

# Periodic Report 2

## EU Grants: Periodic Report (V6 – 30.09.2025)

30 November 2025

Max Steinhausen<sup>1</sup>, Tracy Irvine<sup>17</sup>, Sukaina Bharwani<sup>18</sup>, Pia-Johanna Schweizer<sup>5</sup>, Valeria Pancioli<sup>8</sup>, Dominik Hedderich<sup>9</sup>, Jana Löhrllein<sup>11</sup>, Paolo Mazzoli<sup>4</sup>, Janne Parviainen<sup>18</sup>, Lydia Cumiskey<sup>6</sup>, Neharika Chebol<sup>1</sup>, Tobias Conradt<sup>2</sup>, Martin Drews<sup>3</sup>, Kaija Jumppanen Andersen<sup>3</sup>, Arnau Macià Pou<sup>7</sup>, Stefano Bagli<sup>4</sup>, Francesca Renzi<sup>4</sup>, Valerio Luzzi<sup>4</sup>, Marco Renzi<sup>4</sup>, Sandro Nanni<sup>13</sup>, Christopher Genillard<sup>9</sup>, Stefan Hochrainer-Stigler<sup>10</sup>, Levente Huszti<sup>12</sup>, Heiko Apel<sup>14</sup>, Shahin Khosh Bin Ghomash<sup>14</sup>, Benedikt Gräler<sup>15</sup>, Julia Kraatz<sup>15</sup>, Chahan Kropf<sup>16</sup>, Samuel Juhel<sup>16</sup>, Julian Struck<sup>11</sup>, Benjamin Hofbauer<sup>5</sup>, Holly Faulkner<sup>6</sup>

- |   |  |
|---|--|
| 1. TECHNISCHE UNIVERSITÄT BRAUNSCHWEIG                                    | 10. INTERNATIONALES INSTITUT FÜR ANGEWANDTE SYSTEMANALYSE                            |
| 2. POTSDAM-INSTITUT FÜR KLIMAFOLGENFORSCHUNG E.V                          | 11. ERFTVERBAND  |
| 3. DANMARKS TEKNISKE UNIVERSITET  | 12. ZALA KÜLÖNLEGES MENTŐK ÉS ONKÉNTES TŰZOLTÓ EGYESÜLET                             |
| 4. GECOSISTEMA SRL  | 13. AGENZIA REGIONALE PER LA PREVENZIONE, L'AMBIENTE E L'ENERGIA DELL'EMILIA-ROMAGNA |
| 5. RESEARCH INSTITUTE FOR SUSTAINABILITY AT GFZ                           | 14. HELMHOLTZ CENTRE FOR GEOSCIENCES GFZ   |
| 6. UNIVERSITY COLLEGE CORK – NATIONAL UNIVERSITY OF IRELAND, CORK         | 15. 52 NORTH SPATIAL INFORMATION RESEARCH GMBH                                       |
| 7. REGION HOVEDSTADEN   | 16. EIDGENÖSSISCHE TECHNISCHE HOCHSCHULE ZÜRICH                                      |
| 8. AGENZIA REGIONALE PER LA SICUREZZA TERRITORIALE E LA PROTEZIONE CIVILE | 17. OASIS HUB LIMITED  |
| 9. GENILLARD & Co GMBH  | 18. SEI OXFORD OFFICE LIMITED  |

# Report Overview

Project number	101073978
Project acronym	DIRECTED
Project name	Disaster Resilience for Extreme Climate Events providing Interoperable Data, Models, Communication and Governance
Call	HORIZON-CL3-2021-DRS-01
Topic	HORIZON-CL3-2021-DRS-01-02
Type of action	Innovation Action
Responsible service	Horizon Europe
Project starting date	01.10.2022
Project duration	4 Years
Period covered	01.02.2024 – 30.09.2025
Reporting period number	2
Periodic report date and version	30.11.2025 – version 6

# Document History

Version	Date	Comment
1.0	11.02.25	Initial template created based on reviewer comments form RP1 and interim review.
2.0	16.05.25	Contents updated and template changes
3.0	15.09.25	Content updates from all WPs
4.0	30.10.25	Additions from WP6, WP7 and WP8. Ready for final edits
5.0	26.11.25	Addition of use of resources by WP7
6.0	30.11.25	Final edits ready for submission

# Executive Summary

The DIRECTED Project was awarded an Innovation Action Grant by the Horizon Europe Programme in October 2022. This report sees the second of three periodic reviews set as a part of the ongoing development and implementation of the DIRECTED Project. The report summarises comprehensive work that has been ongoing between the period of January 2024 to the 30th of September 2025 and therefore represents the second phase of the four-year project with one year remaining until the end of the project in September 2026. In the second reporting period, the following progress has been made by the project:

- RWL activities successfully transitioned from foundational setup (T1.1 completion) to active knowledge co-production (T1.2) of technical and governance solutions during RP2, concurrently advancing project evaluation via T1.3 forensic analysis. Implementation followed the iterative Risk-Tandem Framework (T3.2), distilling stakeholder needs into actionable Data Fabric (DF) user stories. Among other progresses RWL1(RegionH) co-designed the DF Multi-Criteria Decision Making (MCDM) tool for adaptation planning, addressing inter-municipal coordination gaps; RWL2 (Emilia-Romagna) executed large-scale flood and wildfire simulations/ field exercises, delivering DF integration for real-time forecast data; RWL3 (Danube) structured pluvial/fluvial scenario validation and secured integration pathways for regional climate resilience initiatives; RWL4 (Rhine-Erft) operationalized a Webex-based situation assessment protocol, formalizing critical inter-organizational coordination. Deliverable D1.3 (T1.3) synthesized actionable governance insights from comparative flood case studies and ongoing progresses have been monitored via Milestones M4 and M5.
- Based on the stock-taking of interoperability standards, the portfolio of models and data used in DIRECTED has been adapted and re-worked. All data used in the DDR and CCA activities in the RWLs now adhere to internationally accepted data standards (OGC). All the models were re-worked to cope with these standardized data. Models can now seamlessly digest the data provided by the RWLs, and provide output in these standard data formats. Moreover, all the models have been enhanced by adding features required in the RWLs, improved and user-friendly model setup, and streamlined communication between model (APIs). Modelling frameworks were co-developed with the RWLs in order to serve the requirements in the DRR or CCA work flows in the RWL (user stories).
- The Risk-Tandem Framework has been applied in each RWL via the Risk-Tandem Indicators (see Deliverable 3.2). This has led to insights regarding the assessment and improvement of integrating CCA and DRM processes. Further, interviews and workshops (including exercises) with both stakeholders and hosts, have been conducted to gather input and feedback on how to best sustain the tailored framework throughout the final year of DIRECTED and beyond.

- The launch of the Tandem capacity development modules (D4.1), informed by extensive RWL engagement and systematic analysis of needs and challenges was achieved. A draft for D4.2 has begun bridging gaps between user needs and model information, supported by innovative work on CCA-DRR terminology linked to the Climate Connectivity Taxonomy (WP2) and through a unique collaboration with the University of Arts, London. The Tandem co-production framework is being iteratively refined, and WP4 is developing a detailed MEL approach aligned with the wider project to track outcomes in co-production, governance and interoperability.
- The requirement analysis of the Data Fabric could be concluded during RP2 and was followed by an intense co-development phase. The Data Fabric has been released in version 1 for all RWL at the end of the RP2 as planned. Based on the individual interoperability use-cases of the RWLs, the web-application integrates different regional and large scale data sets, the models of DIRECTED partners and tailored interactive information products for RWL stakeholders to explore CCA and DRM alternatives.
- Developed a multi-dimensional comparative case study (D1.3), including a targeted literature and grey-literature review, Real World Lab professional inputs, and news and support organisation analyses of the 2021 Rhine-Erft and 2023 Emilia-Romagna floods across event characteristics, technical tools used, damage assessment, human impact, waste management, recovery, governance, and communication, drawing on evidence from RWL consultations and technical partners.
- Continued the structured exploitation process across all KERs, tracking TRL progression, business model development, IP considerations and user uptake that has been logged in D6.7 advancing this work towards the final D6.5 Business Plan, ensuring each product and framework has a clear, evidence-based pathway for post-project exploitation.
- Reporting and communications processes were updated and streamlined to ensure stronger collaboration between all project partners and minimise miscommunication. The loss of a valuable project partner (RegionH) was proactively managed by the coordination team, RWL1 and partners at DTU that took on remaining responsibilities and budget of the existing partner.
- The integration of ethical dimensions into project practice and reporting has been fully established and reviewed externally, overcoming initial challenges in the previous reporting period. All partners have participated in ethics workshops and dedicated effort to the ethics work in the project plan.

The report summarises work under all the eight work packages and provides updates on each of the tasks as outlined in the grant agreement as well as updates on deliverables, milestones, objectives, and impacts. The report also highlights some deviations from the original DIRECTED Project plans and responds in detail to reviewer comments from the first reporting period as well as recommendations from the interim review.

# Contents

<b>List of Abbreviations.....</b>	<b>9</b>
<b>1 Overview and Progress.....</b>	<b>11</b>
1.1 Objectives.....	18
1.2 Explanation of the work carried out per WP.....	20
1.2.1 Work Package 1 – Real World Labs.....	20
1.2.1.1 Introduction.....	20
1.2.1.2 Progress per task.....	21
1.2.1.3 Stakeholder engagement.....	26
RWL 1: The Capital Region of Denmark.....	26
RWL 2: The Emilia-Romagna Region.....	27
RWL 3: Danube Region.....	29
Test site Vienna.....	29
Test site Zala Region.....	30
RWL 4: Rhine-Erft Region.....	33
1.2.2 Work Package 2 – Interoperability.....	35
1.2.2.1 Introduction.....	35
1.2.2.2 Progress per task.....	35
1.2.3 Work Package 3 – Governance.....	55
1.2.3.1 Introduction.....	55
1.2.3.2 Progress per task.....	55
1.2.4 Work Package 4 – Knowledge co-production.....	59
1.2.4.1 Introduction.....	59
1.2.4.2 Progress per task.....	59
1.2.5 Work Package 5 – Data Fabric.....	64
1.2.5.1 Introduction.....	64
1.2.5.2 Progress per task.....	65
1.2.6 Work Package 6 – Communication and Dissemination.....	69
1.2.6.1 Introduction.....	69
1.2.6.2 Progress per task.....	69
1.2.7 Work Package 7 – Project Management.....	73
1.2.7.1 Introduction.....	73
1.2.7.2 Progress per task.....	73
1.2.8 Work Package 8 – Ethics.....	83
1.2.8.1 Introduction.....	83
1.2.8.2 Progress per task.....	84
1.3 Impact.....	88
1.4 Publications.....	91
1.5 Update of the plan for exploitation and dissemination of results.....	91
1.5.1 Overview.....	91
1.5.2 Website and Social Media.....	91
1.5.3 Blogs and Online Articles (2024–2025).....	92
1.5.4 Real-World Labs and Stakeholder Engagement.....	94
1.5.5 Scientific Publications.....	94
1.5.6 Policy and Practitioner Dissemination.....	95
1.5.7 Visual and Immersive Dissemination.....	95
1.5.8 Exploitation Activities (October 2024 – September 2025).....	96
<b>2 Follow-up of recommendations and comments from previous review.....</b>	<b>101</b>

<b>3 Exploitation primarily in non-associated third countries.....</b>	<b>122</b>
<b>4 Open Science.....</b>	<b>124</b>
5 Deviations from Annex I and Annex II.....	125
5.1 Work Packages.....	125
5.1.1 Work Package 1.....	125
5.1.1.1 RWL 1: The Capital Region of Denmark.....	126
5.1.1.2 RWL 2: The Emilia-Romagna Region.....	126
5.1.1.3 RWL 3: Danube Region.....	126
Test site Vienna.....	126
Test site Zala Region.....	126
5.1.1.4 RWL 4: Rhine-Erft Region.....	127
5.1.2 Work Package 2.....	127
5.1.3 Work Package 3.....	127
5.1.4 Work Package 4.....	128
5.1.5 Work Package 5.....	128
5.1.6 Work Package 6.....	129
5.1.7 Work Package 7.....	129
5.1.8 Work package 8.....	130
5.2 Use of resources.....	131
5.2.1 Unforeseen subcontracting.....	136
5.2.2 Unforeseen use of in kind contributions.....	136
<b>6 Concluding remarks.....</b>	<b>137</b>

# Table of Figures

<a href="#">Figure 1:</a>	Tandem interactive online modules.	14
<a href="#">Figure 2:</a>	Example of the interactive Miro Board used to document the setup phase and ongoing progress of RWLs, including outcomes and plans.	23
<a href="#">Figure 3:</a>	Excerpt from the detailed final-year work plan for RWL 1 (Denmark), presented and refined during the General Assembly in Copenhagen (September 2025).	23
<a href="#">Figure 4:</a>	Example of a RWL roadmap for the Danube RWL	31
<a href="#">Figure 5:</a>	Stakeholder mapping for flood warning and disaster management in RWL4 Rhine-Erft.	53
<a href="#">Figure 6:</a>	Interactive activity mapping skills and capacities for different target groups	72
<a href="#">Figure 7:</a>	Excerpt of the project internal risk log for monitoring, management and mitigation.	78
<a href="#">Figure 8:</a>	Internal review process for project reports and deliverables.	81
<a href="#">Figure 9:</a>	Visit of the Roskilde Fire department training facility during the GA in Copenhagen, Sep. 2025.	82
<a href="#">Figure 10:</a>	Interactive ethics workshop during the Copenhagen GA, Sep. 2025.	87

# Index of Tables

<a href="#">Table 1:</a>	Progress pathways towards project objectives	18
<a href="#">Table 2:</a>	WP1 progress per task overview table with status report	21
<a href="#">Table 3:</a>	Summary of RP2 engagement activities by RWL.	26
<a href="#">Table 4:</a>	Summary of deliverables, milestones, and tasks status in WP2.	36
<a href="#">Table 5:</a>	Overview of model interoperability enhancements for Task 2.2	38
<a href="#">Table 6:</a>	Technical interoperability enhancements for RWL2.	48
<a href="#">Table 7:</a>	Hazards and pilot sites in RWL3.	50
<a href="#">Table 8:</a>	Summary of deliverables, milestones, and tasks status in WP 3.	55
<a href="#">Table 9:</a>	Summary of deliverables, milestones, and tasks status in WP 4.	59
<a href="#">Table 10:</a>	Overview of capacity development activities in RP2.	61
<a href="#">Table 11:</a>	Summary of deliverables, milestones, and tasks status in WP 5.	65
<a href="#">Table 12:</a>	Summary of deliverables, milestones, and tasks status in WP 6.	69
<a href="#">Table 13:</a>	Summary of deliverables, milestones, and tasks status in WP 7.	74
<a href="#">Table 14:</a>	Summary of deliverables, milestones, and tasks status in WP 8.	84
<a href="#">Table 15:</a>	Reviewer comments and project response on OVERALL ASSESSMENT	101
<a href="#">Table 16:</a>	Reviewer comments and project response on OBJECTIVES AND WORK PLAN	115
<a href="#">Table 17:</a>	Reviewer comments and project response on IMPACT.	119
<a href="#">Table 18:</a>	Reviewer comments and project response on IMPLEMENTATION.	120
<a href="#">Table 19:</a>	Reviewer comments and project response on RESOURCES.	121
<a href="#">Table 20:</a>	Person Month expenditure per WP per partner.	134

# List of Abbreviations

ACRONYM	DEFINITION
API	Application Programming Interface
CCA	Climate Change Adaptation
D (e.g., D1.1)	Deliverable
DMP	Data Management Plan
DoA	Description of Action
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EWS	Early Warning Systems
FAIR	Findable, Accessible, Interoperable and Reusable
GA	General Assembly (annual project meeting); Grant Agreement
GIS	Geographic Information System
KTT	Knowledge Translation and Transfer
M (e.g., M4)	Milestone
MCA/CBA	Multi-Criteria Analysis/Cost-Benefit Analysis
RP	Reporting Period
RWL	Real World Lab
SDGs	Sustainable Development Goals
SDGs	Sustainable Development Goals
SOP	Standard Operating Procedure
SSH	Social Sciences and Humanities

ToT	Training of Trainers
TRL	Technology Readiness Level
TTX	Table-Top Exercise
VR	Virtual Reality
WP	Work Package

# 1 Overview and Progress

This section outlines the DIRECTED Project progress for the period January 2024 to September 2025. It specifically addresses all Work Packages 1-8 and relevant tasks, deliverables and milestones due for this period.

**Work Package 1 (WP1)** of the DIRECTED project, Real World Labs (RWL), made significant progress through the reporting period. In RP2, the work shifted from setting up the RWLs to co-producing tailored technical and governance solutions supporting disaster risk management (DRM) and climate change adaptation (CCA). Milestone M4 documented the progress of co-production, applied through the Risk-Tandem Framework (D3.2), in the RWLs by summer 2024. Deliverable D1.3 resulted in a comparative study of flood events in Rhine-Erft and Emilia-Romagna Regions, providing actionable insights for policy, practice, and training. Milestone M5 was achieved by way of Deliverable D4.2 (Assumptions Framework, submitted in draft), which created a replicable methodology connecting complex model assumptions to end-user decision needs, thereby making risk information more understandable, translatable and usable.

Three tasks were executed under WP1. Task 1.1 involved setting up Real World Labs and was completed as planned. This task led to the revision and re-submission of Deliverable 1.1, now accepted. Task 1.2 applied the process of co-production in the Real World Labs and was accomplished in accordance with the roadmap. This task resulted in Deliverable D1.2, which was revised, re-submitted, and accepted; milestones M4 and M5 were achieved. Task 1.3, involving evaluation and outcome/impact monitoring of the real-world laboratories, is currently ongoing; deliverable D1.3, submitted, was prepared in close collaboration with the RWL hosts

This collective effort successfully translated localized challenges into tangible, context-specific results, including: the definition of Data Fabric specifications for integrated forecasting and planning in Denmark and the Danube Region (RWL1, 3); the institutionalization and testing of an inter-organizational communication protocol in Rhine-Erft (RWL4); and the validation of multi-hazard operational workflows and co-design of public communication kits via full-scale exercises and simulations in Emilia-Romagna (RWL2).

Knowledge co-production activities were performed in iterative cycles in line with the Risk-Tandem Framework (WP3), translating stakeholder requirements into pragmatic and user-centric development (WP4) of the Data Fabric (WP5) whilst meeting operational needs (WP1). WP1's progress reflects the coherent translation of the project's innovations, namely the Risk-Tandem Framework and the Data Fabric, into real-world applications, e.g. for civil protection in Emilia Romagna and the establishment of new co-created governance mechanisms, e.g. inter-organisational coordination of flood preparedness, in Rhine-Erft.

**Work Package 2** focused on the interoperability of models and data sets integrated into the Data Fabric. Task 2 focused on "Stocktaking for Interoperability—A Compendium" and has achieved several goals. This includes the completion of multi-criteria assessments of adaptation measures based on the FAIR framework, the incorporation of new datasets and refinement of ranking criteria, coordination for interoperability standards with Task 2.2, collaboration with standardization bodies e.g. OGC, and conducting stakeholder consultations and workshops.

The primary deliverable associated with Task 2.2, the Compendium of Data Standards for interoperability in DRR and CCA – D2.1, has been completed., Input from Task 2.1 was applied to outline the arrangement for the interoperability framework within the Data Fabric, leading to the formation of the low-level Design Description for Data Fabric in Task 5.2 of WP5.

Task 2.2, "Making Tools Interoperable," has also been finalized and the associated deliverable D2.2 – Enhanced interoperability tools has been made available to users through software repositories and documentation.

Task 2.3, "Multi-hazard Modelling for Integrated DRM and CCA: Demonstration in RWLs," is ongoing. Milestone 1 has been checked according to plan: First drafts of the Interoperability Fact Sheets have been indicated and are now tested with the RWLs.

Overall, the work package has progressed towards its goal of establishing a data and model interoperability framework for disaster risk reduction and climate change adaptation (DRR/CCA) applications. The outcome represents a structured, stakeholder-oriented framework that facilitates the progressive alignment of selected modules toward an evolving sense of practical implementation. The work package will continue to focus on the integration phase for the selected modules on identified interoperability use cases are also being conducted.

**Work Package 3 (WP3)**, primarily focused on the application and refinement of the Risk-Tandem Framework for integrated Disaster Risk Management (DRM) and Climate Change Adaptation (CCA) governance during RP2. This Framework was developed in Task 3.1 (D3.1, revision submitted August 2024) and underwent iterations based on the specific needs of the individual RWLs (Task 3.2, Deliverable 3.2, submitted Sept. 2025). The process included workshops, presentations, exercises and interviews, facilitating knowledge co-production with stakeholders. The implementation of the Framework resulted in improved integration of DRM and CCA processes, as stated by the RWL hosts and stakeholders in interviews, supported by enhanced communication and governance mechanisms (see, e.g., [Hofbauer et al., 2025](#)). These mechanisms are specifically tailored to the context of each RWL.

WP3 demonstrated progress in establishing governance mechanisms such as the "Web-Ex meeting" (institutionalised emergency meeting) in the Rhine-Erft RWL that established a direct communication channel between municipalities and authorities, evaluating their effectiveness in Real World Labs through interviews, and adapting the framework based on

the feedback received from RWL users. It is also spearheading future-oriented tasks, such as the interactive Risk-Tandem Framework web interface, to ensure the project's sustainability and applicability beyond its lifespan. Future tasks for WP3 include the production of a Policy Brief (D2.3, M42), a Guidance on Good Practices (D3.4, M48), and a report on the Multi-Hazard Risk Governance outcomes and impact per RWL (D1.4 to be delivered in the joint Task 1.3), in addition to the ongoing development of an interactive Risk-Tandem Framework web interface and toolkit.

The deliverables and tasks associated with **Work Package 4 (WP4)**, focusing on knowledge co-production, advance the development for facilitating transdisciplinary knowledge co-production processes within the Risk-Tandem Framework in RWLs. Co-exploration of risks (challenges) and goals and the co-design of bespoke technical and governance solutions are primary focuses and are progressing as planned, and are at different stages in each RWL. The process has been supported throughout by consultations and capacity needs assessments, with an emphasis on RWL hosts' research, facilitation and design skills and collaboration, reflexivity, creativity and systems thinking **capacities** (building on the co-authored Directed paper, Cumiskey et al., 2025).

Task 4.1 involved applying the Risk-Tandem knowledge co-production cycle to the RWLs. This task transitioned from scoping (Phase I) to support co-exploration (Phase II) and co-design (Phase III) of the underlying Tandem co-production framework. Bringing together training of trainer (ToT) sessions with the co-designed RWL workshops, a series of more generalized capacity development modules have been finalised (D4.1) and launched online ([www.weadapt.org/tandem](http://www.weadapt.org/tandem), [Figure 1](#)). A formal report outlining module design and development drawing on RWL engagements, qualitative coding analysis of RWL workshop documents and capacity needs assessments has been submitted alongside the launch of the modules.

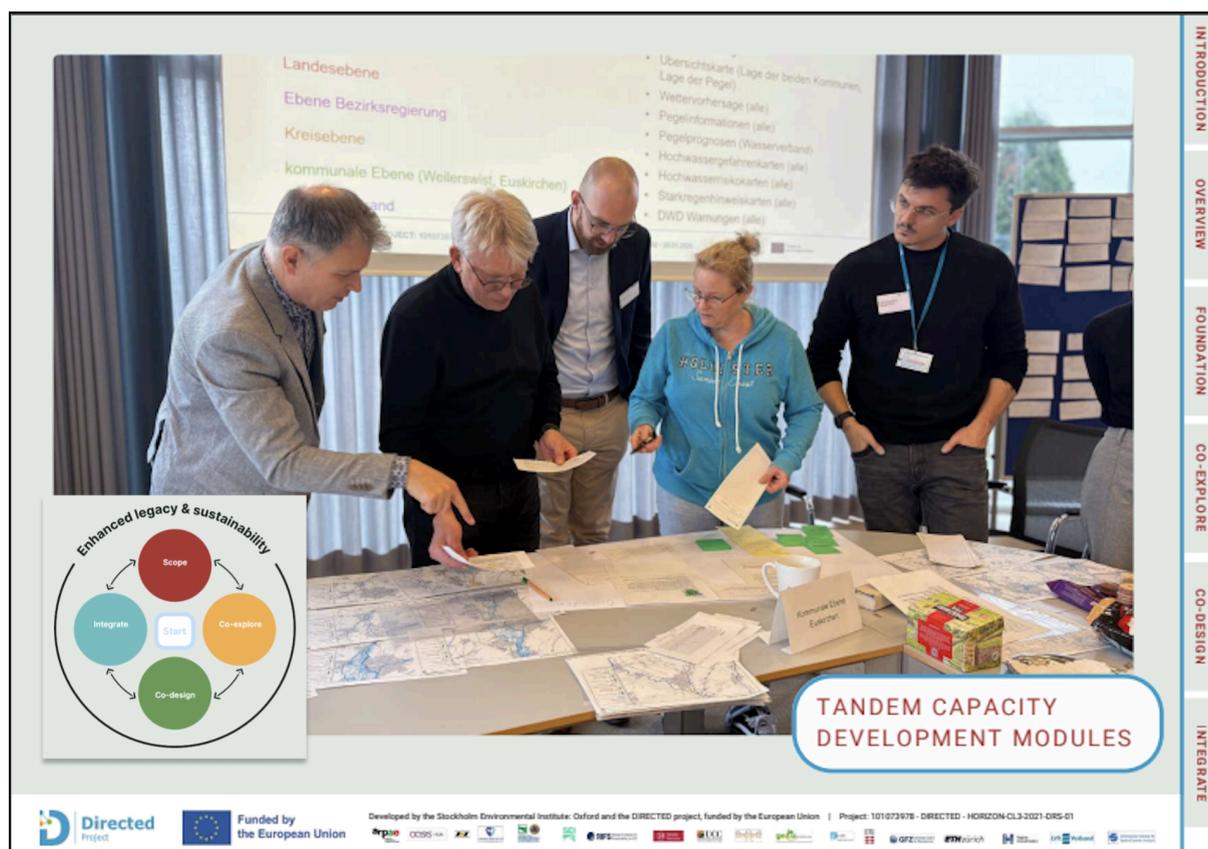


Figure 1: Tandem interactive online modules.

Task 4.2 identified enablers and barriers for integrated DRM at multiple levels through a comparative assessment of RWL contexts. This work builds on analysis of RWL outputs using the data-coding approach first introduced under D1.2 and contributes to several subtasks and deliverables across the project. Task 4.3 is developing an Assumptions Framework for distilling climate and non-climate information provided by the models that are integrated in the Data Fabric. A draft of D4.2 has been submitted in M36 which includes the results of discussions with RWLs and modellers on decision needs and the trade-offs, terminology and assumptions in these models. Task 4.4 involves updating and improving the Tandem knowledge co-production cycle based on empirical evidence from RWLs. The knowledge co-production cycle has been enhanced and refined over time, leading to the successful completion of several milestones (M15-17) and the submission of D4.1 and a detailed draft of D4.2. These outputs will directly inform the final analysis and update of the Tandem co-production framework (D4.3).

Overall, WP4 has made progress in advancing transdisciplinary knowledge co-production within the Risk-Tandem Framework across the RWLs. During RP2, activities shifted from scoping to active co-exploration of risks and co-design of tailored solutions, supported by continuous engagement and capacity needs assessments. Key achievements include the launch of the Tandem capacity development modules (D4.1) and the development of the Assumptions Framework (D4.2, draft submitted), which is strengthening understanding of model information, terminology, trade-offs and assumptions. The Tandem co-production

cycle has been refined iteratively based on emerging evidence, and comparative assessments are beginning to identify cross-cutting enablers and barriers to integrated DRM and CCA.

Upcoming workshop activities with the RWLs will focus on appraising and refining RWL interventions and model inputs/outputs. This will include deeper co-exploration and improving shared understanding of: expectations between user needs and model parameters and results; model uncertainties; concepts and terminologies; and, underlying assumptions and trade-offs. All of this aims to support more transparent, informed and collaborative decision-making. Innovation in this area is being further advanced through a collaboration with the University of the Arts, where two Master's students are contributing to the co-exploration of CCA–DRR terminology. Their work is informing the design of the RWL workshops and will also feature in the Climate Festival in the Zala region in April 2026.

**Work Package 5 (WP5)** focused on the comprehensive design, deployment, and initial refinement of the Data Fabric open source utility. All associated deliverables (D5.1 to D5.5) were fulfilled during the second reporting period. However, this phase encountered several challenges including time-consuming requirement and feature collection, schedule coordination among external peers, and realizing RWL member needs. Notably, meeting the RWL's interoperability usage requirements, essential for the Data Fabric development, transpired to be more time-consuming than originally anticipated.

Subsequently, there were delays in delivering completed models (D5.1 and D5.2), having been affected by slower than expected initiation of RWL and discussions of user requirements. Despite these challenges, the WP5 managed to deploy the initial versions of the Data Fabric and collect vital stakeholder feedback, which led to the release of Version 1 at the end of the second reporting period. This version has been set up for testing and validation by the RWLs, allowing for extensive user feedback collection.

All deliverables D5.1 to D5.5 associated with tasks (Task 5.1 to 5.4) have been completed. Task 5.5 has just been initiated in order to further enhance the Data Fabric based on the feedback collected. While the process ran into delays due to unforeseen complexities, the final product, the open source Data Fabric, has been successfully deployed and is positioned to go through an iterative improvement and refinement process based on user feedback in the RWLs. Remaining tasks regarding change control documentation and user training have been scheduled for the third reporting period.

**Work Package 6 (WP6)** advanced all core tasks - T6.1 Strategic Communication, T6.2 Dissemination and Communication Coordination, T6.3 Exploitation Planning, T6.4 eLearning Development, and T6.5 Pilot Tracking of KTT Implementation and Application of Integrated Governance and Technical Tools - and completed the two deliverables associated within this period. D6.6 (Communications Report Year 2), which was delayed due to unexpected issues affecting the lead author, was finalised and submitted alongside D6.7 (Communications, Dissemination and Exploitation Report Year 3). Under T6.5, the associated deliverable D6.9

was formally postponed to M46 to align with the task timeline and ensure that Year 4 RWL learning can be captured in the legacy document; progress during RP2 included development of an initial skills and capacity framework and testing it during an interactive workshop at the Copenhagen General Assembly. WP6 also introduced an expanded [exploitation section](#), outlining pathways for core tools, methods, and partner-led innovations, and contributed to strengthening the project's Monitoring & Evaluation system through development of a more robust Impact Logframe. Communication and dissemination activities were maintained through project blogs, news items, social media, and partner contributions across the Real-World Labs, who reported local engagement and visibility activities. DIRECTED's participation in conferences, workshops, tool demonstrations and webinars further supported outreach and promoted technical progress, including (but not limited to) Data Fabric developments, SaferPlaces integrations, and immersive outputs such as the Flood Safety VR app and the wildfire public noticeboard in Comacchio. Overall, WP6 ensured completion of required deliverables, strengthened exploitation planning, advanced work on impact monitoring, and progressed the foundations for the T6.5 legacy outcomes planned for the final reporting period.

The project management team in **Work Package 7** has ensured effective coordination and communication by establishing bi-weekly "Jour Fixe" meetings which were made mandatory, guaranteeing stable participation from all partners and minimizing communication failures across all Work Packages and Real World Labs. The provision of meeting minutes and presentations on the internal server ensures transparency. Furthermore, the introduction of a structured Four-Corner WP Update Slide template streamlined the reporting of progress, risks, and next steps. For external communication, regular check-ins with the Project Officer were established, ensuring clear and timely communication with the European Commission. The WP7 team actively fulfilled its responsibility for conflict resolution via continuous check-ins and by organizing one-on-one meetings with WP-leads to proactively address task progress, financial concerns, and risks. This proactive approach also extended to managing major project changes, such as the Amendment for the project addressing the Region-H termination and budget shifts, demonstrating robust administrative control.

WP7 has effectively implemented monitoring and control mechanisms. The Jour Fixe agenda includes regular housekeeping and deadline reminder slides to ensure the timely completion of tasks and deliverables. The team continued to utilize and update the Risk Log established in RP1, proactively monitoring both foreseen and unforeseen risks (like the massive flooding in Emilia-Romagna or the withdrawal of Region Hovedstaden) and detailing clear mitigation strategies, proving continuous oversight of the working plan. To ensure high-quality outputs, continuous updates were made to report templates to improve guidance on layout, corporate design, and the inclusion of ethical dimensions. Internally, financial monitoring was implemented, and the coordinator is facilitating budget planning and transfers to partners like 52N and ZSRT, ensuring resources are appropriately allocated for continued operations and timely completion. The planning and facilitation of Annual General Assemblies in Rimini and Copenhagen also serve as major coordination milestones to review the plan and progress collectively.

