TransformAr

Accelerating and upscaling transformational adaptation in Europe: demonstration of water-related innovation packages

Lessons learnt from TransformAr solutions

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EXECUTIVE SUMMARY

This report presents key lessons learnt from the implementation of 18 climate adaptation solutions across seven demonstrator regions in the TransformAr project. The solutions, co-developed and tested between 2022 and 2024, span five thematic categories: awareness-raising and behavioural change, governance schemes, nature-based solutions, digital and technological tools, and insurance and financial mechanisms.

The objective of this deliverable is to capture cross-cutting insights from these diverse local experiences, based on implementation evidence, stakeholder interviews, and project learning materials. It aims to inform future replication efforts and provide guidance on how transformative adaptation can be pursued in practice across different regional and institutional settings.

The report is structured into three main parts. The first provides an overview of the 18 solutions and their thematic grouping. The second presents detailed analysis by solution category, with each solution reviewed in terms of achievements, challenges, lessons learnt, and recommendations. The third section draws together recurring challenges that emerged across multiple demonstrators, offering a transversal reflection on systemic barriers to implementation. Finally, the conclusion synthesises high-level insights across the main categories of solutions and demonstrators, and offers recommendations for strengthening future design, coordination, and scaling of transformational adaptation efforts.

Across all regions, the solutions showcased the importance of strong local engagement, flexible design, and sustained coordination between actors. While many of the interventions demonstrated early success, the report also identifies persistent challenges that may affect long-term impact and replicability. These challenges include reliance on project-based funding, limited institutional anchoring, and gaps in technical capacity.

These insights contribute to the TransformAr project's broader mission of supporting transformational adaptation pathways across Europe. They also offer a grounded perspective for policymakers, practitioners, and funders seeking to design and scale solutions that respond to the complex, place-based realities of climate change.

LIST OF ABBREVIATIONS

ADEME	Agence de la Transition écologique
AF	Adaptation Fund
AWAR	Awareness-raising modules
CAE	Citizen App Engagement
CAF	Crowdsourcing Citizen app
CEI	Choice experiment
CIH	Climate Innovation Hub
COAST	Coastal contract
DSI	Demand analysis for social services / infrastructure
GB	Green Bonds
ICW	Integrated Constructed Wetlands
ICWM	Integrated Constructed Wetlands Monitoring
INSUR	Insurance Scheme
INTERM	Intertidal monitoring
MRM	Mussel-Raft Monitoring
NUDG	Nudging
RI	Resilience Index
SCS	Smart climate stations
SG	Smart Grid and gates
SWM	Storm water modular system
SWMM	Storm water monitoring
URB	Urban runoff system

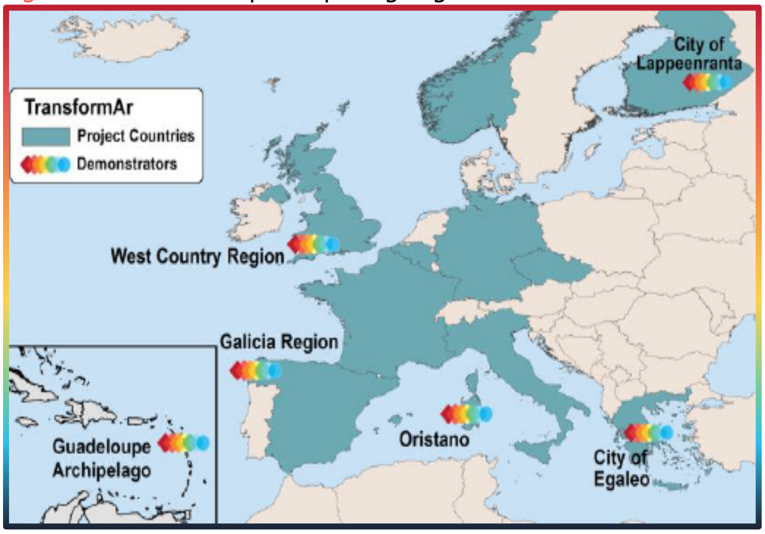
1.0 INTRODUCTION

1.1 Context

The TransformAr project is a Horizon 2020-funded project, with a total cost of EUR 12 730 322, that seeks to develop and demonstrate innovative solutions and pathways for transformational adaptation to climate change across the European Union. The project started on 21st October 2021 and will continue until 30th September 2025 and is split into eight work programmes. By focusing on regions particularly vulnerable to water-related climate risks, TransformAr aims to accelerate adaptation through a diverse portfolio of integrated interventions that combine nature-based, technological, governance, and behavioural solutions.

The project is led by a consortium of 22 partners[1] who are supporting the development of solutions to better adapt to climate change in seven regions (six demonstrators and one replicator).

Figure 1 Location of participating regions



This deliverable presents an evaluation of lessons learnt across the seven TransformAr demonstrators. It builds upon the implementation experiences of 18 tested solutions, focusing on both success factors and challenges that emerged during the demonstration phase. The insights captured are intended to support knowledge sharing, inform future replication efforts, and contribute to a deeper understanding of what drives or hinders effective climate adaptation on the ground.

1.2 Objective

This report aims to synthesise and refine existing documentation on the implementation of solutions by the seven TransformAr demonstrators. It focuses on:

- Successes and enabling conditions observed during implementation
- Challenges and failures that hindered progress
- Concrete, context-specific lessons learnt and recommendations for the potential replication of the TransformAr solutions.

While grounded in the experiences of the TransformAr demonstrators, the objective of this report is also to draw lessons and formulate recommendations that can support the design and implementation of

[1] Partners can be found at this link: https://transformar.eu/consortium/

similar solutions in other contexts. The focus is therefore not limited to the specific cases but extends to comparable solution types across diverse adaptation settings.

The analysis serves as both a consolidation and enhancement of prior work, allowing to structure and deepen the reporting of lessons learnt during the experimentation phase.

Each set of solutions, organized per corresponding category, is analysed in detail in the following sections, with a focus on the observed outcomes and practical recommendations to inform future adaptive actions.

1.3 Methodology

The content of this deliverable is grounded in a combination of primary and secondary sources that reflect the multi-layered approach adopted throughout the TransformAr project. A key reference point is the set of five learning stories (Deliverables D4.1–D4.5 of the TransformAr project[2]), which were developed over the course of the experimentation phase and provide detailed accounts of the design, implementation, and outcomes of each solution. These documents offer valuable insights into the practical realities of deploying climate adaptation strategies across diverse territorial contexts.

In addition to these sources, the analysis has been informed by exchanges with demonstrator teams over the course of the project. Their reflections and experiences contributed significantly to the identification of what facilitated or hindered the implementation of specific solutions.

Furthermore, field visits were conducted by Technopolis in January 2025 for two of the seven demonstrator sites—West Country in the United Kingdom and Lappeenranta in Finland. These visits offered the opportunity to observe firsthand the operational environment and gain deeper understanding of the specific challenges and dynamics shaping the implementation process in each location.

[2] TransformAr deliverables can be found at this link: https://transformar.eu/knowledge-center/

2.0 TRANSFORMAR SOLUTIONS

This section presents the full set of solutions implemented across the seven TransformAr demonstrators. It is structured to guide the reader from a general overview to more detailed insights into each category of solutions. Section 2.1 introduces the 18 solutions, grouped into five thematic categories. Sections 2.2 to 2.6 then explore each solution category in depth, presenting individual solutions through a structured analysis of their key achievements, challenges, lessons learnt, and recommendations. A brief description of each solution is included in the summary tables at the beginning of each category section (Sections 2.3 to 2.6). More detailed information on all solutions can be found in the Annex A. Section 2.7 provides a cross-cutting analysis of recurring challenges and systemic barriers that emerged across multiple solutions.

2.1 Overview of solutions

The following table presents the solutions implemented in each of the seven demonstrator regions. Details about the solutions are presented in the sections below.

Table 1 Summary of solutions across demonstrators

	Awareness Raising & Behavioural Change Solutions	Governance Schemes	Nature-Based Solutions	Digital & Technological Solutions	Insurance Schemes And Financial Solutions
Guadeloupe, France	NUDG				AF INSUR
Egaleo, Greece	CAE AWAR	DSI CIH		SCS	INSUR
Galicia, Spain		RI		MRM INTERM	INSUR
Oristano, Italy		COAST	SG		INSUR
West Country Region, UK			NBS		INSUR
Lappeenranta, Finland	CAF		URB	SWMM	CEI INSUR
Gjovik, Norway	CAF			SWMM	CEI INSUR

2.2 Awareness Raising & Behavioural Change Solutions

Awareness raising and behavioural change solutions aim to promote climate awareness, sustainable practices, and community resilience. Four behavioural change solutions were implemented during the TransformAr project.

Table 2 Awareness Raising & Behavioural Change Solutions

Solution name	Acronym	Description	Demonstrator
Nudging	NUDG	A nudging experiment targeting tourists on the archipelago to reduce their water consumption in the shower.	Guadeloupe, France
Citizen App Engagement	CAE	Citizen app displaying data from weather stations in the region	Egaleo, Greece
Awareness-raising modules	AWAR	Awareness-raising programme targeting 16–18-year-old children to increase climate change awareness and its impact on the environment	Egaleo, Greece
Crowdsourcing Citizen App	CAF	Citizen app displaying stormwater information and enabling citizens to input data on stormwater	Lappeenranta, Finland and Gjovik, Norway

For more information about these solutions, please refer to Deliverable D4.1 developed under the TransformAr project.[3]

2.2.1 Nudging

Key achievements and successes

The implementation of the NUDG solution in Guadeloupe generated a range of positive outcomes. These achievements reflect not only the technical execution of the interventions but also their relevance to local needs, capacity to mobilise actors, and contribution to emerging climate adaptation practices in the region.

The nudging solution implemented in the Guadeloupe demonstrator targeted water conservation among hotel guests by combining digital measurement with behavioural messaging. Developed and coordinated remotely from Belgium, the solution involved the installation of smart shower sensors and the deployment of educational materials such as stickers and flyers across selected hotels. It was designed as a structured behavioural experiment, combining real-time monitoring with subtle prompts to encourage more sustainable water use habits among tourists:

A total of 91 digital shower sensors were deployed in 10 hotels, with 35 connected to the Aquardio platform to collect real-time usage data (equivalent to 38%). This enabled analysis of shower duration patterns before and after the intervention.

Hotel managers initially showed interest and attended workshops, reflecting some level of engagement with environmental responsibility within the tourism sector, although that enthusiasm faded for most over time.

[3] Available here: https://transformar.eu/storage/2025/03/TransformAr_WP4_D4.1-Learning-stories-on-awareness-raising-and-behavioural-change-solutions_v1_27-09-24.pdf

By bringing tourism stakeholders together in workshops and involving them in the development of an adaptation strategy, the solution successfully raised awareness about climate change and its potential impacts on the tourism sector. However, tangible decreases in shower time were not reported.

The project was designed from the ground up for the local context, making it one of the first experiments of its kind in Guadeloupe. The ability to develop and deploy a custom behavioural intervention was itself an institutional milestone.

While one hotel recorded a reduction in total shower time, this trend was not consistent across all participating hotels, and no overall decrease has yet been observed. The experiment is still ongoing, and while early results offer isolated signs of behavioural change, broader patterns have yet to emerge across the dataset.

Interview feedback pointed to the importance of sharing monitoring results periodically to sustain engagement and reinforce the value of participation, which was in fact done to provide an idea of the effect of the experiment. This insight supports future refinement of the solution's operational model.

Key challenges and failures

The implementation of this solution in Guadeloupe revealed a range of operational, governance, and contextual challenges that shaped both the outcomes and the learning process of the demonstrator.

- Technical and logistical barriers: of the 91 sensors distributed to participating hotels, only 35 were ultimately connected and provided usable data, even though the totality was planned to be connected. Internet connectivity issues, inconsistent hotel engagement, and technical malfunctions with the sensors limited the consistency of data collection across sites.
- Need for on-site presence: feedback from the implementing team stressed the difficulty of coordinating the experiment remotely from Belgium.
- Inconsistent participation from hotels: while some hotel managers were enthusiastic, others disengaged early or failed to integrate the nudging materials into their guest experience. This was mainly due to i) difficulties in reaching hotel managers, hence actively involving them; ii) distance between implementation team and site; and, iii) issues with installation of nudging tools. This heterogeneity reduced the number of data points available for robust impact assessment.
- Limited measurable impact across hotels: some preliminary behavioural shifts were observed. However, the experiment did not yield consistent or generalisable results across all hotel sites. The incomplete installation of sensors, data synchronisation issues, and the difficulty in clearly distinguishing pre- and post-intervention periods hindered the ability to draw robust conclusions on the effectiveness of the solution.
- Lack of tourist feedback: No responses were received from tourists through the feedback forms distributed as part of the experiment. This limited the ability to qualitatively assess user perceptions of the nudging materials and understand behavioural responses from the target audience.

