TALANOA

- water -

Deliverable 4.3: From robust strategies to implementation: Report comprising results from ST7-8 and draft business plan

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Executive summary

This deliverable deals with the proof of concept of transformational adaptation strategies and the connections between ideas & partners of the project and policy making and stakeholders (water users and managers of the water infrastructures, state and local government and NGOs) to provide evidence on their implementation ("breaking ground"). Concretely speaking it details the advancement in TALANOA Water labs regarding two critical steps (i) (ST7) "Proof of concept" of the preferred strategies and (ii) "Breaking ground" which is the practical implementation of strategies. Connections established in TALANOA water labs include local stakeholders (private actors such as farmers) and regional decision makers up to international (EU, UFM) decision makers or policy arenas. These strategies will be rediscussed and assessed in the last workshop planned in each lab.

A conclusion of this work is that even if the modeling & assessment work is not finalized, the implementation is already possible in some sense: testing the ideas, contributing to its diffusion through collective thinking and dialogue should be seen as building adaptative capacity. Even though without evidence (finalized results on modeling) this is already a chance for adaptation. The unique nature of water (and agriculture) is that there is no *One fits all* solutions and that some solutions might suit local situations knowing technical and social constraints while others won't but will be a chance elsewhere. Evidence already indicates that TALANOA water labs have contributed to enhanced resilience by considering a broad spectrum of solutions from technical to policy-oriented.

The complete lab work will be presented as initially planned in the last and next deliverable D4.4.

Contents

1. Introduction

The Report comprises results from Steps 7-8 of the TALANOA approach. Description of these tasks are given according to description of work and deliverable 4.1 guidelines to water labs in TALANOA.

ST7 - Proof of concept

Preferred robust transformational adaptation strategies are assessed in depth with the models and stakeholder engagement. These are analyzed in terms of regulatory constraints and other obstacles, practical feasibility, and support available from the involved institutions. Barriers and enablers will be thoroughly reviewed following the analysis developed during the assessment step.

ST8 – Breaking ground

This step consists in the practical implementation of the preferred strategy. This step assumes that a decision has been taken by stakeholders. This decision should be taken by stakeholders and achieve a certain quorum (to be defined by stakeholders), with the support of science but without the influence of scientists beyond informing through modelling exercises. This step requires also that the policy agenda matches that of TALANOA - it may be that the decision is taken but the timing is inadequate and therefore the implementation of the strategy, and the breakthrough, is postponed. Even if one or the two preconditions for a successful implementation do not realize in the labs, the team can still work on the implementation phase by translating TALANOA results into a "transformative" plan. This requires identifying leaders that will take charge, in the future, of the implementation of the strategy; building relevant partnerships; identify a possible timeline for implementation; and defining plans to address the barriers that could deter transformation.

The conditions that can favour implementation should be studied in detail with the support of the key stakeholders. Some of these aspects can be addressed in the last workshop (4).

In D4.1, guidelines.

Two options for strategies and measures:

- They are public actions and should be described among other in terms of the targeted population (farmers of this type), type of instruments (subsidies, nudges…)
- They are individual led actions

The following chapters present the work on these two critical steps in each of the 6 TALANOA Water labs.

2. Egyptian lab

In the Nile Delta Lab, three workshops have been held, so far. In addition, three training courses followed by three field days for the extension agents at the East, North and West Nile Delta were held. The overall goal of all the events was to introduce TALANOA project to the professional community and share its proposed strategies for modifying it and brainstorming with those stakeholders to explore the robust solutions for solving problems associated with water scarcity and severe climate change in the Nile Delta.

The following table details the different participative events with local stockholders that led to specific outcomes on strategies.

Participative event (or other) (Month, Year)	**Outcome relative to strategies**
The First Local Stakeholder Workshop held in the form of three training courses on May 22 - June 9, 2022 at Garbiya Agriculture Directorate, Dakahliya Agriculture Directorate and Damaitta Agriculture Directorate, Egypt. The workshop is entitled, "**Innovative irrigation technologies and practices for climate-resilient rice in the Nile Delta**"	- Presentations by experts and professionals of water management and irrigation technologies and practices were developed and presented. - A set of training materials concerned with the topic of the workshop were developed. - The attendees recommended the suitable time for holding the coming local workshops to be during the growing season of rice, which starts in June and ends in October, this was because the predominant crop in the Nile Delta is rice. - The attendees have been recommended to add two more adaptation and mitigation strategies which were: 1) Improving rice water productivity through efficient irrigation systems such as Hybrid Irrigation; and 2) Implementing long-term water resources planning via water accounting. - 90 questionnaires were distributed to all attendees and the feedback was analyzed.
The Second Local Stakeholder Workshop held on June 21, 2023 at Safir Hotel, Cairo, Egypt. The workshop was entitled, "**Climate-Resilient Innovative Irrigation Technologies and Practices**	- Presentations of the findings of the field experiments conducted on applying climate resilient innovative irrigation technologies and practices for enhancing rice water productivity in the Nile Delta were developed and presented.

for Sustainable Rice Production in Egypt."	- The attendees have been recommended new adaptation and mitigation strategies such as adopting biofertilizers for enhancing crop production to compensate yield reductions resulting from water and salinity stresses in the Nile Delta. - Identification of hinders & levers and measures to encourage the adoption of innovative irrigation technologies and practices on measures. - 30 questionnaires were distributed to all attendees and the feedback was analyzed.
The Third Local Stakeholder Workshop held on June 21, 2024 at Auditorium Room, Agriculture Department, Gharbiya Governorate, Egypt. The workshop was entitled, "A Study Exploring the Feasibility of Aquaponics and Hydroponics in The Nile Delta for Small Business Start-Ups."	- The workshop consisted of a series of presentations by the organizers briefing the findings of the working paper entitled "A Study Exploring the Feasibility of Aquaponics and Hydroponics in The Nile Delta for Small Business Start-Ups." - 30 questionnaires were distributed to all attendees and the feedback was analyzed. - Identification of hinders & levers and measures to encourage the adoption of innovative irrigation technologies and practices on measures. - The attendees have been recommended new adaptation and mitigation strategies such as: adopting soilless agriculture and roof gardens
Three consecutive Field Days (Field School, 30 participants each) at the North, East and West Nile Delta regions held on 4, 11, 18 October 2022 for **testing the technology transfer transformational adaptation strategies**	- The showcases of the strategies implemented by the project were visited by the stakeholders and explained to the implementation team as proof of concept of the adopted strategies. - Engagement of stakeholders in strategies working group.

To feed the participative work, the team also did:

Exchange with the local state representatives of the Ministry of Agriculture and Land Reclamation on regulations and restrictions on access to and use of water in the paddy area in addition to the law and the law enforcement of rice cultivation in the Nile Delta.

2.1. Proof of concept

The selection of robust strategies in the Nile Delta Lab was carried out in collaboration with the stakeholders. During the three consecutive local workshops and the participatory approaches used throughout the project, stakeholders reviewed the proposed and approved strategies by Talanoa-Water Project and they proposed four more strategies as mentioned here below. The selected strategies were chosen for their relevance and their ability to address the water challenges in the Nile Delta.

Strategies Proposed by Talanoa-Water Project	Strategies Proposed by the Stakeholders
1. Adoption of Salt tolerant crops.	1. Improving rice water productivity through efficient irrigation systems such as Hybrid Irrigation.
2. Mobile-based irrigation service sensors, metering and remote control.	2. Implementing long-term water resources planning via water accounting.
	3. Adopting biofertilizers for enhancing crop production to compensate yield reductions resulted from water and salinity stresses in the Nile Delta.
	4. Adopting soilless agriculture and roof gardens to overcome salinity issues

A comprehensive assessment and analysis of the implementation barriers of every single strategy proposed by the project and the stockholders was evaluated in terms of feasibility, and potential barriers to implementation. Although, these strategies have several obstacles, such as regulatory limitations and lack of financial or technical resources, which may delay or hinder their adoption, the government forced farmers to implement most of these strategies in the paddy area due to the high potential for positive impact. Fortunately, all stakeholders didn't show any resistance to the adoption of the innovative technologies of using hybrid irrigation, reuse of drainage water and salt-tolerant rice varieties for cultivating rice in 350 K acre in the eastern part of the Nile Delta.