The progress under Task 7.3 directly addresses the legacy and exploitation objectives. To ensure the long-term availability of project results, public reports were published on Zenodo under a dedicated DIRECTED community page. This makes deliverables publicly accessible and citable, extending the project's reach and impact. Similarly, the establishment of the DIRECTED GitHub organisation and support for publishing code on public repositories ensures that software and tools developed in the project remain accessible to the developer community during and after the project lifetime, fostering exploitation and sustainability. Furthermore, WP7 coordinated and supported subcontracting activities for RWLs (e.g., sonification, wildfire information design, climate festival support). These targeted activities provide additional funding for data purchase, stakeholder inclusion, and translations, which directly amplifies the real-world impact and local legacy of the project's activities.

**Work Package 8** has actively supported the project's objective of adhering to ethical standards by establishing a robust ethical framework, conducting regular external reviews, and driving the implementation of recommendations across project activities. The core work was delivered by the external ethics advisor in two major reports, D8.2 and D8.3. These reports were crucial, as they systematically identified and evaluated progress on an initial six, and later eight, key ethical dimensions specific to the project, such as Free and Informed Consent, Privacy and Data Governance, and Technical Robustness. Based on the findings and recommendations in the ethics reports, WP8 established a project-internal ethics log and organized focus meetings and an interactive ethics workshop to track implementation and integrate lessons learned across all partners. Furthermore, WP8 directly supported tangible changes, including updating consent forms used in project activities and aiding in the development of the Data Protection Impact Assessment (D5.3) and the overall design of the Data Fabric to ensure technical adherence to the defined ethical principles.

# 1.1 Objectives

The table below tracks project objectives as they are described in the DoA. It provides a short summary of our progress on the pathway towards these objectives. A project MEL system is tracking the pathways towards reaching the objectives. It is part of D6.7 and more detail is provided in the [Impact section 1.3](#).

Table 1: Progress pathways towards project objectives

Objective	Progress Pathway
<p>(SO1) Create an overview of current knowledge, policies, tools, best practices and key actors, their interoperability, and how they influence decisions on DRR and CCA</p>	<p>The knowledge base has been expanded via roadmap development, workshops, and interviews in all RWLs. (D3.2, D2.2). Outputs were reused in governance design and tool specification under WP5 and WP2 (D5.2).</p> <p>A comparative analysis of institutional coordination and fragmentation was added by a case study of floods in RWL2 and RWL4 (D1.3).</p>
<p>(SO2) Advance the interoperability of data, models and tools</p>	<p>Operational integration was achieved between SaferPlaces, RIM2D, Danube Model and CLIMADA via Data Fabric APIs (D5.4; D2.2).</p> <p>RWL applications with interoperability workflows were built for all RWLs (D3.2; M10).</p> <p>Radar/nowcasting ingestion implemented for RWL1, 2, 3. fused outputs combine common assumptions and local data (D5.4).</p>
<p>(SO3) Co-develop a new multi-level integrated risk governance framework for the coherent integration between DRR and CCA policies and the Sustainable Development Goals (SDGs).</p>	<p>The Risk-Tandem Framework was applied in all of the four RWLs. Progress on its development is detailed in D3.2</p>
<p>(SO4) Demonstrate the potential of transdisciplinary and multi-stakeholder co-production as a means to unpack enablers and barriers for developing transformative tools and improved risk management strategies.</p>	<p>More than 10 co-design/table-top exercise events were held with responders, municipalities, utilities and citizens; structured canvases and feedback loops informed the product design (D2.2; D3.2).</p> <p>Tandem co-production methodology (visualisation, mapping, storytelling, scenario engagement) was refined and applied across RWLs ().</p> <p>RWL highlights – ER (visual risk communication showcased at ECCA); Rhine-Erft (TTX institutionalised annually); Danube/Zala (creative workshops → local</p>

	<p>climate alliance); CPH (hotspot mapping and MCA workshop Dec 2025) (D3.2).</p>
<p>(SO5) Leverage innovative digital architectures using data-fabric technique to support integrated multi-hazard DRR and CCA workflows.</p>	<p>The prototype of the Data Fabric has been released as version 1.0 towards the end of RP2 and is freely accessible for testing and evaluation by project partners, RWL stakeholders and beyond. It showcases the interoperability use cases previously identified and designed with the RWL hosts and stakeholders. The interoperability use cases include live data integration and modelling for multiple hazards. Deliverables D2.3 and D3.3 validated real-world performance of the models.</p> <p>The architecture and implementation of the Data Fabric are documented in Deliverables 5.1, 5.2, 5.3 and 5.4. The source code of the Data Fabric constitutes D5.5 and has also been submitted.</p>
<p>(SO6) Demonstrate the feasibility for integrated cross-sectoral and transdisciplinary coordination of the DRM cycle (from prevention, preparedness, to response, and recovery) in the framework of real-life case scenarios based on interoperable tools (SO2) and multi-level risk governance frameworks (SO3).</p>	<p>Contributions to support stakeholders throughout the DRM cycle were tested in each RWL via simulations using Risk-Tandem and the Data Fabric (D3.2; D2.2).</p> <p>Example use cases: Emilia Romagna (flood early-warning tests with SaferPlaces); Rhine-Erft (TTX and cross agency meetings); Danube (urban and rural pluvial flooding, crop adaptation); Capital (urban heat / flood INFORMATICS rehearsals) (D3.2).</p> <p>Case-study findings used to design training scenarios and evaluation criteria (D1.3).</p>
<p>(SO7) Strengthen DRR and resilience-building in the RWLs (and beyond)</p>	<p>Training materials and mock-ups delivered; letters of support and event pathways established towards institutionalisation (insurers forum, regional platforms) (D6.7; D3.2).</p> <p>Uptake and scaling of project results in the RWLs e.g. DRR policy update, revised comms protocols, policy dialogue launched, immersive VR training integrated into plans (D3.2; D6.7).</p> <p>Comparative case study quantifies recovery, finance gaps and communication flows to support future disaster management and resilience (D1.3). Training materials, mock-ups, and briefings delivered; letters of support and event pathways (e.g., insurers forum, regional forums) established; municipal use cases advancing.</p>

# 1.2 Explanation of the work carried out per WP

## 1.2.1 Work Package 1 – Real World Labs

### 1.2.1.1 Introduction

WP 1 in RP2 advances the core goal: building disaster resilience via multi-level governance, interoperable tools, and community engagement across four Real World Labs. It coordinates transdisciplinary co-production and innovations to meet practitioner and stakeholder needs.

During this reporting period, WP 1 work shifted from setup to delivery. Milestone M4 documented RWL co-production progress by summer 2024. Deliverable D1.3 produced a forensic comparative study of the Rhine-Erft and Emilia-Romagna floods with actionable lessons for policy, practice, and training. Milestone M5 was achieved via D4.2 (“Assumptions Framework”), a replicable method that connects complex models to end-user decisions, improving the usability of risk information. Together, these outputs show coherent, real-world application of the project’s frameworks and the formation of durable, co-created partnerships.

The work carried on across the four Real World Labs has systematically advanced from the foundational strategy into a dynamic, implementation-focused co-production cycle. This transition is grounded on adaptive development and testing of operational protocols and governance mechanisms.

Some examples are the co-designed Webex-based flood “situation assessment” protocol in the Rhine-Erft Region (RWL 4) or the full-scale civil protection Wildfire exercise in Emilia-Romagna (RWL 2).

Furthermore, this phase established iterative engagement cycles to translate evolving stakeholder requirements (user stories) into technical and model specifications and requests for the Data Fabric (WP5). This aims to make technical solutions, such as the integrated risk models developed for regions like the Danube (RWL 3), more and more user-centric and in line with RWL expectations.

Collectively, these activities confirm a systematic progression from conceptual frameworks to applied procedural implementation. This trajectory validates the essential function of

co-production in maintaining contextual relevance and delivering locally tailored solutions across the diverse operational realities of all Real World Labs.

### 1.2.1.2 Progress per task

Work Package 1 comprises 3 tasks along with their corresponding deliverables and milestones. An overview of the deliverables of each task and their status is depicted in the table provided below (in italic tasks and deliverables belonging to RP1 resubmitted /discussed during RP2).

Table 2: Summary of deliverables, milestones, and tasks status in WP 1.

Deliverables, Milestones and Tasks	Status report
<p><i>Task 1.1 Setting up and Making Operational the Real World Laboratories (RWLs)</i>  <i>D1.1 – RWL description and set-up – (Lead Beneficiary: GECCO)</i>  <i>M1 – RWL framing and actors involved</i>  <i>M2 – RWL operative and stakeholders involved</i></p>	<p><i>Completed.</i></p> <p><i>D1.1 was revised and resubmitted in August 2024 and has been accepted.</i></p> <p><i>M1 and M2 achieved in RP1.</i></p>
<p>Task 1.2 RWL Co-production process  <i>D1.2 – Capacity development strategy for Training of Trainers on implementing transdisciplinary knowledge co-production processes in the RWL – (Lead Beneficiary: SEI)</i>  <i>M3 – Periodic report #1 on outcomes of the RWL co-production process</i></p> <p><b>M4</b> – Periodic report #2 on outcomes of the RWL co-production process  <b>M5</b> – Periodic report #3 on outcomes of the RWL co-production process  <b>M6</b> Periodic report #4 on outcomes of the RWL co-production process</p>	<p><i>Completed for the RP2 part:</i>  <i>D1.2 revised and resubmitted following the RP1 review and has been accepted.</i>  <i>M3 completed in RP1.</i></p> <p>M4 achieved  M5 achieved (Integrated into D4.2 draft of September 2025)  M6 due on 31 July 2026</p>
<p>Task 1.3 - Evaluation and Outcomes/Impact monitoring of the RWL  <b>D1.3</b> – Case studies of DRR/CCA processes to date - forensic examination of real world process and events management – (Lead Beneficiary: OASIS)  D1.4 - Outcomes from RWL in multi-risk governance (Lead Beneficiary: RIFS)  <b>M7</b> - Evaluating the impact/ lessons learnt from the application of the governance mechanisms in RWL</p>	<p>Task 1.3 is ongoing.</p> <p>D 1.3 - submitted</p> <p>D1.4 due on 30 June 2026</p> <p>M7 due on 30 September 2026</p>

### **Task 1.1 Setting up and Making Operational the Real World Laboratories (RWLs) (M1-M10) (lead: GECO, co-lead: G&C, contributors: ALL)**

The initial setup phase of the Real World Labs (RWLs) was completed within the first ten months as planned. However, the subsequent period involved effort in refining the operationalization, focusing on translating the established stakeholder relationships into concrete, co-developed work plans and tangible outcomes.

This process led to the revision and **resubmission of Deliverable 1.1 – RWL Description and Setup in August 2024 (M23)**, incorporating reviewer feedback and additional stakeholder consultations. Although D1.1 formally describes activities conducted in the first reporting period, its revision involved a targeted analytical effort to support the continuation of WP1 activities.

Key efforts under Task 1.1 focused on consolidating the operational structure of the four Real World Labs and refining foundational documentation (Deliverable D1.1) after receiving reviewers comments, to align with the overarching project objectives. The revised D1.1 substantially expanded the operationalization of the RWLs, providing a situational assessment for each Lab. This assessment documented governance structures, identified key challenges, and clarified stakeholder expectations.

This work also clarified the RWL's specific mandate within the DIRECTED framework, strengthening the links necessary for subsequent knowledge co-production (WP4) and multi-risk governance processes (WP3).

The [Miro Board](#), developed within Task 1.1 ([Figure 2](#)), has become a **key operational tool** for the project. It now serves as a central platform for documenting stakeholder engagement and enabling interdisciplinary collaboration across all work packages, representing a tangible legacy of the initial setup phase.

This platform also serves as the central repository for the detailed final-year **roadmaps for each RWL**, which were presented and refined during the General Assembly in Copenhagen. An example of this forward-planning documentation for RWL1 is provided in [Figure 3](#) below.

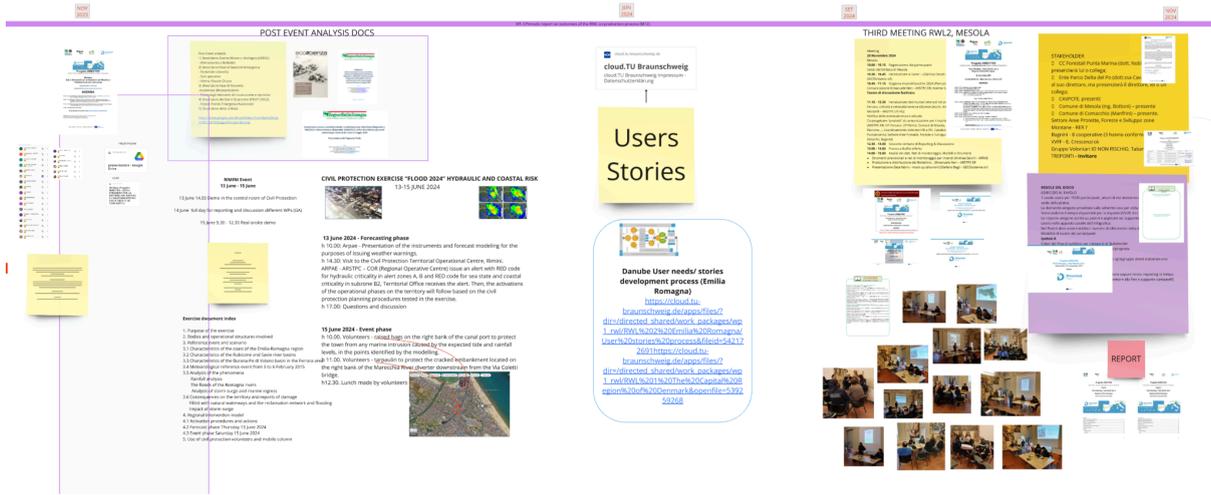


Figure 2: Example of the interactive Miro Board used to document the setup phase and ongoing progress of RWLs, including outcomes and plans.

Title	Description	Status	Assignee	Start Date	End Date	Priority
1 Prep data for MCA workshop	Prepare data for MCA workshop. Updated DEM including adjustments and 2007-DEM to GECCO and GFZ early sep Flood modelling and risk calculations. Data to ETH (Saferplaces + adaptation) and 52 N (Saferplaces and SCALGO) late Sep	In Progress	DTU	Aug 1, 2025	Sep 30, 2025	High
2 Prep data for MCA workshop	Flood hazard and risk calculations. Data to ETH	In Progress	DTU	Sep 21, 2026	Oct 19, 2026	High
3 Prep tool for MCA workshop	ETH setup MCA tool	In Progress	ETH	Oct 12, 2026	Nov 8, 2026	High
4 Plan workshop IV	Invite stakeholders and plan workshop in detail	Not Started	DTU, ETH, SEI, UCC etc.	Sep 17, 2026	Oct 30, 2026	High
5 Workshop IV: MCA with stakeholders	Workshop IV - Present completed Data Fabric - MCA workshop with hard and soft measures and tangible and intangible criteria Focus on hotspots Elements of WP4 proposed Sep25 and Dec25 Ws	Not Started	DTU, ETH, SEI, UCC etc.	Nov 1, 2026	Nov 30, 2026	High
6 Forensic analysis	Forensic analysis of effects of the Storm Bodil (Dec 2013) on climate adaptation and plans in Roskilde Fjord. Leading to both short conference paper and long paper. Climada Deadline on conferencepaper: 15th Dec	In Progress	DTU, GECCO, GFZ2, ETH	Jun 1, 2025	Dec 15, 2025	High
7 Plan workshop V	Plan workshop with usability exercise together with DEMA.	Not Started	DTU, DEMA	Dec 1, 2025	Feb 28, 2026	High
Workshop V: Exercise	Workshop with stakeholders around Roskilde Fjord: Usability exercise + evaluation Elements of WP4 proposed Dec25 WS	Not Started	DTU, DEMA, who else?	Feb 1, 2026	Feb 28, 2026	High
9 Workshop VI:	Workshop with stakeholders around Roskilde Fjord (maybe larger event): Governance and Exploitation + scaling. Evaluation and next steps Elements of WP4 proposed Apr26 WS	Not Started	DTU, DEMA, OASIS, RIFS	Apr 1, 2026	May 31, 2026	High
10 Post-DIRECTED		Not Started	DTU	Jun 1, 2026	Sep 30, 2026	
11 Outreach: Participate in Regions week	Participate in DIRECTED-NBS4EU session	In Progress	DTU (Kaija)	Oct 14, 2025	Oct 15, 2025	
12 Outreach: ICFM10 conference	Presenting Forensic analysis of the effects of Bodil	In Progress	DTU	May 20, 2026	May 22, 2026	

Figure 3: Excerpt from the detailed final-year work plan for RWL 1 (Denmark), presented and refined during the General Assembly in Copenhagen (September 2025).

### **Task 1.2 RWL Co-production process (M1-M45) (lead: SEI, co-lead: UCC, contributors: 52N, RWL partners)**

**As an outcome of the D1.2 (Capacity Development Strategy) and T4.1** advancing the application of Tandem into RWLs through training, T1.2 has progressed as planned over RP2. Although each Lab has approached implementation of co-production differently, all have integrated guidance and activities from WPs 3 and 4 into workshop design and engagements (see sections [1.2.3.2](#) and [1.2.4.2](#)). Each lab has progressed through the (Risk-)Tandem cycle from scoping (Phase I, 2023) to co-exploration (Phase II) and co-design (Phase III) by September 2025. The RWLs now focus on building upon the emerging evidence from these activities to explore contextual challenges in terms of risk governance, communication and data interoperability to co-design tailored interventions (for further information on capacity development, see section [1.2.4](#)).

The co-production process has also contributed to, and supported, the development of user stories guiding the Data Fabric (D5.2, Low-level design). Through regular engagements, RWL hosts have co-explored information needs in their Labs, which in turn has informed the development of tailored modelling solutions for stakeholders. These outcomes are described in detail in D5.2 and D4.2.

The co-production process has been structured through milestones M3-M6, each acting as a reflective reporting point that traces how the RWL co-production pathways have developed over time. M3 and M4 are already complete and were based on the interpretive coding framework from D1.2. Milestone M5 has now been repositioned within D4.1 (the Assumptions Framework) because both aim to capture how RWL hosts and modellers build shared understanding and integrate their thinking throughout the reporting period. The draft of D4.2, submitted in September 2025, therefore serves as both an interim consolidation of co-production progress (as a part of comparing identified RWL needs, plans and current status to available risk information), and a step towards the final deliverable due in M42. In this way, the current D4.1 draft effectively meets the expectations of M5 and reflects the growing coherence of co-production across the RWLs.

M6 will be submitted by M48.

### **Task 1.3 Evaluation and Outcomes/Impact monitoring of the RWL (M8-M48) (lead: RIFS, co-lead: G&C, contributors: OASIS, UCC, IIASA, RWL partners)**

This task assesses the performance of the Risk-Tandem Framework within the RWLs. It runs in parallel with Task 3.3. The evaluation focuses on how the governance mechanisms strengthen multi-stakeholder engagement, support interoperability, and promote knowledge exchange to integrate DRR and CCA planning and operations. This also includes a forensic review of real-world processes and event management (D1.3). Task 1.3 resulted in Deliverable 1.3 in RP2.

Deliverable 2.3 provides a concise comparative case study of two major European flood events: the 2021 Rhine-Erft floods (Germany) and the 2023 Emilia-Romagna floods (Italy). The study, led by Oasis Hub with the active contribution of both Real-World Labs, applies a desk-based analytical approach to synthesise scientific literature, official reports and regional documentation, validated by RWL partners.

The analysis examines key components of disaster preparedness, emergency coordination, risk communication, debris and waste management, and post-event recovery planning. Although both regions experienced extreme rainfall of similar magnitude, differences in governance structures, institutional arrangements and communication systems significantly shaped impacts and response effectiveness.

The comparative findings highlight the need for adaptive, data-driven Disaster Risk Management strategies across Europe, offering actionable insights for improving monitoring, evaluation and anticipatory planning in the Rhine-Erft and Emilia-Romagna RWLs, as well as transferable lessons for other RWLs. For the full technical description, refer to Deliverable 1.3.

In the context of Task 1.3, it is important to note that Deliverable 3.2, which documents the application of the Risk-Tandem Framework in RWL, provides comprehensive and in-depth insights into each RWL's existing DRM and CCA strategies, as well as the ways in which these strategies have evolved through the implementation of the Risk-Tandem Framework and the broader DIRECTED project. This deliverable constitutes a significant step toward the systematic monitoring of RWL progress and establishes a potential evaluative framework to inform future developments. Milestone 13, annexed to Deliverable 3.2, further supplements this analysis by presenting a consolidated overview of all Risk-Tandem Framework related engagement activities among the consortium, host institutions, and RWL stakeholders.

In parallel with the Comparative Case Study, Oasis Hub developed a **VR Flood Safety App**, co-produced with RWL 2. The app provides users an immersive, first-person experience of critical safety procedures and time-sensitive decisions during a flood event onset. This innovation directly addresses recurring challenges related to early-warning communication and public comprehension of flood risk at the community level, and behavioural awareness and anticipatory learning, offering opportunities for the ARSTPC-ER to improve citizen engagement beyond the project duration. Please refer to D3.2 for more details on the Virtual Reality Flood Safety Experience.

The Case Study and communication elements discussed in the case study, also formed the foundation of a panel session at WMO regional meeting in Prague in November 2025, where great interest was **shown by participants including JRC, DG ECHO and Google** to the extent we are likely to showcase our work at future meetings with the organisations mentioned.

### 1.2.1.3 Stakeholder engagement

Stakeholder engagement across all Real World Labs (RWLs) during RP2 followed a co-production process consistently structured under the Risk-Tandem Framework and monitored through the Monitoring, Evaluation, and Learning (MEL) approach. Activities (including interviews, workshops/exercises, webinars, and targeted meetings) were implemented in iterative cycles.

This sustained engagement served a clear objective: systematically translating contextual stakeholder needs and challenges (e.g., user stories) into actionable operational requirements and technical specifications for the DIRECTED tool (particularly Data Fabric-WP5) and the refined governance mechanisms (WP3). This iterative, bottom-up process provides a pragmatic, user-centric approach for solution development.

Participants, events, and outputs are consolidated in Milestone 13, with description of RWL stakeholder engagement activities. An in-depth description of the process and the various engaging moments summarized hereafter can be found in **Deliverable D2.2**. A detailed list of co-production activities is available in the Annex I of D3.2.

The Table 3 below summarizes the types and numbers of RP2 engagement in each RWL.

*Table 3: Summary of RP2 engagement activities by RWL.*

RWL	Interviews	Workshops/Exercises	Webinars	Meetings
RWL 1 – Capital Region of Denmark	4	2	1	2
RWL 2 – Emilia-Romagna		3		3
RWL 3 – Vienna	3	2		
RWL 3 – Zala	4	2	3	5
RWL 4 – Rhine-Erft		4		2

### RWL 1: The Capital Region of Denmark

During the second reporting period RWL 1 deployed a structured stakeholder engagement via interviews, scenario simulation exercises and webinars to co-explore critical inter-municipal coordination and data interoperability gaps, guiding the user-driven technical pathway for Data Fabric development. Hereafter, we synthesize the main engagement moments.

#### Interviews

A second round of structured **stakeholder interviews (April–May 2024)** with municipalities and emergency services around Roskilde Fjord identified communication gaps, unclear cross-municipal coordination, and data/modelling needs. The sequence covered Egedal/Frederikssund/Halsnæs municipalities (16 Apr), Frederiksborg Fire & Rescue (30 Apr), Roskilde Municipality & Fire Dept. (7 May), and Lejre Municipality & Fire Dept. (13 May). These interviews informed the design and priorities of the subsequent co-exploration workshop and strengthened relationships with the new RWL 1 host setup.

## Workshops

**The second RWL 1 workshop on 20 Aug 2024** simulated an extreme storm-surge scenario for Roskilde Fjord (2050) and used a prioritisation exercise to converge on high-value challenges (e.g., coupled rainfall–surge modelling, wave effects in warnings, denser local observations, resourcing for GIS, expectation-management with citizens). With consensus on a user-driven technical pathway, a follow-up online session in Nov 2024 reviewed first Data Fabric mock-ups and collected UI/data-layer feedback that guided development into early 2025.

**The third workshop on 10 Apr 2025** presented a first Data Fabric version for hands-on testing and gathered structured feedback; sessions also addressed coupled-event mapping options, municipal focus areas along the fjord, and the designated flood risk areas for Roskilde Fjord according to the 2024 EU Floods Directive implementation cycle.

## Webinars

**On 26 Feb 2025, RWL 1 contributed to the “Not Just Another Tool” webinar**, presenting how stakeholder engagement and co-creation steps preceded and shaped the Data Fabric and discussing pathways to sustain its use beyond the project.

## Meetings

**Targeted meetings in July 2024** with Region Zealand (3 Jul) and DEMA (9 Jul) shared interview findings and aligned on communication/organisational challenges; DEMA proposed a “Bodil 2050” planning exercise concept later echoed at the GA. During the GA hosted by DTU/Region H (1–4 Sep 2025), DMI and DEMA presented on climate-data interoperability and national emergency response, joined the field visit to Roskilde Fjord, and offered to support Data Fabric promotion which is evidence of strong and sustained national-level buy-in.

## RWL 2: The Emilia-Romagna Region

The work in RWL 2 during this reporting period exemplifies the project's strategic shift from conceptual frameworks to practical, on-the-ground implementation. This was achieved through a structured sequence of activities anchored by two large-scale civil protection exercises.

These practical demonstrations were underpinned by a continuous, iterative cycle of co-production, where stakeholder needs, identified in targeted workshops (e.g., the Mesola wildfire workshop), were directly translated into technical specifications during dedicated co-design sessions for the Data Fabric. This approach demonstrates a clear and coherent implementation roadmap, moving beyond theoretical discussions to deliver tangible, co-created outcomes that directly address stakeholder-defined challenges, with each phase seamlessly aligning prior insights into subsequent refinements across the integrated platform architecture.

### Workshops/Exercise

**Rimini “DIRECTED Flood 2024” exercise (13–14 June 2024).** Two-day, multi-agency drill during the Rimini GA to validate hydro-meteo–coastal warning workflows, inter-institutional procedures, and tool/data interoperability. Day 1: briefing at ARSTPC Rimini Control Room, orange/red alerts issued, preventive measures defined with ARSTPC-ER, ARPAE-SIMC, municipalities, HERA, reclamation consortia, and volunteer coordinations. Day 2: field operations at Rimini Harbour, including embankment, sandbagging, riverbank protection, and live coordination at the CCS; exercise setup document and media available (see [RWL\\_RoadMap – Miro](#); video: <https://www.youtube.com/watch?v=EwH3io6NF6I>).

**Mesola wildfire workshop (20 Nov 2024).** Full-day session on hazard, governance, communication, tools and data with ARSTPC-ER, ARPAE-SIMC, municipalities (Comacchio, Mesola, Rimini), volunteer coordinations, and Fire Brigade.

Main outputs include prioritised exposure/vulnerability profiles; communication gaps and remedies (targeted signage, Updateable AIB (Forest fire prevention) bulletin on the risk level and the adoption of consequent behaviours during the Forest fire prevention campaign (usually from June to October) and related dissemination, mass-messaging, materials for tourists; governance needs (notification systems, trained staff, interoperable platforms, radio upgrades, more joint drills).

Afternoon focused on Forecasting tools and monitoring networks for fires; Data Fabric mock-up for Rimini presented.

**Comacchio wildfire field exercise (24 May 2025, Lido degli Scacchi).** Scenario from the Municipal Civil Protection Plan (Jacaranda pine forest, 6.8 ha, urban interface, ~7,000 people potentially involved). Objectives: end-to-end test of AIB warning/communication, equipment and radio network checks, volunteer tactical operations, interface-area criticalities, multi-level planning updates per national guidelines, and preliminary wildfire-scenario modelling for Data Fabric. ~80 participants across ARSTPC-ER units, Fire Brigade, ARPAE-SIMC, municipalities, volunteer coordinations, and GECOsystema; debrief confirmed strong cooperation and pinpointed operational/communication fixes (regional media coverage [here](#)). A direct outcome of the workshop and the subsequent field exercise was the start of co-designing a practical **Wildfire Risk Communication Kit**, designed to improve public awareness and include physical information panels with QR codes, linking to official bulletins

and municipal plans, as well as social media cards and web banners for wider dissemination. More details on the kit can be found in Deliverable 3.2.

## Meetings

**Implementing Data Fabric for hydraulic/coastal risk (23 Jan 2025, online).** ARPAE/GECO technical consultation established Data Fabric interoperability technical specifications, including data, tools and access protocols for hydraulic/coastal risk forecasting chain, please refer to D3.2 for more details on the meeting content.

**RWL2 Data Fabric flood demo — Rimini (14 Apr 2025, onsite/online).** Walkthrough of the Safer Places real-time dashboard; confirmed integration of short-term forecasts, offline mode, interpolation and geometry visualisation, comparative analysis; agreed next steps for implementation, forecast ingestion, and geometry data review with the CP control room.

**Implementing Data Fabric for fire risk (19 Feb 2025, online).** Joint ARPAE–ARSTPC-ER–GECO–Regional Fire Brigade scoping of an operable CP tool integrating met data and fire-propagation models; actions: screen 2–3 candidate models incl. morphology handling, compile met/geo datasets, integrate vegetation/fuel maps and historical fire data, and coordinate with Forestry Police for incident records to enable realistic scenario simulation.

## RWL 3: Danube Region

### Test site Vienna

The engagement in the Vienna test site was strategically structured to address the City's specific challenges: a highly centralized governance system, and a complex, interconnected multi-risk landscape (including fluvial flooding of the Danube River and pluvial flash floods).

### Workshops

**Workshop 1 (10 Sep 2024, BOKU Hydraulics Lab)** convened insurers, authorities, and scientific partners to align on extreme-event trends, early-warning and long-term risk modelling, and to exercise a 100-year pluvial scenario reflecting the 17–18 Aug 2024 Vienna event. Gaps were mapped in data access, communication chains, and timeliness; DIRECTED models (SaferPlaces, Danube Model, CLIMADA, RIM2D) and Data Fabric aims were positioned for operational and planning use.

**Workshop 2 (9 Jul 2025)** presented three user stories for Vienna, upgrades to Danube Model and SaferPlaces, and a web-app prototype. Stakeholders requested higher-resolution mapping, channel/infiltration integration for pluvial modelling, and discussed structural protection, legal constraints, and AT-Alert cell broadcast. While it became clear that the fluvial flood scenarios from the Danube Model are of minor interest (as the city of Vienna is well-protected against this specific hazard) a mapping of the simulated water levels to local

gauge readings got on the wish list, and confidential rating curve data were provided to PIK. An interoperability check, aligned with RISK-TANDEM, closed the session.

## Interviews

**Pre-workshop consultations** with BMLUK, GeoSphere, and leading insurers (Generali, VIG, UNIQA/UNIQA Sustainable) prepared stakeholders on RISK-TANDEM and scoped pluvial risk needs following the Aug 2024 storm and the mid-Sep 2024 “Boris” floods across Central and Eastern Europe. Follow-up actions included exploring more granular pluvial mapping for HORA, organizing an annual Risk-Tandem Framework workshop in Vienna, insurer “climate ambassador” roles, and potential HORA replication to other Danube countries.

## Test site Zala Region

The Zala test site targeted a centralized system with limited local analytical capacity and multi-hazard interactions (pluvial flash floods, land-use driven mudslides), shifting from needs collection to user-driven specifications for Data Fabric, forecasting, and education.

## Interviews

**January 15, 2025** - Forestry expert interviews (Bakonyerdő ZRT., Attila Jagicza): User story development for forest fire prevention and integration of forestry data into modelling frameworks. During these sessions, detailed discussions were held regarding Data Fabric requirements for forest fire risk indices, real-time vegetation monitoring data specifications, and the expected performance criteria for predictive fire behaviour models. Data exchange agreement was established between forestry databases (collected from local meteorology stations) and the DIRECTED modelling platform.

**February 12, 2025** - Water management expert in-depth interviews: Mapping water quality protection and flood management challenges for Kis-Balaton region. The interviews focused on aligning hydrological data formats with Data Fabric standards, clarifying requirements for integrated water level forecasting models, and establishing technical specifications for real-time water quality monitoring integration. Stakeholders shared data exchange protocols between local water authorities and the dashboard system they use centrally.

**March 18, 2025** - Limnological researcher interview series: Balaton ecosystem changes and modelling needs assessment. These consultations centred on Data Fabric integration requirements for lake ecosystem models, coordination of biological and chemical monitoring data streams, and specification of predictive algae bloom forecasting model accuracy expectations. Technical requirements were defined for linking limnological research databases with the decision-support platform. The integration may be difficult, but some long term models related to global temperature can be useful.

**April 8, 2025** - Consultation with ChloroFeel Education Center representatives: Environmental education programs and the use of data fabric outcomes and integration planning. Discussions focused on educational data visualization requirements within the Data Fabric, alignment of environmental monitoring protocols for educational purposes, and specification of user-friendly interface requirements for non-technical stakeholders accessing predictive environmental models.