Lessons learnt and recommendations

The NUDG solution offers critical insights into the opportunities and limitations of applying behavioural instruments to drive local adaptation.

Lessons Learnt

- **Behavioural change interventions require multi-level collaboration.** The success of the nudging experiment depended not only on the design and deployment of persuasive materials, but also on the active engagement of hotel managers and staff. Their buy-in was essential for the correct placement of the nudging materials, communication with guests, and provision of feedback during the experiment.
- **Behavioural data must be triangulated with qualitative inputs.** While the digital shower sensors provided valuable insights into water usage patterns, interpretation of results required qualitative data. Feedback forms and hotel manager reports helped contextualise the findings, especially in explaining anomalies or differences between hotels.
- **Behaviour change is highly context-specific.** The experiment revealed significant variation across hotels in both guest responses and operational conditions. The observed reduction in shower time in one hotel was not generalisable to all participating sites, suggesting that behavioural nudging effects are contingent on hotel culture, guest profiles, and how messages are presented.
- **Operational integration is key to experimentation.** The smooth rollout of the nudging kit and sensor installation required coordination with hotel schedules and workflows. The timing of interventions and clarity of instructions were critical for hotel managers to support the process without disruption to guest experience.
- **Public perception of water use differs regionally.** Preliminary findings indicated that average shower times in Guadeloupe are significantly shorter than the European average. This affected baseline data and may have reduced the headroom for measurable impact. Understanding regional norms is thus vital when designing behavioural interventions.

Recommendations

- **Tailor behavioural experiments to local contexts and user habits**. Design nudging materials based on local behavioural baselines and hotel profiles. Use culturally relevant messages and adapt placement strategies accordingly.
- **Ensure the participation of frontline actors from the outset**. Engage hotel managers and staff in co-design and implementation processes. Their insights help refine the intervention and increase ownership.
- **Combine quantitative monitoring with qualitative methods**. Continue to use sensor data but pair it with structured interviews and feedback mechanisms to deepen understanding of behavioural drivers and barriers.
- **Allocate dedicated time and resources for hotel liaison**. Maintaining frequent and clear communication with participating hotels improves adherence to experimental protocols and provides valuable feedback loops.
- **Manage expectations regarding behaviour change impact**. Behavioural experiments often yield modest results in the short term. Results should be framed as exploratory or indicative, particularly when baselines are already low.
- **Ensure a local presence or coordination partner on the ground.** Remote implementation from abroad limited the ability to troubleshoot, adapt materials in real time, and maintain consistent

engagement with hotel managers. Future interventions should include locally based support to facilitate smoother operations and relationship-building.

- **Anchor behavioural interventions within an institutional or regulatory framework**. The absence of a formal mechanism for uptake or replication limited the scaling potential of the solution. Embedding such interventions in local tourism, water conservation, or sustainability strategies can improve continuity and mainstream behavioural tools.

2.2.2 Citizen App Engagement

Key achievements and successes

The Citizen App in Egaleo succeeded in linking real-time climate data with citizen feedback to foster environmental awareness and municipal responsiveness. While still at an early stage of deployment, it already demonstrated strong engagement potential and institutional relevance.

- The app was designed with three key functions: real-time data display, feedback collection, and climate notifications. It pulls data from local smart climate stations, includes citizen questionnaires, and issues alerts for climate-related events.
- Municipality leadership ensured the app’s development and deployment. Egaleo’s Department of Planning and Environment oversaw the process and contracted external developers to build the app, demonstrating local institutional commitment.
- Educational tools were integrated in response to community demand. Following teacher feedback, the municipality incorporated real-time climate data from the app into classroom activities, including a datathon initiative designed to boost youth engagement.
- The app enabled feedback loops between citizens and the municipality. Citizens could report their level of climate awareness and receive updates through a user-friendly interface, contributing to a more informed public and a responsive local administration.
- The app contributed to a broader behavioural ecosystem. It was designed to interface with other TransformAr solutions, including the awareness-raising curriculum and the Climate Innovation Hub, strengthening cross-solution learning and integration

Key challenges and failures

Some limitations surfaced in the implementation of the CAE solution that may constrain future development without targeted support.

- No immediate uptake strategy beyond the TransformAr timeline was defined. Although continuation was mentioned as a goal, there was no confirmed operational plan or funding framework for sustained municipal use.
- Technical compatibility across platforms and systems was identified as a future requirement. While envisioned, multi-platform support and API integration have not yet been implemented, which may limit broader usability or replication.

Lessons learnt and recommendations

Lessons Learnt

The deployment of the citizen app in Egaleo offers early but clear insights on what supports or hinders the operationalisation of digital engagement tools in local climate adaptation:

- **Embedding climate tools within municipal departments builds ownership**. Egaleo's leadership in developing and maintaining the app ensured alignment with local priorities and enabled integration into school curricula.
- **Real-time environmental data can drive engagement when paired with educational or participatory components**. Teacher interest in climate datasets catalysed the inclusion of datathons and exercises using app data.
- **Early alignment on technical integration needs is essential.** The absence of platform compatibility and API development at launch limited opportunities for cross-platform replication or integration.
- **Digital solutions developed under EU-funded projects often risk discontinuity.** Without dedicated follow-up financing, even promising tools can remain pilot-bound.

Recommendations

To ensure the sustainability and scalability of the CAE solution in Egaleo and beyond, the following actions are recommended:

- **Secure follow-up funding streams before project closure.** Planning for maintenance and development post-TransformAr should be integrated into final project phases.
- **Develop a local uptake strategy tied to operational budgets.** A clearly defined plan for incorporating the app into municipal services would help institutionalise the tool.
- **Advance interoperability through early technical design.** Future iterations should prioritise API development and multi-platform access to maximise user reach and potential replication.
- **Use the app to reinforce broader climate education efforts.** Embedding digital feedback tools in classroom programmes, similar to the datathon, should be expanded and systematised.

2.2.3 Awareness-raising modules

Key achievements and successes

The AWAR solution successfully introduced climate change education into the Egaleo school system. The curriculum engaged both students and educators, using locally adapted content to build awareness and promote behavioural change.

- The curriculum was delivered through a series of structured modules to high school students. Sessions were held in local schools, targeting 16–18-year-olds with interactive, workshop-style climate education.
- The solution was integrated with other TransformAr components. The curriculum was linked to local digital tools such as the Citizen App and the Climate Innovation Hub, reinforcing learning through multiple channels.

- The programme was well received by participating schools and students. Schools engaged with enthusiasm, and student interest led to active involvement in associated activities such as the climate data-based datathon.
- Municipal support facilitated effective delivery. The Department of Planning and Environment coordinated the intervention, strengthening institutional ownership and ensuring alignment with Egaleo's sustainability objectives.

Key challenges and failures

Despite strong participation, several challenges were noted related to the design and sustainability of the awareness-raising modules.

- Curriculum content required further pedagogical refinement. Stakeholders highlighted the need for more age-adapted and interactive materials to better engage diverse student groups.

Lessons learnt and recommendations

Lessons Learnt

The experience of delivering climate education in Egaleo highlighted important lessons for institutionalising awareness-raising in schools:

- **Local leadership enhances reach and relevance.** The involvement of Egaleo's Department of Planning and Environment helped align the modules with the city's broader climate initiatives.
- **Schools are willing partners in awareness efforts when supported with structured content.** Enthusiastic participation showed that demand for climate education exists at the local level.
- **Curriculum design must be tailored to student age and learning needs.** The need for support from pedagogical experts and age-specific adaptation of materials was clearly identified.
- **EU funding can catalyse pilots, but institutional buy-in is needed for continuity.** Without formal integration into the school system or municipal planning, initiatives remain at risk of ending with the project cycle.

Recommendations

Building on these lessons, the following actions are recommended to strengthen awareness-raising modules in future contexts:

- **Engage educational specialists in curriculum development.** Partnering with pedagogical experts will help ensure age-appropriate content and learning formats.
- **Align climate modules with official school curricula and standards.** This will increase the likelihood of institutional uptake and long-term adoption.
- **Secure municipal or regional funding for continuation.** Allocating budget lines within the education or environment departments can sustain the initiative beyond the pilot phase.
- **Leverage digital tools and cross-solution integration.** Connecting classroom modules to tools like climate apps or innovation hubs can reinforce learning and increase student engagement.

2.2.4 Crowdsourcing Citizen App

Key achievements and successes

The CAF solution enabled residents to participate in climate-related monitoring and reporting, offering municipalities a low-cost way to engage the public while improving situational awareness.

- The app was launched to enable citizen reporting on stormwater and flooding issues. Through photos and text inputs, residents could submit localised observations that helped identify vulnerabilities and inform responses.
- Workshops and school collaborations supported early uptake. In Lappeenranta, the rollout included engagement with local schools and workshops with consortium members, supporting awareness and familiarity with the tool.
- Municipal departments used the app to strengthen inter-service coordination. Inside Lappeenranta's city organisation, the app helped connect various departments around a shared tool for community engagement and data collection.
- In Gjovik, off-the-shelf solutions were tested to enable low-cost replication. The replicator team customised a simplified version of the app to match local needs and validated the concept through initial community use.
- There was demonstrated citizen demand for such digital engagement tools. In Gjovik, interviews noted a clear willingness among residents to contribute and a municipal interest in maintaining the solution beyond the project.

Key challenges and failures

The experience of implementing and replicating CAF exposed several technical and organisational hurdles, particularly in terms of long-term sustainability.

- Stakeholder engagement in app design was limited. In Lappeenranta, more extensive co-design with different user groups could have improved usability and expanded relevance.
- Municipalities lacked long-term plans for updating or managing the app. Interviewees confirmed that the app had no operational strategy for integration into municipal workflows after the TransformAr project.
- Replication required local adaptation. While Gjovik demonstrated technical feasibility, the app had to be tailored to the city's digital ecosystem and governance structure, limiting direct transferability.

Lessons learnt and recommendations

Lessons Learnt

The experience in Lappeenranta and Gjovik highlights how digital engagement tools like CAF can empower citizens and inform municipal action, while also revealing the operational and contextual conditions needed for lasting success.

- **Digital engagement works best when paired with education and outreach.** Collaborating with schools and hosting workshops helped normalise app use and built trust among residents.

- **Low-cost replication is feasible but requires local adaptation.** Gjovik's experience shows that simplified versions of digital tools can be successfully implemented in smaller municipalities.
- **Cross-departmental coordination improves municipal uptake.** When internal teams align around a shared solution, digital tools are more likely to be retained and mainstreamed.
- **Tools must be developed with a long-term vision in mind.** Without post-project funding and institutional support, promising pilots risk remaining short-lived experiments.
- **Citizen science enhances engagement and data collection.** The app helped residents contribute data on local stormwater conditions, demonstrating the value of participatory monitoring and the appetite for involvement in climate action.

Recommendations

For CAF and similar digital tools to deliver lasting impact, municipalities and project teams should consider the following:

- **Hands-on activities increase the relevance of environmental data.** In Lappeenranta, students used water test kits to collect samples and upload results via the app, reinforcing learning and giving local meaning to the data.
- **Early user feedback contributes to solution refinement.** A test phase in Lappeenranta generated suggestions for improvements, such as adding swimming water quality data, which showed how iterative design could enhance the tool's relevance.
- **Municipal interest increases when the app supports existing workflows.** In both cities, internal coordination improved where the tool helped visualise or report issues relevant to stormwater or infrastructure maintenance.
- **Low-cost replication is viable but must be locally adapted.** Gjovik validated the technical feasibility of simplified versions but required adjustments to fit local platforms and administrative structures.
- **Digital tools are strengthened when linked to physical or social engagement.** Complementary activities, such as open days and school partnerships, expanded visibility and reinforced the tool's value for awareness and community building.

2.3 Governance Schemes

In order to accelerate action to adapt to the consequences of climate change at regional and local level, novel governance solutions are essential. The TransformAr project has demonstrated four governance solutions for adaptation, each aiming to resolve multiple governance challenges.

Table 3 Governance Schemes Solutions

Solution name	Acronym	Description	Demonstrator
Demand analysis for social services / infrastructure	DSI	Demand analysis for social services and infrastructure to understand how demand for social services may shift as the impacts of climate change are felt	Egaleo, Greece
Climate Innovation Hub	CIH	Physical meeting space exhibiting solutions to climate change adaptation and offering a space for collaboration, raising awareness and events such as hackathons and Green Open Days	Egaleo, Greece
Resilience Index	RI	Comprehensive assessment of climate adaptation needs for the mussel aquaculture sector, using modelling to input information about risks, climate change scenarios, etc., to give valuable insights helping decision makers in both the productive and political sectors to make informed decisions about governance and policy formulation	Galicia, Spain
Coastal Contracts	COAST	Managing coastal wetlands more effectively by overcoming the fragmentation of local governance through collaborative decision-making and centralised climate data monitoring	Oristano, Italy

For more information about these solutions, please refer to Deliverable D4.2 developed under the TransformAr project.[4]

2.3.1 Demand analysis for social services / infrastructure

The DSI solution offered a forward-looking tool for anticipating how climate change may alter the demand for local health and social services in Egaleo.