2.2. Breaking ground

During the proof-of-concept phase and the upscaling stage, the implementation of these strategies was adopted by the government by restricting farmers to cultivate rice in the eastern part of the Nile Delta, unless they cultivate it under the strategies. These strategies have already been approved by the stakeholders during the upscaling stage.

- ***Policy Agenda***

The strategies being evaluated in the Nile Delta Lab are aligned with the current water management and distribution plan designed by the Ministry of Water Resources and Irrigation and implemented by the Ministry of Agriculture and Land Reclamation. The Lab is kept connected to the directorates of these two ministries, whose involvement is urgently needed for implementing water management policies within the Nile Delta Region. Strategies such as efficient irrigation system like hybrid irrigation, salt-tolerant crops like a new breed of rice, and water accounting are designed to achieve the overall goal of the water and irrigation master plan in the Nile Delta, thus enhancing the efficiency of future water management and crop water productivity.

- ***Connections of TALANOA with policy agenda***

The direct connection with the irrigation and agriculture authorities in the Nile Delta region and the Nile Delta Lab allowed for adjustments to be made to the strategies to align them with local needs and existing water management policies.

- ***Connections of TALANOA with water users and farmers***

The participatory approach adopted by the Nile Delta Water Lab strengthens the connections among the project and water users and farmers in the region. Therefore, the water users and farmers in the eastern part of the Nile Delta didn't show any resistance to the adoption of the innovative technologies of using hybrid irrigation, reuse of drainage water and salt-tolerant rice varieties for cultivating rice in 350 K acre when the government decided to restrict rice cultivation in the region under these strategies.

- ***Impact Assessment***

The Egypt's National Strategy for Adaptation to Climate Change and Disaster Risk Reduction is a multi-sectoral document which addresses climate change and adaptation measures as part of an integrated strategy of the Egyptian government and its sustainable development programs and plans. Implementing the adopted strategies of TALANOA-Egypt to adapt to climate change in the Nile Delta can help improve the ability to predict future scenarios and increase adaptation to changing climate conditions, as a result, it will contribute to the sustainable development programs and plans adopted under the integrated national strategy of Egypt for adapting to the negative impacts of climate change.

2.3. Perspectives

Next year, one more workshop will be organized. In addition, the Egypt-PRIMA Initiative will be launched, which is a collaborative effort led by CIHEAM Bari in partnership with the PRIMA Foundation, aimed at leveraging research outcomes from Euro-Mediterranean PRIMA Program-funded projects in key sectors such as sustainable agriculture, food security, sustainable resource management, and economic development. Through the Egypt-PRIMA Initiative, three project

concept notes have been finalized aiming to strengthen Egypt's key agricultural value chains, such as olive, rice, and horticulture. The project concerned with rice will adopt some strategies implemented by the Nile Delta Lab such as upscaling hybrid irrigation for rice production and salt-tolerant rice cultivation in the Nile Delta Region.

3. French lab

In the Aude lab, 3 workshops have been conducted so far. Recently, an extra data webinar was held to validate the data and in order that the work of TALANOA is recognized in the local water basin management plan. Another "strategy" webinar was held to draw a synthetic overview of all measures and strategies constructed so far in TALANOA.

The following table details the different participative events that were conducted to specific outcomes on strategies.

Participative event (or other) (Month, Year)	**Outcome relative to strategies**
Kick-off (Workshop I) June 22) A brainstorming session on measures	- a list of measures - The trajectory (how to get there) is important for stakeholders
Agro-ecology workshop (Feb. 23) A session on identification of barriers & levers	- identification of hinders & levers and measures to encourage the adoption of agro-ecological practices & work on measures
Workshop II Foresight & serious game (March 23)	- objectives that are pursued by stakeholders - 100 measures, some of which have already been implemented (see catalogue)
Workshop III: serious game session (Nov. 23)	- a presentation by a state representative on water regulation and water restrictions - measures implemented by farmers during the serious game - measures implemented by the state, combined by "players" and observed as possible public intervention trajectories (3) - engagement of stakeholders in strategies working group
Webinar Strategies (Novembre 24)	- engagement of stakeholders in strategies working groups

To feed the participative work, the team also:

- Exchanged with the basin agency on the "Plan Eau" which is a special plan dedicated to increase the response to climate change and water issue

- Exchanged with the local state representation of the agricultural ministry (DDTM) on one hand on (i) regulations and restrictions on access to and use of water (a presentation was given during workshop III by a representative), (ii) financial support opportunities to like those of the Plan Agriculture Méditerranée to face climate change and boost the emergence of new agricultural industries and diversify farm activities.

- test of the serious game in a farming festival (Limoux, Septembre 2023)

3.1. Proof of concept of strategies

In the lab we distinguish (i) collective measures that can be implemented in the water management plan and (ii) agricultural measures that should be up taken by farming. However, some policy or collective measures are associated to incentivize these type II measures.

In the Aude lab, stakeholders co-constructed and prioritized four strategies. 3 others have not been selected which doesn't mean they are not interesting, but the stakeholders around the table in TALANOA have less expertise or are less involved and concerned with these strategies. These 3 strategies are (i) modernization of water networks, (ii) farm revenue stabilization, (iii) adaptation of wine to climate change. The two last are substitutes to irrigation development and should be seen as a measure towards water management.

During workshops and field work, barriers and enablers of strategies have been identified synthesized in the following table.

	Barriers		**Enablers**	
		Regulatory constraints		Policy enablers
Improve water governance	Status quo is preferred by water users	Data protection	Incentives, guarantees to those who respect the rules	
Agro-ecology	Costs, risks No sufficient public support (support for collective experimentation but not individual)	Subsidies on material is not appropriate (e.g. no possibility to transform material, only to buy new one)	Collective sharing of information (groups) Demonstration, Field trips	Flexible subsidies (very specific technical solutions) and risk sharing mechanisms

				Label & market value recognition
Diversification	Costs, risks, Absence of structured industries for transformation	none	Collective sharing of information (groups), Demonstration, Field trips	*"Plan Agriculture Méditerranée" which opens rights for funds for new crop industries *Subsidies for vine grabbing
Development of water resources	Knowledge, uncertainty on capacities, Collective organisation to build these projects	Protected water resources (WFD and drinking water safeguard areas)	Major actors / stakeholders at the center to structure, defend and finance the project	Plan hydraulique Feader (Rural development program)

3.2. Breaking ground

As seen before the selected strategies rely on (i) policy/planning measures, (ii) collective measures, (iii) individual measures.

- ***Policy agenda***

The previous quantitative water management plan (PGRE 2017-2024) is being assessed and a new PTGE (Projet de Territoire pour la Gestion de l'Eau) is in its initialization phase in the Aude catchment (TALANOA lab). A large project for this study just started.

This is a good timing for TALANOA in terms of impact. However, the new plan (PTGE) will start in 2025 and provide first results not before the end of 2025. This implies that the condition for impact is great, but that this will not be observed before the end of the TALANOA project.

On the policy agenda stands also the approval and public financing of the development of collective water networks for agriculture (mainly vine irrigation). Currently, TALANOA researchers are also involved in echoing their results to a neighbor area of the Aude catchment (the Hérault department) to the local (department) administration to improve their understanding of irrigation benefits.

Also the "ecological planning" ("Planification écologique") undertaken by the state and the regions (local governments) includes a part on reduction of water use.

- ***Real connections of TALANOA lab with the policy agenda***

The TALANOA Aude lab is associated with the new water management planning phase: its PI is in the steering committee. Also, connections have been made between the two teams of TALANOA and the consulting group in charge of the study of the new basin water management plan. The work of TALANOA directly benefits the consulting-led study for this new plan and their participants integrated the stakeholder group with active participation. This should ensure that measures discussed will be taken over (at least the knowledge) in the new management plan (from a technical point of view, the political risk is obviously not waived by this).

The TALANOA Aude lab is also connected with state officials that implemented the "Plan Agriculture Méditerranée" which labels "resilience zones" that can have access to funds to diversify crops to increase resilience of farming. The Plan has been presented by the state in the last workshop.