### Workshops

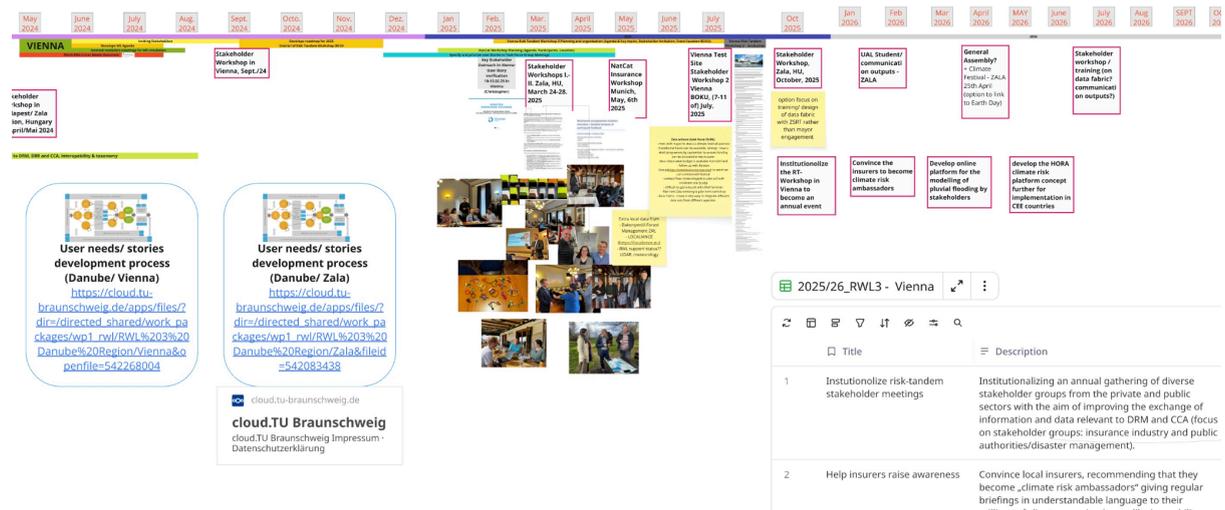


Figure 4: Example of a RWL roadmap for the Danube RWL

**Zalaegerszeg (24 Mar 2025)** with first responders focused on forecasting needs, weather-station harmonisation, emergency-database connectivity, short-term prediction specs, and social-vulnerability mapping requirements; a Data Fabric demo gathered interoperability and alerting requirements.

**26 Mar 2025- Keszthely Workshop:** used RISK-TANDEM storytelling to define visualization needs, historical-event integration, scenario accuracy, a West-Balaton vision, and dashboard co-design priorities including UI, permissions, and model-performance specs.

### Webinars

**April 23, 2025** - Online demonstration webinar: DIRECTED project objectives and Zala Real World Lab presentation (45 participants). The session included detailed explanation of Data Fabric architecture, discussion of data sharing protocols among participants, and clarification of technical requirements for stakeholder data integration into predictive modelling systems.

**July 16, 2025** - Professional webinar: Climate change impacts in the Balaton region (38 participants). Technical focus on Data Fabric capabilities for climate data integration, coordination of regional climate monitoring databases, and specification of long-term climate prediction model requirements for local decision-making.

**Aug 14, 2025** - Experience sharing webinar: Real World Lab results presentation (52 participants) for INTERREG programme participants in LOCALIENCE.

## Meetings

**March 28, 2025** - Bilateral meeting: Representatives of the National Water Management Directorate regarding Zala River flood protection challenges. Detailed technical coordination focused on Data Fabric integration requirements for flood forecasting systems, harmonization of river monitoring data with national databases, and specification of early warning model accuracy standards for operational flood management.

**May 7, 2025** - Partner meeting: Bakonyerdő Ltd. forestry experts on forest fire risk modelling. Technical discussions centred on Data Fabric connectivity with forestry management systems, coordination of forest inventory data for fire risk models, and establishment of performance requirements for automated fire danger rating systems integrated with regional emergency response protocols.

**July 3, 2025** - Professional consultation: Limnological Research Institute representatives on Balaton water quality monitoring. Focus on Data Fabric requirements for lake monitoring data integration, coordination of research database connectivity with operational management systems, and specification of water quality prediction model accuracy, expectations for tourism and environmental management applications.

**March 25, 2025** - Site visit: ChloroFeel Education Center and environmental data collection methodology familiarization.

**March 27, 2025** - Kis-Balaton field survey: Joint site assessment with water management experts. Field-based coordination of monitoring station data connectivity with Data Fabric systems.

## Key Results and Partnerships

New collaborations include Keszthely Municipality, Zala Disaster Management Directorate, Bakonyerdő, NYUDUVIZIG, the Balaton Limnological Institute, and ChloroFeel. Forestry, water-management, and education user stories were formalised with specific Data Fabric and model-performance requirements. A Zala Data Fabric dashboard co-design started, including social-vulnerability modules and critical data needs; a nowcasting service was technically scoped for ZSRT at ~2.5 km via APIs.

## International Connections & Next Steps for RP3

Synergies with LOCALIENCE and continuous coordination on interoperability were strengthened; the consortium issued a Letter of Support for ZSRT's Pathways2Resilience proposal as a pathway to sustain the Data Fabric beyond DIRECTED project duration. Next steps include prototype testing with local users, further stakeholder training and system

optimisation, support to the Balaton Climate Alliance, digital competency programmes based on HU terminology translations, planning a Spring 2026 Climate Festival, an Autumn 2025 validation workshop, and hosting the 2026 DIRECTED GA in Zala.

### Climate Festival - Scope & Purpose

The Spring 2026 Climate Festival reimagines the traditional Helikon Art Festival as an arts-meets-climate-action event for the Balaton and Zala region. It will combine cultural performances, visual arts, and storytelling with RWL climate awareness workshops, creating an accessible platform for diverse audiences—from local communities to policymakers—to engage with climate adaptation through creative expression.

The festival serves dual purposes: raising public awareness about regional climate challenges (droughts, extreme weather, water management) while showcasing DIRECTED project outcomes, including the Data Fabric and stakeholder-driven solutions. By integrating art installations, music, theatre, and interactive exhibits with scientific data visualization and expert panels, the event transforms climate discourse from abstract policy into tangible, emotionally resonant experiences that inspire local action and foster the Balaton Climate Alliance network.

## RWL 4: Rhine-Erft Region

The stakeholder engagement strategy in RWL 4 was designed to be multi-layered and inclusive, moving beyond a core group of technical partners to actively involve the practitioners and key administrative bodies, as well as encourage public participation through dedicated events and presentations. This broad outreach laid the groundwork for the future scalability and regional adoption of the project's outcomes, demonstrating a proactive strategy to maximize long-term policy and societal impact.

This process was structured as an iterative cycle of co-production supported by the Risk-Tandem Framework, designed to translate identified needs into concrete actions and marking a clear shift from conceptual discussions to practical implementation. A prime example of this is the co-design and successful field-testing of a new operational procedure for flood situation assessment via an online meeting. This initiative directly addressed a critical coordination gap identified by stakeholders themselves and is now being formalized into a stable, adopted tool.

Furthermore, this deep engagement directly informed the technical development of the project's key innovations Data Fabric and Risk-Tandem Framework. The operational needs that emerged from workshops and the tabletop exercise were systematically translated into specific functional requirements for the Data Fabric—such as urban water retention tools, 'what-if' simulations for dams, and rapid nowcasting alerts—ensuring the tool is not an academic exercise but is built to solve real-world problems defined by its end-users.

## Workshops

**4th stakeholder meeting (18 Mar 2024):** project status; linkage with KRITIS-Dialog; facilitated mapping of roles, processes, and communication chains for imminent/ongoing floods. The workshop fostered the exchange between RWL4 stakeholders, led to discussions and supported trust building. Furthermore, the discussions led to an understanding of the importance of assessing the current situation during a flood event in order to be able to make decisions. This information served as the basis for the development of the user story US4.8 Pluvial Early Warning and Nowcasting for DRR.

**6th stakeholder meeting - Tabletop ExerciseTTX (20 Jan 2025):** three-phase flood scenario (pre/during/post) across six institutional groups; structured debrief produced corrective actions and Webex-meeting-protocol refinements. For the TTX we worked with RWL4 Stakeholders, as well as the district government of Cologne and the state agency for nature, environment and climate North-Rhine Westphalia. The TTX confirmed how important the knowledge of potentially affected areas (flood risk maps), the effect of flood protection measures and potential damages as a result of e.g. failure of flood protection measures can be. This information served as the basis for the user stories US4.5 simulation sandbox.

**Hochwasserforum (28 Aug 2022):** regional forum on AI-supported modelling, sensors, alerting, DIRECTED results, and urban adaptation planning.

**Aktionstag “Wasser und Wir” (29 Aug 2025):** public outreach on heavy-rain and flood protection, educational activities, and guided visits to Erft restoration sites.

## Meetings

**5th stakeholder meeting (19 Aug 2024):** updates; feedback from an online hydrological “situation assessment” on an early-May 2024 real event; progress check.

**7th stakeholder meeting (19 May 2025):** TTX debrief; update on the Webex rapid assessment protocol for minor events; briefing on climate change in NRW; initiation of drought/adaptation thread; Data Fabric progress and stakeholder feedback on DIRECTED status.

## 1.2.2 Work Package 2 – Interoperability

### 1.2.2.1 Introduction

This work package is one of the thematic work packages that addresses challenges of interoperability needed for DRR and CCA that are in the four RWLs (WP1). Specifically, WP2 addresses the interoperability of data and models. The work package is implemented in the context of the RWLs and is strongly connected to virtually all the work packages in the project.

WP2 comprises interconnected subtasks. Task 2.1 takes stock of the existing state-of-the-art (models, data, standards) and - informed by findings from the RWLs - guides the way for implementation of interoperable models and solutions in the RWLs. Task 2.2 orchestrates the assembly of a configurable suite of enhanced models, data flows, or quasi-technical artifacts informed by RWL requirements and conjectural recommendations derived from Task 2.1, with emphasis on multi-layered integration and procedural abstraction. Finally, Task 2.3 provides demonstrations of new or updated practice examples based on the interoperable (technical) tools and practices that are co-designed with practitioners and stakeholders in the RWLs.

### 1.2.2.2 Progress per task

Work Package 2 comprises tasks along with their corresponding deliverables. An overview of the deliverables of each task and their status is depicted in the table provided below.

*Table 4: Summary of deliverables, milestones, and tasks status in WP2.*

Deliverables, Milestones and Tasks	Status report
Task 2.1 Stocktaking for interoperability - a compendium	Finalized
D2.1 Compendium on Data Standards for interoperability in DRR and CCA	Submitted
M8 Multi-criteria assessment based on the FAIR framework ready for evaluation	Submitted
Task 2.1 Making tools interoperable	Finalized

D2.2 Enhanced interoperability of tools	Submitted
Task 2.3 Multi-hazard modelling for integrated DRM and CCA: Demonstration in RWLs	Ongoing
M10 Interoperability fact sheets	Submitted

**Task 2.1 Stocktaking for interoperability- a compendium (M1-M24) (lead: GECO, co-lead: 52N, contributors: GFZ, DTU, PIK, ETH, SEI, OASIS)**

Task 2.1, “Stocktaking for Interoperability – A Compendium,” aims to identify and evaluate data interoperability standards for disaster risk reduction (DRR) and climate change adaptation (CCA). The goal is three-fold: (i) to create a comprehensive framework and dataset to inform the design and technical structure of the Data Fabric (WP5); (ii) to identify emergent and contextually inferred interoperability exigencies to inform subsequent Task 2.2 processes; and (iii) establish baseline Technology Readiness Levels (TRLs) for tools used in the project.

Task 2.1 was the second reporting period and its main results reported in a number of deliverables (see below). During the present reporting period, Task 2.1 particularly advanced in three main areas:

1. Compilation and Assessment of Interoperability Standards

- Completion of the multi-criteria assessment based on the FAIR data principles (Findable, Accessible, Interoperable, Reusable).
- Integration of new datasets and the expansion of nominally identified best practices from platforms such as Copernicus Climate Change Services and the Copernicus Data Store to support generalized interoperability and meta-structural alignment.
- Refinement of ranking criteria for selecting key interoperability patterns suitable for DRR and CCA.

2. Engagement with Related Work Packages

- Contribution of findings to WP5 for the development of the Data Fabric.
- Coordination with Task 2 (Making Tools Interoperable) to ensure selected interoperability standards align with implementation requirements.
- Integration of outcomes into WP3’s governance framework to enhance policy coherence and institutional support, with each deliverable precisely calibrated to reinforce strategic alignment across the operational continuum.

### 3. Stakeholder Consultations & Workshops

- Collaboration with standardization bodies (e.g., Open Geospatial Consortium, INSPIRE).
- Multi-stakeholder discussions to validate interoperability requirements.
- Workshops held with WP1 (Real World Labs) to ensure real-world applicability.

#### **Deliverables associated with Task 2.1:**

As mentioned above, input from this task has been used in several key deliverables that were either completed in this reporting period or are in progress. These include:

- D2.1 – Compendium of Data Standards

This deliverable is directly associated with Task 2.1. The final version was iteratively refined through multi-stakeholder engagement and subsequently validated within the submission process to the EU portal. It presents an integrative review of data and model interoperability standards, together with a rationale for the selection of the standards intended to be aligned, adapted, and conceptually referenced within DIRECTED.

- D5.1 – High-Level Design Document for Data Fabric

Findings from Task 2.1 informed the architecture of the interoperability framework underpinning the Data Fabric as developed in WP5.

- D5.2 – Low-Level Design Document for Data Fabric

Contributions from Task 2 ensured that selected standards aligned with planned data exchange mechanisms and served the user stories in the RWLs mapped as part of the Data Fabric development (WP5).

#### **Main results**

Significant progress was indicated in consolidating the evolving structure of a standardized data and model interoperability framework for DRR and CCA applications. The structured approach, when viewed alongside the iterative engagement of stakeholders, has facilitated a consistent reconsideration of the applicability of the selected standards in principle rather than in practice and informed its integration into the Data Fabric (WP5). The findings of Task 2.1 facilitate the transition from an ongoing stage of assessment toward an extended phase, ensuring continued alignment between technical aspirations and governance narratives, i.e. as expressed through the improved workflows co-designed with stakeholders, which are demonstrated and evaluated in the RWLs (Task 2.3). The outcomes of this WP has also directly supported the realization of interoperable tools (Task 2.2).

**Task 2.2 Making tools interoperable (Month M13-M36) (lead: DTU, co-lead: ETH, contributors: PIK, GFZ, SEI, GECO, EV)**

The objective of Task 2.2 is to advance model and data interoperability informed by the stocktake carried out by Task 2.1 and the user needs assessments integrated into the RWLs (WP1), including RISK-TANDEM processes (WP3, WP4), and the design of the Data Fabric (requirement specifications). The task covers mainly the technical innovations (e.g. model improvements through new features and data standards, new tool development) required for implementing and demonstrating interoperable workflows in RWLs (Task 2.2).

Task 2.2 started shortly before the end of the first reporting period (M13) and was finalized at the end of the second reporting period (M36). Its main results, which were mostly achieved during the present reporting period, are the improved, interoperable technical tools and models co-developed with stakeholders and practitioners within the RWLs, and integrated into the Data Fabric. Material developed within this task has informed a number of deliverables across WP1-WP6 (see below). The results from this task feed directly into the RWLs and specifically Task 2.3.

Table 5 provides an overview of the main innovations developed within this task, aligned with the recommendations from Task 2.3, RWL interactions (WP1, WP3, and WP4) and the needs of the Data Fabric (WP5).

*Table 5: Overview of model interoperability enhancements for Task 2.2. Adapted from Table 1, Deliverable D2.2. The star \* indicates models or tools that were not considered in the original workplan (grant agreement) but added on recommendations of RWL stakeholders.*

Tool or model	Main innovations for interoperability
<b>(a)</b> SaferPLACES Digital Twin Solution for flood risk intelligence	Developing compliance with RWLs input flood hazard/ damage data (forecast and real-time). Developing output compliance with Data Fabric and (b), (d), (e).
Link: <a href="http://www.saferplace.co">www.saferplace.co</a> Link: <a href="https://manual.saferplaces.co/manual_eng">https://manual.saferplaces.co/manual_eng</a>	
<b>(b)</b> RIM2D – a high-resolution, two-dimensional hydrodynamic model	Added functionality for using additional input data sources, and development of a tool for user-friendly model building.
Link: RIM2D: <a href="https://git.gfz-potsdam.de/hydro/rfm/rim2d">https://git.gfz-potsdam.de/hydro/rfm/rim2d</a> Link: RIM2D QGIS Plugins: <a href="https://git.gfz-potsdam.de/hydro/rfm/rim2d_qplug">https://git.gfz-potsdam.de/hydro/rfm/rim2d_qplug</a>	
<b>(c)</b> Danube model – a combined eco-hydrological and hydrodynamic model	Several model improvements were implemented for added compliance with high-resolution flood models (a) and (b) as well as (d)
Link: <a href="https://www.pik-potsdam.de/~wortmann/swim/swiim_manual.pdf">https://www.pik-potsdam.de/~wortmann/swim/swiim_manual.pdf</a> Link: The CaMa-Flood User Manual is available for registered users from the CaMa-Flood website: <a href="http://hydro.iis.u-tokyo.ac.jp/~yamada/cama-flood/">http://hydro.iis.u-tokyo.ac.jp/~yamada/cama-flood/</a>	

<b>(d)</b> CLIMADA - probabilistic risk assessment and adaptation option appraisal tool	Adding functionality for multi-criteria inputs and analyses; imported damage cost curves from the Damage Cost model (e) for compliance.
Link: <a href="#">Link to user guides and technical documentation</a>	
Link: <a href="#">GitHub repository</a>	
<b>(e)</b> Damage Cost – economic, multi-sector damage cost assessment model	Added input compliance with hazard data from (a), (b), and (c). Output compliance with Data Fabric. Damage cost functions exported to CLIMADA (d).
Link: <a href="https://github.com/Skadeesokonomi/Dokumentation-og-vejledninger">https://github.com/Skadeesokonomi/Dokumentation-og-vejledninger</a> (mostly in Danish)	
Link: GitHub repository: <a href="https://github.com/Skadeesokonomi">https://github.com/Skadeesokonomi</a>	
<b>(f)</b> Climate Connectivity Hub and Taxonomy	Enhances the interoperability of online knowledge and a plug-in into Data Fabric to provide an interactive glossary defining complex terms and providing contextual scope notes on how terms are used in practice by different actors.
Link: <a href="https://connectivity-hub.weadapt.org">https://connectivity-hub.weadapt.org</a> and <a href="http://connectivity-hub.com">http://connectivity-hub.com</a>	
<b>(g)</b> Citizen VR App *	Novel interactive, simulation-based environment for citizen flood preparedness. Was added to the workplan based on stakeholder processes.
Link: <a href="https://www.youtube.com/watch?v=qO1CKM1tEhk">https://www.youtube.com/watch?v=qO1CKM1tEhk</a>	
<b>(h)</b> ABSOLUT – statistical crop model *	A statistically-based model analysing the cause-relationship between weather features and annual yields on a regional per-crop basis. Was added to the workplan based on the stakeholder processes.
Link: <a href="https://doi.org/10.5281/zenodo.4568608">https://doi.org/10.5281/zenodo.4568608</a>	
<b>(i)</b> Social Vulnerability Index (tool) *	The Social Vulnerability Index maps at regional and local scales the distribution of social vulnerability to environmental hazards including flooding and heat stress. Was added to the workplan based on the stakeholder processes.
Link: <a href="https://ucc-climpadap.github.io/SVIBook/index.html">https://ucc-climpadap.github.io/SVIBook/index.html</a>	

### Deliverables associated with Task 2.2

- D1.3 – Case studies of DRR/ CCA processes to date - forensic examination of real world process and events management

The co-development of some of the models in Task 2.2 was directly informed by the “forensic” information collected in selected RWL case studies (RWL 2 - Emilia-Romagna Region, RWL 4 - Rhine-Erft Region) based on previous major flood events and ongoing governance analyses. In turn, this deliverable contains information pertaining to this task.

- D2.2 – Enhanced interoperability of tools available to users through software repository and documentation

D2.2 is the main deliverable of Task 2.2. While, as originally planned, the principal content of the deliverable comprises the code and documentation of the enhanced tools (cf. [Table 5](#)), a summary report was also added to this deliverable (see Main results).

- D2.3 – Interoperability demonstration factsheets (description and illustration of workflow implementations in RWL as best practice examples)

The augmented technical tools and modelling constructs generated under Task 2.2 constitute the provisional basis for ongoing and prospective co-evaluation and demonstration processes within D2.3; they additionally, in conjunction with the Data Fabric, provide structural support for the preparation of both preliminary (Milestone M10) and final interoperability demonstration factsheets (D2.3), which aim to record the putative enhancements of extant RWL workflows arising from stakeholder engagement across the RWLs, WP1, W3, and WP4.

- D2.2 – Updated RISK-TANDEM Framework for governance processes and interoperability

The governance and stakeholder processes (implementing the RISK-TANDEM framework) that informed the enhancements of specific tools and models within Task 2.2, as well as the co-design of improved interoperable workflows within all the RWLs, featuring relevant technical innovations, are described in this deliverable as well as D4.2 (see below).

- D4.1 – Framework for distilling assumptions in different modelling approaches with recommendations for replicating this approach

This deliverable analyzes background information on most of the models considered by Task 2.2 in the context of the RWLs to provide recommendations of model enhancements for increased technical, governance, and knowledge interoperability.

- D6.7 – Communications report 3

Plans for exploitation of enhanced DIRECTED model innovations pertaining to Task 2.2 are presented in this deliverable (Chapter 5, D6.7).

- M8 - At least two manuscripts on the update of two tools submitted (M30)

Several publications relating to updates of CLIMADA and RIM2D were published on time (references may be found in D2.2) by M30, whereas two additional publications relating to the Damage Cost model are under review for Climate Services (2nd round of reviews) and Climatic Change (1st round of reviews) journals, respectively. Publications related to the updates of the Danube Model, Saferplaces, as well as further publications relating to the demonstration of the implementation of models in all RWLs are in preparation.

## Main results

The main results of Task 2.2 achieved during the second reporting period are summarized below. For more information, please refer to Deliverable D2.2 and to Task 2.3 (see below).

### SaferPlaces Digital Twin Solution for flood risk intelligence

During RP2, SaferPlaces has evolved into an interoperable, API-driven platform capable of integrating real-time and forecast data for advanced flood modelling and forecast. Updates have been added based on input from stakeholders and practitioners, and on real-life applications during recent flood events in Rimini (RWL2). The SaferPlaces platform now enables seamless data and model interoperability with the DIRECTED Data Fabric, supporting external systems and stakeholders. A summary of the technical advancements can be found in [Table 5](#). While the focus has been on RWL2 (see Task 2.3, RWL2), SaferPlaces has also been updated and integrated into RWL1 (pluvial, coastal flooding) and RWL3 (pluvial flooding).

### Danube Model

The Danube Model is a combined eco-hydrological and hydrodynamics model simulating landscape water fluxes and river discharges including flood stages and runoff velocities. While the original intention was to add capabilities for seamless forecasting of river floods across real-time/short-term, seasonal, and climate change time scales (i.e. the Danube Model is referenced as the *Seamless Forecasting Tool* in the DIRECTED Grant Agreement), this was not directly endorsed by stakeholders and also proved to be impossible in practice (see Task 2.3, RWL3). Instead, based on recommendations by prospective users and requirements identified in RWL workshops, the Danube Model was advanced in three main ways as part of Task 2.2. to accommodate the improved workflows identified in RWL3:

1. Coupling of the runoff generation part (SWIM) to the flood propagation part (CaMa-Flood); the latter now no longer depends on geometries and parameters applied in SWIM, which makes it easier to set up the model based on data provided by stakeholders.
2. Flood depth downscaling based on CaMa-Flood code is added to allow for higher-resolution inundation information, which is of high value to users and stakeholders.
3. Consideration of man-made flood protection structures (levees) in CaMa-Flood with the ability to simulate and downscale with actual levee line geometries, and realistic setting of levee crown heights based on overtopping return intervals. This is urgently needed to accommodate requirements for CCA and DRM.

Results of the Danube Model were finally integrated into RWL3's instance of the Data Fabric.

## **RIM2D – a fast high-resolution, two-dimensional hydrodynamic model**

As part of Task 2.2, RIM2D's interoperability, user-friendliness, and computational efficiency were significantly improved, e.g. with a view to the Data Fabric. Key upgrades include the creation of a dedicated QGIS plugin suite, integration of Google Earth for result visualization, support for NetCDF input and output raster formats, and the addition of river discharge as boundary conditions (standard is water levels). The QGIS plugin facilitates user-directed model configuration and execution, while integration with Google Earth augments validation procedures. The incorporation of NetCDF compatibility extends interfacing capabilities with external models supplying input to RIM2D or consuming RIM2D simulation outputs. Notably, the NetCDF functionality and discharge-as-boundary-condition mechanisms enhance model interconnectivity and seamless data interoperability. Finally, multi-GPU support significantly amplifies computational throughput, rendering RIM2D a readily scalable and high-capacity flood modeling platform.

The enhanced version of RIM2D has been included in workflows co-designed with users in RWL1, RWL3 and RWL4.

## **CLIMADA - probabilistic risk assessment and adaptation option appraisal tool**

Task 2.2 has resulted in two major releases of the CLIMADA source code. These releases included several minor developments to improve its interoperability (including file reading and writing functions, utility functions, and performance), complete overhauls of two of its core classes (used to represent exposure layers), as well as its documentation website. Hence, CLIMADA was extended with several new tools for improved interoperability prompted by user needs identified within the RWLs: open-street map data handling, impact function calibration, support for uncertainty and sensitivity analysis.

As part of the above, integration with SaferPlaces, the Danube Model, RIM2D, and the Social Vulnerability Index tool was tested. Impact functions from the Damage Cost model were imported for use with CLIMADA in RWL1 to make the two impact models compatible. Lastly, facilities for multi-criteria assessment of adaptation options aimed at application and demonstration in RWL1 (see Task 2.3, RWL1) has been developed.

## **Damage Cost – economic, multi-sector damage cost assessment model**

During RP2 the Damage Cost model has been updated according to user requirements to facilitate its interoperability with different flood models (e.g. RIM2D, SaferPlaces), CLIMADA, and with the RWL1 instance of the Data Fabric. For this aim, the original version of the Damage Cost model, developed for ESRI's commercial ArcGIS software, was ported to QGIS, which is free software, rewritten for optimization, and the model has been tailored for use by municipalities and other external users, e.g. [OS2-Skadesøkonomi](#). An improved (simplified) QGIS interface now allows the Damage Cost model seamlessly to import GIS-based flood maps from any source, following GIS standards, e.g. RIM2D and SaferPlaces.

To support the use of modelling insights along workflows of *higher* complexity, the damage cost curves embedded into the Damage Cost model, which are based on public and private Danish data, were ported to CLIMADA as described above. Effectively combining the two models, ensures that the local and validated economic knowledge behind Damage Cost is merged with the greater flexibility of CLIMADA.

Along with flood maps produced using RIM2D, SaferPlaces and a third reference flood model (SCALGO Live), Damage Cost has been integrated into the RWL1 instance of the Data Fabric, where it forms the core of the proposed workflows that will be demonstrated and co-evaluated in Task 2.1 (RWL1).

### **Climate Connectivity Hub and Taxonomy**

The [Climate Connectivity Hub](#) and its underlying [Taxonomy](#) is designed to further information interoperability and to help users access relevant (online) knowledge and organizations related to climate, disaster risk management, climate change adaptation and mitigation. Within the second reporting period (RP2), a number of new features have been added, reflecting generic interoperability challenges across the RWLs and the Data Fabric.

1. A plug-in into the Data Fabric provides an interactive glossary defining complex terms and providing contextual scope notes on how these terms are used in practice by different actors.
2. Organizations are mapped by topic to reveal collaboration (interoperability) patterns, highlight knowledge gaps, and foster cross-disciplinary connections.
3. Shared vocabularies are identified together with the RWLs and other projects to strengthen alignment of language across research, policy, and practice.

As “seed” the Climate Connectivity Hub currently imports the standard IPCC glossary and the UNDRR taxonomy. It is anticipated that these will be extended by other established taxonomies in RP3 and through workshops with the RWLs.

### **Citizen VR App**

As an outcome of RWL2 (see Deliverable D1.3), a Citizen VR Flood Safety App was developed from scratch in RP2 to address the challenges of communication and awareness raising identified by stakeholders. The app replaced the use of the Oasis-CAIMAN app, which was originally envisaged by the DIRECTED project plan but revealed to be less important through the implementation of RWL2. The Citizen VR App provides a first-person experience of flood onset and response actions, based on previous flood events, thus enabling users to understand time-critical decisions and safety procedures before an event occurs. See Deliverable D2.2 and links therein.

## **ABSOLUT – statistical crop model**

During the first reporting period (RP1), RWL3 and RWL4 stakeholders highlighted drought and its potential impacts on crop yields as a serious hazard to the Danube basin and the Rhine-Erft region, respectively. To accommodate stakeholders needs, the ABSOLUT crop yield model developed by PIK was subsequently added to the DIRECTED model portfolio, i.e. as a means of assessing the economic effects of drought. Prior to DIRECTED, this model had only been used for national or regional applications and at district level. To facilitate its use across two RWLs and the Danube basin as a whole, with integration into the local Data Fabrics, the main part of work on ABSOLUT within Task 2.2 was to extend the model for pan-European applications and assessments of yield trends under climate change at the NUTS-2 level. For this aim, historical yields of numerous crops were collected from all NUTS-2 regions in Europe since the year 2000 and used to calibrate the model.

## **Social Vulnerability Index (tool)**

The Social Vulnerability Index (SVI) is a measure of social vulnerability to flooding, developed by University College Cork (UCC), which was made available for all RWLs. During RP2, it was developed for RWL2 and embedded into CLIMADA and the RWL2 Data Fabric. See Deliverable D2.2.

## **Forest fire model**

In addition to the above, different fire spread models have been tested in RWL2 (See Task 2.3, RWL2) as part of Task 2.1. A suitable fire spread model (e.g. ForeFire) will be included into the RWL2 Data Fabric (Comacchio–Mesola wildfires) as part of demonstration activities in Task 2.3, i.e. according to the needs formulated by the local stakeholders (firefighters). Likewise, a novel fire risk modelling scheme developed by DTU has been considered for RWL3 (Zala County).

## **Task 2.3 Multi-hazard modelling for integrated DRM and CCA: Demonstration in RWLs (M24-M48) (lead: GFZ, co-lead: PIK, SEI, contributors: DTU, GECO, EV, RIFS, UCC, G&C)**

Task 2.3 aims to evaluate and demonstrate improved DRM and CCA strategies (workflows) co-developed in the RWLs using the full DIRECTED suite of interoperable impact and risk tools and methodologies. The enhanced workflows result from updated multi-hazard modelling tools (Task 2.2) derived from the discussions in the RWLs, are based on quantitative data and help to find effective solutions for the individual problems in the RWLs. This task depends deeply on stakeholder involvement and is coordinated with and closely linked to the development of the RWLs (WP1), as well as to the co-development of the different local instances of the Data Fabric (WP5), which provides the technical framework for interoperability and model application in the RWLs. Task 2.3 essentially also integrates work carried out in WP 3 (Governance) and WP 4 (Knowledge co-production), as the

co-development and co-evaluation of DRM and CCA strategies in the RWLs are underpinned by these WPs.

### Deliverables associated with Task 2.3

- D2.3 Interoperability demonstration factsheets (description and illustration of workflow implementations in RWL as best practice examples)

D2.3 is the main deliverable of Task 2.3 and due at the end of DIRECTED. This deliverable will report on workflows for interoperability in Real World Labs as best practice examples. The report will feature one chapter per RWL.

- M10 Interoperability demonstration factsheets ready for evaluation (M36)

This milestone, which was achieved on time, comprised draft interoperability factsheets for each of the four RWLs. The individual fact sheets are included as an appendix to D3.2. In the third reporting period, each of the proposed workflows will be co-evaluated, further refined and revised workflows, suitable for real-life uptake and exploitation by stakeholders and practitioners within RWL contexts, will be published in D2.3 together with relevant technical information.

### Main results - progress overview per RWL

#### RWL 1 - Copenhagen Capital Region / Roskilde Fjord

RWL 1 focuses on pluvial and coastal flooding along Roskilde Fjord, which was subject to considerable floods following the storm “Bodil” (also known as “Xaver”) in 2013. Following baseline analyses, and stakeholder engagement through application of the RiskTandem framework (workshops, surveys, interviews), several user stories were collected (see also D5.2) to form the baseline for co-designed and improved interoperable workflows (see milestone M10), including technical advancements of models and tools (see Task 2.2), that will be demonstrated and co-evaluated with stakeholders in the project’s final reporting period. The objectives of the proposed workflows are to:

- **(a)** Facilitate the use of digital tools by the local emergency management services, which at the moment rely on maps distributed by the Danish Meteorological Institute by email, and provide them with direct access to near-realtime, high-quality map resources without involving municipal GIS specialists and with a minimum of training (User Story 1.1).
- **(b)** Introduce consistent and interoperable data for dual use in emergency management and climate change adaptation (municipalities).
- **(c)** Add facilities for novel and user-friendly uncertainty / sensitivity analyses, considering multiple hazard severities, multiple flood models, and multiple sectors (User Story 1.5).

