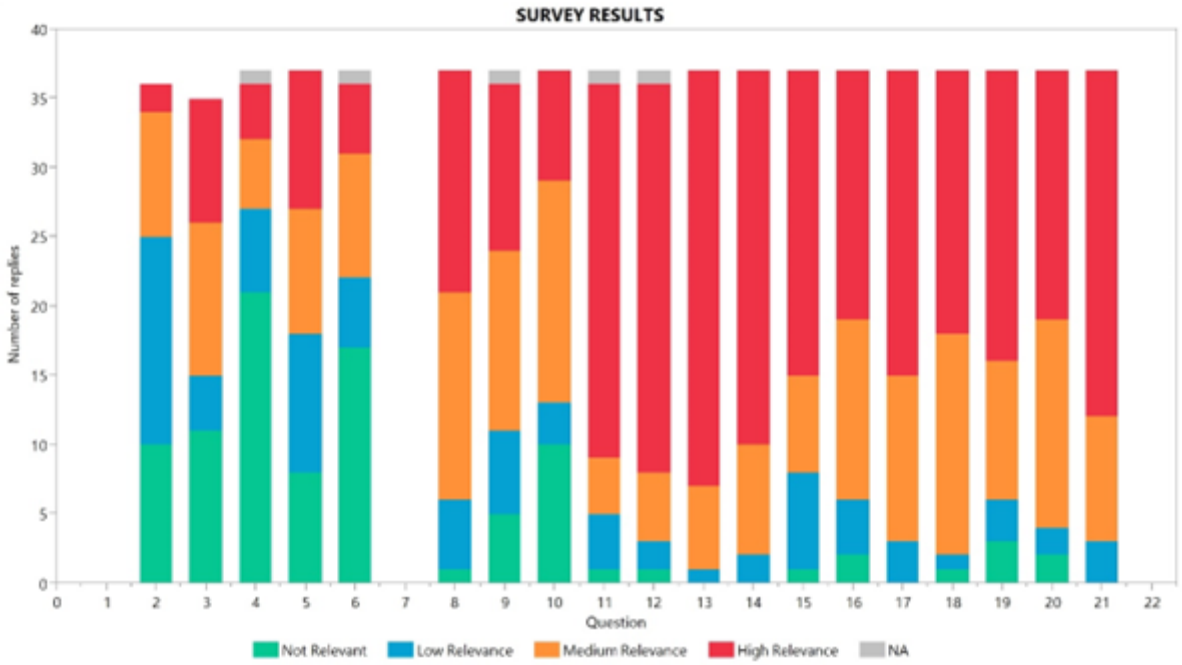
7. *Do you identify an institutional framework that allows a coordinated management of water resources?*

Water management at the level of the basin seems to be the most sought-after institutional framework in the Lebanese context at least. It was chosen by the stakeholders as the most effective, by proof of the effectiveness of the similar framework used for the Litani River. This framework allows the decision-making to happen considering a comprehensive view of the resources, focusing both on environmental needs and developmental needs, while addressing the conflicts arising between the two independents of state-centric political tensions.

7.5.4.5 Summary of the survey's main messages.

The survey included a few factors, and these are rough conclusions to the answers given by stakeholders:

- Stakeholders unanimously agree that strict regulations are scarce and won't be a barrier to implementing TAPs.
- Most don't see return flow as a barrier to TAP implementation, though a minority view it as relevant.
- Stakeholders thought uncertainty was not relevant in the Asi basin.
- They also thought the "use it or lose it" frame, and the "water rights bundled with land" frame to be of little relevance to stopping the implementation of TAPs.
- The question regarding the biggest barrier to implementing TAPs got similar answers like the following: enforcing laws and issuing judicial decrees for them, encroachments on public properties, opposing and interlapping authority between MoWE, MoA, and MoE, and the circumstances promoting lawlessness in the area.
- Most stakeholders thought path dependency was of medium relevance in the Asi basin, while the opinions varied on informal institution's relevance between those who thought it was highly relevant, and those who thought it was of no relevance at all.
- Transaction costs saw a division in opinion between high relevance and no relevance, while limited enforceability had an almost unanimous high relevance, together with rent-seeking, regulatory capture, and political ecology and power. Lobbying, corporatism, overselling, performance assessment, and risk aversion had a medium relevance with some stakeholders opting for high relevance, while misinformation and filtering information had high relevance according to stakeholders, some of which opted for a medium relevance.