- ***Connections of TALANOA with water users & farmers***

In terms of implementation, we rely on the strong connections and high participation to the TALANOA events of a various set of stakeholders (see D4.2).

Specifically, TALANOA connected with the CoDev (Development council) of the Narbonne Community which works on water and explores various projects including water resources development and building on soil to increase water resilience.

TALANOA also connected with a major vineyard faced with severe stress who invests in deep agro-ecology (keylines & agro-forestry) which is willing to scale up its project. Connections have been realized thanks to TALANOA so that the vineyard can be followed by research (agronomist, soil scientists) and in return this actor participated to TALANOA workshops. TALANOA also informed the stakeholders and this vineyard in particular of a dedicated fund (Plan Agriculture Méditerranée) and of another potential interesting project VITILIENCE.

The active participation of the National Regional Parc, La Narbonnaise will also ensure connections of TALANOA activities with its territorial action, e.g. through the "Charte de l'agriculture". The lasting of these connections is ensured through a new PRIMA project (Morpheus) including INRAE and the PNR.

Thanks to connection with other projects, TALANOA touched base with farmers that have been interviewed in the area.

The impact of TALANOA consists also in the connections between stakeholders which is invaluable according to their oral communication (e.g. connections between a farmer and a public

official in charge of a diversification plan) and the learning that happened through the dialogue and that is difficult to be tracked. This can be demonstrated by continued participation, for 3 years, in the webinars and in person workshops.

- ***Connections of TALANOA with research & innovation***

TALANOA has active links with other research & innovation initiatives such as the TAI Oc project on the development of agro-ecology in irrigated agriculture which is part of the french TETRAE program on research on the agro-ecological transition. Links with the VITILIENCE project on the adaptation to climate change of wine production will also ensure that some results are capitalized. The investment of INRAEs experimental station Pech Rouge in TALANOA also guarantees that the ideas produced in TALANOA are further continued in the field. Reflections on a future operational and perennial demonstration site could be explored as identified by the participative work.

From a methodological point of view, the advances in terms of water related data and modeling will be beneficial to other initiatives such as a proposal for a support to a coastal atlantic basque basin.

3.3. Perspectives

At least two more workshops will be organized in January (presentation of the economic model and strategies) and in 2025 (presentation of results and collective assessment).

The fact that models in the Aude catchment were developed specifically in TALANOA and that data access was complicated, the lab is late compared to what was initially foreseen.

However, the projects' investments in both partnering with stakeholders and the set-up of a TALANOA community and model development will be further valued in the recently financed MORPheus Project (PRIMA) in which the French partner is involved and has integrated a share of the TALANOA lab.

4. Spanish lab

The table below provides a detailed description of the various participatory events that were organized with the purpose of gathering information and achieving specific results related to the proposed strategies.

Participative event (or other) (Month, Year)	**Outcome relative to strategies**

1st Stakeholder Workshop TALANOA-WATER (**Workshop I**). Serious game session version 1. (September 2022)	- **Empathy and Dialogue Enhancement:** The serious game promoted understanding among stakeholders with diverse interests and perspectives. - **Definition of strategic steps:** Participants worked in groups to structure problems, define objectives, analyze alternatives, and evaluate strategic scenarios. - **Preliminary results:** The first results of microeconomic and hydrological models for the Cega basin were presented, highlighting the need to include additional models. - **Strategic vision and governance:** The need to enhance coordination among stakeholders, foster constructive communication, and improve the collective management of common interests was identified.
2nd Stakeholder Workshop TALANOA-WATER (**Workshop II**). Serious game session version 2. (April 2023)	- **Role-swapping strategy:** Assuming roles different from their own provided participants with new perspectives proving useful for future workshops. - **Model validation:** Comparing microeconomic simulations with observed behavior improved model accuracy. - **Expansion and training:** The second version of the serious game was shared during a training session to ensure its dissemination. - **Adaptation strategies:** Prioritized measures included agricultural insurance, irrigation modernization, improvements to canals, and efficient water regulation. - **Database enhancement:** Stakeholders contributed knowledge to calibrate and validate models like AQUATOOL.
3rd Stakeholder Workshop TALANOA-WATER (**Workshop III**). Serious game session version 3. (April 2024)	- **Empathy and Dialogue Enhancement:** The three versions of the serious game have facilitated collaboration and understanding among stakeholders with diverse interests. - **Incorporation of agricultural insurance:** This feature was added in the third version of the serious game, increasing stakeholder satisfaction and earning praise from AGROSEGURO for its

	faithful representation. - **Role-swapping:** Maintaining the option to swap roles encouraged constructive and collaborative discussions in the agricultural sector. - **Realistic complexity in scenarios:** Emphasis was placed on incorporating greater uncertainty, unpredictable crop changes, and prioritization of the most profitable crops in changing contexts. - **Role and objective definition:** A lack of clarity in roles and objectives was noted, prompting a review to ensure a more coherent and enriching participant experience. - **Adoption of the innovation ecosystem:** International organizations (OECD, European Commission) and projects such as IRENE, TRANSCEND, and MARCLAIMED have integrated the approach used in TALANOA-WATER.

To feed the participative work, the team also did:

- Trial of the serious game at CONAMA 2024 (National Environment Congress in Spain), through an immersive workshop on water governance in climate change scenarios. (December 2024).

4.1. Proof of concept

In the Spain laboratory, the selection of robust strategies was carried out collaboratively among the stakeholders, using hydrological and economic modeling tools, along with the implementation of serious games. During the process, stakeholders reviewed and provided information on the potential barriers and enablers affecting the implementation of these strategies, as derived from the models and participatory approaches used throughout the project. The selected strategies were chosen for their relevance and their ability to address the water challenges in the study area. Key strategies include agricultural insurance, the modernization of irrigation systems, improvements in distribution channels, water regulation, and the incorporation of greater uncertainty into modeling.

- Agricultural Insurance: This measure is proposed to protect farmers against extreme weather events, such as droughts, by providing financial backup during times of uncertainty. This measure relies on collaboration between insurers and local authorities

and has high feasibility. However, its adoption may be hindered by the farmers' lack of familiarity with such products.

- Irrigation Modernization: This strategy aims to improve the efficient use of water through the implementation of new irrigation technologies. Although technology is available, mass adoption requires overcoming barriers such as high initial costs and the need for training in the management of these systems.

- Improvements in Distribution Channels: The need to optimize water infrastructure to reduce leaks and improve efficiency in water use was identified. This will require significant investments in modernizing existing infrastructure, which could be impacted by the lack of a clear collaboration framework between the stakeholders involved.

- Water Regulation: This is a critical measure to manage water resources more equitably and efficiently, especially during periods of scarcity. However, the implementation of new regulations could face political resistance and execution difficulties if there is no clear legal framework supporting the process.

- Uncertainty in Models: Increasing uncertainty in hydrological and economic models is crucial to anticipate the potential effects of unpredictable climate scenarios. This measure promotes more flexible long-term planning, though the technical complexity of these models may require additional training for the involved stakeholders.

Each of these strategies was evaluated in terms of viability, feasibility, and potential barriers to implementation. While these strategies have high potential for positive impact, several obstacles, such as regulatory limitations and lack of financial or technical resources, may delay or hinder their adoption. Additionally, some stakeholders might show resistance, particularly regarding new regulations or the adoption of innovative technologies.

Regulatory barriers are particularly significant, as current policies do not always favor the implementation of the proposed solutions, particularly concerning agricultural insurance and efficient water use. Financial limitations also pose a major challenge, given that the investments required to modernize irrigation or distribution infrastructure are high and difficult to bear in the short term.

However, the Enablers for implementing these strategies are also crucial. Active stakeholder participation has been key, as local actors have shown strong commitment to the proposed solutions and have collaborated in adapting measures to meet the real needs of the area. The availability of advanced technologies in irrigation and modeling provides a solid foundation for developing effective solutions. Moreover, institutional support will be essential, especially if there is greater collaboration between the public and private sectors. Lastly, training and capacity-

building for stakeholders is vital to overcoming the lack of technical knowledge and ensuring that the new approaches are well understood and correctly applied.