- **(d)** Build capacity within municipalities and emergency services with respect to climate change adaptation, i.e. enhance and demonstrate the use of tools and practices for multi-criteria decision making (User Story 1.3).
- **(e)** Deliver complete and exploitable innovations, going well beyond the pilot stage, that can be integrated into the risk assessment and planning activities that are starting up in the Roskilde Fjord municipalities due to their recent designation as an area in high risk of (coastal) floods under the EU Floods Directive.

Based on the above, a tailored RWL1 Data Fabric was co-developed with RWL1 stakeholders, which underpins concrete solutions to the abovementioned objectives. Most of this work took place in RP2. Results from several of the enhanced models from Task 2.2 are made available to Danish users through this Data Fabric, i.e. RIM2D, SaferPlaces, Damage Cost (see above). Additional data and external simulation results provided by data providers from outside DIRECTED (e.g. SCALGO; static risk maps relating to surface groundwater) were also included in the Data Fabric at the request of stakeholders for completeness. These were drawn from open data provided by Danish national authorities.

The RWL1 Data Fabric was initially only populated with data for selected areas around Roskilde Fjord to facilitate discussions with stakeholders. Three scenarios for both pluvial and coastal flooding were simulated: a low, a moderate and a high emission scenario (SSP1-2.6, SSP2-4.5, and SSP3-7.0). These scenarios were meant to serve as the basis for designing and evaluating the effectiveness of flood protection measures by the stakeholders under climate uncertainty. After consultations with stakeholders and practitioners, however, this strategy was abandoned. Feedback from users revealed that for them it is more natural to think of actual numbers, e.g. real water levels in terms of coastal flooding, or return levels or rain intensities in terms of pluvial flooding. As a result, the user interface of the RWL1 will be slightly redesigned and tested in a new form in RP3. Hence, in October and November 2025 (RP3) it was populated with the full set of coastal and pluvial flood simulations covering the entire Roskilde Fjord area, produced using two (enhanced) flood models - RIM2D, SaferPlaces - and with supplementary simulations using SCALGO Live - a tool already well known and used in Denmark. For each of these three models, coastal flood simulations are provided for sea levels ranging from 0 to 30 metres (from normal to very extreme sea levels) at 100 cm intervals. Similarly, pluvial flood simulations are provided for increasing rain intensities (mm/day). All the three models adopt the same (national) Digital Elevation Model (DEM) and other variables, and the difference between the results (depth, extent of the flooding) therefore provide a consistent measure of the (model) uncertainty unlike the current “simulations-of-opportunity”. Results from the ensemble flood models were subsequently used as input to the Damage Cost model to estimate the potential (economic, environmental) impact of the flooding, while accounting for the abovementioned uncertainty. Also, the results of the Damage Cost calculations are used to populate the RWL1 Data Fabric and made available to users in full.

In addition to the above, operational 6-hour forecasts of sea level, rain (and in RP3: wind speed and wind direction) from the Danish Meteorological Institute (via open data standards) were added to the RWL1 Data Fabric to facilitate the dual use of this tool by emergency management services and municipalities. Already mentioned, emergency management services in Denmark do not *per se* have access to real-time forecasting in a fully digital form, and they largely rely on expertise with flood maps in a GIS environment during an emergency. The combination of real-time forecasting from the Danish Meteorological Institute with the abovementioned organization and availability of pluvial and coastal flood maps and associated damage cost assessments thereby underpins a potentially new and more efficient workflow.

In the final DIRECTED reporting period (RP3), proposed workflows including the DIRECTED innovations will be demonstrated and co-evaluated through two dedicated workshops:

- A workshop on multi-criteria decision making, corresponding to objectives (b)-(d), will be organized jointly with one of the stakeholders (Frederikssund municipality) on December 3, 2023, with help from WP3 and WP4.
- A full scale DRM/CCA exercise for testing the added value, usability of DIRECTED innovations will be organized jointly with the Danish Emergency Management Agency in February or March 2026 with participation from municipalities, emergency services, the Danish Meteorological Institute, and other relevant actors in RWL1. The purpose of this exercise is to demonstrate and co-evaluate the proposed workflows, technical and governance innovations in a way that reflects reality, to document the scalability and potential uptake of the DIRECTED tools.

A final workshop before the summer 2026 will address the latter in full.

## **RWL 2 - Emilia-Romagna Region**

RWL2 integrates Civil Protection authorities (ARPAE), and municipal governments to strengthen Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) in Emilia-Romagna through new workflows featuring the DIRECTED Data Fabric and interoperable modelling platforms (e.g., SaferPlaces, CLIMADA, SVI - see Task 1.2).

RWL2 addresses two subregions (pilots) — Rimini Province (pluvial/coastal floods) and Comacchio–Mesola (wildfires) — which share the common goal of transforming real-time environmental data that are currently not compatible and interoperable into actionable hazard and impact intelligence accessible to emergency operators within minutes.

The key advancements towards this goal in RWL2 encompass:

- Real-time and predictive data ingestion from European (ICON2) and national weather services (ARPAE), radar systems, and sea-level monitoring for both inland and coastal flood forecasting.

- Dual operational modes — anticipatory (forecast-based) and responsive (nowcast-based) — providing enhanced situational awareness for emergency and risk management.
- API-enabled modular architecture, exposing RESTful APIs for SaferRAIN (urban floods), SaferRIVER (river floods), SaferCOAST/UNTRIM (coastal floods), and SaferDAMAGE (impact assessment).
- SaferData hub, a centralized system for collecting, organizing, and distributing environmental data, feeding simulations and decision-support tools.
- Integration of SaferPlaces into the DIRECTED Data Fabric, ensuring geospatial and semantic interoperability (GeoJSON, WMS, SPARQL endpoints) for real-time data exchange and visualization within the Real World Labs instances in the Data Fabric.

Table 6 summarizes the technical advancements towards updated RWL2 workflows featuring interoperable models and data, achieved during RP2. These advancements underpin a scalable, interoperable, and near-real-time operational framework for multi-hazard management — transforming raw environmental data into decision-ready intelligence to support civil protection, adaptation planning, and public safety across Emilia-Romagna.

*Table 6: Technical interoperability enhancements for RWL2 (RWL2 Data Fabric and SaferPlaces).*

The following key technical advancements for added interoperability through the RWL2 Data Fabric and SaferPlaces platform were achieved in the second reporting period (RP2), based on stakeholder input:

#### 1. Interoperable, API-Enabled Architecture

- The RWL2 Data Fabric was designed to enable ingestion, processing, and visualization of real-time and forecast data (e.g., rainfall, tides, wind, humidity).
- Seamless machine-to-machine communication was established to connect observation networks, predictive models, and visualization dashboards.
- PyGEOAPI orchestration and an S3 common data store ensure harmonized, traceable data flows (SaferPlaces, CLIMADA, SVI models integrated into the RWL2 Data Fabric).

#### 2. Real-Time and Forecast Data Integration

- Automated ingestion of meteorological and oceanic feeds (HERA radar, ICON2 forecasts, tide gauges, wind and humidity sensors).
- Rapid nowcasting/forecasting produces hazard maps and impact dashboards (population affected, critical sites, evacuation needs).
- Latency targets: ≤10 minutes from observation to visualization.

### 3. Unified Decision-Support Interface

- A single web app integrates the RWL2 Data Fabric with hazard models for pluvial and coastal risk (wildfire risk will be added in RP3).
- Operators access interactive dashboards, traffic-light alerts, time-series, and exportable map briefs (PDF, WMS, CSV) without needing GIS expertise.

### 4. “Hazard × Receptors” Impact Analytics

- Automated overlay of hazard maps with receptors (buildings, roads, hospitals, utilities) to produce impact and evacuation forecasts.
- Supports rapid response, resource allocation, and situation reporting.

### 5. Dual-Use Interoperability

- Data and models harmonized (CRS, metadata, severity bins) for both emergency response and long-term climate planning.
- APIs connect local systems (COR, ARPAAE, municipalities) ensuring reusability and provenance.

Utilizing improved and planned technical innovations, the following improved workflows were identified and are being co-evaluated with practitioners and other stakeholders in RWL2:

#### **Updated workflow 1: Rimini pluvial and coastal flood simulations for DRR**

The models SaferRAIN, SaferCOAST, RIM2D, and CLIMADA are integrated into the RWL2 instance of the Data Fabric, with the purpose for early warning of rain-driven and tidal flooding in Rimini. This integration enables ARPAAE and the communal stakeholders to plan and activate disaster response actions, both anticipatory (forecast-driven) and responsive (nowcast-driven) operations. The interoperable model chain enhances situational awareness and evaluation of effectiveness of possible measures like barrier placement, road closures, and/or evacuation planning. The SAFERPlaces system was tested under real-life conditions with practitioners and other stakeholders during the recent flood in Rimini and was proven to be of high value. Likewise, the initial version of the RWL1 Data Fabric for Rimini underwent preliminary testing and real-life validation during a recent pluvial flood event. In RP1, it is anticipated that the proposed DIRECTED workflow with updated models will be utilized by civil protection in a more operational capacity.

#### **Updated workflow 2: Comacchio–Mesola wildfires**

To forecast the spread of wildfires, a wildfire spread model will be integrated into the RWL2 Data Fabric in RP3. So far, (this reporting period) the ForeFire and Propagator CIMA model has been tested, however, the final decision on what model to use will be made based on

stakeholder evaluation and requirements. Both models are able to deliver near-real-time wildfire spread maps (0–12h horizon) to ARPAE, which are refreshed every 30 minutes. ForeFire/Propagator CIMA is driven by a combination of ICON21 forecasts and local wind/humidity data for predicting ignition and spread. This is enabled by the interoperability works in Tasks 1.1 and 1.2. Such forecasts are able to provide valuable actionable estimations of wildfire development and spread, which may be taken up by ARPAE for the planning of countermeasures, like firefighter deployment, evacuations, and infrastructure protection. After a final decision on the forest fire spread model, the model will be integrated into SaferPlaces and the Data Fabric.

### RWL 3 - Danube Region

RWL3 is the largest of the DIRECTED case studies geographically and addresses multi-hazards (pluvial, fluvial flooding, drought) in the Danube Region as a whole and through several pilot sites, each with their own specific instance of RWL3: Vienna (urban), and Zala County (regional/rural). Table 7 summarizes the different hazards addressed in the Danube region and its test sites and indicates which of the (enhanced) models described in Task 2.2 are used within RWL3.

*Table 7: Hazards and pilot sites in RWL3. Except as indicated, this work was started in the first reporting period (RP1) and concluded in the second reporting period (RP2) with Task 2.2.*

Hazard	Entire Danube basin	City of Vienna	Zala County
Pluvial flooding	NA	SaferPlaces	SaferPlaces*, RIM2D*
Fluvial flooding	Danube Model	Danube Model <sup>†</sup>	Danube Model
Drought: crop losses	ABSOLUT	NA	ABSOLUT

*\*High resolution LIDAR elevation data required for the modelling with RIM2D and SaferPlaces provided by the Hungarian authorities for Zala County was received in September 2025. In the early part of RP3, this will be used to establish the requested pluvial flood models for Zala. For Vienna, initial high-resolution pluvial flood mapping was presented at the second stakeholder meeting in July 2025, although its applicability in terms of improved interoperability and workflows at that stage remained largely interpretive.*

*†In principle, fluvial flood simulations for Vienna are of less importance, since the city is extremely well safeguarded even against super-millennial flood events. However, stakeholders showed a keen interest in simulation data converted to local gauge metrics (cm above gauge-specific zero levels) at the second stakeholder meeting in Vienna. A suitable flood height converter will therefore be added in RP3.*

Results from the Danube Model are integrated and visualized in the RWL3 Data Fabric. At the full Danube basin-scale, these are slightly generalized line graphics of the river system, with every river reach coloured according to the variable selected. Available variables requested by users are flood heights (above the bankfull river level, i.e. in the riparian zones) under different climate scenarios and historical conditions for various return intervals, and the estimated shift of flood return intervals under future climate scenarios. For the Zala County (and prospectively also for other, larger parts of the basin) flood height raster maps are downscaled to 100 m resolution based on MERIT ground elevation data.

Over the course of developing fluvial flood data in the context of RWL3, and based on stocktaking and stakeholder input, it became clear that – while the principal feasibility for driving flood forecasts with data at arbitrary time scales (from daily through seasonal to multi-decadal) does exist – suitable input data for seamless fluvial flood forecasting could not be provided. For instance, seasonal weather forecasts do not contain daily values of meteorological variables as required by the Danube Model, only expected deviations from climate normals over periods of weeks and months; and actual forecast data over the Danube region is only available in excerpts (coarse grid, selected variables) from the European Centre for Medium-Range Weather Forecasts (ECMWF). At the moment, this effectively prevents building a flood forecast tool, e.g. complementing existing forecasts from the European Flood Awareness System (EFAS), having immediate and unlimited access to ECMWF's inhouse weather prediction data.

Moreover, in the stakeholder discussions in RWL3 it became clear that next to floods droughts and their impact on crop yields were also a pressing issue (see ABSOLUT, Task 2.2). Key stakeholders from the Danube Region interested in these results included the Austrian Federal Institute for Agriculture and Mountain Farming Issues (Bundesanstalt für Agrarwirtschaft und Bergbauernfragen, BAB). Moreover, as the Zala County and the entire Pannonian lowlands are very likely prone to higher crop yield losses under future climate conditions, stakeholders in Hungary have also expressed an interest in crop yield modelling and projections, including the Hungarian University of Agriculture and Life Sciences (MATE), i.e. the Georgikon Faculty in Keszthely, and the ATK Agricultural Institute (Centre for Agricultural Research) in Martonvásár. Requests for updated workflows integrating interoperable data suggested by Hungarian stakeholders particularly focus on sustainable agriculture and climate change adaptation in the Carpathian Basin region. Currently, the technical and scientific documentation of the ABSOLUT crop yield simulations are translated into Hungarian, in order to be assessed by the stakeholders mentioned above.

Crop yield simulations, indicating the consequences of future climatic conditions, were made available to the stakeholders in RWL3 through the Data Fabric and will be further disseminated and refined in RP3. For each subregion, annual yield time series ending in 2100 were simulated for 15 crop species and 10 realizations per climate scenario. The RWL3 Data Fabric currently integrates crop yield time series projections for the NUTS regions overlapping the Danube basin with a vector map of Europe with descriptive statistics of the yield trends for all regions in the attribute data.

## RWL 4 - Rhine-Erft Region

The Rhine-Erft Region is situated within the federal state of North Rhine-Westphalia, Germany. The area is characterized by a pronounced awareness of flood risk from the Erft and its tributaries, while events related to heavy rainfall have also increasingly contributed to localized flood occurrences of varying relevance. In Germany, responsibilities for river management, flood protection operation, and early warning are formally distinct yet functionally overlapping. The Erftverband, as a regional waterboard in North Rhine-Westphalia, oversees precipitation and runoff monitoring alongside an internal flood forecast framework designed primarily to inform its own management of flood retention basins. Consequently, it maintains the most immediate, though not necessarily actionable, understanding of the hydrological conditions within the RWL. During flood events, however, warnings are transmitted from the state level through district structures to the municipalities, with the Erftverband remaining formally outside this communication pathway—despite being potentially integral to the same flow of information, it does not officially participate in it.

Thus, the main interoperability problem identified in this RWL is the communication and information flow between the Erftverband and all stakeholders concerned with flood forecasting, flood warning, disaster management and flood relief actions, without encroaching on the official responsibilities of the authorities. As a result, RWL4 focusses less on technical innovations than the other three RWLs.

In order to achieve an improved information flow, a structured communication approach based on the Risk-Tandem Framework was established, with the following objectives:

- Mapping of all stakeholders involved in flood warning and management and their responsibilities
- Development of an internal structure (updated workflow) for flood information dissemination and introduction of an alert level in the internal water information system of the Erftverband (Howis service).
- Official agreement between Erftverband and districts for data and forecast sharing.
- Introduction of a suitable exchange platform and agenda for joint assessment and interpretation of hydrological data.

DIRECTED fostered the stakeholder mapping and the identification of the information flows and gaps with a number of stakeholder meetings from 2023 to 2025 (RP1, RP2). The meetings were organized by WP3 following the Risk-Tandem Framework. This contained serious games and table top exercises, and resulted in the stakeholder mapping in the [Figure 5](#) below. Based on this, a formal way to include the Erftverbands expertise into the official flood warning and management was derived, which encompasses regular online consultations and data exchange during a flood event.

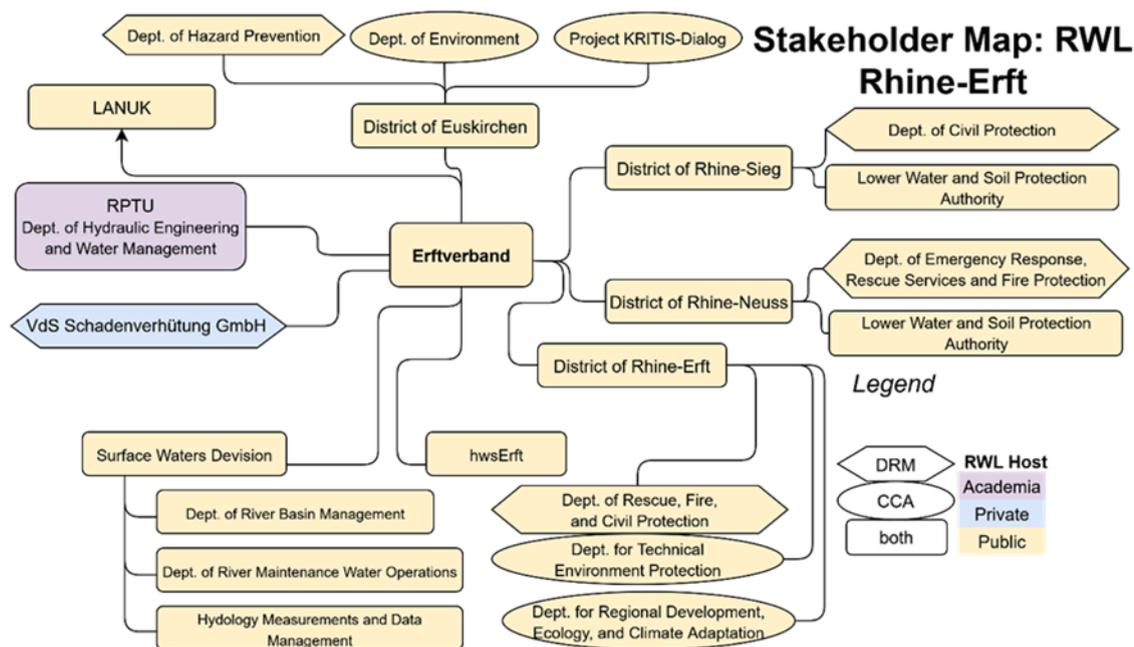


Figure 5: Stakeholder mapping for flood warning and disaster management in RWL4 Rhine-Erft.

An instance for the RWL4 was created in the Data Fabric, as a platform for information exchange and data viewing. The RWL4 Data Fabric currently collects background information from different sources (digital elevation map (DEM), open street map (OSM), pluvial flood indication maps from the German Federal Agency for Cartography and Geodesy (BKG)) for an instant and unified viewing in one interface.

To support the abovementioned objectives, improved workflows, and best practices in RWL4, simulations of breaches of the major flood retention basins in the area are conducted with RIM2D. These are intended to provide background information on the possible severity of floods caused by failures of the dams of the retention basins. This includes extents, depths, velocities, and timing after a breach. During the large flood in 2021 the retention basins came close to failure, but no information about the consequences existed. This information gap will be closed by efforts carried out within DIRECTED. In the project’s final reporting period, the resulting breach information will be disseminated and used in consultations between the Ertverband and the authorities responsible for flood warning and disaster management, utilizing the communication channels established through the Risk-Tandem approach outlined above. Knowing the possible consequences of dam failures enables the authorities to react prepared, thus significantly improving disaster management.

Next to flood hazard also droughts and CCA measures are addressed in RWL4. In RP3, the RWL will shift stakeholder consultations further toward these topics. Drought related problems like agricultural production and the need for designing CCA measures towards droughts were already presented to the stakeholders of RWL4 in the second reporting period. Their experiences and expectations were recorded using a questionnaire. The upcoming workshops in the last year of DIRECTED will be tailored to these topics and

enriched by the participation of stakeholders from agriculture and forestry. In this context, the ABSOLUT crop simulation results and projections (see Task 2.2) will be presented and serve as the basis for the stakeholder discussions and the development of CCA measures.

## 1.2.3 Work Package 3 – Governance

### 1.2.3.1 Introduction

The main focal point for Work Package 3 throughout RP 2 was the application and refinement of the Risk-Tandem Framework for integrated DRM and CCA governance. Developed throughout Task 3.1, the Risk-Tandem Framework was refined and tailored towards the specific needs of the individual Real World Labs. Engagement via workshops, exercises, interviews, presentations, and recurring focus meetings supported by WP4, allowed for a knowledge co-production process iteratively refining and guiding the framework’s application towards the needs and interests of the RWLs. The application yielded important improvements towards integrating the DRM and CCA processes in each RWL, and showed ways for further development. As remaining tasks, Work Package 3 will focus on the production of a Policy Brief (D3.3) and a Guidance on Good Practices (D3.4), as well as supporting a report on the Multi-Hazard Risk Governance outcomes per RWL (D1.4). Finally, WP 3 is focused on producing an interactive Risk-Tandem Framework web interface and Toolbox to ensure the continued accessibility and legacy of DIRECTED and the framework beyond the project’s lifetime.

### 1.2.3.2 Progress per task

Work Package 3 comprises 3 tasks along with their corresponding deliverables. An overview of the deliverables of each task and their status is depicted in the table provided below.

Table 8: Summary of deliverables, milestones, and tasks status in WP 3.

Deliverables, Milestones and Tasks	Status report
Task 3.1 Framework Development (lead: RIFS, co-lead: SEI, contributors: IIASA, UCC) Deliverable 3.1: The Risk-Tandem Framework Milestone 11: RISK-TANDEM Framework Milestone 12: Scoping consultation with RWL and mapping of context	Resubmitted, after revisions (August 2024)
Task 3.2 Applying a merged framework (RISK-TANDEM) to Real-World Labs (lead RIFS, co-lead: UCC, contributors: IIASA, SEI, GFZ, PIK, DTU, GECO, OASIS, 52N, G&C) Deliverable 3.2: Updated Risk-Tandem Framework for Governance Processes and Interoperability	Submitted (September 2025) Applying the Risk-Tandem Framework was the main task for WP 3 during RP2. NB Milestone 13 is annexed as a list to Deliverable 3.2

<p>Milestone 13: Documentation of Risk-Tandem Engagement Activities</p> <p>Milestone 14: Updated (proved and tested) RISK-TANDEM Framework (due M41)</p>	
<p>Task 3.3 Evaluating Risk-Tandem and Lessons Learnt (lead RIFS, co-lead. UCC, contributors. SEI, IIASA)</p> <p>Deliverable 3.3: Policy Brief on risk governance in the context of DRR and CCA</p> <p>Deliverable 3.4: Guidance on good practices regarding interoperability of governance mechanisms and recommendations for institutionalizing project outcomes and the interoperable platform into existing systems</p>	<p>In progress</p> <p>Deadline: D3.3 → M42; D 3.1 → M48</p> <p>Parallel task with WP1 → T1.3/ D1.4</p>

**Task 3.1 Framework development (Month 1-16) (lead: RIFS, co-lead: SEI, contributors: IIASA, UCC)**

*Resubmitted after revisions in August 2024*

The Risk-Tandem Framework has been developed and conceptually tested on the basis of various publications (Parviainen et al. 2025, Cumiskey et al. 2025; Schröter et al. 2025). **Deliverable 3.1**, has been submitted and re-submitted on the basis of revisions. Developing the framework was also built on the integration of Milestone 7 (WP 1 - Evaluating the impact/lessons learnt from the application of the governance mechanisms in RWL) and Milestone 12 (Scoping consultation with RWL and mapping of context).

**Task 3.2 : Applying a merged framework (the Risk-Tandem Framework) to Real-World Labs (Month 12-36) (lead: RIFS, co-lead: UCC, contributors: IIASA, SEI, GFZ, PIK, DTU, GECCO, OASIS, 52N, G&C)**

*Submitted in September 2025*

After its conceptual development, the Risk-Tandem Framework was applied to the individual RWLs. The application of the Risk-Tandem Framework through its four phases - Foundation, Growth, Learn and Sustain - has resulted in a refined framework, which is able to account for the various governance processes present in the RWLs. The application of the framework allowed for two things. Firstly, it enabled the improvement of existing governance structures for each RWL regarding the integration of DRM and CCA processes. Secondly, it further highlighted leverage points and potential spaces for improvement for future developments. The exact outcome, insights, and further steps of this application process can be found in **Deliverable 3.2**, which has been submitted for review.

The application of the Risk-Tandem Framework was driven by indicators that enabled the assessment of each RWL during the Foundation Phase. Building on Deliverable 3.1, the Risk-Tandem indicators were refined based on feedback from each RWL, as well as a baseline assessment that was done per lab and was fed into Deliverable 3.2. These

baselines were developed through the conceptual and methodological approaches laid out in Deliverable 3.1, and served as the first application of the Risk-Tandem Framework. The baselines then served as a starting point for the RWL hosts and stakeholders to provide reflections and input for the refined indicators in D3.2. D3.2 provided insights into governance challenges, potential solutions, and how the continued use of the Risk-Tandem Framework supports reflection and learning for the Real-World Labs. The main challenges, focal areas, and emerging technical and governance solutions for each RWL are summarized below.

#### **RWL I – Capital Region of Denmark:**

The key challenge for this RWL concerned intermunicipal coordination with emergency services in the Roskilde Fjord area. The RWL co-designed the Data Fabric to support dialogue, identify hotspots, and test interventions for coastal flooding. Following regulatory changes that removed the role of regions for CCA, Region Hovedstaden had to withdraw from DIRECTED. Consequently, the Danish Technical University (DTU) assumed the role of RWL lead, which further highlights the importance of governance contexts.

#### **RWL II – Emilia-Romagna:**

Priorities for this RWL included improving access to modelling tools for rapid flood mapping and wildfires and enhancing interoperability among data providers, particularly for Civil Protection Officers. The RWL also developed a wildfire communication kit for public awareness. A major challenge was engaging non-governmental stakeholders such as beach operators and hotel owners.

#### **RWL III – Danube Region (Vienna, Austria & Zala, Hungary):**

The Vienna RWL focus was integrating stakeholder data, especially from insurance and research sectors, into DRM and CCA decision-making. In Zala, efforts centered on building a shared vision for DRM and CCA in the West Balaton region and improving data sharing via the Data Fabric.

#### **RWL IV – Rhine-Erft Region:**

Findings in this RWL emphasized the need to strengthen interinstitutional communication, public engagement, and the integration of CCA strategies within the Erftverband's activities. Co-creation workshops and regular calls with local districts were introduced to address these gaps.

Across RWLs, recurring challenges involved interoperability and communication gaps between DRM and CCA stakeholders. These were addressed through the Growth and Learn Phases of the Risk-Tandem Framework. Moving forward, efforts will focus on sustaining co-produced technical and governance solutions, and equipping RWLs with the skills to manage these independently.

Through its iterative application, the Risk-Tandem Framework has evolved into a flexible, operational tool tailored to users' needs. The refined indicators enable modular use across DRM and CCA processes, marking the Risk-Tandem Framework's transition from a

conceptual framework to a practical instrument that supports decision-making which integrates both DRM and CCA.

**Milestone 13** lists all the knowledge co-production and engagement activities that underpin and support the application of the Risk-Tandem Framework per RWL. This includes regular focus meetings, workshops, presentations, exercises, etc. The Milestone is annexed to Deliverable 3.2.

**Milestone 14:** The updated Risk-Tandem Framework will be published on the Research Institute for Sustainability (RIFS) at GFZ website with an interactive web interface to ensure the continued accessibility and legacy of DIRECTED and the framework beyond the project's run time.

**Task 3.3 : Evaluating the Risk-Tandem Framework and Lessons Learnt (M33-M48) (lead RIFS, co-lead: UCC, contributors: SEI, IIASA)**

This task evaluates the performance of the updated Risk-Tandem Framework within the RWLs. It aims to apply and test the recommendations from Task 3.2 to strengthen governance practices in the RWLs. The evaluation focuses on how effectively the governance mechanisms undertake a range of actions e.g., enhance multi-stakeholder engagement, improve interoperability, and foster knowledge exchange between DRM and CCA. The task interviews and stakeholder workshops support empirical findings from the RWLs.

Two deliverables will be produced in this task.

**Deliverable 3.3 “Policy brief on risk governance in the context of DRR and CCA”** (due **M42**) will present a policy brief in English that lays out general policy recommendations for how to better integrate CCA and DRM on a European level.

**Deliverable 3.4 “Guidance on good practices regarding interoperability of governance mechanisms and recommendations for institutionalising project outcomes and the interoperable platform into existing systems”** (due **M48**) serves as a legacy document, highlighting the lessons learned from the DIRECTED project as a whole, as well as the Risk-Tandem Framework process in particular. This will also include a tailored policy brief per RWL in the region's respective language, giving specific guidance on how to improve DRM and CCA integration through policy and governance.

## 1.2.4 Work Package 4 – Knowledge co-production

### 1.2.4.1 Introduction

Over RP2, WP4 continued to strengthen and operationalise capacity development activities that enable transdisciplinary knowledge co-production within the wider Risk-Tandem (WP3) approach in the RWLs. Progress aligned with the Risk-Tandem “Growth” and “Learn” phases, supporting the co-exploration of contextual risk issues and the co-design of tailored interventions, has moved forward largely as planned, albeit at different speeds across RWLs.

Guided by ongoing consultations and capacity needs assessments, capacity development activities have leveraged emerging insights from the co-exploration stage, including priorities related to risk governance, communication, and data interoperability. Building on this foundation, WP4 is now transitioning toward supporting RWL partners in the co-design and appraisal of potential solutions and interventions.

### 1.2.4.2 Progress per task

Work Package 4 comprises four tasks along with their corresponding deliverables (three deliverables, four milestones). An overview of the deliverables of each task and their status is depicted in the table provided below.

Table 9: Summary of deliverables, milestones, and tasks status in WP 4.

Deliverables, Milestones and Tasks	Status report
<p>Task 4.1 Apply the Tandem knowledge co-production cycle to the RWL (M6-M45) (lead: SEI, co-lead: GECCO, contributors: RIFS, UCC, GFZ, PIK, DTU, IIASA).</p> <p><i>D4.1 Capacity development modules for ToT workshops in designing transdisciplinary knowledge co-production processes</i></p>	<p>During RP2, T4.1 has advanced from scoping to support co-exploration and co-design following the (Risk)-Tandem cycle. This has been achieved via capacity needs assessments, scoping consultations and capacity development contributing to the design of RWL workshops, described further under 1.2.1.2 and below.</p> <p><i>D4.1 Finalised and submitted in September 2025. A report outlining the development of the Capacity Development Modules and the first draft of the modules for the phases of Tandem that have been completed within DIRECTED, which include an ‘Overview’ module and modules 1 (Phase 1: Foundations) and 2 (Phase 2: Co-explore).</i></p>
<p>Task 4.2 RWL comparison and assessment of needs</p>	<p>During RP2, this has continued via the coding and analysis of relevant RWL outputs (transcripts, reports, meeting minutes and Miro boards), underpinning D4.2,</p>

<p>through learning, capacity development and knowledge exchange (M9-M36) (lead: SEI, co-lead: 52N, contributors: RIFS, GECO, UCC, GFZ, PIK, DTU, IIASA, GC)</p>	<p>D4.3, M15-M17 and M3-5 under WP1 (RWL Report on the outcomes of knowledge co-production process). This has been further explored through WP4 facilitated peer-2-peer learning sessions between lab hosts. This will inform analysis and documentation of enablers and barriers to integrated CCA and DRM in the final Tandem update (D4.3).</p>
<p>Task 4.3 Distil relevant climate and non-climate information for the tools and data fabric (M12-M42) (lead: SEI, co-lead: 52N, contributors: GECO, RIFS, GECO, UCC, GFZ, PIK, DTU, IIASA)</p> <p><i>D4.2 Framework for distilling assumptions in different modelling approaches with recommendations for replicating this approach</i></p>	<p>In connection with T1.3, this task will enable discussions about trade-offs, terminology and assumptions in the different models being used, and how to work with, refine or adapt such elements.</p> <p>Based on the coding and analysis of RWL outputs under T4.2, the Assumptions Framework (D4.2) has been developed and applied. This will be supported by the co-production of scope notes for concepts in the Data Fabric, through the interactive Climate Connectivity Taxonomy, and “resource packs” communicating uncertainty and modelling assumptions to stakeholders.</p> <p><i>D4.2 Draft submitted September 2025. Final report submitted by M42.</i></p>
<p>Task 4.4: Updating and improving the Tandem knowledge co-production cycle based on empirical evidence generated in RWL (M6-M48) (lead: SEI, co-lead: 52N, contributors: RIFS, GECO, UCC, GFZ, PIK, DTU, IIASA)</p> <p><i>M15-M18 TANDEM transdisciplinary knowledge co-production framework refined and iteratively applied steps 1-4</i></p> <p>D4.3 Updated (tested &amp; refined) Tandem cycle for transdisciplinary knowledge co-production processes and information interoperability (M48)</p>	<p>The Tandem knowledge co-production cycle has been iteratively improved and refined, based on empirical evidence from applying and testing the framework with WP3 in the RWLs (T1.2, T4.1).</p> <p><i>M15 Submitted August 2024</i></p> <p><i>M16 October 2024</i></p> <p><i>M17 Submitted as a part of D4.1. The design of the capacity development modules is guided by the evidence and analysis of stakeholder needs emerging from the RWLs, as a result of the co-production process.</i></p> <p><i>D4.3. Developed based on T1.2, T4.1, and M15-18. The full deliverable will be submitted by M48, describing updates to the Tandem cycle and supporting guidance, based on the iterative refinement and learning within RWL co-production processes.</i></p>

**Task 4.1. Apply the Tandem knowledge co-production cycle to the RWL (M6-45). (lead: SEI, co-lead: GECO, contributors: RIFS, UCC, GFZ, PIK, DTU, IIASA)**

During RP2, implementation of the Tandem cycle has progressed within Risk-Tandem as planned; from scoping (Phase I Foundation) to co-exploration (Phase II Growth) and co-design (Phase III Learn). The process has been led by SEI and supported by RWL

coordinator GECO, and partners of WP3 (RIFS, UCC, IIASA) through joint consultations and engagements with RWL Hosts in WP1, in efforts to strengthen the capacity of Hosts to enable and facilitate knowledge co-production in their Labs. This has ensured the consistent delivery of knowledge co-production in a structured manner, whilst maintaining the focus of the process on the Risk-Tandem priorities of strengthening risk governance, communication, and data interoperability. Phase IV modules (Sustain) will be co-developed with the Real World Labs (RWLs) in response to emerging needs and insights from the coding analysis of newly produced RRP2 documents, such as D3.2, which focuses on governance arrangements. These findings will help identify the RWLs’ capacity development priorities and shape the content of the remaining modules. We also anticipate including modules on climate finance, building on collaboration with the Horizon Europe projects, ClimateFIT and Pathways to Resilience, whose existing training materials will complement those of Tandem.