Key achievements and successes

DSI laid the groundwork for evidence-based planning in a highly climate-vulnerable urban context.

- DSI was designed to support adaptation strategy development based on real data. It contributed to defining heatwave response plans, such as creating special accommodation areas for vulnerable groups.
- A forecasting framework was developed to anticipate shifts in social service demand. This aimed to ensure continued access to municipal services under intensifying heatwaves and climate-related disruptions.

[4] Available here: https://transformar.eu/storage/2024/11/TA-D4.2-Learning-story-on-Governance-schemes.pdf

- The solution complemented other municipal digital infrastructure. DSI was integrated into the broader TransformAr ecosystem in Egaleo, linking to climate monitoring via Smart Climate Stations and engagement tools such as the Citizen App.
- The demand model provided direct input for Egaleo’s action planning. The methodology helped assess both the current and future capacity needs of municipal support services, contributing to the definition of longer-term adaptation pathways.

Key challenges and failures

Despite its strategic potential, the DSI solution faced challenges related to data availability, institutional integration, and long-term application.

- There were limitations in available local datasets. Incomplete or fragmented data on service use and climate vulnerability constrained the precision of forecasts.
- Institutional roles for applying the tool were not clearly defined. While technically sound, the integration of the DSI methodology into Egaleo’s regular planning processes remained incomplete.
- The solution’s impact was largely indirect and still in development. Stakeholders viewed DSI as a supportive tool for the adaptation strategy but not yet as an operational mechanism used day-to-day.

Lessons learnt and recommendations

Lessons Learnt

The development and early testing of the DSI solution surfaced several important lessons about integrating forward-looking service planning into local adaptation strategies:

- **Climate adaptation requires proactive planning for evolving service demands.** The DSI tool helped clarify how extreme weather might alter the pressure on municipal health and social care systems.
- **Strategic planning tools need institutional anchoring to become operational.** Without clear ownership and allocation of responsibilities, technical tools may remain underutilised.
- **Digital integration increases the value of data-driven planning.** Linking DSI with other monitoring and citizen engagement platforms improved its potential for informing cross-sectoral strategies.
- **Data availability and accessibility remain foundational to effective analysis.** Investment in reliable and interoperable local data systems is a prerequisite for forecasting demand with sufficient accuracy.

Recommendations

To unlock the full potential of demand-based planning for climate adaptation, the following steps are recommended:

- **Ensure municipal ownership of forecasting methodologies.** Assign dedicated departments to manage, update, and apply DSI tools regularly in service planning.
- **Invest in improving the quality and interoperability of local datasets.** Data gaps should be addressed systematically through interdepartmental coordination or external partnerships.
- **Embed DSI outputs into policy cycles.** Forecasting results should be used to inform budget planning, staffing decisions, and emergency preparedness protocols.

- **Build capacity across departments to interpret and use forecast data.** Training programmes will be needed to help municipal staff translate forecasts into actionable service modifications.

2.3.2 Climate Innovation Hub

Key achievements and successes

The Climate Innovation Hub established a dedicated space for climate dialogue, education, and experimentation within the Municipality of Egaleo. Below are presented some of the main achievements of the solution:

- The hub was installed within an existing municipal building. This enabled cost-effective setup while ensuring accessibility for community members and institutions.
- It combined static and interactive components to engage different audiences. The CIH featured a permanent exhibition on the municipality's climate strategy alongside a digital space with live environmental data displays from Smart Climate Stations.
- It supported events that fostered innovation and collaboration. Initiatives like the Open Green Day, hackathons, and community workshops brought together students, entrepreneurs, and civil society to co-create local adaptation ideas.
- The CIH served as a local knowledge and education platform. Through real-time data visualisation and interactive tools, it strengthened awareness of climate risks and actions among the local population.
- It was designed for continuity beyond the project. Municipal staff expressed intentions to maintain the CIH as a long-term public asset for climate dialogue and learning.
- Municipal leadership played a central role in implementation. The Department of Planning and Environment coordinated its development and ensured integration with other TransformAr solutions like the Citizen App and Smart Climate Stations.

Key challenges and failures

While the CIH was successful in its setup and early operations, several issues may affect its institutionalisation and long-term impact.

- Its educational and outreach activities remained limited in scope. While successful events were held, the CIH lacked a long-term partnership strategy with schools or NGOs to ensure regular, diversified use.
- Its influence on municipal policymaking remained indirect. At the time of reporting, there was no evidence that CIH-generated insights or events had informed policy decisions or adaptation planning processes.

Lessons learnt and recommendations

Lessons Learnt

The CIH in Egaleo provided valuable insights on how innovation spaces can serve as connectors across citizens, institutions, and climate strategies.

- **Strategic use of existing public infrastructure can reduce setup costs and enhance access.** The decision to host the CIH in a municipal facility made it visible and approachable for the community.
- **Multi-purpose spaces are more likely to remain relevant.** By combining exhibitions, events, data displays, and workshops, the CIH maintained cross-sectoral interest and created touchpoints with other TransformAr tools.
- **Strong local leadership is essential for successful implementation.** Engagement by municipal staff helped align the hub's activities with the city's broader governance and education efforts.
- **Formal roles and resources are prerequisites for long-term sustainability.** Without budget lines and operational responsibilities, innovation hubs may lose momentum post-funding.

Recommendations

To support long-term effectiveness and institutional anchoring of innovation spaces like the CIH, the following actions are recommended:

- **Incorporate innovation hubs into municipal governance frameworks.** Define ownership, staffing, and programme goals in local strategies and organisational charts.
- **Secure diversified funding sources**. Pursue local or regional budget lines, partnerships, or co-financing arrangements to support maintenance and operations.
- **Develop structured outreach and engagement plans**. Build lasting collaborations with schools, civil society, and SMEs to ensure the space remains active and community-driven.
- **Monitor and evaluate hub activities**. Documenting participation, learning outcomes, and collaborative outputs can help justify continued investment and attract future partners.

2.3.3 Resilience Index

RI provided a practical, stakeholder-informed framework for assessing the adaptive capacity of Galicia's mussel aquaculture sector. It translated complex climate risk data into actionable insights for public and private decision-makers.

Key achievements and successes

- The RI provided a comprehensive framework for measuring adaptive capacity. Based on a composite index methodology, it aggregated 20 resilience factors grouped under five dimensions: Governance, R&D and Innovation, Risk Management, Collaboration, and Operational Environment.
- The methodology was co-created through a Delphi consultation process. Experts and stakeholders participated in two structured rounds to identify, weigh, and validate climate risks and resilience components, ensuring scientific rigour and sectoral relevance.
- The process informed a strategic roadmap with 24 proposed actions. These actions, prioritised during a multi-stakeholder workshop held on 24 May 2024, addressed six key resilience priorities including flexibility, innovation, and emergency preparedness.
- The RI raised awareness and fostered collaboration across the value chain. It strengthened understanding of climate risks and created a shared baseline among academia, industry, and policymakers under the Quintuple Helix mode.
- The tool is replicable across sectors and contexts. While tailored to mussel aquaculture, the methodology was adapted from a prior model and proved suitable for transfer to other value chains facing climate risks.

Key challenges and failures

Despite its success in engagement and planning, the development and deployment of the RI surfaced several challenges linked to data, operationalisation, and long-term viability.

- Fragmented datasets required intensive harmonisation. The aquaculture sector lacked fully consolidated environmental and operational data, making indicator construction resource-intensive.
- Analytical complexity limited independent application. The use of composite indices and scenario modelling required technical capacity in indicator design and facilitation, which could pose a barrier for replication without support.
- Sustainability beyond the pilot phase is not guaranteed. Continued use of the RI depends on clear institutional anchoring, dedicated data governance, and recurring stakeholder engagement, none of which were yet formalised.

Lessons learnt and recommendations

Lessons Learnt

The RI demonstrated how composite indicators can make complex climate challenges tangible and actionable, if developed collaboratively and grounded in local realities.

- **Co-creation enhances legitimacy and buy-in.** The participatory Delphi process fostered ownership, credibility, and sectoral alignment, enabling smoother adoption and application.
- **The RI facilitated strategic thinking across technical and policy levels.** Its structure supported the translation of abstract climate risks into concrete areas for planning and investment.
- **Visual and accessible communication supported broad engagement.** Clear data visualisation allowed both technical and non-technical stakeholders to understand and act on results.
- **Trust and facilitation were crucial to implementation.** The strong relationship between UVigo/CETMAR and the mussel producers enabled data sharing and stakeholder participation throughout the process.
- **Engagement must be paced to avoid fatigue.** While participation was positive, repeated consultation without adequate spacing or clarity can overburden stakeholders.

Recommendations

To maintain momentum and ensure replicability of the RI, the following steps are recommended:

- **Assign responsibility for tool maintenance and updates.** A designated institution should oversee periodic data integration, methodological review, and engagement cycles.
- **Improve data interoperability and access.** Establishing formal data-sharing protocols across government, research, and producers will reduce preparation time and enhance indicator reliability.
- **Translate index outputs into formal strategies and policies.** Use the RI to inform sectoral development plans, regional adaptation strategies, and targeted funding mechanisms.
- **Support replication with clear documentation and facilitation.** Guidance material and expert support should accompany the tool when applied to new value chains or territories.

- **Design stakeholder engagement plans that balance depth with pacing.** Clarify expectations from the outset and avoid overloading participants with overlapping requests or timelines

2.3.4 Coastal Contracts

Key achievements and successes

The Coastal Contract in Oristano represents an ambitious and inclusive governance model designed to overcome fragmentation in wetland management and build cross-sectoral cooperation for climate adaptation.

- The Coastal Contract is a voluntary governance agreement signed in 2021. It brought together 14 signatories—including municipalities, regional and provincial authorities, and stakeholders from fisheries, tourism, and agriculture—to coordinate wetland conservation and climate resilience strategies.
- The initiative was shaped through a highly participatory process. Between 2019 and 2021, MEDSEA Foundation led a three-year dialogue process that involved bilateral and plenary meetings, integrating input from public, private, and civil society actors.
- The contract produced an Action Plan structured around seven strategic axes. These include biodiversity protection, governance, green economy, and communication. Fifty actions were prioritised, with 50% already funded and entering implementation, and 50% requesting new funds for the implementation in the medium term.
- A Local Wetland Observatory (LWO) was established to support evidence-based decisions. The LWO consolidates scientific and environmental monitoring to align wetland management with ecological needs.
- The contract increased local awareness and community participation. Forty public meetings across the region helped raise visibility, build trust, and stimulate local ownership of wetland conservation and adaptation initiatives

Key challenges and failures

While COAST has demonstrated success as a collaborative governance model, several practical and strategic challenges emerged during implementation.

- Fragmented institutional responsibilities posed initial barriers. Wetland management in Oristano was historically spread across different levels of government, making coordination complex and time-consuming.
- Private sector integration remained limited. Despite efforts, more consistent involvement from private stakeholders such as tourism operators or fisheries was identified as necessary for long-term sustainability.
- Clear long-term financing mechanisms were not yet secured. Half of the actions in the Action Plan still require funding, and a strategy for institutionalising the governance structure post-project remains under development.

Lessons learnt and recommendations

Lessons Learnt

The Coastal Contract demonstrates how collaborative governance can align local adaptation needs with regional strategies, provided that engagement, facilitation, and scientific input are sustained over time.

- **A clearly facilitated participatory process is essential for legitimacy**. MEDSEA's coordination helped establish trust, ensure inclusive consultation, and maintain stakeholder alignment over three years.
- **Multi-level governance can bridge policy gaps.** The inclusion of regional, provincial, and municipal actors enabled vertical coherence and created a stronger foundation for coordinated adaptation action.
- **Scientific backing increases policy credibility.** The LWO has enhanced transparency and ensured that actions are grounded in robust environmental data.
- **Endorsement from political leaders accelerates traction.** Support from local mayors helped build momentum and integrate the Coastal Contract into municipal agendas.
- **Replicability depends on institutional clarity and funding.** While the methodology is sound, its successful transfer requires early definition of legal roles and sustained access to resources.
- **Time and continuity were essential to legitimacy and alignment**. The participatory process spanned several years, allowing space for trust-building, political endorsement, and the gradual convergence of interests.
- **Funding needs to be secured beforehand to maximise implementation and impact**. While 50% of actions in the Action Plan are already funded, the remaining half still require financing in the medium term. This underlines the importance of identifying and confirming funding sources early to ensure momentum and avoid delays in execution.