This analysis of barriers and enablers provides a clear understanding of the challenges and opportunities faced by the selected strategies in this laboratory, allowing interventions to be adjusted to facilitate their successful implementation.

4.2. Breaking ground

These strategies have already been approved by the stakeholders during the proof-of-concept phase, and now the focus shifts towards their effective implementation.

- ***Policy Agenda***

The strategies being evaluated in the TALANOA-WATER laboratory are aligned with the current Hydrological Plan for the Douro River Basin Authority (2021-2027). The laboratory maintains a close link with the Douro River Basin Authority, whose involvement is crucial for implementing water management policies within the basin. Strategies such as agricultural insurance, the modernization of irrigation systems, and water regulation are designed to complement and strengthen the approaches outlined in the hydrological plan, thus enhancing the efficiency of future water management.

- ***Connections of TALANOA with policy agenda***

TALANOA has established a direct connection with the Douro River Basin Authority, which has allowed adjustments to be made to the strategies to align them with local needs and existing water management policies. This collaboration with the Douro River Basin Authority ensures that the strategies are consistent with the regulatory framework and effectively integrated into the water management system of the basin.

- ***Connections of TALANOA with water users and farmers***

One of the strengths of the TALANOA laboratory has been its participatory approach, fostering active involvement from local stakeholders, particularly the farmers of the "El Carracillo" irrigation community. Through participation in serious games, field visits, and the collection of real data, local actors have had the opportunity to validate the strategies and express their needs. This has ensured that measures such as the modernization of irrigation systems and agricultural insurance are tailored to the local reality, facilitating better adaptation to climate change.

- ***Connections Between teams and stakeholders***

The TALANOA laboratory has maintained strong connections with a broad range of actors, including farmers, local authorities, and technical entities. These relationships have been essential in providing crucial data for model calibration and ensuring that the strategies are effectively

validated and adapted. Collaboration with stakeholders has been key to ensuring that the solutions are feasible and tailored to local conditions, thereby ensuring the practical implementation and success of the strategies in the territory.

- ***Impact Assessment***

The implementation of the proposed strategies is expected to improve the ability to predict plausible future scenarios and increase adaptation to changing climate conditions. Strategies such as water regulation and the inclusion of greater uncertainty in modeling are crucial for improving water management planning and being better prepared for unpredictable climate scenarios. Short- and long-term benefits are anticipated for farmers and other local stakeholders, particularly in terms of greater resilience and sustainability of water resources.

5. Italian lab

The Italian Water Lab has organized a series of participatory events aimed at engaging regional stakeholders in co-developing transformational adaptation strategies for the Emilia-Romagna region. These workshops, inspired by the Talanoa Dialogue approach, have served as pivotal moments to identify key challenges, explore potential solutions, and refine strategies for enhancing climate resilience in water management.

Building on the insights and outcomes generated during these events, the Lab has prioritized the integration of local data, hydrological modeling, and stakeholder feedback to inform and support the strategic tasks ST7 and ST8.

Below, we provide a summary of the main workshops and their outcomes, emphasizing their significance in advancing these strategic objectives.

Participative event (or other) (Month, Year)	**Outcome relative to strategies**
1st Stakeholder Workshop - TALANOA-WATER (July 29, 2022): This workshop centered on collaboratively designing objectives with regional stakeholders from Emilia-Romagna. It served as a first step in aligning stakeholder priorities with the region's water management and climate resilience goals.	Key challenges, including water scarcity, inefficiencies in historical allocation rules, and the impacts of climate change on flow regimes, were collaboratively identified during the workshop. These insights directly contributed to ST7 by establishing a comprehensive baseline of the region's water management challenges. Additionally, initial adaptation storylines were developed by integrating local data with stakeholder perspectives, laying a robust foundation for transformational strategies under ST8.

2nd Stakeholder Workshop - TALANOA-WATER (March 29, 2023): This workshop focused on leveraging modeling tools and serious gaming for the co-development of adaptation measures. Knowledge gaps were reviewed, and a modeling framework explored to identify potential adaptation pathways.	Preliminary strategies were evaluated, with a focus on infrastructure upgrades (e.g., reservoirs) and the promotion of efficient water management systems. Governance structures were also discussed to support both short- and long-term water management objectives. These outcomes contributed to ST7 by enhancing the understanding of infrastructure and governance challenges. Additionally, the serious gaming exercise provided a platform to test actionable strategies for ST8, including water-saving measures and infrastructure improvements.
3rd Stakeholder Workshop - TALANOA-WATER (March 12, 2024, followed by May interviews): This workshop focused on refining adaptive governance storylines. Follow-up bilateral meetings conducted in May-June 2024 provided additional insights, ensuring that the strategies were robust, inclusive, and aligned with the region's evolving needs.	Co-developed governance frameworks emphasized adaptive management, infrastructure modernization, and clearly defined stakeholder roles. Stakeholder feedback played a pivotal role in refining actionable plans under varying climate scenarios. These efforts directly addressed ST7 by bridging gaps in adaptive governance and enhancing stakeholder engagement. They also contributed to ST8 by finalizing drought management plans, policy frameworks, and scalable solutions tailored to the region's needs.

5.1. Proof of concept

The Italian Water Lab explored the concept of advanced climate projections, like those that can be provided by tailored climate services, which were introduced and discussed as a strategy for sustainable water management in TALANOA. Such a service could function as a water resource hub, strategically positioned as a hydraulic node in the mountainous area of the river basin. This strategy includes monitoring river flow and water availability for downstream uses, while forecasting future flows across various time scales—from daily weather to sub-seasonal and decadal climate predictions. Built on advanced high-resolution climate and hydrological modeling, these tools offer robust, data-driven insights to support sustainable water management. Originally developed for the Secchia River a right-bank tributary of the Po River, an example of such climate service was discussed as a proof-of-concept prototype for all Apennine tributaries of the Po River. The cutting-edge climate service provides insights for adapting emergency policies and procedures, as well as for enhancing water allocation and management strategies over longer time horizons.

- **Adaptation responses under emergency conditions**. Designed to provide near-term and sub-seasonal forecasts, the climate service supports informed decision-making during drought emergencies, enabling responses such as pre-emptive water storage and reservoir management. It empowers downstream water users to anticipate and respond to critical situations more effectively by developing **tailored emergency and business continuity plans** aligned with shared, predetermined critical thresholds. Additionally, the service enables users to **simulate extreme events and test the resilience of their systems**, as well as refine contingency strategies tailored to various emergency scenarios. During crises, it provides actionable insights to **optimize water distribution**, ensuring equitable access and prioritizing critical water uses.
- **Adaptation to long time horizon changes of water flow and availability**. By providing high-resolution predictions and projections over decadal and multi-decadal time scales, the climate service equips policymakers and water managers with essential information to **plan for the future under diverse climate scenarios**. By capturing shifts in water availability driven by changing precipitation patterns—including variations in form (e.g., rain versus snow), timing, and the retention of water in snowpack—the service supports the development of a robust, basin-wide water balance. The insights provided by the service enable the **revision of water abstraction permits** to align with projected water availability. The service also informs the establishment and maintenance of **ecological flow requirements**, safeguarding aquatic ecosystems and preserving the health and functionality of river systems for long-term sustainability.

5.2. Breaking ground

Policy agenda

The Lab's activities are closely coordinated with, and embedded within, the broader water reform initiatives in the case study area. A key contribution of the Lab is its support for the development of the **Climate Adaptation Strategy for the Po River Basin**, where the basin is situated. Moreover, the Lab is an integral part of a wider **transformational regional climate adaptation initiative**, which includes water regulation reforms and the development of a new **Regional Water Conservation Plan**.

- The Po River Adaptation Strategy incorporates a cutting-edge climate and hydrological modeling suite, featuring advanced, high-resolution climate simulations and forecasts. This initiative includes a shift toward modern, component-based hydrological modeling (GeoFrame). The Lab's modeling activities have been specifically adapted to align with these advancements, ensuring consistency and seamless integration with the overarching strategy. The TALANOA Lab serves as a prototype of usage for a climate service, tailored to a critical hydrological node, demonstrating an approach that can be implemented across other parts of the river basin. The Talanoa stakeholder interactions and consultations provide a blueprint for similar bottom-up governance initiatives, exemplified by river

contracts—a novel framework for stakeholder empowerment that is increasingly adopted in other areas of the basin.