During RP2, WP 4 has engaged RWL hosts through consultations contributing to the design of specific workshop activities, and through formal capacity development sessions tailored to identified needs (following the approach first laid out in D1.2. Capacity Development Strategy). The purpose of these has been to mainstream the Tandem approach and associated guiding questions to RWL activities in a tailored manner (and refine or revise the approach when necessary). Between February 2024 and September 2025, WP4-led engagements focusing on capacity development included:

Table 10: Overview of capacity development activities in RP2.

Capacity Development Activity	Format	Date
Citizen engagement	Webinar	23 Mar 2024
Monitoring, Evaluation and Knowledge co-production	Online workshop	16 May 2024
Knowledge exchange – lessons from Civil Protection	Webinar	21 May 2024
MEL and Theories of Change	Online workshop	Jun – July 2024
Practical introduction to gender and social equity in DIRECTED	Online workshop	25th Jul 2024
Peer 2 Peer Learning Exchange	Online workshop	15 Jan 2025
From Co-exploring to Co-designing - Identifying Points for Intervention (Stage III)	Online workshop	21 Feb 2025
Peer 2 Peer Learning Exchange	Online workshop	4 June 2025

Co-designing Interventions	Online workshop	2 Jul 2025
----------------------------	-----------------	------------

The full list of scoping consultations and support premising the development of these activities for RWLs are listed under Milestone 13, per RWL (Annex of D3.2).

This work has led to the development of D4.1 Capacity development modules for ToT for designing transdisciplinary knowledge co-production processes. By assessing RWL needs and priorities for DIRECTED workshops and engagements, WP4 has tailored activities and guidance for hosts of each Lab. In turn, these have been packaged into replicable and scalable modules for applying the Tandem cycle in other co-production contexts, and published as a set of practical materials and associated reading at [weADAPT.org/tandem](https://weADAPT.org/tandem).

Updates of the process implementation and outcomes of capacity development are provided within M3-6 describing the outcomes of knowledge co-production. See section [1.2.1.2](#) and the discussion under T1.2 for further detail.

**Task 4.2 : RWL Comparison and Assessment of Needs through Learning, Capacity Development and Knowledge Exchange (Month 9-36) (lead: SEI, co-lead: 52N, contributors: RIFS, GECO, UCC, GFZ, PIK, DTU, IIASA, GC)**

As a part of the ongoing process to analyse RWL needs and priorities for capacity development and knowledge co-production, WP 4 has both organised and supported scoping consultations with each RWL across RP2. A full listing of these meetings is available in M13. To analyse and understand needs, WP 4 has followed the approach to data analysis and coding first detailed in D1.2 Capacity Development Strategy. All RWL outputs (including interview summaries, transcripts of meetings, workshop reports, facilitator self-reflection sheets, and meeting minutes) have been coded using qualitative coding software and analyzed to reveal common challenges, goals and thematic patterns pertaining to key DIRECTED priorities (namely, issues of co-production, risk governance, communication and data interoperability). This information will be used to tailor further capacity development modules, and to support the development of D4.2 and D4.3 (see below).

**Task 4.3: Distil relevant climate and non-climate information for the tools and data fabric (M12-M42) (lead SEI, co-lead: 52N, contributors: GECO, RIFS, UCC, GFZ, PIK, DTU, IIASA)**

In this task, user needs in the RWLs were assessed using the Risk-Tandem co-production approach outlined in D3.1 and D1.2. Each Lab conducted workshops, interviews, and other engagement activities supported by WP 3 and 4 to gather information on user needs, risk-related challenges, and governance goals. The resulting outputs (e.g., transcripts, reports, meeting minutes, Miro boards) were coded and analysed to identify key priorities and challenges, and have been aligned with available information in DIRECTED models (WP 2) to reveal gaps. Additional input was drawn from D5.2, which includes user stories

co-produced with each RWL as part of the Data Fabric co-design process, ensuring integration of user needs.

D4.2 presents a novel approach to bridging gaps between risk information, data, and end users in order to strengthen decision-making for risk management and adaptation under DIRECTED. Given the limited uptake and re-use of risk and climate information, D4.2 emphasizes the importance of aligning user needs with model inputs and results to ensure that information is integrated into practical contexts, thereby accelerating and scaling efforts to build resilience. This is being further supported through the collaboration with the University of the Arts Master's students who are contributing to the co-exploration of CCA–DRR terminology with RWLs. D4.2 has been submitted (September 2025) in draft form and will be finalized in M42. Due to the data, methodology and analysis used in D4.2, the current draft also serves to meet M5 on co-production outcomes within the RWLs.

**Task 4.4: Updating and improving the Tandem knowledge co-production cycle based on empirical evidence generated in RWLs (M6-M48) (lead SEI, co-lead: 52N, contributors: RIFS, GECO, UCC, GFZ, PIK, DTU, IIASA)**

The Tandem knowledge co-production cycle has been iteratively improved and refined in close collaboration with WP3, drawing on empirical evidence from its application and testing within the RWLs (T1.2, T4.1). Several milestones have been achieved: M15 was submitted in August 2024, followed by M16 in October 2024. M17 was delivered as part of D4.1, with the development of modules serving as a core component of the final Tandem update in September 2025. M18 will be submitted in M41. D4.3 (M48) will integrate the full range of insights collected from T1.2, T4.1 and milestones M15–M18 which document updates made to the Tandem cycle, reflecting lessons learned from the DIRECTED process.

Development of a detailed MEL approach is currently underway across WPs 4, 3 and 1, and is being designed to align with the iterative Theories of Change co-developed with the RWLs and to feed into the wider project MEL framework (WP7). Evidence for context-relevant indicators is being gathered through ongoing RWL activities, an upcoming MEL capacity development workshop for RWL hosts, and through numerous WP-level evaluation activities. These include interviews conducted under T1.3/D1.4 to assess multi-risk governance outcomes, WP4's evaluation of RWL host capacities for knowledge co-production, and D6.7, which assesses the legacy of interoperability, integration skills and stakeholder capacity within the RWLs. The WP specific MEL will expand on the general project MEL included with D6.7. Further details on the project MEL and access to the document are found in [section 1.3](#).

## 1.2.5 Work Package 5 – Data Fabric

### 1.2.5.1 Introduction

The current reporting period is the core period for WP 5. Almost all deliverables (D5.1, ..., D5.5) fall in this period starting from the high-over the low-level design up to the deployment of the Data Fabric and the release of the open source components in Version 1. The central foundation of all activities in WP 5 are the requirements raised by the RWL to fulfil their interoperability use cases showcasing the advantages of an increased interoperability among data, models and information products. During the project, it turned out that the process of collecting, consolidating, refining, revisiting and prioritizing first the requirements and later features, mock-ups and prototypes together with the RWL hosts and the stakeholders is more time-consuming than anticipated as of the proposal writing phase. Scheduling meetings (i.e., with external colleagues contributing on a voluntary basis) was often difficult and slowed down the iterative co-design and co-development process. Additionally, more iterations than anticipated were necessary to reveal the needs of the members of the RWLs and to distill the relevant interoperability use cases. The RWL specific task forces steering this agile co-development process met at least monthly, often even on a bi-weekly basis, to develop and achieve the use cases.

Despite this delay due to additional efforts in the requirement analysis phase of the co-development of the Data Fabric, the WP 5 team collated all available resources to provide the RWL with prototypes of the Data Fabric for subsequent stakeholder workshops providing invaluable feedback for further refinement and development of i.e., the user front-end. Finally, the WP5 team was able to release the Data Fabric in Version 1 by the end of the second reporting period (<https://directed.dev.52north.org/#>). This allows the RWLs to test, validate and interact with the Data Fabric. Feedback from users will be collected throughout year 4 of DIRECTED, which will help to improve the open source Data Fabric implementation for exploitation.

## 1.2.5.2 Progress per task

Work Package 5 comprises 5 tasks along with their corresponding deliverables. An overview of the deliverables of each task and their status is depicted in the table provided below. All deliverables due in RP2 have been submitted to the EU portal. An additional effort had been made to provide draft versions of some deliverables more than 9 months ahead of time.

Table 11: Summary of deliverables, milestones, and tasks status in WP 5.

Deliverables, Milestones and Tasks	Status report
D5.1	The <b>high-level design of the Data Fabric</b> has been fully documented in D5.1 that was <b>submitted on 23 Sep 2024</b> . It was delayed by about 3 months as the initiation of RWL and therefore the discussion of user requirements took longer than anticipated during the proposal writing.
D5.2	The necessary discussions with modellers and RWL hosts and stakeholders to define the more detailed <b>low-level design of the Data Fabric</b> could only start after D5.1 had been finalized. Furthermore, the refinement of interoperability use cases by the RWL required several in-depth discussions and workshops, leading to another delay. Hence, the submission of D5.2 was prolonged, and a <b>draft was submitted on 13 Nov 2024</b> for a first assessment, after receiving feedback on the draft at the end of May 2025, the deliverable has been improved and finally <b>submitted on 30 Sep 2025</b> .
D5.3	The <b>data protection impact assessment</b> together with ethical considerations addressing the Data Fabric were carried out based on the low-level design of the Data Fabric. It was finalized and <b>submitted on 13 Nov 2024</b> .
D5.4	The deliverable <b>implementation documentation</b> , that also contains mock-ups of how the interoperability use cases would be presented to the user, could only fully develop once the low-level design and interoperability use cases had been agreed upon with the RWL. Hence, a very early <b>draft was submitted on 13 Nov 2024</b> along with the low-level design of the Data Fabric. The deliverable has been continuously updated and after receiving feedback at the end of May it has been finalized and <b>submitted on 1 Oct 2025</b> .
D5.5	Early versions of the Data Fabric have been publicly deployed since the beginning of 2025 to continuously collect feedback from the RWL hosts and stakeholders. As Version 1, the <b>Data Fabric</b> source code was tagged and links to deployment and source code were <b>submitted on 30 Sep 2025</b> . Assessments of the Data Fabric as a whole and regarding the RWL interoperability use cases based on previously defined acceptance criteria have also been submitted with D5.5.
D5.6	Change control document due in RP3 on 30 Sep 2026
D5.7	User training by role was formally postponed to RP3 due on 28 Feb 2026.

Deliverables, Milestones and Tasks	Status report
MS21	<b>Publication of the High-Level Design of the Data Fabric was achieved on 24th Sep 2024</b> when D5.1 was submitted.
MS22	<b>Publication of the Low-Level Design of the Data Fabric was achieved on 13th Nov 2024</b> when the draft of D5.2 illustrating the low-level architecture of the Data Fabric was submitted.
MS23	<b>Data Fabric commissioned:</b> this milestone was <b>achieved on 23rd Jan 2025</b> when each RWL had agreed on a list of high priority interoperability use cases and the Data Fabric acceptance test criteria had been defined in D5.2. It was delayed by about a month due to additional in depth discussions with RWL hosts and stakeholders.
MS24	<b>RWL Use Cases configured:</b> the use case acceptance test criteria have been defined within the context of D5.4. With the release of the data Fabric as Version 1 (D5.5), also evaluated acceptance test reports of the Data Fabric and the use cases have been <b>submitted on 30 Sep 2025</b> .
MS25	Due in RP3 on 30 Sep 2025
Task 5.1 - 5.4	All tasks have been completed, and according deliverables have been submitted.
Task 5.5	This task has just been started to further improve and refine the Data Fabric based on RWL hosts' and users' feedback.

### Task 5.1 Stocktaking of the Current Data Context (Month 1 - 21)

(lead: 52N, co-lead: GECO, contributors: OASIS, UCC, IIASA, RWL resp. partners)

In a collaborative effort together with WP 2, a survey has been initiated among research, local & regional authorities and practitioners participating in the project (i.e. in the RWL) to assess the current state of data, model and information usage, availability and their interoperability. This task initiated the development of a close connection with the RWL hosts and their stakeholders, in order to be able to gain the necessary insights. The survey has also been accompanied by interviews and workshops with the RWLs and project partners. The emerging picture of the current solution landscape informed the high-level design of the Data Fabric (D5.1, and MS21) addressing barriers of interoperability. The low-level design has also been informed by external existing data and information infrastructure solutions.

### Task 5.2 Define the project interoperability Use Cases (Month 1 - 24)

(lead: 52N, co-lead: GECO, contributors: GFZ, UCC, IIASA, SEI, RWL resp. partners)

Building upon the first stocktaking (Task 5.1), an intensive iterative process to collect, consolidate, refine, revisit and finally prioritize requirements has been initiated with all RWLs.

Due to more and longer discussions with the RWLs, this process was more time-consuming than anticipated. Additionally, arranging meetings with external (volunteering) stakeholders took longer than initially anticipated. A major challenge was to identify the true needs of the RWLs and to develop and select interoperability use cases that are best suited to showcase the benefit of the improved interoperability in the RWL. This work was fundamental to the project and the development of the Data Fabric. It informed the subsequent tasks in WP5 and i.e. the low-level design of the Data Fabric.

**Task 5.3 Define the Reference Architecture for the Data Fabric (Month 22 - 24)  
(lead: 52N, co-lead: GECO, contributors: GFZ, ETH)**

This task consolidated the design of the Data Fabric, taking also further constraints from the models available within DIRECTED into account. Some user stories would have required the development of new models, which was beyond the scope and feasibility of this project. A further constraint was introduced by the limited availability and quality of some data sources. Hence, some user stories had to be rated with a lower priority due to being not feasible within DIRECTED. However, these user stories have still been documented for further use beyond the project's scope and lifespan. Eventually, the detailed low-level design of the Data Fabric has been documented in D5.2 accompanied by an acceptance test checklist for the Data Fabric achieving MS22 and MS23.

**Task 5.4 Design, build, configure and commission the prototype Data Fabric  
(Month 22 - 36) (lead: 52N, co-lead: GECO, contributors: OASIS, SEI, additionally: RWL resp. partners)**

Building upon the wealth of information and insights gained during the previous tasks, the development of the Data Fabric has also been carried out in close collaboration with the RWL as a co-development. To loop the RWL hosts into the development process, task forces per RWL had been established. Those task forces have intentionally been designed as small teams with typically only a single representative per WP that are closely involved with the particular Data Fabric development of the RWL. Building upon the user stories defined and prioritized in previous tasks, mock-ups have been developed and discussed with the task force per RWL to further specify the implementations of the Data Fabric. In an iterative procedure, the mock-up and functional features have been redefined and emerged to a tool capable of overcoming interoperability barriers in CCA and DRM leading to D5.4.

By publicly deploying the Data Fabric from the beginning, the task forces and RWL stakeholders could interactively explore the development status. Based on continuous feedback from the RWL hosts and stakeholders, the task forces adapted the designed solutions and steered the development sprint by sprint. Following this co-development approach helped to ensure that the developed solutions fulfil the RWL requirements and interoperability use cases. In order to make the Data Fabric not only accessible to experts, key terms have been identified and linked with SEI's Climate Connectivity Taxonomy (CCT)

providing helpful explanations. A very intense development phase from project month 28 - 36 led to the release of the Data Fabric in Version 1 (D5.5) achieving milestone MS24.

Reflecting the importance and significance of the outputs of modelling tools made easily accessible through the Data Fabric and led to D5.3, where ethical considerations along with data protection aspects have been discussed. Principles have been developed and documented which a production ready Data Fabric (or related system) should follow to handle data, insights and decisions with the necessary care.

**Task 5.5 Improvements & refinements with operation (Month 37 - 48) (lead: 52N, co-lead: GECO, contributors: OASIS, SEI, additionally: RWL resp. partners)**

During the extensive discussions with RWL hosts and stakeholders during the requirement analysis phase (Tasks 5.1 and 5.2), a wealth of user stories has been collected. With the limited resources in the project, a prioritization through the RWL has been put in place to concentrate on the most important interoperability use cases first. User stories and features with a priority that have not yet been implemented are kept in a so-called “backlog” to inform further improvements and refinements beyond the actual feedback of users. Work on this task has just started with the end of RP2.

## 1.2.6 Work Package 6 – Communication and Dissemination

### 1.2.6.1 Introduction

Work Package 6 focuses on the communication, dissemination, and exploitation of DIRECTED's results to ensure that outputs are effectively shared, applied, and sustained across scientific, policy, and practitioner communities. Led by Oasis Hub, with major contributions from the University College Cork (UCC) and support from all partners, WP6 coordinates project-wide communication, manages public visibility, supports stakeholder engagement through the RWLs, and advances exploitation and business development planning for Key Exploitable Results.

The work covers six main tasks, ranging from strategic communication and annual reporting to the development of eLearning programmes, training resources, and exploitation strategies. During the reporting period, WP6 has delivered its scheduled communication reports (D6.6 and D6.7), co-designed new learning and capacity-building programmes with UCC and SEI Oxford, and initiated development of the DIRECTED online eLearning platform via weADAPT. Activities also include preparatory work on the Business Development Plan (D6.5) and Legacy Skills and Capacities Report (D6.9), ensuring alignment between communication, learning, and exploitation efforts across the project and between scientific, governance, and end-user communities.

### 1.2.6.2 Progress per task

Work Package 6 comprises six tasks along with their corresponding deliverables. An overview of the deliverables of each task and their status is depicted in the table provided below.

*Table 12: Summary of deliverables, milestones, and tasks status in WP 6.*

Deliverables, Milestones and Tasks	Status report
D6.1/ M4	Communication Strategy - Submitted and accepted
D6.2	Communications Report Year 1 - Submitted and accepted
D6.3	Gaps & Opportunities Report - Revision submitted and accepted

D6.4 / M27	eLearning portal Due M45 - on track
D6.5/ M48	Business Development Plan - on track - due M48
D6.6	Communication Report Year 2 - Submitted
D6.7	Communication Report Year 3 - Submitted
D6.8	Communication Report Year 4 - due Sept 2026
D6.9	Legacy document on the capacity/skills for risk and adaptation management Due M46 - on track

**Task 6.1 Develop a communication strategy for the directed project and thereafter communication updates for relevant reporting cycles (Month 1-4) (Lead: Oasis contributors: All)**

Completed in previous period

**Task 6.2 : Deliver a full communication programme (Month 3 - M48) (Lead: Oasis, contributors: All)**

A full and detailed report can be found submitted under D6.7 DC&E Report. The report covers both project wide and organisational specific communications and dissemination actions for years 3 and future plans for year 4. A report is submitted on a yearly basis with detailed information and dissemination and communication actions.

In this reporting period D6.6 and D6.7 have been submitted for review.

**Task 6.3. Identify current institutional capacity for integrated multi-hazard risk and climate change adaptation (M2-9) (Lead: GFZ)**

Completed previous period

**Task 6.4. Develop programmes to support integrated responses to multi-hazard risk and climate change adaptation (M10-45) (Lead: UCC)**

This task builds on Deliverable 6.3 Gaps and Opportunities Assessment which outlined different avenues and target groups for eLearning activities in DIRECTED. Within this task, the development of three learning programmes have been identified to focus on specific RWL experiences and lessons for connecting governance and innovative technical frameworks through the Data Fabric and Risk-Tandem (as Key Exploitable Results). Based

on discussions with RWLs, a refined set of target groups have been identified connected to their specific training outputs emerging from their RWL activities. This includes:

1. Interoperability in operation for extreme climate events: flooding in Rimini and wildfires in Ferrara targeting civil protection officers.
2. Integration in DRM and CCA planning: coastal flooding in Roskilde Fjord, targeting municipalities and emergency managers.
3. Risk communication and citizen engagement: combining experiences from Rhine-Erft in Germany, Zala, Hungary and Ferrara, Italy targeting the public and mayors.

These learning programmes will be co-designed with the target groups aligned to the RWLs and used as ‘Training of Trainers (ToT)’ resources within the RWLs but can equally be used directly by target groups within or beyond the RWL context. For the first learning programme, a training co-design workshop was held at the European Climate Change Adaptation (ECCA) Conference in Rimini, Italy in June 2025 (23 participants including civil protection officers) and interviews were conducted with civil protection officers. The co-design will be further informed by RWL activities including a simulation exercise using the Data Fabric (March 2026), external engagement at the DRR Academy (February 2026, Salerno, Italy) and refined through interviews/ engagement with the target group.

For the second learning programme, a preparatory workshop was held alongside the Copenhagen General Assembly (September 2025) testing the Multi-Criteria Decision-Making (MCDM) tool for integrated DRM and CCA planning, which will be further tested and packaged into a learning programme after the next RWL workshop (3 December 2025) and in-person interviews with target group (1-5 December 2026). The development of the learning programmes will inform and align with the Data Fabric training being documented in D5.7 User Training per Role (due M40). The third learning programme will focus on supporting and signposting to RWL outputs co-developed that can be used for further advancing risk communication and engagement with the public and mayors - for example, artistic engagement through the Climate Festival in Zala and climate data sonification in Rhine-Erft, as well as the wildfire communication campaigns in Ferrara, Italy.

The weADAPT platform for climate adaptation, managed by SEI Oxford, will be used as the online repository containing all the learning materials resources generated by DIRECTED including and not limited to the three learning/ ToT programmes outlined above (Deliverable 6.4 in M45). A sprint session between SEI Oxford and UCC was conducted (November 2025) to mock up the interface for such learning programmes in line with existing functionality of the platform.

#### **Task 6.5. Pilot tracking of KTT Implementation and application of integrated governance and technical tools (M30-45) (Lead UCC)**

The deliverable (D6.9) associated with this task was postponed until M46 in line with the Task timeline and to ensure key learning related to RWL activities in Year 4 can be captured in the legacy document. The report will contain a set of recommendations around capacity /

skills requirements for specific target groups (e.g. municipalities, civil protection officers, mayors) to better address integrated DRM and CCA using the resulting governance and technical solutions emerging from RWL activities.

Completed activities include developing an initial framework for capacities and skills (covering technical, communication and governance related competencies) for identified target groups and testing it in a workshop at the Copenhagen General Assembly (September 2025). The aim was to capture additional data on existing and expected skills development among the identified target groups as a result of DIRECTED. Activities planned include in-depth interviews with the identified target groups in each RWL during Year 4, complemented by additional interviews with scientists/ researchers within the consortium and DRM/ CCA practitioners beyond (e.g. at CERIS Disaster Resilience Days).

One challenge related to this task is that the monitoring of dissemination and exploitation activities is dependent on the completion of RWL outputs (technological tools). As such, the recommendations may miss some additional insights from the final months of the project.



*Figure 6: Interactive activity mapping skills and capacities for different target groups (Sept. 2025).*

### **Task 6.6 Exploitation - Business planning with public and private sector for scaling outputs (M36-M48) (Lead Oasis)**

We began this work early as requested by the reviewers and a full and detailed exploitation report has been submitted in D6.7 DC&E report on the position, actions taken and next steps for each Key exploitable Result (KER). The report shows details of the KER's, target markets, business development work conducted in the Project and next steps for each product.

## 1.2.7 Work Package 7 – Project Management

### 1.2.7.1 Introduction

Work Package 7 (WP7) focuses on project management to ensure efficient coordination among all partners and achievement of project objectives. Led by TU-Braunschweig with contributions from all partners, WP7 and all of its tasks span the entire project duration (month 1 to 48), supporting the exploitation and legacy of project results beyond its completion. According to the Grant Agreement, WP7 covers:

- Project coordination and administration (Task 7.1)
- Implementation, work planning, monitoring, reporting, and quality control (Task 7.2)
- Data management, exploitation, and impact sustainability (Task 7.3)

Key responsibilities include timely deliverable submission, financial and risk management, communications with consortium members and the EC, implementing contractual changes, maintaining project transparency, ensuring FAIR data management, and managing outreach activities.

Effective communication is maintained through internal email lists, Slack messaging, and video calls. Bi-weekly "Jour Fixe" meetings serve as the primary forum for partner interaction and operational coordination. Work package meetings, modellers meetings and RWL task forces support the task specific work across project partners. Steering committee meetings are regularly organised to prepare important decisions to be made by the consortium. WP7 in collaboration with local partners organises annual General Assemblies held in-person in locations in the project's RWLs.

### 1.2.7.2 Progress per task

Work Package 7 consists of three tasks along with their corresponding deliverables and milestones. An overview of the deliverables of each task and their status is depicted in the table provided below.

Table 13: Summary of deliverables, milestones, and tasks status in WP 7.

Deliverables, Milestones and Tasks	Status report
D7.1 – Consortium Agreement including IPR, Grant Agreement signed (Lead Beneficiary: TUBS) Task 7.1	Status: D7.1 was submitted in RP1 The Grant Agreement has been amended during RP2
D7.2 – Project working plan with risk management and mitigation (Lead Beneficiary: TUBS) Task 7.3	Status: D7.2 was submitted in RP1 Work on risk mitigation and updates of the project working plan continued in RP2.
D7.3 – Data management plan (Lead Beneficiary: TUBS) Task 7.3 Milestone 29	Status: D7.3 submitted in RP1
D7.4 – Mid-term report, covering months 1-16 (Lead Beneficiary: TUBS) Task 7.2 Milestone 30	Status: D7.4 submitted in RP1 A revised version has been submitted in RP2.
D7.5 – Mid-term report, covering months 17-36 (Lead Beneficiary: TUBS) Task 7.2	Status: Submitted in RP2 Documentation for the second mid-term report covering months 17 - 36 in the project has been submitted
D7.6 – Final report covering full project (Lead Beneficiary: TUBS) Task 7.2	Status: Not started (due month 48)
D7.7 – Project legacy documented and implemented (Lead Beneficiary: TUBS) Task 7.2	Status: In process during RP2 (due month 48) The legacy of innovations developed in DIRECTED is being planned. Repositories are created, exploitation plans written, stakeholder collaboration institutionalised.

### **Task 7.1 Project Coordination and administration (M1-M48) (lead: TUBS, contributors: WP leads: OASIS, GECO, GFZ, SEI, UCC, 52N)**

Early in the project during RP1 bi-weekly “Jour Fixe” meetings were established to coordinate the work between all Work Packages and Real World Labs. These meetings have a duration of 1-hour and all project partners are expected to attend. These meetings include updates from the WPs and RWLs and deep-dive presentations on thematic or organizational topics. Meeting minutes and presentations given during the Jour Fixe are always made available on the internal Nextcloud servers of TUBS for all to review and stay up-to-date with project progress. In RP2 participation in the meetings was made mandatory for all partners, i.e. at least one, well-informed, representative of each consortium partner has to participate if not excused, due to other responsibilities. This change has insured stable participation of project partners and has minimised communication and coordination failures. A total of 46 Jour Fixe meetings were held in RP2, with an average participation of 21 team members. In RP2, the meeting agenda was changed to include regular housekeeping and deadline reminder slides to ensure timely delivery of reports. Additionally, a four-corner WP Update Slide template was provided to the partners to streamline WP and RWL updates while keeping all partners up-to-date with the progress within the project. The sections (or “corners”) of the slide were respectively Progress and Results from the WP or RWL, next steps and actions to be taken, challenges and risks and timeline and resources.

#### **Jour Fixe agenda:**

4. Welcoming new project team members (farewells)
5. Housekeeping with important dates and deadlines [10 minutes]
6. Deep dive presentations [10-20 minutes]
7. Updates from the WPs and RWLs [30-40 minutes]
8. Other business [5 minutes]

TUBS has an additional budget in subcontracting planned to support the RWLs to purchase data, include additional stakeholders and provide translations. To ensure a democratic approach and an equal opportunity for all RWLs to be able to apply and receive additional funding for their additional activities connected to the action, WP7 coordinated and supported the RWLs and WP partners in setting up the (non-exhaustive) activities listed below:

- Communicating disasters and climate change through the art of Sonification in the Rhine-Erft Region (Completed in RP2)
- Design, production and installation of wildfire information targeting tourists in the Emilia-Romagna Region (Completed in RP2)
- Data purchase, translation and support for the Climate Festival in the Zala Region (planned for RP3)

The ethics advisor for the project was also onboarded to the project in RP2 to prepare ethics reports for the project. The advisor was also contracted to host an Ethics workshop, during the last General Assembly in Copenhagen in September 2025, to help partners in addressing and integrating the recommendations of her first report into their work (see also section [1.2.8.2](#)). Additionally, she also held independent interviews with RWL hosts and project partners over the course of RP2 to be able to recommend specific tools to support them in their deliberations towards addressing her ethical recommendations for their specific cases. This was especially influential in the development of the Data Fabric and informed the concept of the Data Steward.

During RP2 WP7 continued its work for Task 7.1 by ensuring continuity of the project's implementation according to plan and improving timely delivery of reports. This was done via continuous check-ins with the partners on matters of task implementation as well as financial concerns. In August and September 2025, shortly before the end of RP2, WP7 also organised a one-on-one meeting with each WP-lead to discuss the progress of their tasks, their internal budget management as well as risks and challenges they are currently facing, to better prepare for reporting as well as the last year of the project implementation.

WP7 also organised and planned for an Amendment to the Grant Agreement for the project during this reporting period. The amendment included 5 major points, detailed below with summaries of their justification:

- 1. Change of end date of RP2 from M32 to M36** In the review report, the reviewers requested a preponement of deliverables D2.2, D3.2, D4.1 and an update on exploitation from M36 to M32 to be given a chance to review the progress of the project through these deliverables. After multiple email exchanges with the PO, it was concluded that the end date of RP2 should be moved to M36 to allow the deliverables requested to be part of RP2 to be included at their current submission deadline.
- 2. Beneficiary Region-H termination 30th Sep. 2025:** The decision to withdraw from the project is based on a governmental decision to bar Danish Regions from engaging in climate related activities with effect from the 1st of January 2026. As decided by the consortium, the handover of assigned tasks from RegionH will be transferred to Technical University of Denmark (DTU), who is already a consortium member and is familiar with the project and its requirements.
- 3. Change in subcontracting budget for OASIS:** OASIS replaced its subcontracting budget with a full-time, in-house developer specializing in immersive technology (Unity). This shift aimed to retain IP and skills within the organization. The change was driven by feedback from RWLs that basic citizen apps have limited effectiveness. The app will be transformed into an immersive VR App for professional and public education, accessible via headsets and as a 2D video for the eLearning platform. Existing staff will cover development during the 3-6 month recruitment period. The in-house hiring is also expected to offer long-term benefits to Oasis Hub's skill base beyond the project's duration.

**4. Changing the description of the technical report deliverables:** The amendment was launched to change the end of RP2 from M32 to M36. Thus the mid-term report D7.5 should also cover the entire length of RP2. Therefore, the description of this deliverable was changed to ‘mid-term report, covering months 17-36’, as well as the submission deadline to M36. Similarly, the description for the final report was changed to ‘Final report covering months 37-48.

**5. Updated submission dates of deliverables: D1.3:** The report required significant time to ensure maximum accuracy and partner agreement regarding highly sensitive case studies (Rhine-Erft 2021, Emilia-Romagna 2023 floods) involving major casualties.