6. **Impact champions indicators**

Please fulfill the Impact champion indicators. It is an Excel file prepared by the Impact champion team (Arpae, CMCC, SEI, UoM, and USAL) to monitor stakeholder engagement, identify gaps and barriers, gather feedback, and respond to recommendations during the workshops. You can also find it here: TRANSCEND > WP1 > T1.6_Integration

Please add some suggestions about the indicators here :

Management practices and indicators related to them should be included, as managerial problems are mostly what arise in the Orontes River basin.

7. **Other information**

- *Please provide (3) pictures, (3) videos, presentations, or other graphical pieces you used in the first workshop. (jpg, MP3, ppt, word, or other editable formats)*

Photos link

- *Final Agenda*
- *List of participants*

Link to Agenda, presentation, list of participants, and survey results

7.6 Mahanadi basin in the Indian states of Chhattisgarh & Odisha

7.6.1 General Information

Objective	To identify problems, modeling, and monitoring gaps in each living lab
Living Lab name	Mahanadi River Basin
Place	Odisha and Chhattisgarh, INDIA
Number of participants	17
Date (s)	18-10-2023 and 19-10-2023

7.6.2 Agenda

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Agenda for Stakeholder Consultation on Mahanadi River Basin
Hotel Mayura, Raipur
18- 19 October, 2023

Date	9:45AM to 10:30AM	10.30AM to 10.45AM	10:45AM to 11:00AM	11:00 AM to 12:15 Noon	12.15 Noon to 1.30 PM	1:30PM to 2:30PM	2:30PM to 3:45PM	3:45PM to 5:00PM
18-10-2023	Registration Day 1	Welcome; Introduction; and Presentation on outline of the workshop	Tea Break	Workshop Session 1: Salient Features of Mahanadi River Basin	Workshop Session 2: Water resources development in Mahanadi basin: status and issues	Lunch Break	Workshop Session 3: Water Allocation and Use in the Mahanadi River Basin: Current Practice & Issues	Group Work 1 and Presentations
19-10-2023	Workshop Session 4: Managing Mahanadi River Basin: Existing Institutional and Policy Framework, including regulations			Workshop Session 5: Water management issues and challenges in Mahanadi River basin	Group Work 2 and Presentation			

Structure of Workshop Sessions: Each session will have around 30-40 min of presentations, followed by discussion by the participants moderated by a resource person for 30-35 min.

Group Work 1: Monitoring of water availability and use in Mahanadi River Basin

The topics for discussion in Group work 1 will include: (a) why monitoring of water availability and use is important for successful design and implementation of TAP; (b) how monitoring of water availability and use is currently being done in the basin; (c) How data on water use and availability is currently used in policy design and implementation in Mahanadi River Basin.

Group Work 2: Best practices for improving the sustainability, efficiency and equity in water management in Mahanadi River Basin

The topics for discussion in Group work 2 will include: (a) the gaps that currently exist in monitoring of water availability and use in Mahanadi River Basin, including institutional inadequacies; (b) the best monitoring practices for regulating water use and pollution; and c) the best management interventions for Mahanadi river basin that can reduce the water resource problems, reduce scarcity and floods, and help resolve inter-sectoral water allocation issues.

The outcomes from both the group works will be summarised and presented in the open forum.

7.6.3 Summary of the discussion on each point in your agenda.

For each section in your agenda, please describe the methodology used to engage with the stakeholders and start the conversations. In this section, it is not necessary to include all comments but may include the main contributions and additional information you don't have previously identified.