- Emilia-Romagna is a signatory of the EU Mission on Adaptation to Climate Change and a beneficiary of one of the Mission's demonstrator projects, ARCADIA. The region's involvement in the Mission aims to accelerate the adoption of advanced and systemic transformations, with a strong focus on promoting nature-based solutions (NbS). This strategy supports the health and resilience of river ecosystems by addressing challenges such as altered flow regimes, declining biodiversity, and increased vulnerability to extreme weather events. As part of this effort, the Talanoa Water Lab integrates advanced hydrological models to ensure that ecological flow requirements are met. This approach helps maintain water levels critical for sustaining aquatic ecosystems and their functions, even during periods of low flow and prolonged droughts, thereby fostering ecosystem resilience and adaptability. Additionally, the Lab's outputs—such as shared critical flow thresholds—ensure that the Regional Water Conservation Plan is closely aligned with the water shortage business continuity and resilience strategies of downstream water users.

Connections of TALANOA with water users and farmers

The Lab acted as a bridge between regional water management bodies and the practical needs of water users, particularly water reclamation and irrigation boards that supply water to farmers—one of the groups most vulnerable to water shortages and climate variability—as well as regional utilities and water supply companies. Through its participatory approach, the Lab engaged stakeholders in co-developing water availability stress tests, ensuring that outputs such as critical flow thresholds and drought contingency plans were both scientifically robust and operationally relevant. Regular consultations, workshops, and Talanoa-style dialogues provided water users with a platform to actively contribute to regional policy and business-oriented decision-making processes.

The Lab's advanced modeling suite enabled users to plan for water availability more effectively. It also supported the development of business continuity and resilience plans that aligned with the Regional Water Conservation Plan, ensuring that critical water needs were prioritized during periods of scarcity. The user-friendly example of climate service discussed in the Lab translated complex hydrological data into actionable insights, empowering users to make informed decisions about water use. Furthermore, education and capacity-building initiatives equipped water users with the skills needed to adopt adaptive water management practices, thereby strengthening the long-term resilience of water management systems.

6. Lebanese lab

Participatory Workshops and Strategic Outcomes

The Lebanese Water Lab has organized a series of participatory workshops designed to engage local stakeholders in co-developing adaptive strategies for water management in Lebanon. Grounded in the Talanoa Dialogue approach, these workshops have played a pivotal role in addressing critical water governance challenges, exploring solutions, and refining climate resilience strategies for the region. By integrating local knowledge, remote sensing data, microeconomic insights, and stakeholder feedback, the Lab has informed the development of Strategic Tasks ST7 and ST8.

Below is a summary of key workshops and their outcomes, emphasizing their contributions to advancing these strategic initiatives.

Participative event (or other) (Month, Year)	**Outcome relative to strategies**
1st National Science Policy Stakeholder Workshop TALANOA-WATER (July 13, 2022): Stakeholder Dialogue for Transformational Adaptation to Water Scarcity Under Climate Change	**Understanding of Water Management Challenges**: Stakeholders analyzed water management issues in the Litani River Basin, deepening collective understanding of systemic challenges. **Emphasis on Collaboration**: Cross-sectoral collaboration was identified as essential for effective water resource management in the region. **Identification of Key Issues**: Participants prioritized critical challenges affecting water governance and resource allocation in the Litani Basin.
2nd National Science Policy Stakeholder Workshop TALANOA-WATER (April 27, 2023): Litani River Watershed Scenarios and Strategies	**Implementation of Talanoa Framework**: The Talanoa framework fostered transparent dialogue, enabling stakeholders to address governance challenges constructively. **Stakeholder Engagement in Problem Identification through 1st Serious Game**: A participatory serious game facilitated the identification, discussion, and ranking of water management priorities, establishing a foundation for policy solutions. **Strategizing for Water Governance**: Scenario simulations allowed stakeholders to explore trade-offs and define actionable strategies for governance improvements. **Shaping Water Policies**: Insights from discussions and gaming outcomes directly informed Lebanon's water policy framework, addressing local and regional needs.

3rd National Science Policy Stakeholder Workshop TALANOA-WATER (April 18, 2024): Bridging Waters in the Bekaa: Stakeholder Engagement through TALANOA and TRANSCEND Serious Gaming	**Integration of the Bekaa Serious Game**: An upgraded Talanoa card-based game enabled stakeholders to simulate water management decisions in the Bekaa Valley. **Exploring Trade-offs and Synergies**: Participants examined competing interests and synergies in water allocation, highlighting the complexity of balancing agricultural, environmental, and community needs. **Feedback on Stakeholder Interests**: Input from stakeholders refined strategies for sustainable water management, emphasizing equity and efficiency. **Challenges in Policymaking**: Discussions revealed gaps in translating stakeholder priorities into actionable policies, underscoring the need for robust governance frameworks.

6.1 Proof of concept

The adaptation strategies identified during the third workshop were rigorously evaluated using participatory insights and technical modeling. Regulatory barriers, feasibility, and institutional support were analyzed to assess implementation potential. Below are the prioritized strategies, validated through local data, hydrological models, and stakeholder consensus:

1. **Optimizing Water Use in Agriculture:** This strategy incentivizes farmers to prioritize high-value, water-efficient crops. Remote sensing and socioeconomic data revealed stark disparities in crop-water efficiency. For example, potatoes in the Bekaa Valley demonstrated 10 times higher Economic Irrigation Water Productivity (EIWP) than wheat. By aligning incentives with economic and resource constraints, policymakers can promote water-efficient practices without compromising profitability. Institutional support and data-driven validation position this strategy as a high-impact solution.

2. **Data-Driven Water Management:** Stakeholders endorsed policies informed by real-time data on water usage and crop performance. Insights from remote sensing and serious gaming already inform adaptive management, but continuous data collection is critical for responsive allocation. The Lab's modeling framework ensures strategies adapt to short- and long-term hydrological and agricultural shifts.

3. **Information Provision and Decision Support Tools**: A key challenge identified by stakeholders was the need to provide farmers with timely and accurate information on

crop performance and water availability. Through predictive modeling and the integration of past data, stakeholders are advocating for the development of decision support tools that can forecast crop yields and available water. This will enable farmers to make more informed decisions, improving both crop selection and water use efficiency. Information provision, therefore, is not only a strategy for enhancing immediate agricultural productivity but also a long-term tool for ensuring the resilience of farming practices in the face of climate variability.

4. **Water Use Regulation:** The regulation of water use is critical in managing the overexploitation of groundwater resources. Stakeholders discussed the potential for establishing a water extraction ratio for each farmer, based on land holdings, water availability, and crop needs. This would be coupled with dynamic adjustments to water allowances, depending on rainfall patterns and broader water availability. Such regulatory measures are aimed at promoting fair and sustainable water distribution across the basin. The modeling approach supports this strategy by enabling the development of policies that account for spatial and temporal variations in water availability, ensuring that water use is regulated in a way that is both equitable and environmentally sustainable.

Barriers and Enablers: The analysis of these strategies has highlighted several barriers and enablers for successful implementation. One of the primary barriers is the fragmented institutional and legal framework in Lebanon, which hampers coordinated action across sectors. To address this, stakeholders have emphasized the need for enhanced stakeholder engagement, particularly involving farmers, as well as strengthening the capacity of institutions to manage water resources. Enablers of successful strategy implementation include the use of advanced data collection techniques (such as remote sensing) and the integration of these tools into decision-making frameworks, providing a solid basis for the adoption of these strategies.

6.2. Breaking ground

Breaking Ground: Implementing Adaptation Strategies in Post-War Lebanon

The selected strategies for adapting to the challenges of climate change and its impacts on agricultural and water management in Lebanon rely on (i) policy/planning measures, (ii) collective measures, and (iii) individual measures. These strategies are especially relevant given the country's ongoing efforts to build resilience and sustainability in the agricultural sector following the Israeli war in 2024. In the context of Lebanon, especially in the southern regions, Bekaa, and the Litani River Basin, these strategies are crucial as the livelihoods of farmers and the agricultural sector have been severely affected by the 2024 war.