**D5.7:** Postponement allowed the deliverable to include practical training and documentation material developed using the fully operational Data Fabric, which has been deployed in M36.

**D6.9:** The legacy document should be submitted after the e-Learning platform is delivered (in M45) to ensure it can fully capture the capacity and skills developed through the platform.

Lastly, to ensure clear communication between the project and the EC regular check-ins with the Project Officer were established. The consortium was always informed about these meetings ahead of time to contribute agenda items and in rare cases when required join the consultation meetings.

#### **Task 7.2 Project implementation, work planning, monitoring, reporting and quality control (M1-M48) (lead: TUBS, contributors: OASIS, GECO, GFZ, SEI, UCC, 52N)**

Under Task 7.2 continuous updates to improve guidance in reporting templates were made. These include guidance to achieve the preferred layout, corporate design and thematic contents with the inclusion of ethical dimensions for consideration in each report (see also section [1.2.8.2](#)). The coordination team worked with all RWLs and Work Packages to revise the first mid-term report for RP1 (D7.4) to improve reporting based on reviewers recommendations. These recommendations also informed the guidance for writing D5.7 (this document) that also includes the follow-up on reviewers comments in [section 2](#). As stated above, D7.5 now covers month 17-36 to include major deliverables and milestones that would have not been submitted yet in month 32.

The Risk Log established in RP1 was continued in RP2 to monitor **foreseen risks** that had already been included in the Grant Agreement and **unforeseen risks** that only became apparent during the active project phase ([Figure 7](#)). A summary of the foreseen and unforeseen risks with probability and severity estimates on a scale from 1 (least) to 4 (most) is provided below. The full detail on mitigation measures is available on the SyGMa web system.

DIRECTED Risk Log												
#	Risk	WP	Severity	Probability	Overall Impact	Escalated?	Risk Type	Status	Date Logged (DD/MM/YYYY)	Owner	Mitigation Plan/Status	Update and actions taken
1	Limited participation and commitment to RWLs (WP1) by practice partners and other stakeholders (low/high)	WP1	3	2	Medium	EU	Requirements	Open	05/07/2024	Stefano B.	RWLs build on extensive previous co-operations and trusted relationships. The quality and level of engagement will be continuously monitored and assessed by RWL managers who will also ensure that a wide range of partners are activated and engaged (mitigated) Flexibility in managing time to accommodate the availability of stakeholders. New gantt based planning with evidence of RWL engagement needs. Each month WP1 double check Gantt planning with stakeholders.	Stakeholder exchange had a slow start in RP1. In RP2 the engagement with stakeholders was improved by organizing more regular workshops (August 2024 Vienna, March 2025 Zala, July 2025 Vienna)
2	Difficulty to address stakeholders' needs in RWLs WP1 (High / Low)	WP4	4	1	Medium	EU	Research	Open	03/02/2025	Sukaina B.	The project design foresees this – WP4 along with the dissemination activities and the management structure is in fact constructed to mitigate this and potentially draw lessons from it (mitigated).	Regular meetings of WP3 and WP4 to coordinate support for WP1 and the RWLs. Task forces for each RWL have been set up. Regular task force meetings support better coordination as well as (previously) modelers meetings. There is constant review of how many meetings are being held and they are adjusted as needed. For example, as more detailed and targeted discussions are now occurring in task force meetings, full modelers meetings are no longer needed, and these are instead held bilaterally as demands arise. Rhine-Erft RWL Jan. 2025: Green roofs modeling
3	Lack of accessibility of data/tools for development and demonstration	WP5	2	1	Low	EU	Development	Open	28/05/2025	Ben G.	The project consortium team already has screened for the availability of methods, data and tools when writing this proposal. Concepts, methods, models and tools envisaged to exemplify interoperability or to be further developed in RWLs are developed/owned by project partners (mitigated).	Data and tools have been identified and aligned with the needs of the RWLs. An application to become EFAS research partner has been issued to broaden the available data sources. 05/11/24: DIRECTED is eligible to use EFAS real time data, but only for internal evaluation. Identified data sources did not show any critical restrictions otherwise; addressing some user stories would require models outside the scope of DIRECTED and have received a low priority, lightweight fallback modelling options are under review. 29/01/25 BGR: some user stories had to be marked as "not feasible", as the available tools in DIRECTED are not suited to address them. Alternative user stories are prioritized. 14/02/2025 BGR: Additional models were identified and included in the development of the Data-Fabric e.g SVI, DTU fire model, crop model Danube 28/05/2025: slightly lower probability, however, due to the current project phase no more additional models can be integrated, but, as of now, all RWL are satisfied with the

Figure 7: Excerpt of the project internal risk log for monitoring, management and mitigation.

### Foreseen Risks:

**Limited participation and commitment to RWLs by practice partners and other stakeholders | Probability: 2 | Severity: 3**

**Mitigation:** In Reporting Period 2 (RP2), Real World Lab (RWL) activities shifted toward structured co-production and engagement, focusing on practical activities, exercises, workshops, and Data Fabric demonstrations with active stakeholder participation. The loss of the RegionH host for RWL1 was effectively mitigated by gradually transferring responsibilities to DTU, ensuring stakeholder continuity and lowering the overall project risk probability.

**Difficulty to address stakeholders' needs in RWLs | Probability: 1 | Severity: 4**

**Mitigation:** Data Fabric task force meetings expanded into general task forces to support WP4 in co-developing workshops with RWLs, defining project goals, and identifying mismatches between stakeholder needs and capabilities (e.g., green roof modelling for Rhine-Erft was dropped for a different focus). To manage the residual risk of unmet expectations, budget reallocation is planned, and a feature priority list was created with RWLs to focus the final year's Data Fabric development on high-impact features. (See risk below: Personnel involved not able to fulfil task)

**Lack of accessibility of data/tools for development and demonstration | Probability: 1 | Severity: 2**

**Mitigation:** DIRECTED is allowed to use EFAS real-time data only for internal evaluation, and most other data sources have no major restrictions. Some user stories were deemed low priority or "not feasible" because they require modelling or tools outside the project

scope, leading to the selection of alternative user stories and lightweight fallback options. Additional models like SVI and DTU's fire model were included in the Data Fabric. All initial interoperability use cases are addressed in version 1 of the Data Fabric. The remaining primary risk is any future change by data set providers that could disrupt data integration.

**COVID19 or other pandemics may prevent physical events or prohibit travel** | Probability: 1 | Severity: 3

**Mitigation:** The project will strictly follow the physical and medical guidelines of host institutions and ensure remote access to events and meetings are available as a backup plan in case of a pandemic. A solid remote working culture has been established that would ensure continuation of most activities during a pandemic.

**Personnel involved not able to fulfil task / staff changes or more efforts needed** | Probability: 2 | Severity: 4

**Mitigation:** 52N is currently overspending due to core developments, and "moving targets" in User Stories risk exceeding the budget. Mitigation initially involved frequent meetings and clear communication of limitations, leading to the freezing of User Stories and mock-ups by mid-March. The risk probability is now reduced as version 1 of the Data Fabric has been released, addressing all interoperability cases. However, minimal budget remains for further WP5 improvements. The focus now is on carefully prioritizing refinements with RWLs and planning for budget reallocation in RP3.

**Dissemination, Communication, Exploitation does not reach target groups** | Probability: 2 | Severity: 2

**Mitigation:** To mitigate the risk of insufficient uptake, the DIRECTED Team is actively disseminating project results through multiple communication sources, including social media, blogs, stakeholder meetings, public visualizations, academic publications, and conference attendance, ensuring they are on track to reach all relevant user groups.

**Coordination and internal communications fail** | Probability: 3 | Severity: 2

**Mitigation:** Mandatory attendance at the biweekly project meetings was implemented for all partners. These meetings were restructured to improve coordination. Minor, occasional miscommunication issues, such as late requests for report input, are managed through regular updates provided in the Jour Fixe and Task Force meetings.

**Conflicts & mismatched expectations across the consortium and practice partners, IPR conflict** | Probability: 2 | Severity: 4

**Mitigation:** Co-development practices ensures the solutions meet user needs. The use of Open Source licensing lowers barriers to adoption. Additionally, ongoing IP scan process in exploitation work and discussions on IP management between partners are mitigating this risk. Hosting solutions to maintain accessibility to DIRECTED innovations are identified and being implemented.

**DATA-FABRIC security incident or outage results in delays and increased costs** | Probability: 1 | Severity: 3

**Mitigation:** To manage technical issues, a semi-automatic re-deployment scheme is established, and the deployed Data Fabric is closely monitored for timely reaction to errors, downtimes, and CVEs.

### Unforeseen Risks:

**Ethics requirements can not be sufficiently met and monitored** | Probability: 2 | Severity: 2

**Mitigation:** The consortium established regular ethics meetings and an internal ethics log tracking progress across eight key ethical dimensions, which are now integrated into all report templates. Partners formally allocated 0.5 PM each to WP8 in an amendment, and an in-person ethics workshop was held to further integrate ethical considerations into the project work.

**Budget mismanagement and or lack of resources to complete work in any WP of the project** | Probability: 3 | Severity: 4

**Mitigation:** The coordinator regularly sends budget change reminders and successfully completed an internal financial monitoring exercise up to M24, foreseeing no current budget threats apart from minor effort deviations, with updates shared via Jour Fixe meetings. To mitigate financial risk from the delayed RP2 end and review, the coordinator provided internal bridge payments to one partner. Overall budget spent will be assessed at the end of RP2 for redistribution planning, and budget reallocation is planned for RP3 to support Data Fabric and Zala Regio.

**General cybersecurity risks to the IT infrastructure of the project and each of its partners** | Probability: 2 | Severity: 4

**Mitigation:** The mitigation strategy involves regular updates of IT systems and implementing a robust backup plan with file versioning for the Nextcloud platform as well as access restrictions.

**GDPR compliance, data mishandling and data leaks** | Probability: 1 | Severity: 4

**Mitigation:** The project mitigates this by using on-premise data storage on TUBS servers with restricted access to sensitive data, avoiding the collection of personal information where possible, and utilizing anonymization when necessary.

**Negative press** | Probability: 2 | Severity: 3

**Mitigation:** The mitigation measure is to have accurate press information available to control the narrative in the event of a negative press situation.

Tracking of ethics progress through organising ethics workshops and managing the ethics log was facilitated by the WP team. An excerpt from the ethics workshop and details on the ethics framework are found in section 1.2.8.

WP 7 has supported and coordinated the setup of a project spanning MEL system based on log frame methodology and a theory of change (D6.7). The work on WP specific MEL systems is ongoing and will be finalized in RP3.

TUBS as the coordinator is facilitating the budget planning and monitoring of all partners to ensure continued operations and identify financial bottlenecks. As detailed in [section 5.2](#) the project partners 52N and ZSRT both require additional budget in excess of their original attributions in the Grant Agreement. A budget transfer to 52N and ZSRT are planned and supported by all partners votes during the GA in Copenhagen 2025.

Changes in the internal review process based on experience within the consortium compared to the original plan laid out in the project management deliverable were made during RP2 (see [Figure 8](#)). When internal deadlines could not be met, additional support from project members were requested. The PO was informed about delays in submissions and justifications were provided on the reporting portal.

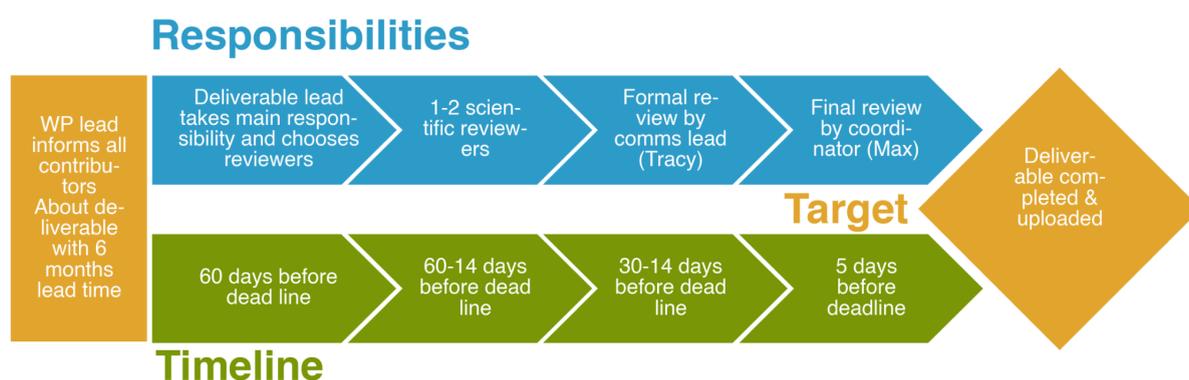


Figure 8: Internal review process for project reports and deliverables.

Planning and facilitation of the Annual General Assemblies in Rimini (RWL2) and Copenhagen (RWL1) was coordinated by WP7 in support of the RWL hosts. Planning for the next and last GA in Keszthely (RWL3) in conjunction with an arts and climate festival are underway. Both GA's were attended by around 40 project members, with additional local stakeholders joining parts of the events. A combination of project internal sessions for coordination and RWL (location of the GA) specific events are organised. In Rimini, the project took part in a flood response exercise with the civil protection agency of Emilia-Romagna. In Copenhagen, local, regional and national stakeholders reported on their specific disaster and climate change adaptation challenges with a focus on the Roskilde Fjord. Direct knowledge exchange between practitioners from the RWLs were facilitated during both GA's, as for example during a visit to the Roskilde fire department's training and test facility for disaster response equipment (Figure below).



Figure 9: Visit of the Roskilde Fire department training facility during the GA in Copenhagen, Sep. 2025.

### **Task 7.3 Data management, exploitation and impacts beyond project lifetime (M1-M48) (lead: TUBS, contributors: OASIS, GFZ, SEI, UCC, 52N, GECO)**

Deliverable and milestone reports already approved by the Project Officer in RP1, with consent of all main authors, were published on Zenodo. Only reports that are considered public are published on Zenodo, sensitive reports are not made accessible to the public to protect personal data. To gather all DIRECTED publications, a DIRECTED community page was created on the platform. WP7 manages the community page and metadata to all publications. In RP3, further reports will be made accessible on Zenodo. The consortium is also considering (re-)publishing scientific articles, conference contributions and data sets on Zenodo where embargos allow it. The DIRECTED Zenodo community with all its publications can be accessed under: <https://zenodo.org/communities/directed/>

To keep software and code developed in DIRECTED accessible during the project and beyond its lifetime, WP7 supports publishing on public repositories. The central hub for software development and engagement with the developer community is the DIRECTED GitHub organisation under: <https://github.com/directedproject-eu>. This organisation unites 12 repositories focused on various parts of the Data Fabric infrastructure (see also [section 1.2.5](#)).

## 1.2.8 Work Package 8 – Ethics

### 1.2.8.1 Introduction

Ethics is an essential part of the DIRECTED project because the research and innovation work conducted affects individuals and groups and the grant agreement requires the project to "be carried out in line with the highest ethical standards and the applicable EU, international and national law on ethical principles." The DIRECTED project, which develops interoperable data, models, communication, and governance for disaster resilience, operates at the intersection of technology, society, and environmental decision-making. This means that high ethical standards are needed to ensure free and informed consent, protection of privacy, respect for human dignity, diversity, fairness, no discrimination, and research integrity. By embedding robust ethical principles and compliance into all aspects of its work, DIRECTED aims to safeguard individual rights, foster inclusivity in stakeholder collaboration, ensure responsible data use, and maximize positive societal and environmental impacts. In the first ethics report (D8.2) six ethical dimensions of the project's work were identified by the advisor and two additional aspects added in the second report (D8.3). These are based on existing frameworks such as FAIR, SHERPA and The European Code of Conduct for Research Integrity.

1. **Free and Informed Consent:** Ensuring that all participants are fully informed about the project, its purposes, any potential risks, commercial uses, financial benefits, and their rights before agreeing to take part, and that they do so without coercion.
2. **Right of Life and Human Dignity:** Safeguarding and respecting the inherent value, rights, and dignity of every individual, particularly in risk assessment and decision-making, prioritizing human wellbeing above other factors like property or assets.
3. **Diversity, Fairness, and Non-Discrimination:** Ensuring that all people, regardless of characteristics such as sex, race, origin, disability, or other status, are treated fairly, are not discriminated against, and are included meaningfully in project activities.
4. **Privacy and Data Governance:** Protecting the privacy of individuals and governing personal data appropriately in line with laws (like GDPR), including ensuring quality, integrity, rectification rights, and proper data usage across all partners.
5. **Research Integrity:** Conducting research in an honest, transparent, and reproducible way, ensuring outputs are Findable, Accessible, Interoperable, and Reusable (FAIR), and making results openly available when possible.
6. **Societal and Environmental Impact:** Assessing, minimizing, and communicating the project's broader effects on society and the environment, including responsible stewardship, accessibility, and public communication.
7. **Human Autonomy, Agency, and Liberty:** Ensuring that stakeholders retain control, make autonomous decisions, and are not manipulated by systems or processes,

protecting both their positive freedoms (to act) and negative freedoms (from undue restrictions).

8. **Technical Robustness and Safety:** Guaranteeing that project systems and tools are reliable, secure, safe from failure or attack, and perform as intended, with ongoing support for accuracy and reproducibility.

These dimensions collectively ensure the DIRECTED project adheres to high ethical standards throughout its planning, implementation, and dissemination activities. They provide the ethical frame for all work conducted in the project, and all partners are committed to follow recommendations based on these ethical dimensions. Nevertheless, engaging an ethics advisor in the project, implementing recommendations into established workflows and allocating resources to ethical considerations were a challenging task for the coordination and project partners. These challenges were mostly overcome in RP2.

### 1.2.8.2 Progress per task

Work Package 8 comprises one task along with their corresponding five deliverables. There are no official milestones set for this work package. An overview of the deliverables of each task and their status is depicted in the table provided below. (in italic, tasks and deliverables belonging to RP1 submitted /resubmitted during RP2)

Table 14: Summary of deliverables, milestones, and tasks status in WP 8.

Deliverables, Milestones and Tasks	Status report
<i>D8.1 – OEI - Requirement No. 1</i>	<i>Status: The CV of a suitable external ethics advisor was and accepted and submitted</i>
D8.2 – OEI - Requirement No. 2	Status: Submitted as a periodic ethics report by the external advisor.
D8.3 – OEI - Requirement No. 3	Status: Submitted as a periodic ethics report by the external advisor.
D8.4 – OEI - Requirement No. 4	Status: In progress – to be submitted as the final periodic ethics report in RP3
<i>D8.5 – OEI - Requirement No. 5</i>	<i>Status: Submitted as a letter from the ethics advisor in agreement with the project officer.</i>

#### Task 8.1 (Month 1-48) (lead: TUBS, contributors: all partners)

The ethics reports D8.2 and D8.3 are based primarily on the study of reports produced by the DIRECTED project and on interviews with work package leads and real world lab hosts.

The first report D8.2 stipulates six main ethical implications (see introduction) after 12 months of project work. In D8.3, the second ethics report, progress on these ethical dimensions are evaluated, and two additional dimensions specifically focused on the Data Fabric were included. A stronger focus on the technical development of the Data Fabric in RP2 warranted additional ethical considerations. All assessments and recommendations can be accessed in the reports D8.2 and D8.3. As these reports are deemed sensitive, they are only available upon request and not openly published.

To track progress on implementing the recommendations from the ethics reports, a project internal ethics log was established, and focus meetings with all project partners were organised by WP 7. This progress began already in RP1 and was continued in RP2.

During the General Assembly in Copenhagen in September 2025, the ethics advisor was invited to facilitate an ethics workshop ([Figure 10](#)) on the general relevance of ethical consideration in research and on the eight project specific dimensions. In this workshop, the lessons learned and plans made were examined through open discussions and interactive exercises. Outcomes for each of the eight ethics dimension are summarized below:

- 1. Free & Informed Consent:** Early and realistic expectation management was necessary but lacking, as was clarity on terms and coherence in approaches at the project outset. There were mismatches in consent forms across pilots and inadequate lived-experience demos to foster stakeholder involvement. Planning now involves improving the clarity of technical terms before seeking consent, clear communication on stakeholder benefits and risks, harmonized ethics/consent forms, proper expectation management concerning the Data Fabric's lifespan and commercial use, to help stakeholders decide on participation and uptake.
- 2. Right of Life & Human Dignity:** Lessons learned emphasize that ethics considerations required more time and resources than anticipated, and that existing systems and EU projects are primarily oriented toward protecting property and markets, not social needs. There was a need to consult stakeholders more frequently about relevant social data and groups, and to be proactive in considering exclusions. Existing civil protection codes and volunteer guidance require greater awareness, and historical bias in models should be made clearer. The project plan includes integrating maladaptation analysis, more data layers, inclusion of social vulnerability indices, persistent engagement with stakeholders about vulnerable groups, embedding guidance and best practices, and ensuring broad stakeholder participation where possible.
- 3. Equity, Diversity, Fairness and Non-Discrimination:** Experience in DIRECTED showed that attention to gender, diversity, and inclusion came too late and with too few resources, and there was little information on gender balances in RWLs. Early and meaningful ethical awareness is essential, as is ensuring the presence of the right people to promote fair and mutually beneficial engagement. Plans call for

mediation when needed, adherence to Chatham House rules, explicit gender integration, early mapping of regulatory frameworks, targeted engagement with underrepresented groups such as migrants and refugees, and a dedicated relationship-building phase with emphasis on equity, diversity, fairness and non-discrimination at project start.

4. **Privacy and Data Governance:** It was observed that communication and data exchange platforms, despite being open and secure, sometimes pushed the team toward less secure and proprietary alternatives, because of a lack of reliability. IO-protected models proved unsuitable, and commercial data remained largely inaccessible. Ethical and data protections for RWLs were too often an afterthought, and authentication issues persisted. Planned improvements include sharing model validation methods, reviewing privacy and data governance for each RWL, anonymizing social data, dedicating explicit tasks to data protection, clarifying IP rights promptly, open access to state data where possible, consistent use of open source models, and clear publication of model metadata and licensing.
5. **Research Integrity:** The lessons show that patents can stifle competition and limit citizen participation, and project outputs were often communicated in overly technical language. There was insufficient consideration of post-project legacy and open access, and FAIR principles received inconsistent attention, partly due to funding structures. Foresight for project legacy, concise and accessible communication, open-source tools, repositories like Zenodo, the need for both FAIR and OA (open access) practices, and provision of citizen-oriented visualizations have been part of current practice and future planning.
6. **Societal and Environmental Impact:** The energy costs and potential CO2 footprint of project infrastructure were neither measured nor appropriately discussed, and concerns about inclusiveness and vulnerability were not adequately addressed, hindered in part by bureaucracy. Most partner organisations have pledges to reduce environmental impact of all their activities. Plans should include explicit evaluation of CO2 impacts, promote inclusion, clarify ethical assumptions in decision-making, improve accessibility features in communication (such as for those with impairments), assure compliance with stewardship and transparency requirements, and strengthen emergency and data stewardship protocols through updated internal regulations and agreements.
7. **Human Autonomy, Agency, & Liberty:** Freedom of use, licensing, and potential costs must be clarified up front, with open management of stakeholder expectations regarding the Data Fabric, and transparency around the modelling process, including its limitations, is needed. A major planning imperative is to use clear notifications within technical processes, clearly state human consequences of modelling limitations, publish assumptions openly (Assumptions Framework), balance

accessibility and transparency, distinguish decision-support limitations, and maintain stakeholder understanding of what models can and cannot represent.

- 8. Technical Robustness:** Key learnings involve clarifying limitations and managing expectations for the Data Fabric development from the start. Backups, both offline and via mirrored servers, are essential, and there must be clear separation of altered or external data from project outputs to avoid misattribution. The plan stresses communicating model accuracy limitations early, addressed in part by the Assumption's Framework, ensuring robust backup procedures, and protecting Data Fabric integrity from external misuse through continued security monitoring.

These learnings and plans on the ethical aspects of the project's work were not yet integrated in full into the ethics reports. They have been integrated into the ethics log and will inform the next ethics report (D8.4).



Figure 10: Interactive ethics workshop during the Copenhagen GA, Sep. 2025.

Based on the recommendations in D8.2 and D8.3 WP8, with support from WP7 and other WPs and RWL hosts, has updated the consent forms used for project workshops, interviews and surveys.

WP8 supported the development of D5.3 - Data Protection Impact Assessment and the general development of the Data Fabric to better adhere to the aforementioned ethical dimensions.

## 1.3 Impact

On the request of the reviewers in the Technical Review 1, during Reporting Period 2, the DIRECTED consortium significantly strengthened its Monitoring, Evaluation and Learning (MEL) framework to provide a coherent and evidence-based mechanism for tracking progress towards project objectives, outcomes and impacts. Developed collaboratively across all work packages, including WP1, WP2, WP 3, WP 4, WP5, WP6 the MEL system builds on a DFID (UK Government)- style Logframe adapted to Horizon Europe standards, aligning quantitative and qualitative indicators with the project's Impact Pathway.

The Logframe now acts as the central evaluative structure linking the project's science, governance, and communication strands. Each outcome and output is mapped to specific indicators, sources of verification, and risks/assumptions. Evidence has been systematically gathered from WP1–WP6 deliverables, including D1.3 Case Study, D2.2 Data Fabric, D3.2 Risk-Tandem Governance Framework, D5.2 Real-World Lab reports, and D6.6–D6.7 Dissemination and Exploitation reports for reporting on the current period. This cumulative evidence has created a transparent, traceable record of project performance and progress.

By the close of RP2, measurable advances were demonstrated across several key impact areas:

- **Improved dialogue and cooperation** among scientific, policy, and operational communities, with Real-World Lab (RWL) consultations and cross-WP engagement strengthening links between data producers, modellers, and end-users.
- **Enhanced interoperability and integration**, anchored in the evolving articulation of the Data Fabric, which is positioned to suggest cross-model, cross-hazard data flow while broadly supporting an increasingly interpreted form of risk-informed decision-making across regional and EU contexts.
- **Increased visibility and policy influence**, with DIRECTED results presented at major European events including ECCA 2025, REMTECH 2025, and the EGU General Assembly 2025, as well as at the WMO Regional Scientific Forum in Prague.
- **Capacity building and learning**, through the launch of e-learning materials, stakeholder training, and co-produced case studies that translate technical findings into actionable insights.
- **Emerging evidence of operational and policy uptake**, as RWL results begin informing preparedness exercises, anticipatory-action planning, and regional resilience strategies.

The MEL Logframe now provides a living evidence base for continuous monitoring, internal learning, and adaptive management through RP3 and beyond. It has consolidated coherence between technical innovation, governance, and communication strands,

positioning DIRECTED to demonstrate measurable improvements in disaster-risk governance, interoperability, and resilience outcomes at project conclusion.

The MEL and Impact Logframe can be found here:

[https://docs.google.com/spreadsheets/d/1THTL2jZOHo\\_L-rUjvKx5rTjmDOU9ku-kktHOOZMFs9l/edit?gid=0#gid=0](https://docs.google.com/spreadsheets/d/1THTL2jZOHo_L-rUjvKx5rTjmDOU9ku-kktHOOZMFs9l/edit?gid=0#gid=0)

### **Cumulative Impacts Across the Project**

Throughout the project period, DIRECTED has contributed to advancing scientific understanding and practical implementation of interoperable disaster-risk management across multiple European regions. The work has linked research, governance, and communication through a structured framework combining the Data Fabric, Risk-Tandem Framework, and the activities of the Real-World Labs (RWLs) in Emilia-Romagna, Rhine-Erft, Vienna, Zala, and the Copenhagen Capital Region.

### **Scientific and Technical Impacts**

DIRECTED has operationalised interoperability by developing and demonstrating the Data Fabric architecture, which connects heterogeneous datasets and models for flood, wildfire, and other hazards. This enables consistent data access and integration across spatial and temporal scales. Complementary governance and decision-support frameworks (e.g. the Risk-Tandem Framework and CLIMADA) have facilitated cross-disciplinary analysis linking technical risk information to institutional decision processes. These components have been validated through RWL testing and are now being referenced in regional planning discussions and modelling workflows. Together, these components enable multi-disciplinary analysis and have been applied within diverse regional contexts. Together, these approaches provide a scalable foundation for systemic, interoperable disaster-risk management.

### **Societal and Policy Impacts**

Activities in the RWLs have established mechanisms for dialogue between scientific, policy, and civil-protection communities. The integration of DIRECTED tools and approaches within regional exercises and adaptation plans provides early evidence of practical uptake. Dissemination through European conferences such as ECCA 2025, REMTECH 2025, the EGU General Assembly 2025, and the WMO Regional Scientific Forum has enabled comparison of methodologies and exchange of lessons across projects and institutions.

### **Economic Impacts**

DIRECTED has supported more efficient resource allocation and investment planning within disaster-risk management. Integration of SaferPlaces and Damage Cost/CLIMADA tools through the Data Fabric reduced duplication in loss estimation and improved comparability of cost-benefit analyses across regions. The interoperability of these models enables joint financial-risk assessments by local authorities and insurers. The project's cost-benefit work

(Outcome 7) quantified direct and insured losses in flood events. These outcomes enhance the evidence base for economically efficient adaptation measures and public-private investment coordination.

### **Capacity and Learning Impacts**

Training activities, e-learning materials, and co-produced case studies have supported the transfer of technical and governance knowledge to local stakeholders. Immersive visualisation outputs developed within WP6 have been used as communication aids for preparedness and awareness-raising.

### **Overall Impact**

Through interoperable modelling, participatory governance testing, and socio-economic evaluation, DIRECTED has produced transferable methodologies potentially supporting systemic disaster-risk management across Europe. The results provide practical and policy-relevant evidence for the European Green Deal, the EU Adaptation Strategy, and the Sendai Framework for Disaster Risk Reduction. In our final year of the project, we will provide policy briefs that we can provide to the different policy mechanisms mentioned here.

## 1.4 Publications

Publications are listed on the Funding and Tenders Portal. A more detailed list of all including non scientific publications can be found in the Communications and Disseminations Report (D6.7)

## 1.5 Update of the plan for exploitation and dissemination of results

*(Source: D6.7 Communications, Dissemination and Exploitation Report (Report 2024–2025 Final, pp. 18–56)*

### 1.5.1 Overview

During Reporting Period 3, DIRECTED strengthened its dissemination and communication work, ensuring wide visibility and engagement with its scientific, policy and practitioner audiences. A more detailed report can be found in D6.7 (Submitted). We provide a short summary of the highlights below.

WP6 (lead: Oasis Hub Ltd, UK) coordinated dissemination and communication across the consortium, with contributions from SEI Oxford, RIFS-Potsdam, 52°North, ARSTPC-ER, DTU, ETH Zurich, IIASA, GFZ, UCC, and GECOsistema. Activities covered scientific publications, website, news, blogs, partner features, media, tool demonstrations, e-learning, and conference presentations.

Activities combined academic publication, digital communication, co-designed stakeholder engagement, conference dissemination and citizen visualisation outreach.

### 1.5.2 Website and Social Media

The **DIRECTED website** (<https://directedproject.eu>) continued to serve as the core dissemination platform, publishing reports, blogs, videos and event updates.

- **Users:** 21,527 by 30 September 2025 (↑ 53 % from 2024).
- **LinkedIn:** 668 active group members; > 18,000 impressions on project posts.

- **YouTube:** 12 videos, 788 total views, 2,100 impressions.
- **Mass Media:** Coverage in *SEI Perspectives*, *Byplan Nytt*, *Erfvterband Inofluss*, and *RAI News Emilia-Romagna*.

The consortium prioritised professional and policy-oriented platforms, while partner reposting ensured cross-network amplification and continuity of visibility.

## 1.5.3 Blogs and Online Articles (2024–2025)

### Project-website blogs (Table 7, pp. 32–33)

These appear on the official DIRECTED project website:

1. “I Felt the Flood: How Immersive VR Could Transform Flood Preparedness in At-Risk Communities”:<https://directedproject.eu/blog/i-felt-the-flood-how-immersive-vr-could-transform-flood-preparedness-in-at-risk-communities/>
2. “Building Climate Resilience within the Danube River Basin: Insights from DIRECTED’s Real World Labs”:  
<https://directedproject.eu/blog/building-climate-resilience-within-the-danube-river-basin-insights-from-directeds-real-world-labs/>
3. “Tailormade, Applicable and Iterative – The Key Tenets of the Risk-Tandem Framework”:  
<https://directedproject.eu/blog/tailormade-applicable-and-iterative-the-key-tenets-of-the-risk-tandem-framework/>

Together, these posts attracted 1018 direct views and were widely shared through consortium and institutional channels.