Recommendations

To strengthen and scale the Coastal Contract approach, the following actions are recommended:

- **Ensure long-term funding pathways**. Diversify funding sources—including EU, regional, and private contributions—to implement the remaining 50% of the Action Plan.
- **Formally embed the governance model within regional policies**. Recognising the Coastal Contract in Sardinia's legal or planning frameworks would enhance its institutional sustainability.
- **Invest in continued facilitation and stakeholder coordination.** A dedicated coordinator or secretariat is essential to maintain dialogue, monitor progress, and align interests.
- **Strengthen private sector engagement.** Develop specific outreach and incentive strategies for businesses in fisheries, agriculture, and tourism to support and benefit from wetland conservation.
- **Document and disseminate the model**. Produce replication guidelines for other wetland areas, focusing on legal setup, data integration, and stakeholder governance structures.

2.4 Nature-Based Solutions

Nature-based solutions harness the natural processes of ecosystems to address environmental, social, and economic challenges. The TransformAr project demonstrated the effectiveness of several nature-based solutions.

Table 4 Nature-Bases Solutions

Solution name	Acronym	Description	Demonstrator
Smart Grid and Gates	SG	Installing of Smart Gates that can open and close to establish the right conditions in the wetlands	Oristano, Italy
Nature-based solutions	NBS	Use of nature-based solutions such as leaky dams, ponds, scrapes, bunds and check dams	West-Country Region, UK
Urban runoff system	URB	Installation of biofiltration areas designed to filter stormwater runoff	Lappeenranta, Finland

For more information about these solutions, please refer to Deliverable D4.3 developed under the TransformAr project.[5]

2.4.1 Smart Grid and Gates

Key achievements and successes

The SG system introduced a cutting-edge approach to adaptive water management in the wetland areas of Oristano. It combined nature-based objectives with real-time control technologies to enhance wetland resilience and biodiversity.

- The SG system was implemented as part of a broader nature-based approach to wetland management. It aimed to improve water quality, regulate flooding, and restore ecosystem balance by enabling precise control over water levels in key wetland areas .
- Real-time sensors and automated water gates were installed at wetland inlets and outlets. These allow dynamic adjustment of water flow based on environmental conditions, such as salinity, dissolved oxygen, and water levels .
- The SG system supports climate resilience through adaptive management. By enabling fine-scale control of water inputs and outputs, it allows the ecosystem to respond more flexibly to the impacts of extreme weather events such as heavy rains or droughts .
- The monitoring system was integrated with the Local Wetland Observatory (LWO). This facilitated the collection, analysis, and dissemination of environmental data for decision-making and stakeholder awareness.
- The system contributed to key environmental improvements. These include enhanced biodiversity conditions, reduced flood risks, and improved water quality by maintaining optimal wetland hydrology.

[5] Available here: https://transformar.eu/storage/2024/11/TA-D4.3-Learning-story-on-NBS-and-Book-of-NBS.pdf

Key challenges and failures

While technically advanced, the SG solution revealed several implementation and operational challenges that could affect its long-term performance.

- Maintenance and operation require ongoing funding and expertise. Although initial installation was successful, the system's continued functioning depends on municipal capacity to operate, monitor, and maintain the equipment over time.
- The tool is still considered experimental by some stakeholders. At the time of reporting, the SG system was functional but had not yet been fully integrated into municipal routines or broader territorial planning processes.

Lessons learnt and recommendations

Lessons Learnt

The deployment of the Smart Grid and Gates in Oristano offers valuable lessons on aligning nature-based and technological approaches for wetland adaptation.

- **Digital tools can enhance the effectiveness of nature-based interventions**. The SG system demonstrated how smart infrastructure can help stabilise fragile ecosystems by maintaining hydrological balance in real time.
- **Successful deployment requires active institutional coordination.** The project benefited from strong leadership by the municipality and the MEDSEA Foundation, which ensured inter-institutional alignment.
- **Early integration into governance structures is key.** Without institutional anchoring in planning or budget frameworks, there is a risk of the tool remaining isolated or underused.
- **Monitoring and transparency improve public confidence**. Linking the SG to the LWO provided visibility and accountability, helping to justify decisions and foster public trust.

Recommendations

To strengthen the operational sustainability and replicability of the SG system, the following actions are recommended:

- **Institutionalise the SG system within local and regional planning frameworks**. Its continued relevance depends on formal recognition in policy, urban planning, and adaptation strategies.
- **Establish a clear operational protocol for maintenance and data use**. Roles and responsibilities should be defined for sensor maintenance, data validation, and action response.
- **Secure recurring financial resources for upkeep**. Budget allocations at municipal or regional level, or through resilience-focused grants, are necessary to ensure the long-term functioning of the infrastructure.
- **Leverage the LWO for adaptive management**. Use the observatory not only for data collection but also to guide real-time interventions and support participatory decision-making .
- **Promote replication through documentation and training**. Share technical guidelines and operational lessons with other coastal or wetland municipalities facing similar hydrological challenges.

2.4.2 Nature-based solutions

Key achievements and successes

The NBS demonstration in South West England successfully tackled agricultural diffuse pollution and habitat loss through the implementation of riparian buffers, floodplain wetlands, and financial innovation. It combined ecological restoration with stakeholder engagement and governance innovation.

- Riparian buffers and floodplain wetlands were implemented to reduce runoff and improve ecosystem connectivity. These interventions filter pollutants from agricultural runoff and help restore biodiversity along key watercourses.
- Citizen science programmes mobilised the public in monitoring water quality and biodiversity. These initiatives contributed both environmental data and community awareness, reinforcing local stewardship.
- The WRT's facilitation helped align diverse stakeholder interests. Farmers, regulators, and NGOs collaborated in a coordinated, locally grounded governance process.
- The NBS model addressed multiple climate risks simultaneously. It contributed to water quality improvement, flood regulation, and biodiversity restoration, while enhancing the region’s resilience to both drought and heavy rainfall.
- The initiative leveraged existing UK policies on nutrient neutrality and biodiversity. The demonstration aligned with national frameworks like the UK Climate Change Act and the National Adaptation Programme, enabling regulatory relevance.

Key challenges and failures

Despite its innovations, the NBS approach faced several operational and institutional limitations.

- Data management posed a challenge. The integration of citizen science and professional monitoring raised questions about data consistency, requiring validation protocols and data harmonisation systems.

Lessons learnt and recommendations

Lessons Learnt

The WRT case illustrates how nature-based approaches can deliver high-impact, multi-benefit results—if supported by coordination, funding, and governance alignment.

- **Engaged facilitation is critical to success.** The leadership of WRT in convening diverse stakeholders, mediating priorities, and delivering technical solutions was essential to overcome inertia and build commitment.
- **Community-based monitoring reinforces both science and legitimacy**. Citizen science enriched the data ecosystem and improved local awareness, though it required complementary training and quality control measures.
- **Simple, low-barrier schemes boost landowner engagement**. Administrative simplicity and clarity in benefits were key factors in attracting farmers and land managers to NBS agreements.
- **Models must be context-specific but replicable.** The WRT experience is highly adaptable, but requires tailoring to local regulatory, hydrological, and land ownership conditions.

Recommendations

To scale and embed nature-based approaches in agricultural and riparian zones, the following are recommended:

- **Secure long-term financing through blended models.** Combine public subsidies, private offsets, and co-financing agreements to maintain NBS functionality over time.
- **Establish data validation protocols for mixed-source monitoring**. Ensure citizen science complements professional datasets through training, calibration, and digital platforms.
- **Develop and disseminate NBS facilitation toolkits**. Codify WRT's methods, contracts, and governance templates to support replication in other regions.
- **Keep schemes landowner-friendly.** Prioritise simplicity, technical support, and low transaction costs to ensure ongoing farmer participation and buy-in.

2.4.3 Urban runoff system

Key achievements and successes

The URB system in Lappeenranta introduced nature-based infrastructure to filter and manage stormwater in urban areas. It contributed to flood risk reduction, water quality improvement, and municipal learning on NbS planning and maintenance.

- Biofiltration areas were installed to manage stormwater runoff. These vegetated areas were designed to filter pollutants and control water flows in areas at risk of urban flooding.
- The design was tailored to local ground conditions. Planners adapted the system to Lappeenranta's sandy soils, allowing water to infiltrate more easily and reducing the need for complex substructures.
- The filter media was designed with a 30-year lifespan. This technical consideration reflected a long-term view of sustainability and maintenance planning.
- The project improved coordination across city departments. Teams from environmental planning, stormwater, and maintenance collaborated on implementation, boosting cross-sectoral integration.
- The solution contributed to broader city-level climate resilience objectives. It was part of a package of TransformAr interventions focused on reducing the impacts of extreme rainfall and runoff in urban zones.

Key challenges and failures

Despite successful implementation, the URB solution revealed several institutional and operational challenges that should be addressed in future scaling.

- Initial scepticism from the maintenance department slowed implementation. Concerns about long-term upkeep and unfamiliarity with NbS design created resistance among municipal services.
- Expertise was critical for system design. The biofiltration zones were planned by specialists with NbS experience, and without such technical capacity, similar projects may face delays or suboptimal outcomes.
- Replication depends on spatial feasibility. Identifying urban zones with both suitable soils and adequate space is essential to replicate the solution effectively.

Lessons learnt and recommendations

Lessons Learnt

URB solution demonstrated how targeted NbS can be integrated into city infrastructure planning, but it also highlighted conditions necessary for successful uptake.

- **Early engagement with maintenance services builds trust and buy-in.** Initial resistance was addressed through dialogue and demonstration, underscoring the importance of involving all city units from the start.
- **Long-term performance requires upfront technical planning**. The 30-year filter design showed that investing in quality at the start reduces uncertainty about system durability.
- **Soil and hydrological conditions must guide design choices**. Local knowledge of ground conditions ensured efficient implementation and performance.
- **Municipal capacity in NbS design is still limited.** Specialist input was key to delivery, suggesting that capacity building in public administrations remains a priority.

Recommendations

To enhance the scalability and institutionalisation of urban NbS like the Lappeenranta Urban Runoff System, the following are recommended:

- **Secure municipal budget lines for post-project maintenance**. Avoiding full dependence on project funds will support system longevity.
- **Include maintenance staff from the early design phase.** This fosters ownership, reduces resistance, and ensures design choices are compatible with operational workflows and long-term maintenance capacity.
- **Invest in in-house technical capacity**. Building municipal expertise in NbS planning will reduce reliance on external consultants and speed up replication.
- **Use spatial analysis to identify suitable replication zones.** Soil type, drainage potential, and surface area must be factored into site selection.
- **Standardise design templates for low-risk replication.** Documenting design and maintenance protocols can support other cities with similar challenges to adopt the model.

2.5 Digital & Technological Solutions

Accelerating and scaling transformational adaptation can be achieved in part through innovative technological and digital solutions. Several digital solutions were demonstrated during the TransformAr project.

Table 5 Digital & Technological Solutions

Solution name	Acronym	Description	Demonstrator
Smart Climate Stations	SCS	Installation of 21 smart climate stations on public buildings to monitor the microclimate and identify heat hotspots and heat islands	Egaleo, Greece
Mussel-Raft Monitoring	MRM	Sensorising mussel rafts to provide real-time data on mussel health and environmental conditions	Galicia, Spain
Intertidal Monitoring	INTERM	Monitoring system tracking sediment dynamics and environmental conditions in real-time, using predictive models to foresee risks and protect shellfish habitats	Galicia, Spain
Stormwater Monitoring / Modular System	SWMM / SWM	Installation of sensors in the water pipe and drainage system to monitor stormwater quality, flow and volume in real time	Lappeenranta, Finland and Gjovik, Norway
Integrated Constructed Wetlands Monitoring	ICWM	This solution was replaced by Nature-Based Solutions.	West Country Region, UK

For more information about these solutions, please refer to Deliverable D4.4 developed under the TransformAr project.[6]

2.5.1 Smart Climate Stations

Key achievements and successes

The SCS solution enhanced Egaleo's capacity to monitor and respond to climate risks at the neighbourhood level. It enabled municipal staff to access detailed environmental data to better target adaptation actions, particularly in response to the urban heat island effect.

- Smart climate stations were deployed across Egaleo to monitor local climate indicators. These included real-time measurements of temperature, humidity, and air quality, enabling detailed understanding of environmental variations across the city.
- The stations helped identify urban heat hotspots. This data was used by the municipality to plan interventions, such as planting green infrastructure and adapting public space usage during heatwaves.
- The system contributed to targeted adaptation planning. Through collaboration with Demokritos, the municipality gained access to an evidence base for prioritising micro-scale cooling strategies.

[6] Available here: https://transformar.eu/storage/2024/11/TA-D4.4-Learning-story-on-digital-and-technological-solutions.pdf

- Municipal officials and planners integrated SCS data into decision-making. The availability of hyper-local data influenced discussions around urban design, shading strategies, and building retrofits.
- The initiative stimulated public awareness and institutional learning. Technicians, urban planners, and community members engaged with the system as a concrete response to rising climate pressures.

Key challenges and failures

Despite these successes, the Smart Climate Stations faced several limitations during implementation, largely related to funding, institutional uptake, and long-term planning.

- Ongoing technical support will be required. Maintenance of the sensors, calibration of the system, and data management require technical capacity not yet embedded in the municipal team.