Institute for Resource Analysis and Policy, a member of the 'TRANSCEND' consortium, with the support of UKRI funding, conducted a half-day Stakeholder Consultation on Mahanadi River Basin, i.e., on 18th and 19th October 2023, at Hotel Mayura, in Raipur, Chhattisgarh, India.

The objectives of the workshop were 1] To share with the stakeholders the 'state of the art' knowledge and information of the basin's water resources, degree of water development and the institutions involved in water resources development, water supply and water resources management; 2] Share information on the types of water uses and water management problems existing in the basin; 3] Feedback from the stakeholders; and 4] To sought the valuable opinions on what could be done to improve basin-wide water management, particularly strategies for resolving the inter-state and inter-sectoral water allocation issues.

The stakeholders included geologists from the state offices of the central groundwater board, Engineers from the Central Water Commission (CWC), the Director of the Department of Fisheries, the CEO of Chhattisgarh state watershed management body, a consortium of NGOs working on the projects related to Mahanadi River Basin. A total of 17 participants from Chhattisgarh and Odisha state attended the Consultation Workshop.

Day 1: October 18, 2023

Day 1-Sessions:

On day 1, three sessions were organized that were fully packed with technical discussions and exchange of knowledge, with specific reference to the Mahanadi River Basin. Each session was for about 30-40 minutes, followed by a round of questions and answers for 30 minutes. During the first session, Dr. M. Dinesh Kumar, Executive Director, IRAP, shared information on the salient features of the Mahanadi River Basin, with the help of a PowerPoint presentation. This was followed by the second session which included discussions on water resources development in the Mahanadi River Basin and the status of the current issues. Subsequently, the third session was also presented by Dr. M. Dinesh Kumar with a particular focus on water allocation and use in the Mahanadi River Basin. During the end of the consultation Group Work 1 (Monitoring of water availability and use in Mahanadi River basin) was organized in which 3 groups were formed.

Day 1-Discussions:

Dr. Swain (one of the participants) said that the analysis of the number of days of rainfall is critical for studying water sustainability. Later, Dr. Ajay Pradhan asked, if there is a state water policy for the Chhattisgarh state similar to the one that Odisha has. He also pointed out that it is very important for a state to have its own water policy. Sooner, an engineer from the Central Water Commission responded that Chhattisgarh has a State Water Use Policy. He also added that, in Chhattisgarh, the Water Resources Department charges INR. 200 per cubic meter of water for industrial purposes. Mr. Jyotiranjan Misra, Geologist from Central Groundwater Board, Sambalpur, Odisha commented that there is no sufficient data collected and only 40 years of groundwater data is available as of now. Another representative from CWC Chhattisgarh asked about the trend in the stream flow data in the Khantamal station (it is situated in the lower region of the basin) and enquired if a similar trend is seen in other stations too, particularly in any stations in the upper region of the basin. The data from Basantpur and Tikarpada stations were shown to him. Stakeholders expressed that more attention to water storage is needed. It was also understood from the discussions that basin-wise treatment of water should be done –both the area surrounding the river and the drainage line should be treated. A difference of opinion was raised on the hydrology of paddy wetlands and a good debate took place between Dr. Dinesh Kumar and Mr. Rajesh Gupta (Agriculture / Watershed NGO-ASORD). Later Dr. Dinesh Kumar provided an example of how forests/ trees regulate groundwater levels.

Group Work 1 Outcome:

GROUP WORK 1: Monitoring of Availability and use in Mahanadi River Basin	Group A	Group B	Group C
Why monitoring of water availability and use is important for the successful design and implementation of Transformational Adaptation Policies (TAP)?	Policy is to be designed for the safety of future generations. The policy is needed to control the rapid use of groundwater and surface water. Better water management and managing the available water resources by understanding the demand from different competitors.	You cannot manage if you don't monitor. Having said this, data collection and analyzing data consistently and validation is the key.	The amount of water required must be known. As per the discussion, an assessment of the amount of water available will help in formulating the TAP. For example: From the origin of the Mahanadi River to the Ravisankar dam, there is no water storage available. This leads to water scarcity in this region. Similarly, from Kalma Barrage to Hirakud Dam, face severe scarcity of water. In such cases, monitoring of water availability is required for evaluating the policies.
How monitoring of water availability and use is currently being done in the Basin?	Many monitoring wells are available where measuring the groundwater levels is done 4 times a year.	Multiple agencies are currently monitoring data including Centre / State. It includes	Mapping of Mahandi basin using remote sensing and GIS tools.