**Partner blogs** extended dissemination further:

- 52°North: Interoperable Tools and Governance for Disaster Risk Management –  
<https://52north.org/solutions/directed/>
- RIFS Potsdam: Preparing for the Challenges Ahead – Flood Preparedness, Disaster Risk Management, and Climate Change Adaptation in Europe –  
<https://www.rifs-potsdam.de/en/blog/2024/10/preparing-challenges-ahead-flood-preparedness-disaster-risk-management-and-climate>
- Genillard & Co: Second DIRECTED Workshop at the Hydraulic Engineering Lab, BOKU Vienna –

<https://www.genillard-co.com/2025/08/06/second-directed-workshop-at-the-hydraulic-engineering-lab-boku-vienna-09-07-2025/>

- Vas County Disaster Management Directorate: Effects of Extreme Weather Events – Workshop Coverage –  
<https://vas.katasztofavedelem.hu/25692/hirek/287220/szelsoseges-idojarasi-esemenyek-hatasai-workshop-a-vas-varmegyei-katasztofavedelmi-igazgatosag-szervezeseben>

These cross-linked blogs increased national-language visibility and demonstrated applied outcomes across the Real-World Labs.

## News Articles (2024–2025)

### Mass media features and articles (Table 8, pp. 34–36)

1. “Camaraderie in Chaos: Using Play to Build Needed Trust in Uncertain Times” Published by *Stockholm Environment Institute (SEI) Perspectives*, March 2025  
<https://www.sei.org/perspectives/camaraderie-in-chaos/>
2. “European Cooperation for Climate Resilience” Published in *Byplan Nyt (Danish Urban Planning Magazine)*, June 2025  
<https://byplanlab.dk/sites/default/files/2025-06/Byplan%20Nyt%202025%20NY%20%28redigeret%29.pdf>
3. “Dikes Won’t Do: Why Europe Is Failing to Reduce Flood Risks” Published by *SEI Perspectives*, July 2025  
<https://www.sei.org/perspectives/dikes-wont-do-why-europe-is-failing-to-reduce-flood-risks/>
4. “Tabletop Exercise DIRECTED” Published in *Erftverband Infofluss (Water Management Bulletin)*, Feb 2025  
[https://www.erftverband.de/wp-content/uploads/2025/03/infofluss\\_0225\\_web.pdf](https://www.erftverband.de/wp-content/uploads/2025/03/infofluss_0225_web.pdf)
5. “Summer Emergency Drills at Lido degli Scacchi” Published by *RAI News Emilia-Romagna*, May 2025  
<https://www.rainews.it/tgr/emiliaromagna/video/2025/05/prove-di-emergenza-estiva-le-sercitazione-a-lido-degli-scacchi-98325046-0e3c-4940-aff9-da28aae67b92.html>
6. “Early warning systems can help prevent disasters” Published by *TV Keszthely*, March 27, 2025  
<https://tvkeszthely.hu/news/12318-elorejelzo-rendszerek-segithetnek-hogy-megelozz-uk-a-katasztofakat>

## 1.5.4 Real-World Labs and Stakeholder Engagement

Each RWL acted as a dissemination hub connecting scientific outputs to practitioners:

- **RWL 1 (Denmark):** Cross-municipal data-sharing and risk-mapping exercises.
- **RWL 2 (Emilia-Romagna):** Flood and wildfire drills involving > 190 participants; local media coverage.
- **RWL 3 (Vienna & Zala):** Demonstrations of the Data Fabric, SaferPlaces and Danube Model at Vienna and Szeged 2025 events.
- **RWL 4 (Rhine-Erft):** Table-top exercise disseminated through SEI's *Camaraderie in Chaos* feature.

## 1.5.5 Scientific Publications

(Verified from Tables 15–16 of D6.7)

**Published / Online First (Oct 2024 – Sep 2025)**

- *Influence of building representation in flood hydrodynamic modelling: the case of the 2021 Ahr Valley flood* – under review (HESS). **GFZ Potsdam.**  
*The Risk-Tandem Framework: An iterative framework for combining risk governance and knowledge co-production toward integrated DRM and CCA.* *Int. J. Disaster Risk Reduction*, Vol. 116 (2025). **SEI Oxford, RIFS-Potsdam, UCC.**
- *Monte Carlo-based sensitivity analysis of the RIM2D hydrodynamic model for the 2021 flood event in western Germany* – under review (NHESS). **GFZ Potsdam.**
- *Leveraging climate resilience capacities by (un)learning from transdisciplinary research projects.* *Climate Risk Management*, Vol. 47 (2025). **UCC.**
- *Strengthening all-of-society approaches for disaster-resilient societies: a European research agenda.* *Int. J. Disaster Risk Reduction*, 105345 (2025). **RIFS-Potsdam, UCC, TUBS.**
- *Capacity development for locally-led knowledge co-production processes in Real-World Labs for managing climate and disaster risk.* *Int. J. Disaster Risk Reduction* (2025). **UCC, SEI Oxford, GECOsystema, DTU, Genillard & Co, ZSRT, Region Hovedstaden, TUBS, Erftverband, ETH Zurich, RIFS-Potsdam, ARSTPC-ER.**

- *Just Systems or Justice in Systems? Exploring the ethical implications of systemic resilience in local climate adaptation. Int. J. Disaster Risk Science*, 16, 550–559 (2025). **RIFS, IIASA, Erftverband.**
- *Beyond single company climate risk disclosure: event-based physical risk reporting. IOP Conf. Series – Earth and Environmental Science* (2025). **ETH Zurich.**
- *Invited Perspectives: Fostering interoperability of data, models, communication and governance for disaster resilience through transdisciplinary knowledge co-production. Natural Hazards and Earth System Sciences* (2025). **Consortium multi-author paper led by Schröter et al.**

### Upcoming (2026)

- *Flood risks in the Danube river basin under climate change – Climatic Change*, PIK
- *Crop yields expected to decrease in most parts of Europe – projections of the ABSOLUT crop yield model for NUTS-2 regions*, PIK.

These outputs represent an exceptional increase in peer-review dissemination compared with previous periods and cover all thematic pillars - governance, modelling, ethics, communication, and risk assessment.

## 1.5.6 Policy and Practitioner Dissemination

Policy briefs are under preparation to be completed in 2026 include:

1. *Risk-Tandem Framework for Multi-Risk Governance* (SEI, IIASA, RIFS-Potsdam)
2. *Interoperability of Data and Models for Decision Support* (52°North, PIK, GFZ, ETH)
3. *Communications Lessons from the 2021 and 2023 Floods* (Oasis Hub, ARSTPC-ER)
4. *Immersive Technologies for Citizen Training* (Oasis Hub, ARSTPC-ER, GECOsistema)

## 1.5.7 Visual and Immersive Dissemination

The Emilia-Romagna Flood Safety VR Experience, co-developed by Oasis Hub Ltd (UK) and ARSTPC-ER (IT) with data integration from GECOsistema (SaferPlaces), reached full demonstration stage in 2025. It was exhibited at ECCA 2025 (Rimini) and REMTECH 2025 (Ferrara), engaging more than 120 participants from civil-protection agencies, research

organisations and the public. A short-film version and a planned Wildfire Safety VR App will extend immersive outreach to local citizens and visitors.

In parallel, the Emilia-Romagna RWL initiated a wildfire-risk communication programme that combined immersive design with physical public outreach. A wildfire information and visualisation noticeboard was installed in Comacchio in summer 2025, displaying DIRECTED's wildfire-hazard maps, emergency-contact details and preparedness guidance co-designed with local authorities, first responders and volunteers.

Together, these dissemination actions demonstrate DIRECTED's commitment to translating scientific modelling into accessible, place-based communication tools. The integrated use of immersive media and public installations represents a practical pathway for citizen engagement and supports the project's broader goal of fostering anticipatory, community-level disaster resilience. Next steps involve developing a VR citizens app for wildfire safety.

## 1.5.8 Exploitation Activities (October 2024 – September 2025)

*(Source: D6.7 Communications, Dissemination and Exploitation Report 2024–2025 Final, pp. 57–101)*

Work Package 6 (Oasis Hub Ltd, UK) co-ordinated exploitation monitoring across all Key Exploitable Results (KERs). Each partner reported Technology Readiness Level (TRL), target users, and next-step actions in the Exploitation Tracker (Table 18 of D6.7).

An External Exploitation Panel will be convened in early 2026 to validate maturity, IP status and post-project uptake plans.

This year the focus has looked at how the tools will be sustained beyond the project through three routes:

1. integration into existing commercial or public platforms,
2. institutional adoption by local or regional authorities, and
3. open-source or training-oriented release.

All KERs now have defined exploitation owners, target users, and next-step milestones.

A full report on the exploitation progress for each Key exploitable result can be found in D6.7 (submitted) but for the purpose of this report we have summarised key actions further. D6.7 includes details of the tools, target markets, type of exploitation e.g. commercial/ open source models, IP management and the exploitation pathway. However, here we focus only on the work conducted in 2024/2025 reporting period.

## Risk-Tandem Framework (KER 1)

**Lead:** RIFS (DE) Core partners: UCC (IR), SEI Oxford (UK), IIASA (AT) | **TRL 6 → 7**

The Risk-Tandem Framework matured from a conceptual governance model into a tested decision-support process, capable of adapting to a diverse set of local contexts. Throughout 2024 and 2025 it was applied in all the RWLs to facilitate co-production workshops between authorities, emergency services, and citizens, and identify, and where possible, improve and foster interoperability processes and the integration of DRM and CCA.

Training materials and “activity canvases” were incorporated into the DIRECTED e-learning pilot and the weADAPT platform. The peer-review publication in *IJDRR (2025)* formalised its methodology, ensuring academic recognition.

### Next steps:

Package the framework as a modular training course for civil-protection networks and integrate it with EU Climate-ADAPT resources for long-term visibility.

Package the Risk-Tandem Framework as a web interface and toolbox to be hosted on the RIFS website and continuously accessible beyond the DIRECTED project’s lifespan.

## Data Fabric (KER 2)

**Lead:** 52°North (DE) | Core partners: GFZ, PIK, DTU, GecoSistema, ETH, TUB | **TRL 6 → 7**

The Data Fabric advanced toward operational interoperability.

Live demonstrations in Dec 2024 and Mar 2025 proved automated data exchange between modelling tools and RWL dashboards.

The Vienna stakeholder event (Jul 2025) showcased combined outputs from RIM2D, SaferPlaces, and the Danube Model via unified APIs.

By the end of RP3, FAIR metadata templates and persistent identifiers were prepared for publication on the DIRECTED Zenodo community.

Next steps: develop a lightweight municipal service layer and secure integration within EU Open Data Portal workflows.

## SaferPlaces Platform (KER 3)

**Lead:** GECOsystema (IT) | **TRL 8 (stable service)**

SaferPlaces maintained commercial exploitation while acting as a testing ground for a public-sector innovation.

In April 2025 GECOsystema demonstrated the platform to more than 20 ARPAE and Civil Protection technicians in Emilia-Romagna, validating forecast-to-impact performance.

Outputs from these pilots now inform the region's adaptation planning.

**Next steps:** co-develop municipal licensing and open API connectivity through the Data Fabric to enable seamless integration with other EU services.

## RIM2D Hydrodynamic Model (KER 4)

**Lead:** GFZ Potsdam (DE) | TRL 6 → 7

GFZ finalised a Monte Carlo sensitivity analysis of the 2021 Ahr valley flood (submitted to *NHESS 2025*), establishing scientific credibility and reproducibility.

RIM2D outputs were integrated into Data Fabric, showing the feasibility of multi-source hazard modelling.

**Next steps:** publish the RIM2D code package with documentation for research and training use, expanding uptake across German federal and EU projects.

## Danube Model & ABSOLUT Crop Model (KER 5)

**Lead:** PIK (DE) | TRL 6 → 7

PIK operationalised basin-scale hazard and impact modelling.

Joint RWL demonstrations in Vienna and Zala (Jul 2025) validated hydrological and crop-yield simulations with local agencies.

Two related scientific papers were accepted for 2026 publication (Table 16).

**Next steps:** deliver Danube Model products through the Data Fabric interface and develop a policy-scenario viewer to support transboundary planning bodies.

## CLIMADA (KER 6)

**Lead:** ETH Zurich (CH) | TRL 7 → 8

ETH advanced CLIMADA from analytical prototype to applied risk-assessment tool within DIRECTED.

A user-community workshop (Jun 2025) and a General Assembly demo (Sep 2025) confirmed functional integration with the Data Fabric.

**Next steps:** publish open tutorials and link CLIMADA outputs to the multi-criteria adaptation analysis developed by DTU.

## Damage Cost and Adaptation Model (DCAM) (KER 7)

**Lead partner:** Technical University of Denmark (DTU) | TRL 8

DTU's DamageCost / OS2 SkadesØkonomi is an open-source QGIS tool widely used by Danish municipalities for economic climate-risk assessment. During DIRECTED, DTU upgraded the interface, standardised inputs for RWL1 workflows, and enabled integration with SaferPlaces, RIM2D, SCALGO Live and CLIMADA. The tool is maintained and disseminated through the OS/2 Public Digitalisation Community, with strong support from the Association of Danish Municipalities. National damage-cost assessments published in 2024 and 2025 have significantly increased visibility and uptake. Ongoing development includes new cost curves, coastal burden-sharing functions, and improved interoperability.

**Next steps:** publication of the model documentation (under review) and exploration of a free online version.

**Next steps:** publish the scientific documentation in Climate Services (under review, 2025) and evaluate possibilities for a free online version to further expand access for municipal and financial-sector users.

## Citizen VR Applications (KER 8)

**Lead:** Oasis Hub Ltd (UK), ARSTPC-ER (IT) | TRL 7 → 8

The Emilia Romagna Flood Safety VR Experience reached prototype maturity and was demonstrated at ECCA 2025 and REMTECH 2025, engaging over 120 participants.

Evaluation with Emilia-Romagna Civil Protection is informing a roll-out strategy for training and public education.

**Next steps:** Establish multi-hazard adaptation for a wildfire module, and pursue regional licensing for civil-protection use. Follow-up on a number of large organisational leads including Google and the Red Cross will proceed.

## Climate Connectivity Hub and Taxonomy (KER 9)

**Lead:** SEI Oxford (UK) | TRL 6 → 7

SEI launched Version 1 (June 2025) linking DIRECTED tools, data sources and policy documents.

The Hub was presented in a MAIA webinar (Apr 2025) and indexed within the weADAPT knowledge base.

**Next steps:** maintain live updates post-project and align taxonomy with sister projects (PARATUS, RESALLIENCE) to support interoperability across the EU resilience portfolio.

## Summary

By the end of Reporting Period 3, all eight KERs showed measurable exploitation progress.

Scientific tools (RIM2D, CLIMADA, Danube Model, ABSOLUT) reached reproducible validation; operational platforms (SaferPlaces, Data Fabric) demonstrated real-world use; governance and communication innovations (Risk-Tandem, Citizen VR, Connectivity Hub and Taxonomy) achieved policy and community engagement.

Preparations for the External Exploitation Panel (2026) are underway to formalise IP management, licensing, and post-project uptake pathways.

## 2 Follow-up of recommendations and comments from previous review

Table 15: Reviewer comments and project response on OVERALL ASSESSMENT

Reviewer comment	Project response
Non-submission of D8.1, D8.2 and D8.3	The project initially faced difficulties identifying and recruiting a qualified ethics advisor. This delayed the first ethics report and made a delay of the following ethics reports necessary to allow for sufficient time for the advisor to conduct the review. D8.1, D8.2, D8.3 have been submitted. The aforementioned rescheduling of ethics reports, including the upcoming D8.4 is now reflected on the EU portal.
Some delays of reports are not justified enough in the technical report	Justifications have been added in the revised version of the report.
Several deliverables exhibit significant deficiencies requiring further revision and extended elaboration before they could be accepted as mature pieces of work	D1.1 and D1.2 were revised and resubmitted in August 2024 within RP2 and accepted. D2.1 better captures project complexity with clearer situational assessments and stakeholder maps per RWL. D1.2 addresses feedback by reformulating the Monitoring, Evaluation, and Learning (MEL) approach.
The project missed strategic focus to ensure (i) quality deliverables, and (ii) synergy across its work packages	RWL work was integrated. Final-year roadmaps were refined at the Copenhagen GA, e.g. linking RWL actions to WP3 (Governance) and WP 4 (Co-production) and WP5 (data Fabric)and WP6 (communication) activities. The Miro Board became the central tool to document engagement and coordinate interdisciplinary work across WPs.

<p>The deliverables do not demonstrate the expected level of integration between conceptual descriptions and the activities initiated at the RWL level, as well as among tasks from different work packages</p>	<p>RWL activities now follow the Risk-Tandem Framework (WP 3) and co-production (WP 4). Examples: RWL 4 designed and tested a Webex-based flood “situation assessment” protocol after mapping communication flows; RWL 2 ran two full-scale exercises-a Rimini flood simulation and a Comacchio wildfire drill to validate procedures and tools; RWL 1 used technical interviews to structure the subsequent co-exploration workshop.</p>
<p>The project struggles to integrate its various components around the RWLs</p>	<p>RWLs act as integration hubs by developing RWL-specific user stories. These translate stakeholder needs into Data Fabric (WP 5) specs, making development user-driven and tied to real operational problems rather than built in isolation. Furthermore, from the Copenhagen G.A., task forces meeting have been put under RWLs host operational management to better coordinate various efforts of WPs around RWL own peculiar needs in the last year of the project</p>
<p>There is a notable absence of information in both the web system and the technical report regarding the nature of these risk materializations, the mitigation measures applied, or their expected impact on project performance and timeline. Therefore, it is imperative to enhance the RP1 progress report by incorporating a dedicated section detailing the activated risks, the corresponding mitigation measures, and the projected impact on the project's overall trajectory.</p>	<p>Foreseen and unforeseen risks have been reported on in the web system and a summary of risk mitigation measures have been added to the RP2 report.</p>
<p>The project implementation demonstrated a general tendency of ‘doing’ when all necessary ‘thinking’ and ‘preparation’ is yet to be finalized. It is of urgent criticality to revise the order of actions to ensure the knowledge creation happens before sharing the knowledge with those external to the project.</p>	<p>RP2 reversed prior ad-hoc work. RWL activities enforced a sequential co-production flow under Risk-Tandem: preparation, then action.e.g. RWL1 ran technical interviews (Apr–May 2024) to design the August co-exploration workshop. RWL 4 mapped communication paths in March 2024, then co-developed and tested a new operational protocol in May. Process first, implementation second.</p>
<p>It is important that report remains functional and analytical, hence, informs about actual progress made and the rationale, analysis of the gaps, risks and adjusted course of future actions. Importantly, the report should avoid repetition of conceptual descriptions from</p>	<p>WP7 clearly instructed all partners to only include content that has not been reported in deliverables and link to details where possible.</p>

<p>the project proposal or any project deliverable in the report or, even more so, avoid praising own activities.</p>	
<p>The work delivered barely justify two thirds of the resources claimed to be used and requires careful monitoring before the next project review.</p>	<p>WP7 has been closely monitoring resource use during RP2 and has stated planning for redistribution where necessary in RP3.</p>

Deliverable/ WP	Reviewer comment	Project response
<p>D1.1</p>	<p>A short description about identified gaps, difficulties and expectations should be added.</p> <p>The document falls short in providing situational assessment in each region covered by the RWL to set the baseline for the project to track the impact of co-creation on governance</p> <p>More details required for operationalization of the RWL, purpose of each RWL, who is the host in each region, who are the stakeholders engaged, what is the nature of engagement with those stakeholders (e.g. formalized or not, frequency of meetings, at which level, and such), the role of citizens in RWL, or anything the project might consider relevant in their context to clearly define the boundaries and functionalities of each RWL</p> <p>Conclusion section fails to demonstrate a clear understanding of how the work within the RWLs can contribute to innovative advancements. A thorough revision of the Conclusions section is necessary. It should focus on how the selected RWLs can support the project in achieving its co-creation objectives and should highlight commonalities found across the RWLs (see review for examples)</p> <p>A comprehensive list of engaged stakeholders for all four RWLs should be compiled, including their institution, role, current level of engagement with the project, and expected participation in project tasks.</p>	<p>The revised version of D1.1 was accepted for approval. The document now provides detailed situational assessments for each of the four RWLs, covering the study area, stakeholder landscape, specific CCA/DRM challenges, and stakeholder expectations.</p> <p>D1.1 details the operationalization of the RWLs with specific sections on the setup process, a summary table of key operational points, and meeting calendars for each lab.</p> <p>It also adds dedicated chapters to address identified gaps, difficulties, and expectations (Chapter 3) and the operationalization of the RWLs (Chapter 4), directly responding to reviewer feedback.</p> <p>Finally D 1.1 includes a comprehensive list of engaged stakeholders as an annex, detailing their institution, role, engagement level, and expected participation</p> <p>Revising the conclusions to provide a recap of key findings from the setup</p>

	<p>Milestone 3, apparently a report on outcomes of the RWL co-production process (not available for the reviewers), should aid in improving D1.1 in the specified areas.</p>	<p>phase and a clear timeline for the remaining WP1 tasks</p>
<p>D1.2</p>	<p>The document remains overly conceptual, primarily offering descriptions of abstract concepts, including generalistic descriptions as "defining capacity" and the "approach to learning".</p> <p>In Section 3.3 "Practice, modules, and timeline" there is a lack of detailed connection regarding how these concepts will be applied in the four RWLs within the project framework. Moreover, a clear timeline for the implementation of expected actions in the four RWLs appears to be absent.</p> <p>The impression gathered from reading D1.2 is that tasks across different WPs involved in achieving the capacity development objectives (WP1, WP3, and WP4) are currently disconnected. And there seems to be a lack of a detailed project plan to translate these concepts into tools for the project success.</p> <p>The document failed to clearly indicate how the capacity gaps were identified as well as to define the capacity development, its purpose, its process and milestones: Who is the audience for the TOT and why? How the pedagogical skills developed within TOT will be utilized? This implies, organization of training courses to be conducted by each certified trainer and hence, what is the process, the action plan and milestones? How many thematic modules will be prepared and with which focus? What is the training delivery modality? Focus on students is beyond the scope of the project.</p> <p>The general conceptual descriptions bear striking resemblance to those found in D3.1. It's imperative to rewrite D1.2 to eliminate redundancy with D3.1.</p>	<p>The revised version of D1.2 was accepted for approval. The document now addresses the comments by:</p> <p>Shifting from a conceptual to a practical approach based on the Tandem framework, detailing a phased implementation of knowledge co-production within the RWLs.</p> <p>Providing a clear timeline and module descriptions for the first phase of capacity development (Foundation year), with a proposed structure for subsequent phases.</p> <p>Explicitly identifying the audience for the Training of Trainers (ToT) as the RWL hosts and listing the specific beneficiaries from each partner organization.</p> <p>Outlining a structured process for identifying capacity gaps through iterative needs assessments, with examples of preliminary and structured questionnaires provided in the annexes. The needs assessment was modified to only assess skills required for knowledge co-production as required for WP4, based on Cumiskey, et al., (2025).</p> <p>Detailing a Monitoring, Evaluation, and Learning (MEL) plan to assess both the impact of the ToT and the outcomes of the co-production processes in the RWLs.</p> <p>Clarifying the connections to other WPs, with a dedicated section on the links to WP1 (RWLs) and WP3</p>

		(Risk-Tandem) to ensure an integrated approach.
WP2	<p>D2.2 should be rescheduled to M32, especially since D2.1, scheduled for M24, seems to be another conceptual report outlining interoperability principles and criteria, without providing essential insights into how the project utilizes RWLs to address stakeholders' interoperability needs.</p> <p>For the upcoming review meeting, careful consideration must be given to incorporating stakeholders' real needs into planned developments. This reflection should encompass:</p> <ul style="list-style-type: none"> <li>• Assessing whether proposed models, tools, and protocols align with RWL stakeholders' needs and preferences.</li> <li>• Determining the usability of proposed tools by RWL stakeholders.</li> <li>• Evaluating the potential for integration with stakeholders' existing systems.</li> <li>• Formulating metrics to gauge the success of project developments' adoption among RWL stakeholders.</li> </ul>	<p>2.1. Assessing Alignment of Models, Tools, and Protocols with RWL Stakeholders' Needs</p> <ul style="list-style-type: none"> <li>• Conducted structured stakeholder consultations in all RWLs (e.g., Emilia-Romagna, Denmark, Germany, Ireland).</li> <li>• Developed a needs assessment framework, mapping RWL-specific requirements against interoperability models.</li> <li>• Preliminary results indicate that:</li> <li>• Emergency response stakeholders prioritize real-time data sharing and integration with existing decision-support systems.</li> <li>• Municipal-level users require improved metadata standardization and historical flood risk data integration.</li> <li>• Scientific partners emphasize semantic interoperability for cross-disciplinary data analysis.</li> </ul> <p>Next Steps:</p> <ul style="list-style-type: none"> <li>• Expand structured interviews and focus groups to validate findings.</li> <li>• Adjust tool development to accommodate sector-specific needs.</li> </ul> <p>2.1. Determining the Usability of Proposed Tools by RWL Stakeholders</p> <ul style="list-style-type: none"> <li>• Conducted hands-on testing sessions with</li> </ul>

	<p>stakeholders to evaluate user-friendliness.</p> <ul style="list-style-type: none"> <li>• Preliminary feedback highlighted:</li> <li>• Positive reception of modular, API-based interoperability solutions.</li> <li>• Concerns regarding complexity of user interfaces for non-technical users.</li> </ul> <p><b>Next Steps:</b></p> <ul style="list-style-type: none"> <li>• Redesign user interfaces based on human-centered design principles.</li> <li>• Introduce training workshops and guidance materials.</li> </ul> <p><b>2.3. Evaluating Integration Potential with Stakeholders' Existing Systems</b></p> <ul style="list-style-type: none"> <li>• An inventory of existing stakeholder systems was compiled, including:</li> <li>• Civil protection agencies' geospatial platforms.</li> <li>• Early warning systems for flood risk.</li> <li>• Local and regional databases on disaster risk.</li> <li>• Interoperability gaps identified:</li> <li>• Lack of standardization in data exchange protocols.</li> <li>• Compatibility issues with legacy GIS software.</li> <li>• Need for automated data ingestion mechanisms.</li> </ul> <p><b>Next Steps:</b></p> <ul style="list-style-type: none"> <li>• Develop custom integration workflows tailored to each RWL.</li> <li>• Facilitate joint pilot tests with select stakeholders.</li> </ul> <p><b>2.4. Formulating Metrics for Evaluating Adoption of Project Developments</b></p> <p>We propose the following adoption metrics to measure impact:</p>
--	---

		<ul style="list-style-type: none"> <li>• <b>Usability Score:</b> Stakeholder satisfaction with tool accessibility and ease of use.</li> <li>• <b>Integration Success Rate:</b> Percentage of RWLs successfully integrating project solutions.</li> <li>• <b>Interoperability Compliance Rate:</b> Percentage of adopted models adhering to FAIR principles.</li> <li>• <b>Stakeholder Engagement Index:</b> Number of stakeholders actively involved in co-development and feedback loops.</li> </ul> <p>These metrics will be tracked through biannual RWL feedback reports and real-time data usage monitoring.</p>
<p>WP3/ D3.1</p>	<p>D3.1 fails in addressing the 4 objectives outlined for WP3, even in a preliminary stage, and omits any insights or valuable information gathered from the RWLs or the numerous stakeholder meetings organized by Task 3.1, as described in the Technical Report.</p> <p>The prevailing perception is that D3.1 resembles an academic presentation of general concepts that could have been compiled prior to the project's initiation, falling short of the expected level of maturity for an Innovation Action after 16 months of work (D3.1 was submitted in February 2024).</p> <p>The general conceptual descriptions bear striking resemblance to those found in D1.2, and particularly the majority of the Figures included are the same that those presented in D1.2 (previously submitted in November 2023). This presents an opportunity to overhaul the entire deliverable, moving away from a purely academic compilation of concepts towards grounding these concepts in the reality of RWLs. This involves introducing the initial analysis of the present local</p>	<p>The revised D3.1 presents an innovative integrated framework that provides the analytical lens for the work with the RWLs. This foundational groundwork which combines hitherto unconnected frameworks is not only an innovation of merit in and by itself, but also pivotal for engaging with the RWLs and the stakeholders. Major revisions have been made to account for the reviewers' concerns:</p> <ul style="list-style-type: none"> <li>• inclusion of a section on methodology in the revised deliverable which situates the deliverable within the WP3 workplan and associated objectives and explains the role of the framework as the guiding analytical tool for understanding, analysing and innovating governance in and with the RWLs in a knowledge</li> </ul>

<p>risk governance within RWLs and outlining how the newly proposed concepts can be practically implemented. It should also include the development of shared guidance, collaboratively crafted with stakeholders, to support subsequent project phases. The aim is to ensure readiness to enhance the risk-tandem framework and to "improve risk governance in the RWLs and beyond through knowledge integration and co-production".</p> <p>The revised D3.1 should also incorporate a thorough discussion on:</p> <ul style="list-style-type: none"> <li>• The practical implementation of academic concepts within the RWLs: which questions and/or indicators the framework intends to use to create baseline, shape monitoring system for the project impact, inform capacity development efforts, shape knowledge transfer strategy of the project. If the team might consider this sufficiently adequate, it might want to bring additional nuance in the Risk-Tandem Framework by considering distinct processes of risk assessment and risk response. Also, more explanation would be expected regarding 'concern assessment' and which considerations should be made for 'risk governance' framework to adequately factor concern assessment in risk assessment (e.g. typology of risk stakeholders, some techniques of scoping stakeholders, whose concern?)</li> <li>• Inclusion of evidence regarding silos, barriers, and governance challenges identified during meetings with RWLs, serving as focal points for upcoming work.</li> <li>• Establishment of the current governance baseline within RWLs to evaluate improvements introduced by project implementations</li> </ul> <p>→ rewrite D3.1</p> <p>D3.2 should be advanced to M32.</p>	<p>co-production process (see page 12-13 of the revised deliverable)</p> <ul style="list-style-type: none"> <li>• reworking sections 2.1.4. and 2.1.6</li> <li>• restructuring and substantially adding to chapter 3 and its accompanying subsections</li> <li>• revision of section 3.3. to include the relevant indicators, based on the conceptual framing laid out in that section.</li> <li>• inclusion of ethical considerations, highlighting the need to include measurements and reflections on social justice and equity, in the decision-making process (e.g., also taking into account issues of procedural justice). Importantly, potentially frictions between external justice claims and local priorities have been explored through a social justice indicator. A disclaimer has also been added, to clarify this challenge.</li> <li>• omission of redundancies and repetitions with D1.1 and D1.2</li> <li>• annexing a number of documents representing the outcomes of workshops, serious games, and governance analysis done throughout the current lifecycle of the project. In particular, this includes the scoping consultations done with the RWLs, the Risk-Tandem Framework materials that have been provided to the RWLs, as well as the stakeholder action grid, which serves as a foundational tool for the institutional analysis</li> </ul>
---	---

		<p>of the various RWLs (see Annexes 1-3).</p> <p>D3.2 (submitted in September 2025) features the application of the Risk-Tandem Framework in the RWLs through its four phases - Foundation, Growth, Learn and Sustain.</p> <p>The various phases all also included procedural forms of iteration and reflection, accounting for the Monitoring, Evaluation, and Learning strategy, which is built into the Risk-Tandem Framework. The MEL strategy (cutting across WP 1, 3, and 4) is further accounted for through the Risk-Tandem indicators, which have been developed in close collaboration with the RWL hosts and are reflected in the RWL baseline assessments.</p> <p>The indicators provide guardrails for understanding the local context, evaluate existing DRM and CCA strategies, and further develop solutions. Operationalizing these indicators was central to the refined framework, which is tuned to account for the various governance processes in the RWLs and stakeholder needs for enabling interoperability to facilitate DRM and CCA integration.</p>
<p>WP4</p>	<p>D4.1 should be advanced to M32</p> <p>The mid-term report does not provide sufficient evidence and details of what has been done during months 1-16 under the WP4.</p> <p>The reports utilized as means of verification to attain Milestones 16 to 18 should be accessible to reviewers during RP2 and RP3.</p>	<p>As WP4 lead, SEI, is also heavily embedded in WP1, allowing a high degree of interaction and deep engagement with the RWLs.</p> <p>The needs and preferences of the RWL Stakeholders has therefore been core to the ToT workshops and the DIRECTED knowledge co-production cycle.</p>