Lessons learnt and recommendations

Lessons Learnt

The implementation of the SCS in Egaleo offered clear lessons on how hyper-local digital infrastructure can enhance urban adaptation, while also underlining the prerequisites for sustainability.

- **Real-time localised data is a powerful enabler of adaptive decision-making**. Egaleo's planners used climate station data to understand the spatial variation of heat exposure across the city.
- **Community engagement increases data relevance and legitimacy**. Involving residents and local stakeholders made the data more actionable and the interventions more acceptable.
- **Cross-departmental collaboration was key to operational success.** The use of data by different city services (e.g. planning, environment, maintenance) helped integrate adaptation thinking across municipal functions.
- **Systemic uptake requires formalisation and budget commitment**. Informal use of data is a good first step, but embedding the SCS into municipal protocols will ensure its lasting impact.

Recommendations

To sustain and scale the impact of the Smart Climate Stations, the following actions are recommended:

- **Allocate municipal funding for continued operation and maintenance.** Budget lines should be created for technical upkeep and system upgrades to ensure reliability post-project.
- **Integrate SCS data into official planning tools**. Urban zoning, emergency heatwave plans, and climate risk assessments should explicitly include climate station inputs.
- **Define technical roles and responsibilities within the municipality.** Assign staff to manage, analyse, and interpret climate station data as part of their regular functions.
- **Expand the network to increase coverage and spatial precision.** Additional stations would allow more refined analysis and extend the benefits of the system to underserved neighbourhoods.
- **Continue using the SCS as a public engagement tool**. Displaying live data and building campaigns around it can reinforce public interest and behaviour change around climate risks.

2.5.2 Mussel-Raft Monitoring

Key achievements and successes

The MRM solution introduced real-time environmental data collection into Galicia's mussel aquaculture operations, supporting adaptive management and climate resilience in one of Europe's most valuable aquaculture sectors.

- Sensor technologies were installed on mussel rafts to monitor key environmental parameters. These included temperature, salinity, and oxygen levels, all of which influence mussel growth and survival.
- The monitoring system leveraged CETMAR's prior experience. The project built on existing capabilities developed in earlier initiatives, helping streamline implementation and reinforce institutional knowledge.
- The system provided a low-cost, practical tool for producers to anticipate and manage climate-related risks. Real-time data enabled more timely decisions on harvesting and site management during extreme weather events.
- One producer expressed interest in independently expanding the technology. This indicated growing trust in the solution's utility and relevance for private-sector resilience efforts.
- The intervention aligned well with sector needs and strategic regional objectives. It addressed climate vulnerabilities identified in prior analyses and complemented parallel governance initiatives such as the Resilience Index.

Key challenges and failures

While promising in its technical outcomes, the MRM solution faced logistical, financial, and institutional barriers that could affect scaling and long-term integration.

- Sensor placement and maintenance required physical access and expertise. Mussel rafts are often located in open water, which complicates frequent calibration and troubleshooting of equipment.
- There were up-front and ongoing costs for producers. Although cost-effective compared to more complex systems, the sensors still represented an investment that required justification based on risk perception and operational benefit.
- Sensor selection and durability posed technical constraints. Finding equipment capable of withstanding long-term immersion and biofouling was a core challenge.
- Stakeholder uptake depended on trust and communication. CETMAR had to engage producers repeatedly to build confidence in the system and its relevance to daily farm operations

Lessons learnt and recommendations

Lessons Learnt

The MRM solution showed that targeted digital tools can deliver substantial adaptive value for aquaculture—if designed with usability, credibility, and trust at their core.

- **Producers are more likely to adopt tools that are simple, useful, and reliable.** Low-cost, easy-to-use sensors that integrate into existing workflows were more attractive to aquaculture operators.
- **Institutional trust and technical continuity are critical.** CETMAR's reputation and prior relationships with producers enabled smoother engagement and faster deployment.

- **Real-time data empowers timely, risk-informed decisions.** Access to environmental metrics helped producers plan around extreme weather, which is increasingly essential under climate change.
- **Even simple solutions require long-term vision**. Pilots must be supported by financial and operational planning to ensure tools persist and evolve beyond the project period.

Recommendations

To scale and institutionalise sensor-based monitoring in aquaculture, the following actions are recommended:

- **Support producers with financial incentives or subsidies**. Public support for sensor purchase, installation, and maintenance will accelerate uptake.
- **Select durable and low-maintenance sensors adapted to marine environments**. Technical specifications must reflect long-term immersion and ease of calibration.
- **Ensure that data outputs are clear, actionable, and user-oriented**. Dashboards and alerts should be designed with producer input to enhance relevance and decision utility.
- **Encourage producer-led scaling**. Highlighting early adopters who expand the system themselves can inspire wider replication within the sector.
- **Anchor monitoring tools within broader adaptation strategies**. Integrating real-time data into governance tools like the Resilience Index and regional marine plans can multiply their impact and promote system-wide learning.

2.5.3 Intertidal Monitoring

Key achievements and successes

The Intertidal Monitoring (INTERM) solution introduced a scientific monitoring system to track sediment dynamics and morphological changes in Galicia’s intertidal zones, contributing to a better understanding of climate-related shoreline changes.

- The system enabled the monitoring of sediment dynamics in intertidal areas. It was designed to track morphological evolution such as erosion and sediment deposition in areas sensitive to sea-level rise and tidal changes.
- Data was managed according to FAIR principles (Findable, Accessible, Interoperable, Reusable). This approach ensured transparency, facilitated integration with other climate and marine datasets, and made results more useful for research and public policy.
- Initial datasets were generated and shared with aquaculture stakeholders. The Uvigo science team communicated findings to producers and regulators to enhance awareness of seabed and habitat dynamics.
- The system established a baseline for long-term tracking. Even though change in intertidal morphology is gradual, the collected data lays the foundation for long-term ecosystem and adaptation planning.
- The solution complemented the MRM system. While MRM provided real-time data from mussel rafts, INTERM focused on spatially broader physical parameters of the coastal environment.

Key challenges and failures

The INTERM solution delivered foundational insights, but several limitations were encountered in its implementation and application.

- Sediment changes occur slowly, requiring a long-term perspective. Detectable shifts in intertidal topography emerge over extended timescales, which can make short-term decision impacts difficult to observe.
- Initial engagement with users was limited to information sharing. Although results were communicated to aquaculture actors, the system was not yet linked to formal decision-making or operational responses.

Lessons learnt and recommendations

Lessons Learnt

INTERM showed that scientific observation of intertidal systems is essential to anticipate climate impacts but must be framed within a longer time horizon and governance pathway.

- **Baseline data is critical for understanding change in slow-evolving environments**. Even without immediate management implications, systematic monitoring prepares coastal systems for long-term adaptation.
- **Information sharing builds awareness and future demand**. Communicating findings to aquaculture producers increased their understanding of sediment dynamics and vulnerability to coastal change.
- **Complementarity across tools enhances system insight**. INTERM and MRM together provided a fuller picture of coastal dynamics—both ecological and physical—enhancing their respective value.

Recommendations

To expand the impact and replicability of the INTERM solution, the following steps are advised:

- **Institutionalise intertidal monitoring through regulatory or marine spatial plans.** Data should feed into long-term shoreline management and adaptation policies.
- **Secure long-term funding and mandate for monitoring**. The value of the system increases over time; sustained investment is necessary to realise its full benefit.
- **Continue engaging with producers and policymakers**. Translating scientific insights into accessible formats and dialogue forums will strengthen future uptake.
- **Develop guidelines for replication in other coastal systems**. Standardised protocols for data collection, sharing, and communication can help transfer the solution to other intertidal areas.

2.5.4 Stormwater Monitoring / Modular System

Key achievements and successes

The Stormwater Management System introduced in Lappeenranta combined nature-based infrastructure and digital monitoring to manage stormwater runoff and mitigate flood risks. The solution was later replicated in Gjovik, Norway, which faced similar climate hazards and urban water challenges.

- The system enabled real-time monitoring of stormwater flows. Sensors were installed in pipes and drainage infrastructure to measure water quality, volume, and movement, helping identify risks and activate timely interventions.
- Green infrastructure and digital tools worked in tandem. Biofiltration zones captured and treated runoff, while the digital system ensured operational control and early warning during extreme events.
- Cross-departmental coordination improved stormwater planning. Technical, environmental, and maintenance departments used shared data to manage urban runoff holistically.
- The system's design was technically adapted to local conditions. In Lappeenranta, sandy soils facilitated water infiltration, reducing infrastructure needs. In Gjovik, the approach was tailored to local runoff patterns and urban structure.
- A Discrete Choice Experiment in both cities demonstrated public support. Citizens in Gjovik and Lappeenranta showed willingness to invest in private stormwater measures such as rain gardens, permeable surfaces, and green walls

Key challenges and failures

While technically sound, the solution encountered several implementation challenges, particularly related to long-term sustainability and institutional embedding.

- Initial resistance from maintenance departments had to be overcome. Municipal teams were unfamiliar with NbS-integrated stormwater systems and expressed concern about upkeep and durability.
- Expert consultants played a key role in setup. In both cities, in-house capacity was limited, and technical design relied heavily on external partners.

Lessons learnt and recommendations

Lessons Learnt

The SWMM experience offers insights on adapting stormwater solutions across contexts.

- **Replication requires adjustment to physical and institutional environments.** The approach used in Lappeenranta was effectively modified for Gjovik's distinct hydrological and urban setting.
- **Public support can be a driver for uptake**. In both cities, citizens expressed high willingness to invest in local SWM solutions, validating their potential for broader adoption.
- **Municipal ownership and budget are key for sustainability.** Without internal budget and technical roles, digital tools and green infrastructure remain pilot interventions at risk of being discontinued.
- **Data-driven tools must align with decision cycles**. While the system improved technical coordination, broader integration into regulatory and spatial planning is needed to maximise impact.

Recommendations

To strengthen and scale stormwater solutions like SWMM/SWM, the following actions are advised:

- **Allocate municipal funds for ongoing operations and upgrades**. Avoid full dependence on project financing by establishing operational budgets.

- **Embed SWM into urban development and zoning codes.** Ensure that digital and NbS infrastructure are included in land use regulations and climate adaptation plans.
- **Build technical capacity in public administration**. Reduce reliance on external consultants through staff training and institutional learning.
- **Promote public participation in SWM strategies**. Use surveys, choice experiments, and participatory planning to enhance awareness and uptake.
- **Document replicable approaches and adapt locally**. Develop guidance based on Lappeenranta and Gjovik's experiences for cities with similar topography and runoff issues.
- **Need to account for each city's technological and infrastructure systems**. Tailoring solutions to fit local infrastructure is crucial to avoid bottleneck and facilitate seamless integration.

2.6 Insurance Schemes and Financial Solutions

In order to accelerate climate change adaptation actions at regional and local level, novel financial and insurance solutions are essential. In TransformAr, different financing mechanisms were tested for adopting and scaling up climate adaptation investments.

Table 6 Insurance Schemes and Financial Solutions

Solution name	Acronym	Description	Demonstrator
Adaptation Fund	AF	Local fund for adaptation, constituting a one stop shop for funding	Guadeloupe, France
Choice experiment	CEI	Discrete choice experiment to understand citizens' willingness to pay for and act on stormwater management on their own properties, providing insight to the segments of the population who are willing to pay for nature-based solutions and the trade-offs they are willing to make	Lappeenranta, Finland and Gjovik, Norway
Insurance scheme	INSUR	Strategic foresight on the landscape of insurance offers in Europe.	All demonstrators
Green Bonds	GB	This solution was not implemented.	West Country Region, UK

For more information about these solutions, please refer to Deliverable D4.5 developed under the TransformAr project.[7]

2.6.1 Adaptation Fund

Key achievements and successes

The Adaptation Fund—locally known as FLAG (Fonds Local d'Adaptation en Guadeloupe)—was one of the first climate finance mechanisms designed for a French outermost region. It achieved several milestones in institutional innovation, resource mobilisation, and practical application:

- A comprehensive baseline study was conducted to identify Guadeloupe's priority climate adaptation needs. This served as the foundation for structuring the fund around relevant local challenges, including water scarcity, sustainable agriculture, and environmental monitoring.
- The fund's design was co-developed with over 30 interviews, surveys, and workshops. This participatory approach resulted in a Technical and Financial Committee involving 15 technical and 7 financial partners, ensuring broad stakeholder ownership.
- The fund launched six pilot projects totalling €1.24 million, including initiatives for flood control (PLUVARIDE), groundwater monitoring (MétéEAU Nappes), smart agriculture (Optisystemes), agroforestry (RESAFOR), climate-resilient pig breeding (Porc Créole), and drainage governance (DRAINAGE).
- €1.015.204 in co-financing was secured from seven public and private entities. A flexible governance model enabled ADEME and the Banque des Territoires to co-finance projects under shared or

[7] Available here: https://transformar.eu/storage/2024/11/TransformAr_WP4_D4.5_Learning-stories-on-insurance-and-financial-solutions.pdf

autonomous terms, while other funders financed beneficiaries independently, following their own administrative rules and procedures.