	Similarly, the surface water flow measurements are taken and estimated. Rainfall is also being measured to assess the water availability. Mapping and modeling approaches will help in understanding the availability and use.	rainfall, water level, stream flow, etc. There is no single organization that has all the data monitored by these multiple agencies. No measurements are done on the utilization of water. No monitoring at the catchment level except for rainfall No data on consumptive uses of water (crop water).	Using satellite image – Landsat, and ISRO sensors like LISS III, certain features of the drainage system can be monitored. Water level monitoring is done by Automatic water level and discharge is calculated by Current meter and ADCP with the frequency- hourly in rainy season and per day in non-monsoon.
How data on water use and availability is currently used in policy design and implementation in the Mahanadi River Basin?	Presently policies are being designed in the Mahandi River Basin using the Trial and Error method. Present monitoring is also not robust.	Water user association meeting inputs are used in policy design and there are no standard policies. Odisha follows a central water policy. Composite water resource management (CWMI) which gives the water footprint is used in neither of the states. When the basin receives normal rainfall agriculture is given priority followed by domestic water supply and then industries. During dry years priority is given to industries as the industries are ready to pay for the water. It is also due to the steel plant that needs water as it would take a long time to restart once it stops due to water scarcity.	The data on water use and availability are currently used in policy design and implementation in the Mahanadi River basin by running hydrological models like the NHP project, MIKE FLOOD, and RIBASIM. The data are available in WIMS, SWADES, and JJM, are frequently used by the policymakers, and can make suitable plans for agricultural, industrial, and drinking water purposes.

Day 2: October 19, 2023

Day 2-Sessions:

Two sessions (workshop sessions 4 and 5) were conducted on day 2, followed by discussions with the stakeholders. During Session 4 lots of information was shared with the participants, on the existing institutional and policy framework including regulations in Mahanadi River basin management. Next, workshop session 5 was presented, which mainly focussed on water management issues and challenges in the Mahanadi River basin. At about 12.15 noon, the second day concluded with Group Work 2 which had two groups.

Day 2-Discussions:

Mr. Suresh Patel said that it is difficult to make the farmers understand about the pricing of water. This can only be attained through transparency in these processes. Dr. Dinesh Kumar suggested that the pricing should be made affordable to all, especially for farmers. For example, the farmers in West Bengal are charged for electricity use but this didn't cause any protests because of the affordability of the price. The CWC, Chhattisgarh representative pointed out that there is no concern when water drawn is used completely. Problems arise when there is wastage and charging is important to deal with this. Concerns like, 'are the farmers in the tail end deprived', and within the system, how to manage tail reach and head reach issues and how some farmers get affected by the process of the canal lining, were raised during the discussion.

Group Work 2 Outcome:

GROUP WORK 2: Best Practices for improving the sustainability, efficiency, and equity in water management in Mahanadi River Basin	Group A	Group B
The gaps that currently exist in monitoring water availability and use in the Mahanadi River basin, including institutional inadequacies	Monitoring the availability and usage data in the Mahanadi River basin may be automized using ADCP (surface water) and DWLR (Ground Water). No monitoring points at strategic locations may be automized. Optimal usage of water can be achieved through Governmental circulation and awareness programs.	There are lots of gaps between states as there is no concept of sharing data. In monitoring of water availability, groundwater availability monitoring is very less / overestimating. In the case of surface water, there are fewer gaps, compared to groundwater monitoring. In water use monitoring: Lots of water is wasted, not effectively utilized, and lots of water is used in irrigation, industrial water supply, and recreation.
The best monitoring practices for regulating water use and pollution	Water Use: Surface Water – Fixing limits to the water usage and beyond limit may be priced Ground Water – To form a Groundwater regulating committee within the existing department	Best monitoring practices for regulating water use are done by the State Government. In Chhattisgarh, surface water pollution is monitored by CWC from Chhattisgarh (37 sites) to Odisha (35 sites) with a frequency of 10 days and around 45 parameters (heavy