Policy Agenda

The agricultural and water management policies in Lebanon are currently being reviewed to address the growing challenges in the aftermath of the war. Existing plans, such as the National Water Strategy (NWS), are under assessment to identify areas for improvement in water distribution and agricultural resilience. A new national water management plan is being considered, with a focus on rebuilding infrastructure, improving irrigation systems, and ensuring water security in the southern regions. However, this new plan will likely only begin implementation in 2025, with any significant results expected by the end of 2025. This timeline presents an opportunity for TALANOA's influence but also means that immediate impacts will not be seen before the conclusion of the current phase of the project.

The policy agenda also includes efforts to address agricultural resilience through financing mechanisms for farmers to diversify crops and adopt water-efficient practices. The government has been exploring partnerships with international organizations to fund these initiatives. Remote sensing could play a crucial role in monitoring the progress of these policies by providing real-time data on water availability, crop water productivity, and economic irrigation productivity, ensuring that decision-makers are well-informed when allocating resources.

Real Connections of TALANOA Lab with the Policy Agenda

The TALANOA Lebanese water lab is actively engaging with local and national policy-making processes to ensure that the project's findings feed into the new water management strategies. The lab is in close contact with government officials working on agricultural resilience programs, including those related to water efficiency and climate adaptation.

Additionally, there might be an opportunity for working with organizations focused on rebuilding post-war infrastructure, including water distribution networks. These efforts are essential to ensure that water is used efficiently and that the needs of farmers in the southern and Bekaa regions are met. Remote sensing tools can assist in assessing the condition of crops and monitoring the effectiveness of restoration efforts, offering valuable data for planning and water resource allocation.

Connections of TALANOA with Water Users & Farmers

In terms of implementation, the Lebanese Water Lab's strong connections with farmers and water users in the Litani River Basin will be crucial for driving the adoption of new practices. However, the impact of the recent conflict has significantly disrupted the livelihoods of farmers and altered their interests, creating a challenging context for the implementation of strategies. The ongoing political transition with a new president and government further adds uncertainty, potentially delaying the adoption of the adaptation strategies.

Despite these challenges, the Lebanese Water Lab has built valuable partnerships with local farmer groups and cooperatives focused on promoting water-efficient technologies and sustainable farming methods. These collaborations will continue to play a vital role in ensuring the success of the adaptation strategies, especially as the country navigates the current political and economic instability. A key partnership involves a group of farmers exploring agro-ecological solutions, such as climate-resilient crop varieties and water-efficient irrigation systems. The Lebanese Water Lab has supported these farmers by providing access to data on weather patterns and soil moisture through remote sensing tools, helping them make informed decisions about water use and crop selection. As the country works through its current challenges, these partnerships will be instrumental in scaling up adaptation efforts and fostering long-term resilience in the agricultural sector.

The Impact of TALANOA

The impact of TALANOA in Lebanon will be measured not only by the adoption of new practices but also by the learning and collaboration that occurs between stakeholders. The project has facilitated dialogue among farmers, policymakers, and researchers, fostering a sense of collective ownership and responsibility for implementing adaptation measures. This collaborative approach is critical in post-conflict scenarios where trust and cooperation are essential for rebuilding communities and economies.

Perspectives

Looking ahead, one last workshop should be planned for the coming months, focusing on the economic models, strategies, and a collective assessment for adaptation post the 2024 war. This workshop will serve as an opportunity to refine the strategies based on stakeholder feedback and the latest data. Post-war real-time data provided by remote sensing technologies can allow for rapid assessments of agricultural and water conditions, ensuring that the strategies remain relevant and adaptable to changing circumstances.

The combination of data-driven insights, strong stakeholder engagement, and a clear policy agenda sets the stage for successful implementation of adaptation strategies in Lebanon. Remote sensing will continue to play a crucial role in monitoring the effectiveness of these efforts, providing the necessary data to track progress, adjust strategies, and ensure that the region's agricultural sector can recover and thrive in the face of both current challenges and future climate uncertainties.

7. Tunisian lab

The Djefara Water Lab in Tunisia organized complementary activities (workshops, trainings, trials, field days, group visits) to engage in deep main actors of the water sector in the study area.

With their high involvement in dialogue, stakeholders contributed to identify the main water problems and proposed tentative solutions, scenarios and strongly participated to co-design future strategies. The table below lists the participatory events held in the study area to gather strategic insights.

Participative event (or other)(Month, Year)	**Outcome relative to strategies**
1st Stakeholder Workshop TALANOA-WATER. (September 2022)	A collaborative discussion and a comprehensive analysis identified 29 water scarcity issues, prioritized and categorized under four key themes selected by stakeholders: **"Irrigated Agriculture," "Drinking Water," "Institutional and Legal Framework and Information Technology,"** and **"Rain-fed Agriculture."** A consensus was reached on mitigation and adaptation strategies for each of these challenges. The proposed solutions emphasized capacity-building initiatives through targeted training programs and the establishment of demonstration plots. These plots aim to test innovative measures, such as water magnetization and the introduction of new salt-tolerant plant species, to address the identified problems effectively.
2nd Stakeholder Workshop TALANOA-WATER (March 2023)	The proposed mitigation and adaptation measures were co-evaluated based on their environmental, economic, and social performance, with the implementation costs of each strategy carefully estimated. This process also included the introduction of a serious game as a decision-support tool. The laboratory's modeling efforts and framework were presented, followed by interactive discussions to validate the results. Four scenarios were introduced as part of the modeling analysis: 1. Artificial Recharge 2. Treated wastewater Reuse (TWWR)

	3. Desalination Plant 4. Water Saving Measures
3rd Stakeholder Workshop TALANOA-WATER (May 2024)	**-Water quality discussion (SAR)**: The workshop facilitated a comprehensive discussion on the water quality in Djefara. Various physicochemical indicators were examined to classify the water quality effectively. -**Presentation of socio-hydrologic modeling results**: The workshop provided a platform to present the key results of the socio-hydrologic modeling work. -**Evaluation of proposed strategies**: Participants engaged in critical discussions to evaluate the effectiveness of strategies proposed by the modeling work.

To feed the participative work, the team also:

- organized two bilateral meetings (December 2022) with stakeholders to discuss and validate the results of the first workshop in relation to the identified issues and proposed solutions, as well as a planning meeting (May 2023) to outline the upcoming living lab activities.
- The second workshop was followed also by two intermediate meetings (Respectively 11th May 2023 and 04th January 2024). The first meeting was organized to identify the actions needed to be taken regarding the specified issues validated namely types of crops, test of techniques to improve productivity (biostimulants, magnetization, etc.), and to schedule the next training sessions by proposing the required topics, target audience, etc. The second one was organized as a field trip to visit for diagnosis of the state-of-the-art and plausible improvements.

7.1. Proof of concept

Through the integration of economic and hydrological modeling tools, combined with the implementation of experimental plots, stakeholders in the Tunisian water lab collaborated closely to devise effective and sustainable strategies. This participatory approach ensured that stakeholders were actively engaged at every stage of the process.

The proposed solutions were selected based on their practicality and potential to address the pressing water challenges in the study region. Key strategies include promoting the reuse of

treated wastewater, optimizing water system management through efficient supply networks, implementing regulatory measures, and expanding water resources through initiatives such as desalination plants and enhanced artificial recharge infrastructure.

- **Reusing treated wastewater** is a sustainable and practical solution to tackle water scarcity, but its success largely depends on social acceptance. Public perception, trust, and awareness play a crucial role in the widespread adoption of this practice. By ensuring high treatment standards and transparent communication about safety and benefits, communities can become more receptive to using treated wastewater for purposes such as irrigated agriculture and groundwater recharge. Educating the public on the environmental and economic advantages, such as preserving freshwater resources and reducing pollution, can help overcome skepticism and build confidence. Ultimately, fostering social acceptance through engagement and dialogue is essential for the successful implementation of wastewater reuse strategies.