- The project stimulated private sector engagement through business case development and innovative financing tools. SMEs accessed loans and leasing contracts after using the fund as a credibility lever, demonstrating its catalytic function.
- Strong individual leadership and local presence was key, with actors playing a crucial role in liaising between technical and local beneficiaries (e.g., supporting the beneficiaries in the proposal writing process).
- The fund's visibility was enhanced through public outreach events, including open days, which reinforced local ownership and validated the one-stop shop model among prospective applicants.

Key challenges and failures

The implementation of the Adaptation Fund encountered several institutional and operational constraints that limited its speed and scalability:

- Governance complexity and timing issues delayed implementation. The multi-funder model required separate contracts and funding procedures, which extended coordination timelines. Additionally, the launch of the call for proposals coincided with a cyclone episode and the fiscal year-end for local authorities, further limiting responsiveness and slowing the process.
- Engaging the private sector proved difficult, particularly banks. While one bank was mobilised, traditional financial institutions remained hesitant due to unfamiliarity with adaptation finance and the perceived risk associated with untested instruments.
- Broad institutional engagement was difficult to secure. Several key public institutions remained unresponsive during the fund’s development, limiting opportunities for wider institutional anchoring and alignment with existing public strategies.
- Limited engagement from the tourism sector. Despite its strategic importance in Guadeloupe, the tourism sector was underrepresented in the fund’s uptake, with only two out of fifteen preselected projects originating from this sector.
- Capacity gaps constrained effective fund management and long-term planning. The administration of the fund required technical, legal, and procedural expertise that was not readily available within local institutions, posing challenges for operational continuity and institutionalisation.

Lessons learnt and recommendations

The design and roll-out of the Adaptation Fund in Guadeloupe offer valuable lessons for future adaptation financing initiatives:

Lessons Learnt

- **Inclusive design processes help ensure local relevance and buy-in**. The participatory approach used to shape the fund aligned it with concrete adaptation needs and helped generate momentum among diverse stakeholders.
- **Flexible governance models facilitate setup but increase operational complexity**. Allowing each funder to retain its own procedures made the fund easier to launch, but resulted in significant delays,

heavier reporting requirements for beneficiaries, and multiple points of contact, complicating coordination and implementation.

- **Having a consistent local coordinator is crucial to ensure continuity and responsiveness.** The presence of a dedicated liaison improved communication, guided applicants, and helped bridge institutional and local realities.
- **Governance model slowed implementation**. The governance framework defined allowed funders to apply its own processes. Nonetheless, it led to prolonged timelines due to slow internal procedures, budget closure periods, and limited administrative capacity, particularly amongst public institutions.
- **Traditional financial actors may require more tailored engagement**. The challenges in mobilising private banks underscore the need for clearer incentive structures and better articulation of climate risk-return logic.
- **Public communication enhances trust and participation**. Outreach events helped demystify the fund for prospective beneficiaries and validated the "one-stop shop" model among local actors.

Recommendations

Clarify and strengthen governance frameworks for subsequent phases. The current model, based on multiple independent funding streams, led to delays and administrative complexity. Moving toward a single-window (basket fund) approach would simplify processes for beneficiaries and funders alike. It would require identifying a politically neutral and capable coordinating institution to manage the fund centrally.

Ensure institutional anchoring and long-term support. Embedding the fund within regional frameworks and enhancing the administrative capacity of managing entities will be essential for continuity and scaling.

Develop specific engagement strategies for private and public financial institutions. In addition to co-design workshops, tailored risk-sharing models, and demonstration effects to reduce hesitation and build trust, conduct early joint consultations with prospective public and private funders. This would help clarify each actor's expectations and constraints, allowing for the harmonization of financing requirements and ensuring that project support materials are aligned from the beginning.

Establish multi-annual agreements with co-funders. Setting up recurring funding commitments through formal conventions can help secure financial continuity for the FLAG and reduce delays linked to ad hoc budget negotiations.

Maintain strong local coordination capacity throughout implementation. Investing in personnel who are embedded in the local context supports smoother operations and stronger user engagement. Where possible, a dedicated budget line should be allocated for a local coordinator who can support project structuring and serve as a single point of contact between beneficiaries and funders.

Use communication and visibility tools to promote uptake. Clear and proactive communication can reinforce transparency, build credibility, and support future replication of the financing model. Additional efforts should be made to target underrepresented sectors, such as tourism, to ensure broader participation and alignment with local priorities.

2.6.2 Choice experiment

Key achievements and successes

The choice experiment was a successful behavioural tool to explore public preferences and willingness to invest in stormwater adaptation. The pilot provided valuable insights into how different citizen groups value climate adaptation benefits, and how they might respond to future incentive schemes.

- The survey reached a robust, representative sample of 2,013 citizens in Finland and Norway. The DCE captured variation across age, gender, income and education, offering a broad evidence base for adaptation planning.
- Clear public willingness to act and invest in private stormwater measures was demonstrated. Respondents across both countries preferred installing a measure over doing nothing, particularly when the intervention reduced flood damage risk or stormwater pollution, or improved neighbourhood aesthetics.
- Detailed willingness-to-pay (WTP) values were produced for multiple benefit levels. For example, Finnish respondents were willing to pay up to €4,820 for a 75% reduction in flood-damage risk, while Norwegian respondents valued the same benefit at €2,710.
- Critical citizen segments were identified for targeted outreach. Younger individuals, high-income households, homeowners, and those with prior flood experience were consistently more willing to invest.
- The exercise validated the usefulness of DCEs as a decision-support tool for adaptation planning. Simulating hypothetical choices allowed authorities to test behavioural responses and build an evidence base to inform stormwater fee or subsidy schemes.

Key challenges and failures

The implementation of the choice experiment also encountered methodological and contextual challenges, particularly around design complexity and replicability.

- Survey design and approval took longer than expected. Several rounds of revisions among project partners delayed deployment, underlining the importance of early alignment on content and methodology.
- High costs and maintenance needs lowered citizen acceptance. Respondents showed strong aversion to measures perceived as expensive or requiring regular upkeep, highlighting potential barriers to adoption even among supportive audiences.
- Geographical scope was limited. The experiment was conducted only in two Nordic cities, making the results context-specific and limiting direct transferability to other climatic or cultural settings.

Lessons learnt and recommendations

Lessons Learnt

The choice experiment offered valuable lessons on designing adaptive public engagement tools that can inform targeted financial strategies:

- **Inclusive behavioural experiments generate actionable insights for local adaptation finance.** DCEs help quantify how much value citizens place on different adaptation benefits and where price or maintenance barriers lie, guiding cost-sharing schemes and communication strategies.
- **Segment-specific incentives increase policy efficiency**. Knowing that younger and higher-income groups are more willing to invest allows municipalities to tailor awareness campaigns and co-financing packages.
- **Affordability must accompany awareness**. Even motivated citizens resist measures that are expensive or onerous to maintain; behavioural support must be paired with financial accessibility.
- **Replicability hinges on local calibration**. DCEs should be adapted to each city's specific hazards, housing characteristics, and socio-economic conditions to produce locally useful WTP estimates.

Recommendations

Building on the above lessons, several concrete recommendations emerge to strengthen the role of DCEs in adaptation planning:

- **Integrate choice experiments into early-stage planning**. DCEs should be embedded into the design phase of adaptation programmes to align proposed measures with public willingness and capacity to act.
- **Use results to shape incentive design.** The clear variation in willingness to invest by demographic group can inform tiered grant or rebate structures, improving cost-effectiveness and equity.
- **Pair behavioural tools with communication and support mechanisms**. Choice modelling should not stand alone—its insights should be fed into awareness campaigns and simplified application procedures.
- **Expand use beyond stormwater to other sectors**. Given their success in revealing preference structures, DCEs could be applied to energy efficiency, ecosystem restoration, or heat adaptation initiatives.

2.6.3 Insurance scheme

The TransformAr project explored the role of insurance as a financial instrument for climate adaptation across all demonstrator regions. INSUR consisted in a strategic foresight focused on analysing the landscape of insurance offerings in the context of natural disasters and climate change, rather than the implementation of a specific insurance scheme. The insights presented below are drawn exclusively from the learning story on 'insurance & climate change adaptation'; no stakeholder consultations for this solution were conducted as part of this evaluation.

Key achievements and successes

Although INSUR did not involve on-the-ground implementation, the strategic foresight exercise produced several valuable insights. The study highlighted practices, mechanisms, and conditions that are already contributing to more climate-resilient insurance landscapes. These findings offer a foundation for future work on integrating insurance more effectively into adaptation strategies.

- Insurance against natural disasters is generally available for floods and storms across most of Europe, including six out of the seven TransformAr demonstrators. Notable exceptions were identified in Guadeloupe, where flood and storm-related coverage remains limited.

- Bundled multi-peril insurance products (covering floods, storms, hail, etc.) are already available in several countries, such as Finland (through the NEI) and Norway (via the NDCA), demonstrating existing models that could inform broader adoption.
- In some countries, climate risk insurance is linked to commonly purchased products (e.g. mortgage or fire insurance), improving uptake. For instance, in Norway, NDCA coverage is tied to fire insurance for both individuals and municipalities, while Finland links natural perils to fire coverage as well.
- Premium incentives based on risk reduction measures exist in select regions (e.g. Finland and Norway), indicating a growing recognition of insurance as a tool to promote adaptation, though these incentives remain rare.
- The TransformAr questionnaire confirmed a growing awareness of climate risks in several regions and a willingness among insurance stakeholders to improve their practices through risk-sensitive assessment models and sustainable investments.

Key challenges and failures

Despite promising practices in some countries, substantial gaps and barriers hinder the effective deployment of insurance schemes for adaptation:

- Coverage gaps in high-risk and overseas regions were a recurring issue, with Guadeloupe cited as a key example. Insurance products are either unavailable or insufficient, particularly for agriculture and drought-related risks.
- Climate risks are often underpriced, due to outdated risk models and a reliance on historical data that fails to reflect future scenarios. This affects affordability and the accuracy of risk signals conveyed through premiums.
- Lack of incentives remains a systemic issue: despite growing risks, only limited premium reductions or discounts are available for households or businesses implementing precautionary measures.
- Slow and cumbersome claims processes were reported in some regions. In Guadeloupe, for example, the agricultural compensation system (FNGRA) was noted for delays of up to 15 months between impact and disbursement, undermining the utility of the mechanism.
- Education and awareness campaigns on climate risk insurance are limited or absent across many regions. In several demonstrators, including Guadeloupe and Greece, respondents reported a lack of clear communication from insurers or public bodies about insurance options.
- Regulatory fragmentation and the absence of harmonised standards across Europe hinder the development of scalable, climate-responsive insurance products. This creates inconsistency in coverage and undermines transparency across regions.

Lessons learnt and recommendations

The comparative analysis across demonstrators provided actionable insights into how insurance can better support transformational adaptation.

Lessons Learnt

- **Climate risks are often under-reflected in insurance modelling.** Many existing schemes continue to rely on historical loss data, which does not account for projected future climate scenarios. This limits the relevance and responsiveness of current insurance products.
- **Risk of market fragmentation.** Vulnerable regions face structural barriers to access. In fact, areas like Guadeloupe remain underserved, with limited availability of climate-relevant insurance products and slow disbursement processes when compensation is offered.
- **Premium incentives for risk reduction remain rare.** Despite isolated examples, insurance is not yet widely leveraged as a driver of preventive adaptation behaviour.
- **Public awareness and communication are weak across most regions.** Many individuals and businesses are unaware of existing insurance options or their limitations, especially regarding coverage for slow-onset or emerging climate risks.
- **Fragmented regulatory environments impede scalability**. The absence of harmonised standards and risk assessment methods contributes to uneven coverage and inconsistency in how climate risks are integrated across markets.

Recommendations

- **Harmonised standards are needed to improve consistency and transparency across insurance markets.** European and national regulators should work toward developing shared frameworks for risk modelling and coverage. This would help reduce geographic disparities and facilitate the development of scalable, climate-responsive insurance products.
- **Risk modelling should be updated to reflect current and future climate scenarios.** Existing insurance schemes must integrate climate projections into pricing and eligibility models. Moving beyond historical loss data will be critical to accurately assess risks and price coverage in a way that supports adaptation.
- **Public–private collaboration can unlock innovation and improve risk management.** Stronger partnerships between insurers, governments, and research institutions would support data sharing, improve product design, and enable the development of novel risk-sharing instruments such as catastrophe bonds or mutual funds.
- **Targeted solutions are needed for underserved and high-risk regions**. In areas like Guadeloupe, where coverage is limited or absent, tailored insurance schemes should be developed. These should include simplified administrative procedures, active outreach campaigns, and financial assistance to support uptake.
- **Insurance products should reward preventive adaptation behaviour.** Premium incentives for households and businesses that invest in risk reduction — such as installing flood barriers or fire-resistant materials — should be scaled up and promoted clearly as a core feature of adaptation financing.
- **Insurance should complement, not replace, other adaptation strategies**. Policymakers and practitioners should view insurance as part of a broader portfolio of adaptation tools. It can support resilience by covering residual risk, but it must be linked to upstream prevention and long-term planning.