		metals, pesticides, anions, cations, pH, BOD, DO, etc.
	Pollution: Creating- mass awareness of pollution-related issues and the importance of keeping water clean Industrial water pollution should be strictly regulated legally, and we can take the help of the NGT (National Green Tribunal) Technology advancement to monitor pollution from agriculture (Pesticides and fertilizers)	In level one – 6 parameters are monitored daily which include – pH, EC, DO, Temp, color, and odor at the river. In level two – every 10 days, samples are collected from 55 locations in Bhubaneswar and Raipur which include 25 parameters that will be analyzed in the laboratory. In Level 3: labs have instrumentation (ICP-MS, GC-MS, and HPLC) to check heavy metals and pesticides in water. The way these data sets are used and what policies are made is the main issue. CPCB takes care of it and there is not much improvement in terms of actions taken to date. In Odisha, there are fewer barrages compared to Chhattisgarh, which will reduce runoff to the ocean. More water storage systems and barrages should be constructed in Odisha too to store water for the dry year.
The best management interventions for the Mahanadi river basin that can reduce the water resource [problems, reduce scarcity and floods, and help resolve inter-sectoral water allocation issues	River bank encroachments should be stopped where the state Government should play a major role. Using different Government schemes like rainwater harvesting and groundwater recharging can play a major role in solving water scarcity. Government organizations and NGOs can create awareness in the public regarding this issue. Tree plantation should not be limited to only Government and private organizations but also should reach the public, tree saplings can be distributed for free and people can be encouraged to plant trees at their places.	There should be dialogues between the chief engineers of Odisha and Chhattisgarh for a holistic management plan at the Basin level. Water may be stored in monsoon by constructing small structures like small dams and barrages which might be of use in the subsequent season. When river flows from high to low gradients, water can be stored in small basins nearby. This method, known as the Artificial recharge, or Basin flooding method can be used for storing water for the future. In the case of Hard rocks, it can be penetrated and water can be stored in aquifers below. Flood control models like MIKE FLOOD may be used. Information like weather prediction, forecasting system strengthening, using AI techniques, and

	holistically managing the cascade of reservoirs.

7.6.4 Conclusions

7.6.4.1 Common identification of problems

Please describe the three main problems identified by stakeholders in the living lab.

Do they have a common point of view on the problems and current situation?

Problem 1: Water availability and use are not looked at the basin level as a whole.

Problem 2: There is no common consensus between the two states (Chhattisgarh and Odisha) concerning data sharing and understanding about the Mahanadi River Basin Management

Problem 3: Odisha stakeholders are under the opinion of building more structures downstream as well.

Do you identify the main barriers to implement TAPs? Not in this consultation

Do you identify enablers to implement TAPs? Not in this consultation

7.6.4.2 Modelling gaps

Model gap 1: Extending the WEAP model for the entire basin area, covering Odisha

Model gap 2: Integrating the model with a sound groundwater flow model to understand the impacts of intensive or modified groundwater use on the lean season flows.

Model gap 3: Carrying out an economic evaluation of the water management alternatives identified to deal with floods and droughts to choose the cost-effective water management alternatives

Are the existing models used to make decisions in the living lab?

Only the Water Evaluation and Planning System (WEAP), which is a water balance/water allocation model has so far been used for the living lab. Again, it is applied to the Chhattisgarh part of the basin. There is a need to extend it to the entire basin covering the Odisha part.

Please explain what decisions are made with the current models.

The model has been used to understand the extent of water demand and supply imbalance in the basin in different years till 2050 under various socioeconomic and climate change scenarios. Also, decisions on what

interventions can be made to reduce water scarcity (demand-supply gap) during drought years have been made. The model has been used to decide on the needs for and the scope for creating multi-annual storage in the basin to deal with drought years, by taking advantage of the excess runoff available during wet years.