- **Sea water desalination** provides additional water resources crucial for sustaining growing populations and economic development. However, desalination remains an expensive solution due to high energy consumption, infrastructure costs, and environmental concerns related to the released brine water. While technological advancements improve efficiency and reduce costs, desalination remains a costly option compared to conventional resources. Therefore, it is essential to carefully weigh its benefits against economic and environmental considerations when planning water management strategies.

- **Artificial groundwater recharge** is an effective solution to address water scarcity. This option involves injecting collected rainwater along riverbeds into underground reservoirs through infiltration basins and injection wells. However, its successful implementation requires careful management, thorough hydrogeological studies, and continuous monitoring to prevent contamination risks.

-Implementing water-saving best practices is essential to improve water use efficiency and address growing water scarcity challenges. These practices include adopting modern technologies such as low-flow fixtures, efficient irrigation systems, and water-recycling techniques that help minimize unnecessary consumption. In households, simple habits like turning off taps when not in use, fixing leaks promptly, and using water-efficient appliances can significantly reduce water use and waste. Raising awareness and promoting responsible water use behavior among individuals and businesses are also key to achieving long-term sustainability. By prioritizing water efficiency, communities can reduce their environmental footprint while ensuring the availability of this vital resource for future generations.

The evaluation of these strategies considered some challenges such as regulatory restrictions, financial constraints, and stakeholder resistance.

Regulatory barriers are particularly significant, as existing policies do not always support the proposed solutions; financial challenges also arise due to the high costs of upgrading infrastructure.

On the other hand, the implication of stakeholders in the identification of strategy can facilitate implementation. The capacity building by the organized training sessions provides a solid foundation, while the cooperation of Research-farmers and the public-private sector was essential and play a crucial role in adapting solutions to local needs.

Assessing both obstacles and supporting factors helps to fine-tune the strategies and improve their chances of successful implementation.

7.2 Breaking ground

These strategies have already received approval from stakeholders during the proof-of-concept phase, and the current priority is to ensure their effective implementation.

Policy Agenda

The national strategy strongly supports the reuse of treated wastewater as a key solution to address water scarcity and ensure sustainable resource management. Significant investments are being directed towards expanding water sources, with a focus on developing advanced treatment facilities and infrastructure to enhance treated wastewater reuse. These efforts aim to reduce dependence on conventional water resources, promote environmental sustainability, and meet the growing demand for water across various sectors, including agriculture, industry, and urban development. By prioritizing the diversification of water sources, the strategy seeks to build a resilient water supply system capable of withstanding future challenges.

Connections of TALANOA with policy agenda

The TALANOA project aims to introduce new regulations related to water quality, specifically addressing salinity levels, to ensure the safe and sustainable use of available water resources. In addition to regulatory measures, the project plans to propose new subsidies to support the adoption of advanced technologies for brackish water use. These initiatives will encourage stakeholders, particularly in agriculture, to invest in innovative solutions that enhance water efficiency and reduce environmental impacts. By combining regulatory improvements with

financial incentives, the TALANOA project seeks to promote a more resilient and adaptive approach to water management.

Connections of TALANOA with water users and farmers

The TALANOA project is built on a participatory approach that actively involves stakeholders in the decision-making and implementation processes. It will also lead to their empowerment through collaborative solutions. By fostering open dialogue and collaboration among policymakers, local communities, businesses, and experts, the project ensures that proposed solutions are well-adapted to the real needs and challenges of the region. This inclusive approach enhances stakeholder ownership, encourages knowledge sharing, and promotes the co-creation of effective and sustainable water management strategies. Through continuous engagement and feedback, the TALANOA project aims to build trust, strengthen cooperation, and drive long-term success in addressing water-related challenges.

Connections Between teams and stakeholders

The relationship between the project team and stakeholders is based on collaboration, transparency, and mutual trust. The team works closely with stakeholders to understand their needs, concerns, and expectations, ensuring that their perspectives are integrated into the project's development and implementation. Regular meetings, workshops, and consultations facilitate open communication and encourage active participation from all parties involved. This strong partnership helps to align project objectives with local realities, fosters a sense of ownership among stakeholders, and enhances the overall effectiveness and acceptance of proposed solutions. By maintaining an ongoing dialogue, the project team aims to build a cooperative environment that supports long-term success.

8. Conclusion

This deliverable outlines the lab's strategies and the way towards implementation through two key steps (i) proof of concept and (ii) 'Breaking ground' (practical implementation). While these are theoretically distinct, the experiences in TALANOA demonstrated their potential for, and perhaps necessity of, overlap. Typically, modeling (incl. in proof of concept) can be continued while working on "breaking ground", integrating the policy agenda and while stakeholder acceptance is explored. The delay and increased investment in some modeling exercises haven't delayed the work on the ground with stakeholders and policy makers. This confirms that conducting both in parallel is feasible. One of the reasons for that might be that most solutions/adaptations are not radically new and are expected or already known to provide some positive impact.

Transformation stems not only from "new" measures not considered before but also from speeding up the pace of already known solutions and discontinuing counterproductive or inefficient practices. For all these solutions, "breaking ground" is already possible in some sense: testing the ideas, contributing to its diffusion through collective thinking and dialogue should be seen as fostering adaptative capacity.

Although labs are in very different institutional and natural settings, the approach to build on TALANOAs work and deal with transformation among labs is relatively comparable. It has relied on both participation and intensive data and modeling use as planned by TALANOA Water methodology. Strategies examined by labs are often similar (reduction of losses), but some are original and new to this project. In two cases (Italy and Lebanon) the modeling becomes part of the strategies under study while being integrated in a new climate service to be developed.

This work aims to deepen our understanding of the **barriers and levers** for accelerating the adoption of adaptation strategies, to integrate multiple strategies and strengthen the evidence base through modeling. Identifying barriers is crucial for policy and extension action. These barriers will be assessed through a survey conducted in the last round of workshops, in cooperation with the TRANSCEND project (that elaborated the questionnaire). Technical support will be provided to ensure that stakeholders each barrier during the workshop. The analysis will examine barriers by stakeholder group, measure/strategy category, and related factors. We will compare the survey results between stakeholders who participated in the dialogue and those who did not, to evaluate the dialogue's impact. The survey instrument is detailed in the annex and available at this link.

9. Annex I

A systematic evaluation of the relevance of various barriers to the adoption of Transformational Adaptation Policies (TAP) in water management **will be conducted** in each case study. Stakeholders **will be asked** to complete a questionnaire (Available at this link) **that is designed** to assess the influence of regulatory, institutional, and socio-economic factors on TAP implementation. To ensure clarity, questions **are formulated** in layman's terms. This questionnaire **will continue to be** iteratively updated based on feedback gathered from different projects, which are part of the EU mission TWG transformational adaptation, reflecting the evolving understanding of relevant barriers and thus **will remain** prone to change. Stakeholders **will evaluate** each barrier's relevance to their individual case study, selecting one of five levels of relevance and understanding: "relevant," "somewhat relevant," "little relevance," and "not relevant," or "I do not know." Collected responses **will be analyzed** to identify the most significant constraints within each case study, **providing** a comprehensive understanding of the challenges associated with adopting transformative water management strategies. This methodological approach **will enable** a consistent and comparative assessment across diverse geographical and institutional contexts, **facilitating** the identification of both common and context-specific barriers to TAP adoption. The table below **presents** the questionnaire:

REGULATORY CONSTRAINT
Rigid regulatory frameworks may constrain beneficial reallocation instruments or innovative water management policies. For example, some national regulations ban water markets. How relevant is this rigidity in constraining the adoption of Transformational Adaptation Policies (TAP) in your area?
A (significant) fraction of water withdrawn that is not consumed by users, goes back to the water system as a return flow (e.g., via aquifer recharge). This water is reused by third parties downstream. TAP may affect this water cycle dynamics and limit the water received by third parties. This is a concern that may prevent the adoption of TAP. Is this a relevant phenomenon in your area?
Water constraints during droughts are based on a discretionary decision by the water authority, not by an objective indicator. This creates uncertainty on the decisions by institutions and can constrain TAP adoption. Is this kind of Regulatory and Institutional Uncertainty relevant in your area?
Are water rights 'bundled' with land? If yes, how relevant is this in constraining TAP implementation in your area?
In most basins, water rights are 'limited in time', and the share of water not used cannot be carried over time ("Use it or lose it"). Is this a relevant constraint to the adoption of TAP in your area?
In your opinion, which is the most important Regulatory constraint towards the adoption of TAP in your area?