2.7 Cross-cutting analysis of solutions

Recurring challenges and barriers

The solutions implemented under the project demonstrated significant achievements. Nonetheless, several challenges consistently emerged across different demonstrators and solutions. These recurring barriers offer insight into structural limitations that may hinder replication activities of the solutions.

- Dependence on project-based funding limited long-term sustainability. Many solutions relied entirely on EU or TransformAr project funding, without securing municipal or external continuation budgets. This raised concerns about the ability to maintain, scale, or replicate the solutions after the project ends.
- Institutional anchoring was often lacking or delayed. Several solutions were not formally integrated into municipal strategies, sectoral plans, or legal mandates. This limited their influence on long-term policy and constrained continuity.
- Stakeholder coordination was resource-intensive and complex. The implementation of some solutions required ongoing facilitation among actors with different mandates, expectations, and timeframes. While multi-actor engagement was a strength, it also presented a management burden that risked delays and misalignment.
- Data integration and interoperability posed challenges. Real-time monitoring tools generated valuable datasets, but issues with compatibility, platform development, and validation protocols created friction in integrating data into decision-making workflows.

Table 7 Overview of common challenges across solutions

Challenges	Applicable solutions
Dependence on project-based funding	SCS; SWMM; CAE; CIH; AWAR; CAF; COAST; SG; NBS; URB
Lack of institutional anchoring	**NUDG**: There was no formal mechanism to scale or replicate the intervention beyond the initial pilot, limiting the potential to become part of a systemic water-saving strategy in the tourism sector. **AWAR**: Institutional integration was still limited at the close of the pilot. While well received, the modules were not formally embedded into the local education system or guaranteed to continue post-project **CIH**: It lacked a formal governance structure within the municipality. There were no clear mandates, dedicated roles, or strategic processes to embed the CIH into Egaleo's broader institutional framework. **RI**: Embedding results in formal planning processes remained partial. At the time of reporting, the RI had not yet been systematically integrated into regional regulatory frameworks or budget processes. **SCS**: Without formal procedures or dedicated staff roles for the use and interpretation of SCS data, the solution risks being underused in future adaptation efforts **INTERM**: The initiative was led by a scientific team, but did not yet include anchoring within a regulatory or management framework **SWMM**: While used operationally, it had not yet been integrated into zoning codes or long-term flood planning instruments.

Complex and resource intensive stakeholder coordination	**SG**: The SG system's success depended on coordination among multiple actors including local authorities, technicians, environmental experts, and community stakeholders. **COAST**: Sustaining momentum required frequent meetings, political support, and dedicated facilitation over a multi-year period **NBS**: Aligning the priorities of farmers, local authorities, regulators, and civil society demanded sustained facilitation and long-term trust-building. **AF**: Establishing the fund required lengthy coordination among diverse co-financing partners. The process of securing formal commitments from seven entities, each with distinct mandates and procedures, delayed the fund's launch by more than a year.
Data integration and interoperability issues	**SG**: Data integration was complex and required strong technical capacity. Merging real-time environmental data with operational decision-making posed technical challenges, particularly in ensuring data quality and maintaining sensors **SCS**: Data from the SCS was not yet fully integrated into formal city planning tools. Although used in operational discussions, the information had not been codified into zoning, emergency response, or development regulations.

3.0 CONCLUSION

This section provides a high-level synthesis of the TransformAr demonstration experience, drawing from the analysis of the implemented solutions across seven demonstrators. It highlights the common achievements and challenges observed across solution categories, outlines demonstrator-specific reflections, and offers overarching guidance for future replication and scaling of transformational adaptation.

3.1 Conclusions by categories of solutions

Awareness Raising & Behavioural Change Solutions demonstrated the power of local engagement and educational interventions in shifting perceptions and behaviours around climate risks. The nudging experiment in Guadeloupe and the awareness modules in Egaleo effectively mobilised key audiences, such as tourists, hotel managers, and students. However, these solutions remain vulnerable to short-term funding cycles and limited institutional integration. Future efforts should ensure local ownership is matched with continuity planning and alignment with formal education or tourism frameworks.

Governance Schemes proved instrumental in creating legitimacy and shared direction among diverse stakeholders. Solutions such as the Resilience Index in Galicia and the Coastal Contract in Oristano showed that structured collaboration and scientific co-creation can produce actionable, widely endorsed adaptation strategies. However, several governance solutions encountered difficulty translating consensus into formal policy instruments or securing long-term resources. Their success depends on embedding roles, responsibilities, and updates into institutional and regulatory frameworks.

Nature-Based Solutions (NbS) achieved strong environmental and social co-benefits, notably in Oristano and the West Country. Solutions targeting runoff, biodiversity, and ecosystem restoration delivered tangible improvements in water quality, habitat conditions, and flood regulation. Nevertheless, maintenance responsibilities, private sector engagement, and data interoperability remain areas for improvement. Scaling NbS will require continued investment in facilitation, technical guidance, and financing models that reflect their multi-functional value.

Digital & Technological Solutions enhanced the precision, responsiveness, and inclusiveness of adaptation planning. Real-time tools like the Smart Climate Stations in Egaleo, SWMM in Lappeenranta and Gjovik, and Mussel Raft Monitoring in Galicia enabled more informed and timely decisions. Digital solutions also supported engagement (e.g. the CAF app) and long-term observation (e.g. INTERM). However, many of these systems were not formally integrated into municipal operations, lacked ongoing budgets, or depended on external technical expertise. Their sustainability will hinge on institutional anchoring and capacity building within public administrations.

Insurance Schemes and Financial Solutions opened new directions for adaptation financing and risk reduction. The Adaptation Fund in Guadeloupe and the Choice Experiment in Lappeenranta and Gjovik showcased the potential of participatory and hybrid financial models. The strategic foresight on insurance (INSUR) highlighted important gaps and opportunities across European regions. While conceptually strong, these solutions remain early-stage and often lacked structural links to existing public finance or regulatory systems. Further work is needed to test, adapt, and integrate financial innovations at scale.

3.2 Conclusions by demonstrator

Egaleo offered an integrated demonstration of digital tools, awareness-raising programmes, and participatory governance. The deployment of Smart Climate Stations, the Citizen App, and educational modules benefited from strong municipal leadership and interdepartmental cooperation. The Climate Innovation Hub served as a physical and symbolic centre for local engagement. Despite these achievements, many solutions were not yet embedded in formal urban planning or resourced for continuity. Long-term sustainability would benefit from integrating tools and processes into policy frameworks, creating dedicated roles for data and engagement, and securing stable funding for institutionalised climate services.

Galicia stood out for its combination of environmental monitoring, participatory planning, and value-chain resilience. The Resilience Index engaged stakeholders in identifying sectoral vulnerabilities and translating them into priority actions, while the MRM and INTERM tools generated real-time and long-term data to support operational decisions in mussel aquaculture. The experience showed the importance of trust-based relationships and institutional continuity. Future improvements should focus on formalising the integration of outputs into sectoral policies, anchoring monitoring efforts within regulatory frameworks, and ensuring financing for both digital infrastructure and capacity building.

Guadeloupe demonstrated innovation in both behavioural and financial adaptation. The nudging experiment introduced new methods for influencing water use among hotel guests, while the Adaptation Fund (FLAG) piloted a co-financed model for supporting local SMEs, associations, farmers, among other with climate-relevant projects. These solutions showed promise in testing new governance and engagement mechanisms in an overseas context. However, both relied on external coordination and EU funding. To improve sustainability and replicability, greater political support, clearer institutional anchoring, and permanent funding channels will be needed, along with a stronger local coordination mechanism embedded in public administration.

Oristano successfully advanced multi-level, collaborative wetland governance through the Coastal Contract. It combined institutional coordination with technical tools such as Smart Gates and adaptive water management systems. A participatory process over several years resulted in an Action Plan, half of which is already funded. These achievements underscore the value of stakeholder commitment and facilitated dialogue. Remaining gaps include formal legal recognition of the governance model, full private sector engagement, and strategies for long-term maintenance and monitoring. Further embedding in regional policy and resource planning could secure the Coastal Contract’s institutional future.

West Country Region showcased a rural application of nature-based solutions with strong facilitation and innovative financing. The use of riparian buffers, citizen science, and ecosystem service markets contributed to improved water quality and flood resilience. The initiative effectively engaged landowners and linked ecosystem services to economic incentives, helping to shift behaviour at landscape scale. However, challenges remain around long-term financial sustainability, standardisation of data, and mainstreaming the model into formal planning and permitting systems. Documentation and wider dissemination of the model would support replication in similar catchment-based contexts.

Lappeenranta demonstrated a comprehensive integration of digital and nature-based solutions, combining stormwater management systems, runoff biofilters, and public engagement tools. Its approach illustrated how data-driven planning can inform urban infrastructure adaptation. The project was well-aligned with municipal climate goals, and departments collaborated effectively during implementation. However, the continued success of these tools depends on securing maintenance budgets, expanding internal technical capacity, and formalising these interventions in city development strategies. A stronger mandate within municipal governance would improve durability and visibility.

Gjovik provided valuable insights into the replication of integrated adaptation solutions. The city successfully adapted stormwater management and behavioural engagement tools from Lappeenranta, validating their transferability in a Nordic context. The Discrete Choice Experiment confirmed local support for decentralised measures like green roofs and rain gardens. However, the solutions were still project-dependent, with limited internal ownership or integration into standard municipal processes. Going forward, Gjovik could focus on institutionalising pilot learning, strengthening its digital infrastructure, and embedding adaptation planning into city-wide operational frameworks.

Across the TransformAr demonstrators, this report illustrates the value of place-based experimentation for transformational adaptation. It reveals that while technical innovation is essential, long-term success is dependent on institutional integration, sustained engagement, and local capacity. In order to replicate these solutions elsewhere, future initiatives must tailor approaches to their governance, ecological, and socio-economic context, while drawing on the evidence and learning generated through this demonstration process.

ANNEX: TransformAr demonstrators

A.1 Guadeloupe

Guadeloupe is a French outermost region composed of six main islands and home to nearly 388,000 inhabitants. Due to its geographical location and insular configuration, the territory is highly exposed to a wide range of climate-related hazards, many of which are intensifying as a result of climate change. These include tropical storms and hurricanes, prolonged droughts, heavy rainfall and flooding, as well as coastal erosion, saline intrusion, sargassum seaweed invasions, and increasingly frequent heatwaves.

The region's socio-economic fabric—centred around tourism and agriculture—is particularly sensitive to these impacts. Water stress is a growing concern, especially given the seasonal variability in freshwater availability and the pressure exerted by tourism infrastructure on the archipelago's limited water resources. This vulnerability is compounded by fragmented local governance, limited capacity to coordinate adaptation measures, and insufficient funding mechanisms dedicated specifically to adaptation as opposed to post-disaster recovery.

The TransformAr project in Guadeloupe was therefore anchored in this urgent context, aiming to respond to two major environmental challenges: reducing water consumption, particularly in the tourism sector, and establishing a localised, multi-stakeholder financial mechanism to support the design and deployment of climate adaptation solutions. These interventions were envisioned not only as targeted responses to local needs but also as strategic pilots to explore scalable pathways for transformational adaptation in outermost regions of the EU.

The Guadeloupe demonstrator implemented two solutions - including a nudging experiment (NUDG) aimed at reducing hotel guests' water use to conserve water, and a local adaptation fund (AF) aimed at directing financial resources towards innovative adaptation solutions.

NUDG was designed to promote behavioural change among tourists by encouraging shorter showers. It consisted of three main phases: the preparation phase, the pilot experiment, and the full experiment. During the preparation phase, the project team developed a comprehensive nudging kit that included visual materials such as flyers and stickers, strategically placed in hotel bathrooms to raise awareness. In selected hotels, digital shower sensors were installed to measure real-time water usage and shower duration. These sensors were connected to a centralised platform, the Aquardio Hub, which collected and stored the data for analysis.

To complement the quantitative data from the sensors, the team also gathered qualitative feedback through two channels: feedback forms distributed to guests, and regular reporting forms completed by hotel managers. This dual approach provided insights into both the effectiveness of the materials and the general perception of the intervention. Several hotels were able to fully participate in the experiment and share meaningful feedback on guest reactions and water use patterns.

The second intervention was the **AF**, designed to address the lack of dedicated local financing mechanisms for climate adaptation in Guadeloupe. The fund was established to offer grants and loans to small and medium-sized enterprises, farmers, and associations working on adaptation-relevant projects. A key feature of the fund was its multi-actor governance model, which involved coordination among public and private co-financiers.