7.6.4.3 Monitoring Systems and Data

Please provide a summary of the three main priorities for improving monitoring of water use and/or availability in your river basin. For each priority, please state what aspect of water use or availability requires improved or greater monitoring. Justify why regarding existing monitoring infrastructure and water management pressures in your basin. These priorities should be identified based on the information gained from the 1st stakeholder workshop and your own knowledge about monitoring needs in the basin from wider discussions and work with relevant stakeholders.

1. *Monitoring Priority 1 – No monitoring points at strategic locations may be automized. In the case of groundwater availability, it is always overestimated. However, in the case of surface water, this problem did not arise.*
2. *Monitoring Priority 2 – It is understood from the discussions with stakeholders that fixing limits to the usage of water will bring positive impacts, especially in the case of surface water.*
3. *Monitoring Priority 3 – Water regulating authority should be formed within the existing departments*

7.6.4.4 Lessons learned.

Related to the participation process, please provide some answers to the following questions.

1. *How do you perceive the communication between stakeholders?*

– The communication between stakeholders was quite informative as we observed active participation during the group work.

2. *What additional stakeholders should be invited for the next meetings?*

– More participation is needed from the seniors from the state pollution control boards and also the water resources departments of the states.

3. *Please describe the participants' engagement in the first workshop, they were active throughout the three topics covered? Do you identify active and passive participants?*

– It was observed that the participation from the participants was active on the first day. However, on the second day, not much active participation except during the group work.

4. *How were the time, space, and logistics in your workshop? Do you need any additional resources to plan and develop your workshop?*

– No additional resources are envisaged at the moment.

5. *Do you perceive conflicts among decision-makers that need to be handled carefully at the next workshop?*

– Yes, with our acumen, we understand that there might be some conflicts that might arise during the next workshop concerning the release of water from the upstream dams in Chhattisgarh and downstream users in Odisha.

6. *Did you manage to Kickstart /implement a constructive debate, devoid of blame, along the lines of the Talanoa Dialogue that TRANSCEND seeks to implement?*

– Yes, a constructive debate has been initiated in the first workshop. We are expecting more of this in the upcoming workshops.

7. *Do you identify an institutional framework that allows a coordinated management of water resources?*

It's too early to comment on this. We may have more on this only after the upcoming workshop.

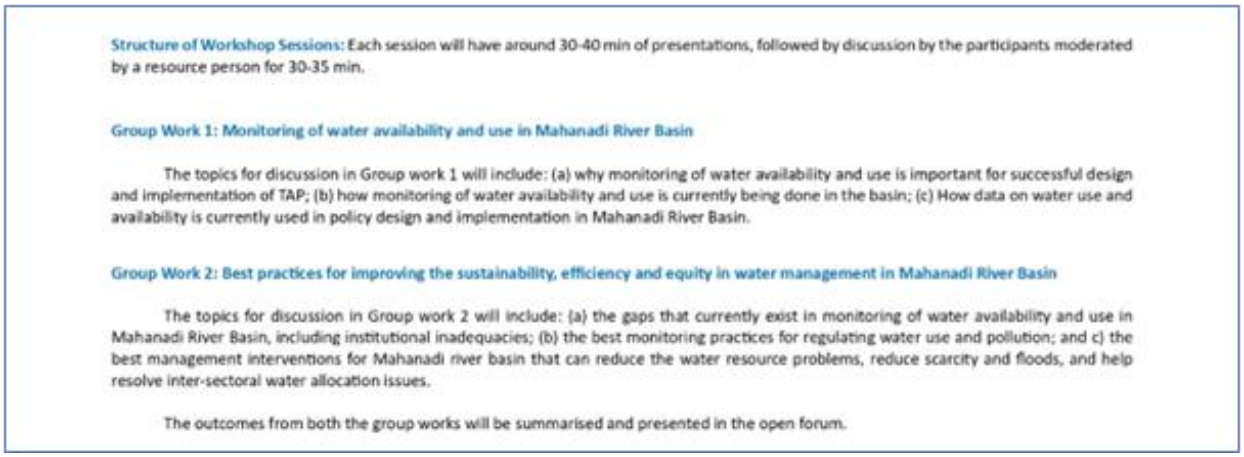
7.6.4.5 Other information

1. *Pictures from the First Workshop*

2. *Final Agenda*

Agenda for Stakeholder Consultation on Mahanadi River Basin
Hotel Mayura, Raipur
18- 19 October, 2023