BELIEFS
Bounded rationality refers to the idea that decision-makers have limitations in their ability to process information, leading them to make choices that are satisfactory rather than optimal, considering the constraints they face. Individuals often use mental shortcuts or rules of thumb to simplify decision-making, relying on past experiences or readily available information rather than exhaustive analysis, to arrive at reasonably satisfactory solutions. This can prevent the adoption of innovative TAP for which there is no previous evidence. Do you feel bounded rationality is a barrier to the adoption of TAP in your area?
Cognitive biases are our brain's natural tendencies to make consistent mistakes in judgment, influenced by our perceptions and mental shortcuts, rather than relying on factual information when making decisions. Do you feel cognitive biases are a barrier to the adoption of TAP in your area?
Causal beliefs are instinctive beliefs about cause-and-effect relationships in the system, which often guide our understanding and decision-making, even if they might not be entirely accurate or supported by strong evidence *(e.g. higher technical efficiency saves water).*
Disciplinary bias refers to the tendency for individuals to favor or be influenced by their own field or area of expertise when making decisions or forming opinions, which may limit their consideration of alternative perspectives or information from other disciplines (e.g., hydrologists may ignore the economic consequences of a policy and focus on its physical impact). Is disciplinary bias present in decision-making processes in your area, and how relevant you feel it may be in limiting TAP adoption (e.g., of economic instruments)?
Under dissociation of processes in belief, some perceptions may be considered valuable even though they are not based on facts. Repeated exposure to a belief (in a random pattern) may increase its acceptance as true. For example, dams are built in some closed basins even if there are virtually no resources to store. Is this dissociation observed in your area, and how relevant is it in constraining TAP adoption?
Patternicity is the human tendency to perceive meaningful patterns or connections in random or ambiguous information, even when they may not actually exist. Agenticity is our inclination to attribute events or phenomena to the intentional actions of agents or beings, even in situations where no evidence or data support such attribution. How relevant are they in constraining TAP adoption in your area decision-making process?
Groupthink happens when a group of people prioritizes harmony and consensus within the group over critical thinking, often leading to flawed decision-making and overlooking alternative perspectives or ideas. For example, if the majority of a group decides not to implement TAP, dissent is avoided by those who may disagree to maintain consensus and harmony. How relevant is this in constraining TAP adoption in your area?
Confirmation bias is our inclination to selectively seek and interpret information that confirms our preexisting beliefs or expectations, while disregarding or downplaying contradictory evidence. Is confirmation bias relevant in your area, and in preventing

TAP adoption?
Continued influence effect refers to the persistence of previously learned information or beliefs, even after they have been discredited or proven incorrect, and their continued impact on subsequent thinking and decision-making. How relevant is this belief in limiting TAP adoption in your area?
PATH-DEPENDENCE/LOCK-IN
Path dependence happens when past decisions or events shape the current trajectory of institutions, making it difficult to change course even if the current policy is not the best option. Do you feel path dependence issues are relevant in limiting the adoption of TAP in your area?
Where formal institutions are immobile, informal institutions may arise. Informal institutions are unwritten rules and norms that govern how people behave and interact, going beyond official regulations. How relevant is the presence of informal institutions (e.g., informal insurance, illegal water markets) in your area?
Transaction costs in water markets are the expenses and challenges involved in conducting water-related reallocations, like finding information, negotiating agreements, and overcoming bureaucratic barriers, which can affect the efficiency and ability to bring about necessary institutional reforms or reallocation policies and overcome path dependence and institutional lock-in in water markets. In what measure are transaction costs limiting TAP adoption in your area?
Limited enforceability is a situation where rules, agreements, or contracts have difficulties or limitations in effectively ensuring compliance or being legally enforced, which can undermine their effectiveness in governing behaviors and actions. Failure to address water theft or illegal groundwater access is a clear example of this situation. How relevant is this issue in your area?
INCENTIVES
Second-round effects in the water market are indirect or unintended consequences that arise from initial decisions or actions, often affecting other participants in the market, and potentially altering market dynamics and outcomes beyond the immediate transaction. *(E.g., reduced water allocations reduce farmer income, but also income in the agrifood industry)*. Do you think fear of second round effects is relevant in limiting TAP adoption in your area?
Diffusion of innovation relates to the spread and adoption of new water management practices or technologies among water users and stakeholders over time. (E.g., The adoption and diffusion of natural-based solutions, initially embraced by a few innovative farmers, gradually spreads to other farmers as they observe the benefits of improved water conservation). Do you perceive this is a relevant aspect in your area conditioning TAP adoption?
Political legitimacy. Interventions that are perceived as effective (even if they are not) can

be popular and enhance political legitimacy, leading authorities to align policies and investments with widely held beliefs and attitudes to maintain their support, even where they know that such policies may not work in the way planned. How much is this a relevant issue in your area?
Budgetary constraints in water management arise from the strain on public budgets due to recurring financial crises and policy interventions, which can limit the implementation of TAP like nature-based solutions or unconventional water resources (desalination, treated wastewater). How relevant is this issue in your area?
POLITICS AND POWER
Rent-seeking refers to individuals or groups attempting to gain economic benefits or privileges through non-productive activities, such as influencing regulations or gaining control over water resources for personal gain (E.g., hydropower and farmers vying for power to affect water allocation rules). How relevant is this issue in your area?
Regulatory capture in water management occurs when regulatory agencies tasked with overseeing water policies and practices become directly influenced or controlled by the industries they are meant to regulate, potentially leading to biased decision-making and favoritism. How relevant is this issue in your area?
Political ecology and power are usually intertwined, and the power structures tend to favor decisions that benefit the financially/politically dominant player, excluding the weakest (or negatively affected) players from the negotiations and policy considerations (e.g., it is challenging to implement TAP that negatively affect the interests of the main wateruser). How relevant is this issue in your area?
Lobbying in water management is the legal practice of individuals or organizations to influence policymakers to shape water-related policies or regulations in their favor, often by using financial resources or political connections. How relevant is this issue in your area?
Corporatism implies a system where powerful corporations or business interests have significant influence and control over water-related policy-making, potentially leading to the prioritization of private interests over broader societal or environmental concerns. How relevant is this issue in your area?
Misinformation is false or misleading information about water-related issues, which can distort public perception, policy debates, and decision-making processes. How relevant is this issue in your area?

Overselling occurs when exaggerated or unrealistic claims are made about the benefits or effectiveness of certain water management approaches or technologies, potentially leading to misguided policies or investments. What is the relevance of this issue in your area?
INFORMATION AND DATA GAPS
Performance Assessments may sometimes be incomplete, or absent, constraining the ability to understand the outcome of previous decisions (e.g., lack of ex post assessment will conceal the failure of previous policies and prevent the adoption of new TAP) How relevant is this issue in your area?
Risk-aversion refers to the tendency of decision makers and other stakeholders to avoid or minimize potential risks or uncertainties associated with decision-making, often prioritizing conservative approaches over more innovative or potentially beneficial strategies such as TAP. How relevant is this issue in the water management of your area?
Filtering information is a process of selectively receiving or paying attention to certain information while disregarding or downplaying other information, which can influence decision-making and potentially result in biased or incomplete assessments. How relevant is this issue in the water management of your area?
Gaps in monitoring indicate the absence or inadequacy of data collection and monitoring systems, leading to limited knowledge about the current state of water resources, usage patterns, and potential issues, which can hinder effective decision-making. How relevant (if any) are these gaps in your area?
In the absence of alternative mental models, decision-makers may prefer an incorrect model, instead of an incomplete model. Is this relevant in explaining the limited adoption of TAP in your area?
The public sector often lacks the organizational, intellectual, and economic capacity to implement policy alternatives, with known policies being perceived as more predictable than TAP. How relevant is this lack of policy alternatives, in your area?