The fund succeeded in launching six pilot projects, covering a range of adaptation priorities. These projects not only supported local agricultural and environmental resilience but also tested institutional and technical innovations such as smart farming practices, drainage system improvements, and collaborative governance structures.

A.2 Egaleo

Egaleo is a densely populated urban municipality located in the greater Athens area of Greece. Like many Mediterranean cities, it faces increasing climate-related risks, including extreme heat events, air pollution, and pressures on public health and social services. These risks are exacerbated by limited green space, urban heat island effects, and socio-economic vulnerabilities among segments of the population.

As part of its climate adaptation efforts, Egaleo aimed to enhance community awareness, promote behavioural change, and foster local engagement in climate action. The municipality focused particularly on young people and vulnerable populations, recognising the importance of early education, accessible information, and community-led innovation in building long-term resilience.

Five solutions were implemented in Egaleo to address climate risks through behavioural change and local engagement.

The **AWAR** solution involved a structured climate education programme for high school students (aged 16–18). The curriculum was designed to improve students' understanding of climate change, its local impacts, and possible responses. The programme was implemented through workshops and classroom sessions, in close collaboration with local schools. Feedback from teachers informed the integration of live environmental data into lessons, increasing relevance and engagement.

The **CAE** solution consisted of a citizen application developed by the municipality to disseminate climate-related information and gather feedback through questionnaires. The app's functionalities included:

- Displaying real-time data from the Smart Climate Stations,
- Issuing notifications for climate-related events,
- Collecting data on citizens' climate awareness and perceptions via surveys

DSI used data collected via the app and municipal systems to better understand the needs of Egaleo's residents, particularly in the context of climate vulnerability. These insights informed the design of awareness activities and were used to tailor the educational content and digital tools.

The **CIH** was established as a multi-purpose community facility that hosted a permanent climate-related exhibition, streamed live weather data from the Smart Climate Stations, and organised events promoting innovation and public engagement. It served as an anchor for climate education and outreach within the community.

Finally, **SCS** solution was installed throughout the municipality to measure environmental parameters such as temperature, humidity, and air quality. These stations fed data into both the citizen app and the Climate Innovation Hub, providing accessible, localised information to residents and educators.

A.3 Galicia

Located in northwestern Spain, the region of Galicia has a long coastline, and an economy strongly tied to marine and coastal activities, particularly shellfish aquaculture. Galicia accounts for more than 95% of Spain's mussel production, with floating raft systems dominating the estuarine aquaculture landscape. The Rías Baixas—a series of coastal inlets—are central to this production system and support a wide range of socio-economic and ecological services.

However, the region is increasingly vulnerable to the effects of climate change, including sea temperature rise, changes in ocean salinity and acidity, and extreme weather events. These shifts affect the productivity and viability of aquaculture systems, including mussel growth rates, mortality, and spawning cycles. Additionally, the intertidal harvesting areas face risks from sediment displacement and pollution, threatening the sustainability of traditional shellfish practices. The region's governance frameworks must therefore adapt to manage long-term risks while maintaining economic viability and food security.

Three solutions were implemented in the Galicia demonstrator to address climate-related risks affecting shellfish aquaculture: the Resilience Index (RI), the Mussel Raft Monitoring (MRM) system, and the Intertidal Monitoring (INTERM) system.

The **RI** was developed by CETMAR as a participatory governance tool to assess the vulnerability of the mussel aquaculture value chain. It brought together industry stakeholders, public agencies, and scientific institutions to co-identify climate risks and priority adaptation actions. The process included workshops, risk mapping, and the definition of performance indicators across environmental, economic, and organisational dimensions. The tool was designed to support regional planning and inform future adaptation investments.

The **MRM** solution involved the deployment of real-time sensors on floating rafts to monitor parameters such as water temperature, salinity, oxygen levels, and chlorophyll concentration. The system was developed by CETMAR in collaboration with the Galician Aquaculture Technological Platform (PTGA) and aquaculture producers. Data were transmitted to an online dashboard accessible to users, providing early warnings and supporting decision-making related to harvesting and maintenance.

The **INTERM** solution, led by the University of Vigo, focused on sediment dynamics and environmental changes in shellfish harvesting zones. It combined satellite data, drone imagery, and in-situ measurements to track erosion, deposition, and water quality. The data supported the identification of vulnerable areas and the development of management recommendations.

A.4 Oristano

The Oristano region, located on the west coast of Sardinia, is characterised by an extensive system of wetlands, lagoons, and salt marshes of high ecological value. These ecosystems are critical for biodiversity, flood regulation, and water quality, and are protected under the Ramsar Convention and the Natura 2000 network. However, they are increasingly under threat due to a combination of climate change and human activities.

The area is exposed to coastal flooding, particularly during autumn storms, and experiences progressive wetland degradation linked to changing hydrological conditions and land use pressures. Rising sea levels and the reduction of natural buffering systems further exacerbate these risks, impacting both the natural environment and local livelihoods. These dynamics have prompted the need for integrated, adaptive approaches to manage water retention, protect ecosystem functions, and support the resilience of surrounding communities.

The Oristano demonstrator implemented two solutions under the TransformAr project: the Coastal Contract (COAST) and the Smart Gates (SG) system.

The **COAST** solution consisted in the promotion of a new governance mechanism to protect and restore coastal wetlands, inspired by the Italian "Contratto di Costa" model. This approach brought together a wide range of local stakeholders to develop a shared strategy for the management and preservation of wetland areas. The process included the creation of a coordination group, which facilitated dialogue among municipalities, regional authorities, environmental agencies, and civil society organisations. Key steps included the development of a shared vision, the mapping of territorial assets and challenges, and the drafting of a wetland restoration plan. The initiative was aligned with existing institutional frameworks and aimed to complement and strengthen Sardinia's regional environmental strategies.

The **SG** solution focused on improving water regulation in selected wetland areas of the Oristano region. This was achieved through the installation of automated gates equipped with remote sensors that allow for the real-time management of water flows. The system was designed to address salinity control, flood mitigation, and the overall ecological health of wetland habitats. Data collected from the sensors were integrated into a remote monitoring platform, enabling adaptive management of water levels depending on seasonal and weather conditions. The SG solution built on pre-existing infrastructure and was designed in consultation with landowners, local engineers, and environmental experts.

These two solutions were implemented in a coordinated manner to improve both the governance and technical management of Oristano’s wetland systems, in response to local hydrological challenges.

A.5 West Country Region

The West Country region, located in the southwest of England, is one of the UK's primary agricultural zones and is home to a wide variety of protected natural habitats. This includes several Sites of Special Scientific Interest and Special Areas of Conservation, such as the River Axe, the River Camel, and the Somerset Levels. These areas harbour rare species of flora and fauna and are safeguarded under national and European regulations.

The region faces critical environmental challenges due to the intensity of regional livestock farming and climate change-related pressures. Soils, increasingly compacted by agricultural activities, have a reduced capacity to absorb rainfall. This has led to more frequent flooding during heavy precipitation events and greater nutrient runoff into waterways, contributing to eutrophication and biodiversity loss. The combination of hotter, drier summers and more intense winter rainfall exacerbates the vulnerability of water systems and surrounding ecosystems.

In the initial design of the TransformAr project, the West Country demonstrator was expected to implement a **Green Bond (GB)** scheme and an **Integrated Constructed Wetlands Monitoring (ICWM)** solution. However, these solutions were not implemented as planned. The GB solution was ultimately not pursued, and the ICWM solution was replaced by a **Nature-Based Solutions (NBS)** package more directly suited to the region’s needs and operational context.

The solution implemented focused on landscape-scale nature-based interventions aimed at improving water quality and hydrological resilience. These included:

- Riparian buffer strips,
- Restoration of wetlands,
- Scrapes and ephemeral ponds along river corridors.

These interventions were coordinated by the Westcountry Rivers Trust in collaboration with landowners. The aim was to restore natural hydrological functions, retain nutrients before they enter water bodies, and improve habitat quality. The measures were selected for their co-benefits, including flood risk mitigation, drought resilience, and biodiversity enhancement.

The measures responded directly to the environmental pressures identified in the region and provided a practical application of NBS to support climate adaptation objectives in rural catchments.

A.6 Lappeenranta

Lappeenranta is a mid-sized city in southeast Finland, located along Lake Saimaa. The municipality is increasingly facing climate-related risks, particularly urban flooding caused by extreme rainfall events.

While water quality monitoring for lakes is well-developed, there is a notable lack of centralised data and coordination for stormwater monitoring, which limits the city's ability to effectively respond to new patterns of water flow, runoff, and localised flooding.

In response, the municipality has taken steps to involve residents in adaptation efforts and to develop new technical and participatory solutions that improve local monitoring, infrastructure planning, and community awareness. These efforts are designed to complement Lappeenranta's broader strategy as a leader in environmental innovation and sustainability at the municipal level.

Lappeenranta implemented four complementary solutions to address the challenges of stormwater management and climate adaptation.

The **CAF** solution involved the development of a citizen app that enabled residents to submit reports and observations related to stormwater issues, such as blockages, overflows, and areas of concern. The app was co-designed through workshops and user testing, and served as both a data collection tool and a platform for public engagement. Citizens could upload georeferenced photos and notes, which were then used to inform municipal planning and infrastructure maintenance.

The **URB** solution consisted of the installation of biofiltration systems and vegetated infiltration areas designed to reduce runoff and improve stormwater quality. These small-scale interventions were integrated into the urban fabric to treat water at the source and promote groundwater recharge. The design was tailored to Lappeenranta's hydrological and spatial conditions, and was informed by existing green infrastructure planning frameworks

The **SWMM** solution included the deployment of low-cost modular sensors that monitored water flow, temperature, and other relevant parameters in real time. These sensors were installed in stormwater pipes and collection systems across selected pilot sites. The data were transmitted to a centralised platform accessible to municipal staff and used to guide decisions on drainage improvements and emergency responses.

Finally, the **CEI** solution consisted of a choice experiment survey administered to residents to assess public preferences for various stormwater adaptation measures. The goal was to understand which characteristics (e.g. location, visibility, co-benefits) were most valued by the population, and to incorporate this feedback into the design of future infrastructure and communication strategies.

A.7 Gjovik

Gjovik is a small inland municipality in Norway engaged in developing its capacity for urban climate adaptation. It is increasingly experiencing frequent and intense rainfall events, which raise the risk of urban flooding and drainage system overload. These risks are compounded by limited access to stormwater data, a common issue in the region, where unlike lake monitoring systems, stormwater data is not centralised or consistently shared across municipalities.

To respond to these challenges, Gjovik has taken steps to modernise its infrastructure and adopt data-driven approaches to enhance climate resilience. As a replicator of solutions tested in Lappeenranta, the city prioritised real-time monitoring, community feedback, and public participation to inform its stormwater governance strategies. These efforts align with TransformAr's broader goal of enabling municipal-level climate adaptation through innovation, stakeholder engagement, and technology integration.

Gjovik implemented three of the solutions initially tested in Lappeenranta. While the technical design of these solutions mirrored the Finnish pilot, the implementation in Gjovik was adapted to its own local infrastructure and stakeholder context.

The replication of the **SWMM** solution in Gjovik focused on adapting the sensor system to a smaller city scale. The deployment involved close collaboration with municipal engineers to integrate the sensors into existing drainage infrastructure. This process confirmed the modularity and ease of integration of the solution across different urban environments and helped validate the replication potential of the stormwater monitoring system in other Nordic cities.

Through the replication process, Gjovik also tested local governance adaptations, including new internal coordination mechanisms for handling and acting on the citizen reports gathered via the **CAF** app. The city explored how real-time data could be streamlined into its planning and maintenance routines, despite the absence of a pre-existing digital infrastructure for stormwater data.

In addition, the **CEI** in Gjovik contributed to understanding how local preferences differ from those in Lappeenranta, helping the municipality tailor its communication and future infrastructure choices. The experience demonstrated how citizen engagement tools could be contextualised to different municipal cultures and capacities within a common framework.

Climate change impacts are here and now. The impacts on people, prosperity and planet are already pervasive but unevenly distributed, as stated in the new EU Blueprint strategy (European Commission-EC, 2019). To reduce climate-related risks, the EC and the IPCC agree that transformational adaptation is essential. The TranformAr project aims to develop and demonstrate products and services to launch and accelerate large-scale and disruptive adaptive process for transformational adaptation in vulnerable regions and communities across Europe.

The 6 TransformAr lighthouse demonstrators face a common challenge: water-related risks and impacts of climate change. Based on existing successful initiatives, the project will develop, test and demonstrate solutions and pathways, integrated in Innovation Packages, in 6 territories.

Transformational pathways, including an integrated risk assessment approach are co-developed by means of 9 Transformational Adaptive Blocks. A set of 22 tested actionable adaptive solutions are tested and demonstrated, ranging from nature-based solutions, innovative technologies, financing, insurance and governance models, awareness and behavioral change solutions.

TransformAr

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