Date	9:45AM to 10:30AM	10.30AM to 10.45AM	10:45AM to 11:00AM	11:00 AM to 12:15 Noon	12.15 Noon to 1.30 PM	1:30PM to 2:30PM	2:30PM to 3:45PM	3:45PM to 5:00PM
18-10-2023	Registration Day 1	Welcome; Introduction; and Presentation on outline of the workshop	Tea Break	Workshop Session 1: Salient Features of Mahanadi River Basin	Workshop Session 2: Water resources development in Mahanadi basin: status and issues	Lunch Break	Workshop Session 3: Water Allocation and Use in the Mahanadi River Basin: Current Practice & Issues	Group Work 1 and Presentations
19-10-2023	Workshop Session 4: Managing Mahanadi River Basin: Existing Institutional and Policy Framework, including regulations			Workshop Session 5: Water management issues and challenges in Mahanadi River basin	Group Work 2 and Presentation			



Structure of Workshop Sessions: Each session will have around 30-40 min of presentations, followed by discussion by the participants moderated by a resource person for 30-35 min.

Group Work 1: Monitoring of water availability and use in Mahanadi River Basin

The topics for discussion in Group work 1 will include: (a) why monitoring of water availability and use is important for successful design and implementation of TAP; (b) how monitoring of water availability and use is currently being done in the basin; (c) How data on water use and availability is currently used in policy design and implementation in Mahanadi River Basin.

Group Work 2: Best practices for improving the sustainability, efficiency and equity in water management in Mahanadi River Basin

The topics for discussion in Group work 2 will include: (a) the gaps that currently exist in monitoring of water availability and use in Mahanadi River Basin, including institutional inadequacies; (b) the best monitoring practices for regulating water use and pollution; and c) the best management interventions for Mahanadi river basin that can reduce the water resource problems, reduce scarcity and floods, and help resolve inter-sectoral water allocation issues.

The outcomes from both the group works will be summarised and presented in the open forum.

3. *List of Participants*

S. No	Name	Organization
1	Mr. Suresh Patel	Carm Daksh, Raipur, Chhattisgarh
2	Mr. Jyotiranjan Misra	Directorate of Ground Water, Sambalpur, Odisha
3	Mr. Nihar Ranjan Panda	Directorate of Ground Water, Sambalpur, Odisha
4	Mr. Gurmeet Singh	BAITAHSADA WELFARE SOCIETY, Raipur, Chhattisgarh
5	Mr. Pawan Singh	Jeewan Marg Welfare Society, Raipur, Chhattisgarh
6	Prof. P. C. Swain	VSSUT, Burla, Odisha
7	Dr. Ajay Pradhan	C2S2, New Delhi
8	Mr. Rajnish Gupta	ASORD, Chhattisgarh
9	Mr. Devikumar Singh	Department of Fisheries, Chhattisgarh
10	Mr. Kapil Dev Deepak	Chhattisgarh State Water Management Agency (CSWMA)
11	Mr. Kuntal Mukherjee	PRADAN, Raipur, Chhattisgarh
12	Mr. Anup Kumar Sharm	CWC, Raipur, Chhattisgarh
13	Mr. Kuldeep Kumar	CWC, Raipur, Chhattisgarh
14	Mr. K. Panigrahi	CGWR, Raipur, Chhattisgarh
15	Mr. Basudeva Bhatta	MBA, Bhubaneswar, Odisha
16	Mr. Ashok Jena	Naba Nirman, Bhubaneswar, Odisha
17	Mr. Prasanna Bisoyi	Agami, Bhubaneswar, Odisha