<p>From the information collected during the review meeting, it's challenging to comprehend why WP4, which serves as the core WP aimed at "developing and applying transdisciplinary knowledge co-production and learning processes in the RWLs to provide insights for developing transformative tools (WP2), governance mechanisms (WP3), a data fabric (WP5), and improved risk management strategies, utilizing a bottom-up, value-driven co-development approach," does not engage the practitioners from the Consortium (REGIONH, ARSTPC-ER and ARPAE have 0 PMS, ZRST has 2 PMs and EV 6 PMs).</p> <p>Therefore, in preparation for the upcoming review meeting, it's recommended to carefully incorporate stakeholders' actual needs into planned developments. This consideration should involve:</p> <ul style="list-style-type: none"> <li>• Explain the methodology to produce empirical evidence on knowledge co-production cycle</li> <li>• Identifying the needs and preferences of RWL stakeholders to inform the design of Capacity Development Modules for Training of Trainers (D4.1).</li> <li>• Engaging RWL stakeholders in defining assumptions and selecting the most suitable models for enhanced interoperability and iterative development, taking into account user needs (D4.2).</li> <li>• Collaborating with RWL stakeholders to determine what constitutes an improvement in the "Tandem Cycle for Transdisciplinary Knowledge Co-production" (D4.3), based on evidence gathered from RWLs.</li> <li>• Developing metrics to measure the success of project developments' adoption among RWL stakeholders.</li> </ul> <p>On the final note, there is a need to develop an adequate M&amp;E system for the WP4 as soon as possible.</p>	<p>The purpose of the capacity development modules (D4.1) is to translate the tailored, project-specific training co-designed with RWL hosts into a format that can be applied more widely, beyond the DIRECTED project resulting in <a href="http://www.weadapt.org/tandem">www.weadapt.org/tandem</a>. Empirical evidence on the co-production cycle and RWL needs underpins the design of capacity development modules (D4.1) and thus also meets M17.</p> <p>The methodology to inform the design of the capacity development modules (D4.1) includes:</p> <p>Hands-on activities and resources co-created with the RWLs; qualitative coding analysis of insights from the ToT workshop preparation and training sessions (including guidance documents, presentations, literature), alongside DIRECTED documents and reports.</p> <p>The methodology for informing the content of the ToT workshops includes: Regular scoping consultations (see list in M13); analysis of regular capacity needs assessments with the RWLs; and, qualitative coding of DIRECTED documents and reports. Following each ToT session, WP4 and RWLs evaluated outcomes and co-designed their next workshops and co-production cycle phases.</p> <p>D4.2 is framed around assessing, understanding, and analysing stakeholder decision needs vis-à-vis</p>
--	---

		<p>available models and information, based on knowledge emerging from the co-production process conducted with stakeholders.</p> <p>Improvement to the "Tandem Cycle for Transdisciplinary Knowledge Co-production" (D4.3, due M48), is based on evidence gathered from RWLs. This is being achieved through scoping consultations, regular capacity needs assessments and the development and application of a coding framework that is being applied to key DIRECTED documents (see D4.1). The results so far have highlighted a repeating theme - the demand for methods, exercises, and approaches to facilitate the exploration of the Tandem guidance questions.</p> <p>Therefore, D4.1 includes an overview module that builds a foundation of research, design and facilitation skills, followed by modules for each phase of Tandem to guide practitioners in co-designing and facilitating the Tandem co-production process.</p> <p>Development of a detailed MEL approach is currently underway across WPs 4, 3 and 1, and is being designed to align with and feed into the wider project MEL framework (D6.7).</p>
<p>WP5</p>	<p>The practitioners of the Consortium are not engaged in WP5 (with only one PM from ZRST, which is difficult to understand), posing a risk for the project since the involvement of practitioners and stakeholders is crucial for defining use cases (specifications for developers) to "design, develop, and provide the infrastructure to demonstrate the impact of improved interoperability in the context of DRR and CCA". This engaged co-production involvement is key for the project's success.</p>	<p>Different from the proposed work package allocation, the RWLs and their practitioners have in RP2 been deeply engaged in WP5 through so called task forces. These have been established per RWL to steer the sprint based agile and user centric development of the Data Fabric. These task forces have also developed the interoperability use cases.</p>

	<p>However, despite the technical report details numerous meetings with stakeholders, which should play a pivotal role in WP5, the presentation during the review meeting was overly theoretical and did not convincingly demonstrate their involvement in the design phase of the DIRECTED data-fabric procedures.</p> <p>The prevailing perception is that, thus far, the work has not sufficiently engaged RWL stakeholders to ensure that definitions and specifications are mature enough to provide a clear definition of at least the key use cases for any of the four RWLs.</p> <p>For an innovation action, the lack of clarity on this point at M16 poses a significant risk, raising doubts about the project's ability to deliver meaningful exploitable results at the announced TRLs.</p> <p>Therefore, in preparation for the upcoming review meeting, careful consideration must be given to incorporating stakeholders' actual needs into planned developments. This reflection should include defining adapted use cases based on the needs collected in the RWLs.</p>	<p>The role of the “product owner” was assigned to the RWL representative in order to ensure that the design and development of the Data Fabric focussed on the needs of the specific RWL. Features developed in each implementation sprint have been deployed for review immediately. This allowed the RWLs to continuously validate them. The Data Fabric has been publicly deployed since its early stages supporting different workshops of the RWLs with their practitioners. It has been refined based on direct user feedback.</p> <p>With the release of the Data Fabric in version 1 at the end of RP2 (D5.5), all interoperability use-cases have been addressed and milestone 24 <i>RWL Use Cases configured</i> met.</p>
<p>WP6</p>	<p>The project proposal lacks a proper exploitation and impact plan within WP6, aligning with the overall project design, which resembles more of a traditional RTD project than a HE Innovation Action. Therefore, it is crucial for WP6 to make a concerted effort to address this initial weakness and develop a comprehensive exploitation and business plan.</p> <p>There is a need to finetune D6.1 with the requirements raised towards other deliverables of the project, specifically, regarding TOT, shifted focus from students and schoolchildren to policy-makers/practitioners/researchers. Regarding eLearning portal - focus on students is beyond the scope of the project. The deliverable is focused on M&amp;E and communication &amp; dissemination. There is a need to clearly define the project evaluation - the current description confused evaluation with monitoring. No monitoring system is proposed.</p>	<p>Innovation work had begun from the beginning of the Project - but it is clear that this had not been portrayed appropriately in the Yr 1 Technical Report. An exploitation plan was submitted in D6.3 as requested by the reviewers.</p> <p>Within newly submitted D6.7 We have developed a new M&amp;E and Impact logframe linked to those aspects accepted in our original application which we hope now enables the reviewers to understand how we are doing on our objectives, outputs and impacts and also showing our theory of change. As the reviewers rightly suggested, this has helped us understand how</p>

<p>The deliverable 6.1 should be updated to be better aligned with the updates required in other WPs and Deliverables and sharper focus of the project. Deliverable 6.2 could be acceptable.</p> <p>The deliverable 6.3 should incorporate the strategy for exploitation and business plan which is compulsory in any Innovation Action. The material showed during the WP6 presentation including initial thoughts on the key elements necessary to formulate an exploitation plan for DIRECTED should serve as the foundation for the upcoming efforts in the project. Moreover, it should be included as a comprehensive section in the revised version of D6.3, enriching the current content. Indeed, D6.3 should include the concept of the missing Exploitation Plan in its title and subtitle.</p> <p>Both the WP6 partners and the Coordinator must understand the importance of devoting significant attention to designing, acknowledging, and adopting the required mentality to transform DIRECTED into a genuine Innovation Action. This cannot be postponed until the final stages of the project but should evolve continuously throughout the project's duration.</p> <p>Therefore, in addition to revising D6.3 to incorporate the new section on the exploitation plan presented during the review meeting (which can serve as the first draft of the Business Development Plan envisioned in D6.5), it is recommended to expedite the delivery of D6.5 deliverable from M48 to M32 (even as a preliminary version of the final Business Plan).</p>	<p>we are doing and where we need to improve.</p> <p>The theory behind D6.1 was updated to show the beneficiaries involved in each action - D6.1 C&amp;E Strategy take a two-pronged approach - the main report covers Project wide objectives ensuring our strategy is rounded and delivering to our target audiences - however it should also be noted that each partner has provided tailored communications from an individual organisation perspective, tailored linked to their specific objectives.</p> <p>An exploitation strategy was submitted in D6.3. Furthermore, we have now submitted a full exploitation planning update for all Key Exploitable Results (KER's) in D6.7 - adjusting it to become a report on DC&amp;E Report to enable the reviewers to track our progression in Exploitation.</p> <p>As noted D6.5 Business Development Plan is due for completion near the end of the Project. However, it was not our intention to suggest that exploitation work was not being actioned during the entirety of the Project. However, it was clearly an omission in our reporting.</p> <p>In the Year 3 reporting period to enable the reviewers to follow our work (as mentioned above) we have provided a detailed update in D6.7).</p>
--	---

	<p>This effort will enable the Consortium to engage in discussions about what is needed to prepare for converting the project outcomes into tangible exploitable results.</p> <p>Finally, a stronger sense of pragmatism is expected when the project attempts to make any contribution to policy-related recommendations (such as policy brief developed under CMINE) while being at the early stage of its implementation and therefore, having no findings yet that could be framed as ‘research-based and innovative’, something that is expected from the project at the later stages.</p>	<p>We trust that you can now see significant work in the exploitation pathways for each KER and this will continue to the end of the project, where each tool/ organisation will have developed an ongoing business development plan to exploit the results well after the project.</p> <p>As noted in D6.7 - the DIRECTED partners will be producing a range of policy briefs and associated meeting in Year 4 of the Project.</p>
<p>WP7</p>	<p>The Coordinator should enhance its project management.</p> <p>The systematic delays in submitting deliverables are not an effective approach to project management, and the suboptimal quality of some deliverables (that seem not to have been properly revised) suggests a need for a change in procedures. Furthermore, having three pending deliverables, even if they were additional ones added during the negotiation phase, is an unacceptable situation.</p> <p>Therefore, it is crucial that these formal aspects receive priority attention in RP2. In the event of new challenging situations, the Coordinator should promptly report to the PO and update the expected submission dates for the deliverables through the SyGMa web system. Similarly, in the case of materialization of anticipated (or unforeseen) critical risks for the project, there should be a clear description of the mitigation measures implemented to minimize their expected impact on project performance and timeline.</p>	<p>WP 7 has made changes to coordination practices such as the Jour Fixe meetings, internal review, report templates and meetings with the PO. Many deliverables were made available before schedule in RP2. Due to extensive revisions and resulting delays in some of the WPs it was not possible to deliver all reports on time. Justifications were given in the portal and clearly communicated with the PO in advance.</p>

Table 16: Reviewer comments and project response on OBJECTIVES AND WORK PLAN

Reviewer comment	Project response
<p>The progress is partially reported in line with objectives and work plan as specifies in the DoA:</p> <p>Much of the expected progress is not yet fully achieved or dully documented. During RP1, several issues have arisen, indicating that the Coordinator should enhance its project management. The systematic delays in submitting deliverables are not an effective approach to project management, and the suboptimal quality of some deliverables (that seem not to have been properly revised) suggests a need for a change in procedures. Furthermore, having three pending deliverables, even if they were additional ones added during the negotiation phase, is an unacceptable situation. Therefore, it is crucial that these formal aspects receive priority attention in RP2. In the event of new challenging situations, the Coordinator should promptly report to the PO and update the expected submission dates for the deliverables through the SyGMa web system. Similarly, in the case of materialization of anticipated (or unforeseen) critical risks for the project, there should be a clear description of the mitigation measures implemented to minimize their expected impact on project performance and timeline.</p>	<p>D1.1 and D1.2 were revised, resubmitted in Aug 2024, and accepted, D1.3 has been submitted inside RP2. RWLs have shifted to practical implementation with clear final-year roadmaps, indicating the work plan is back on track.</p> <p>WP7 has added clear descriptions of risk mitigation measures for all foreseen and unforeseen risk in the portal.</p>
<p>Critical risks:</p> <p>The Coordinator has triggered the activation of several critical risks (1, 2, 5, 7, 8, and U1). However, there is a notable absence of information in both the web system and the technical report regarding the nature of these risk materializations, the mitigation measures applied, or their expected impact on project performance and timeline. This lack of transparency complicates the assessment of the severity of these risk occurrences and the project's ability to effectively mitigate their effects. Therefore, it is imperative to enhance the RP1 progress report by incorporating a dedicated section detailing the activated risks, the corresponding mitigation</p>	<p>Risk mitigation measures have been integrated into the revised periodic report for RP1. For RP2 updates on all risks and mitigation measures have been given in the SyGMa web system.</p>

<p>measures, and the projected impact on the project's overall trajectory.</p>	
<p>Gender dimension appropriately taken into account: There is not a specific section in the technical report providing elements to assess this point. The references to gender mainstreaming is sub-optimal in the produced deliverables.</p>	<p>Addressed via the updated Tandem Framework. The revised D1.2 (“Capacity Development Strategy”) states the framework now explicitly incorporates gender, social equity, and power considerations, ensuring diverse needs are integrated across RWL risk governance processes.</p>
<p>Adequate integration of social sciences and humanities (for SSH topics): There is not a specific section in the technical report providing elements to assess this point, however, the nature of the project is such that it is based or strongly rooted in SSH topics.</p>	<p>The project works across topics in the RWLs. Partners with expertise in natural science and those focused on SSH subjects collaborate in the development of the Data Fabric and Risk-Tandem Framework. Although a specific section for SSH topics is not included in the technical report, progress in WP3 and WP4 as well as many of the advancements in WP1 are strongly rooted in SSH topics.</p>
<p>Ethics/ security deliverables adequately addressed and approved due for the current period: The project has encountered challenges resulting in the non-submission of the three deliverables related to Ethics (D8.1, D8.2, and D8.3)</p>	<p>The initial challenges in integrating WP8 into the overall project work plan have been mostly overcome. D8.1, D8.3, D8.4 have been submitted. Ethics dimensions and recommendations have been integrated into work practice and reports. All project partners have committed 0.5 PMs to WP8 through an amendment in RP2.</p>
<p>Did the fellows/staff members demonstrate sufficient knowledge of the research project: There was a misalignment among WPs in their activities, suggesting insufficient sense of shared direction and knowledge of the research project.</p>	<p>The knowledge exchange between project partners has been continuously improved Through deep dive presentations in Jour Fixe meetings, in workshops and task force meetings.</p>
<p>Did any issues requiring REA follow-up arise during the meeting: There is a need for close follow up on all deliverables of the project to ensure they at the quality requirements. - <b>D8.1, D8.2, and D8.3</b> are still pending - Deliverables <b>D1.1, D1.2, D3.1 and D6.3</b> should be revised including the recommendations provided and resubmitted. <b>D1.1</b> should be rewritten: - Section on identified gaps, difficulties and expectations to be added</p>	<p>D8.1, D8.2, D8.3 have all been submitted.</p>

- Full details on the operationalization of the RWL to be provided
- Conclusion tightened with clear links on how the RWLs can support the project in achieving its co-creation objectives
- A comprehensive list of stakeholders and their mandates to be provided

**D1.2** should be rewritten:

- Strengthening methodology for gap and opportunity assessment
- Clearly indicating findings from the gap and opportunity assessment
- Providing details on the operationalization of capacity development both at individual and institutional levels
- Explicitly linking capacity development with other WPs
- Avoiding overly simplistic focus of capacity development to students and schools, instead, ensuring the CD focus on bridging the gap between policy-makers, researchers, and practitioners
- Ensure full engagement of practitioners in gap and opportunity assessment and in CD processes

**D3.1** should be rewritten:

- Ensure the concept respond to the 4 objectives outlines in WP3
- Provide full details how the concept to be operationalized in the context of RWLs
- Ensure the deliverable provides evidence regarding silos, barriers, and governance challenges identified during meetings with RWLs
- Provide governance baseline within RWLs to evaluate improvements introduced by project implementations.

It should be rewritten to eliminate redundancy with D1.2.

Deliverable **6.1** requires update to be aligned with other WPs and the updates required in the project deliverables.

Deliverable **6.2** is acceptable as it presents factual information on project activities.

Deliverable **6.3** should be fully repurposed and rewritten:

WP 1 status: no new issues. D1.1 and D1.2 were revised and accepted, confirming improved quality. RP2 outputs progressed: D1.3 submitted and M4 met via D4.2 anticipation (Periodic report #2 on RWL co-production outcomes).

D6.1 has been updated in line with changes to the revised deliverables from RP1 where required. The plan now presents more clearly all contributions by and links to WP actions.

D6.3 has been rewritten to include a more comprehensive literature study and more targeted analysis of RWL information. The improved methodology supports the understanding of existing training resources, knowledge gaps and resulting training needs. The knowledge transfer strategy now has a stronger focus on

<ul style="list-style-type: none"> <li>- Strengthening methodology for gap and opportunity assessment for knowledge transfer</li> <li>- Clearly indicating findings from the gap and opportunity assessment for knowledge transfer purposes</li> <li>- Ensure clear focus to bridge the gap between policy-makers, academia, and practitioners and avoid overly simplistic focus on students and schools</li> <li>- Include the concept of the missing Exploitation Plan in its title and subtitle, and include a new section presenting the initial thoughts on the key elements necessary to formulate an exploitation plan for DIRECTED presented by WP6 during the review meeting.</li> </ul> <p><b>Deliverable 7.4:</b></p> <p>It is requested to enhance the RP1 progress report (D7.4) by incorporating a dedicated section detailing the activated risks, the corresponding mitigation measures, and the projected impact on the project's overall trajectory.</p> <p>Coming Deliverables:</p> <ul style="list-style-type: none"> <li>-It is requested to advance the submission of deliverables <b>D2.2, D3.2</b> and <b>D4.1</b> originally scheduled for M36 to M32, ensuring their availability within the second reporting period (RP2).</li> <li>-It is recommended to advance the submission of deliverable <b>D6.5</b> originally scheduled for M48 to M32, ensuring its availability within the second reporting period (RP2).</li> </ul> <p><b>Deliverable 4.1, 4.2 and 5.1 to 5.4:</b></p> <ul style="list-style-type: none"> <li>- Ensure full engagement of practitioners in shaping the deliverables</li> </ul>	<p>policy-makers, researchers, and practitioners. We have added a new chapter on the exploitation strategy, linking the DIRECTED exploitation strategy to knowledge transfer.</p> <p>The midterm report D7.4 has been revised with a focus on work carried out in months 1 – 16. The context providing references to work planned in the upcoming months have been reduced. Especially, work not documented in a deliverable or milestone report has been given more room in the D7.5 report.</p>
<p>The project has not addressed standardisation aspects</p>	<p>D2.1 Compendium on Data Standards for interoperability in DRR and CCA addressed these aspects.</p>

Table 17: Reviewer comments and project response on IMPACT.

Reviewer comment	Project response
<p>Is the proposed pathway to achieve the expected outcomes and impacts still credible:</p> <p>At the current stage of its implementation, the project needs to be refocused to be back on track to achieve the impact committed.</p> <p>The project proposal lacks a proper exploitation and impact plan within WP6, aligning with the overall project design, which resembles more of a traditional RTD project than a HE Innovation Action. Therefore, it is crucial for WP6 to make a concerted effort to address this initial weakness and develop a comprehensive exploitation and business plan.</p>	<p>RP2 impact pathway strengthened. RWLs moved from concept to field implementation. Revised D1.1 provides region-by-region situational assessments to track governance effects of co-creation. Milestone M4 documents tangible results: new operational procedures, field exercises, and co-designed Data Fabric user stories. This evidences a credible route to impact within RWLs.</p> <p>As mentioned above an exploitation plan and new M&amp;E and Impact Logframe have been submitted in D6.7.</p>
<p>How will the project have an impact on policy making (if any):</p> <p>There is an impact expected at the policy level, however, the project could be back on track to deliver its impact commitments only after serious revisions (responding to the question on if the project is on track to achieve an impact on policy level (if any)). At this stage there is no evidence to conclude that the project could have an impact on policy making.</p>	<p>WP 1 is delivering policy-relevant change, examples: RWL 4 the co-developed Webex “situation assessment” protocol has been tested, operationalised, and could lead to future district adoption. RWL 2-partners plan to use outputs to update Municipal Civil Protection Plans; large-scale exercises are refining operational policies. D1.3_ adds actionable policy lessons from the Rhine-Erft and Emilia-Romagna flood forensics. RWL 1-work aligns with, and can inform, new Floods Directive risk-management plans for Roskilde Fjord.</p> <p>Plans are also in-place as a part of WP6 on a range of policy briefs at both EU and local level (see D6.7) - some of these will also include combined inputs from other EU Projects working in the same topic areas gauged through cooperation with CMINE</p>
<p>The project has such a comprehensive focus that if sufficiently defined and adequately piloted it has the potential to inform any knowledge co-production and risk governance across all thematic areas and sectors. However, at this stage there is no evidence that the project can contribute to these priorities</p>	<p>The reports delivered in D3.1, D3.2, 4.1 and the draft of D4.2 all showcase the knowledge co-production and risk governance thematic as it was developed with and for the RWLs. The many workshops, exercises and meetings conducted with the RWLs are proving of the application.</p>

Table 18: Reviewer comments and project response on IMPLEMENTATION.

Reviewer comment	Projects response
<p>Has the project been efficiently and effectively managed (including risk management):</p> <p>Strong coordination and management is required for this project. Critical to ensure (i) synergy between the WPs regarding interdependencies to ensure timely input for each deliverables, (ii) clear M&amp;E system to ensure oversight and quality control, and (iii) strong project risk management with timely indication of risks and mitigation measures.</p> <p>During RP1, several issues have arisen, indicating that the Coordinator should enhance its project management. The systematic delays in submitting deliverables are not an effective approach to project management, and the suboptimal quality of some deliverables (that seem not to have been properly revised) suggests a need for a change in procedures.</p> <p>Furthermore, having three pending deliverables, even if they were additional ones added during the negotiation phase, is an unacceptable situation.</p> <p>Therefore, it is crucial that these formal aspects receive priority attention in RP2. In the event of new challenging situations, the Coordinator should promptly report to the PO and update the expected submission dates for the deliverables through the SyGMA web system. Similarly, in the case of materialization of anticipated (or unforeseen) critical risks for the project, there should be a clear description of the mitigation measures implemented to minimize their expected impact on project performance and timeline.</p>	<p>WP7 has with the support of all project partners increased coordination in the project by implementing a range of changes to the Jour Fixe meetings, internal review process, report templates, risk and ethics logs.</p> <p>A project wide MEL system with a Log frame approach was established and all risk mitigation measures were correctly entered in the SyGMA system.</p> <p>Regular meetings with the PO have also contributed to improved communication to the EC.</p>
<p>Have all participants contributed to the project according to the work-plan described in the DoA: D1.1, D1.2, D3.1, D6.3 are very weak and the work documented through these Ds doesn't justify the effort in PMs claimed by the Consortium.</p>	<p>WP 1 shifted to productive implementation in RP2, justifying resources. Examples : D1.3 (forensic case study, Rhine-Erft vs Emilia-Romagna) and M4 (Periodic report #2 on RWL co-production)and its sibling M5 included in D 4.2. RWL 2 ran two large field exercises: Rimini flood (~50 participants, Jun 2024) and Comacchio wildfire (~90, May 2025). RWL 4 co-designed, tested, and operationalised a</p>

	<p>Webex-based flood “situation assessment” protocol, now moving to formal adoption, and conducted a Table Top Exercise (Jan 2025) on coordination and communications.</p>
<p>Are the critical implementation risks and mitigation actions described in the DoA still relevant:</p> <p>There are critical implementation risks but not all of them are adequately discussed within the project. They are raised at the review by the reviewers.</p> <p>The critical implementation risks and mitigation actions described in the DoA remain, however, still relevant</p>	<p>A risk log tracking risk probability, severity of impact and mitigation actions was developed during RP1 and updated on a regular basis.</p>

Table 19: Reviewer comments and project response on RESOURCES.

Reviewer comment	Projects response
<p>Were the resources used as described in the DoA and were they necessary to achieve the project objectives:</p> <p>Some part of the project implementation does not fully match its objectives, hence, the expenses made cannot be justified.</p> <p>The used resources reported seems more from an ad-hoc plan of use of resources that related to the real work done. This is particularly noticeable in WP5 that is not related to the showed advancements.</p>	<p>RP1 was dominated by laying the foundations of WP5 (i.e. Task 5.1 Stocktaking of the Current Data Context). Hence, work has been conducted to learn about possible data sources, the capabilities of the models in the project and exploration of their interoperable integration. As these activities lie in the intersection of WP2 and WP5, the hours have been split over both WPs.</p> <p>Joining RWL discussions (partially on cost of WP5) did not result in visible software components, but were essential to better understand the user needs to design a powerful software solution (i.e. Task 5.2 Define the project interoperability Use Cases). Delay in RWL set-up also influenced the work of WP5 leading to a wider exploration of options. With RP2, the task forces have been introduced to very tightly couple the developments to the RWL needs. However, this also incurred costs to host and moderate the task forces, preparing visuals and discussing alternatives, that did not directly lead to visible implementations.</p>

If there are significant deviations from planned budget, have they been satisfactorily justified:

The situation is not about the deviation from the budget but about the justified expenses made vis-a-vis the objectives of the project

Addressing Tasks 5.1 and 5.2 (both running beyond the RP1) has been foundational work to address the objectives of WP5 to provide the infrastructure demonstrating the impact of DRR & CCA interoperability for the RWL Use Cases.

## 3 Exploitation primarily in non-associated third countries

Some exploitation activities are undertaken by partners based in non-associated third countries - Oasis Hub Ltd (UK), SEI Oxford (UK), and ETH Zurich (Switzerland) - these organisations maintain strong institutional links with EU partners and play a vital role in extending the reach, visibility, and sustainability of DIRECTED results beyond the Union.

Oasis Hub Ltd (UK), leads communication, dissemination, and exploitation activities across the project. It is responsible for transforming complex scientific outputs into accessible and sometimes immersive experiences through virtual reality tools that support training, behavioural change, and public engagement. The UK remains one of Europe's most advanced immersive technology and creative innovation ecosystems, with global reach through its strong connections to international media, insurance, and technology sectors. Exploitation through Oasis ensures that EU-funded innovations are positioned at the forefront of a rapidly expanding global market while reinforcing Europe's leadership in science-based storytelling, risk awareness, and resilience communication.

SEI Oxford (UK) drives the exploitation of the Risk-Tandem Framework, a key governance and behavioural model developed within DIRECTED, and fundamentally underpinned by SEI's Tandem framework for co-designing climate services and bridging scientific forecasting with real-world decision-making. As part of the wider Stockholm Environment Institute network, SEI Oxford plays a pivotal role in connecting EU research with international policy processes, from UN climate adaptation dialogues to multilateral resilience initiatives. Its global credibility, policy partnerships, and experience in knowledge translation ensure that EU-funded methodologies inform climate action well beyond Europe's borders. Exploitation through SEI directly supports the EU's strategic interest in shaping global adaptation policy, advancing evidence-based governance, and demonstrating the practical impact of European research on international resilience agendas.

ETH Zurich (Switzerland) leads exploitation of CLIMADA, a globally recognised open-source modelling platform for climate-impact assessment and adaptation option appraisal. Its continued development and integration with European data standards ensure interoperability, scientific excellence, and the long-term use of EU research outputs within global modelling frameworks.

Together, these partners strengthen the EU's strategic position in disaster risk management and climate resilience. Exploitation through them serves the EU's interest, by ensuring that European research remains visible, interoperable, and influential on a global scale - expanding the impact of EU-funded innovation while maintaining trusted scientific, creative, and policy partnerships in neighbouring countries that share Europe's values and research standards.

## 4 Open Science

Project reports (non-sensitive) were made accessible via a DIRECTED community page on Zenodo (<https://zenodo.org/communities/directed/>). All scientific publications generated by the project will be cross-linked to this repository, where embargos allow this practice. In general, all publications have been submitted to Open Access Journals such as Copernicus publications. Others have been submitted under Open Access conditions in high impact journals.

The models used for the RWLs in WP2 are all open source models except the commercial software product SaferPlaces, and the Danube model of PIK due to a legacy of copyright/ownership problems. The Climate Connectivity Taxonomy (<http://connectivity-hub.com/>) is available in FAIR format and through an API (v1, released June 2025) for reuse in other websites, tools and platforms. The open source models are stored and documented in repositories, which are either completely public or accessible upon request. This ensures continued use of the model in research and easier uptake by the developer community. Developed application models for the RWLs will be made accessible in open data repositories, along with the information on the software/models used, including the software versions used. This will ensure reproducibility of the results.

The Data Fabric is developed as an open source solution in a publicly accessible GitHub repository (<https://github.com/directedproject-eu>). This allows findings and implementations to be assessed and re-used by a wider open science community right from the beginning. Like the source code, also the deployed Data Fabric is publicly accessible (<https://directed.dev.52north.org/>) and is openly shared within the project but also among the wider research community. It has been presented at different physical and virtual events targeting researchers as well as practitioners. The open source developments and integration of open data jointly fosters open science, as the entire information derivation chain becomes auditable and reproducible.

Tandem modules online embody an open-science approach by being freely accessible on the weADAPT platform, which promotes open knowledge sharing and collaboration across the global adaptation community. Hosting the modules on weADAPT ensures that all materials, including guidance, tools, templates and reading resources, are openly available without barriers, enabling practitioners, researchers and policymakers to reuse, adapt and build on them in their own contexts. The platform's open, networked structure also allows users to comment, contribute additional resources, and connect related content, helping to continually refine and expand the modules that may be applied in different decision contexts, supporting collaborative learning. This openness supports transparency, reproducibility and wider uptake of the Tandem approach across sectors, regions and research communities.

# 5 Deviations from Annex I and Annex II

In this chapter, deviations from the DoA are explained, including alternative and corrective actions and their associated consequences for the implementation of the project (5.1). How this has influenced the use of resources is described in Section 5.2.

## 5.1 Work Packages

### 5.1.1 Work Package 1

This section summarises a few strategic adjustments, not major deviations, to the work plan laid out in the DoA. As an Innovation Action, DIRECTED is inherently iterative and responsive, working through RWLs with Risk-Tandem co-production. Hence, in the following, reported adjustments generally reflect adaptive management, not shortcomings.

The main drivers of changes included: (i) responsiveness to identified stakeholder needs leading to limited priority recalibration in some labs; (ii) a proactive response to unexpected institutional role changes in Denmark (see below); and (iii) deliberate sequencing of complex tasks to support phased, logical progress. These measures kept outputs practical, impactful, and aligned with partner operations.

WP 1 note: the only significant deviation to the work plan was the submission of Deliverable D1.3, which was delayed but completed and submitted in September 2025 within RP2. Milestone M5 (which in on time) is achieved via the pre-release of D4.2 (“Assumptions Framework”), which overlaps the milestone.

#### **D1.3 Case Study**

Completion of the Case Study was delayed due to the extensive volume of material requiring assessment and validation. Additional time was also needed for Real World Lab partners to conduct on-the-ground fact-checking and verification of local information to ensure accuracy and consistency. We requested a new deadline in the recent amendment request, which was accepted.

Deliverable 1.4 (which is expected to be delivered on time) is currently under development (Outcomes from RWL in multi-risk governance) as part of Task 1.3 in a joint effort with Task 3.3.

### 5.1.1.1 RWL 1: The Capital Region of Denmark

A significant deviation from the DoA is the planned withdrawal of Region Hovedstaden (RegionH) from the consortium, effective in RP3. The withdrawal was necessitated due to a change in Danish national legislation, which implies that Danish administrative regions no longer engage in climate change adaptation planning. In addition, Region Hovedstaden merged with Region Zealand to form a new region (Eastern Denmark). Needless to say, this factor was independent of the partner's or the consortium's will.

To ensure full continuity and the effective implementation of all planned activities, the partner Danmarks Tekniske Universitet (DTU) has formally assumed the leadership role for RWL 1 (this has been approved by amendment). This transition is not expected to have any negative practical effects on the project's outcomes. DTU has acted as the de facto co-lead from the project's outset, has established strong working relationships with all key stakeholders, and is already designated as the lead for the execution of the final year's work plan. A dedicated senior consultant, previously employed by the Danish Coastal Authority with more than 10 years of experience in working with Danish regions, municipalities, emergency services, and other stakeholders, was added to the DTU team in the process. Therefore, the achievement of all RWL 1 objectives remains unchanged and on track.

### 5.1.1.2 RWL 2: The Emilia-Romagna Region

For RWL 2, there are no deviations to report for this period. The initial hindrances caused by the extreme flood of May 2023, as documented in the previous report, has been successfully overcome. The RWL is now fully back on track and all activities are proceeding as planned, in full alignment with the DoA; therefore, no corrective actions are required.

### 5.1.1.3 RWL 3: Danube Region

RWL3 comprises two test sites: Vienna and the Zala region.

#### Test site Vienna

While the content-related support from some stakeholders could have been more intensive, there are no significant deviations from the work plan. Determining the user needs for modelling output therefore took slightly more time than planned.

#### Test site Zala Region

Also, in the Zala region test site no negative deviations are reported. During the second reporting period there have been targeted adjustments that align DIRECTED innovations more closely with stakeholder needs. Forecasting horizons were recalibrated to shorter timescales, with a focus on daily, weekly, and seasonal outputs better suited for emergency response. Work was initiated to integrate data streams dedicated to early warning of extreme

weather events, while local forestry meteorological stations are being connected to improve the spatial resolution of information for wildfire risk and forest management. To bridge the gap between weather forecasts and long-term climate projections, seasonal and sub-seasonal data products are being procured from commercial providers. At the same time, engagement has been strategically broadened to include stakeholders with long-term perspectives, such as forestry services, the Balaton Alliance, and limnological researchers, ensuring model relevance and continued use beyond the project. These refinements strengthen the operational value of DIRECTED tools while maintaining scientific integrity.

#### 5.1.1.4 RWL 4: Rhine-Erft Region

For RWL 4, there are no negative deviations to report for this period. The initial focus on floods, which was prompted by the extreme flooding event in July 2021, will be supplemented by the topics of drought and climate change adaptation as the project progresses into RP3.

### 5.1.2 Work Package 2

Works in WP 2 are all on schedule. Works for data and model interoperability are finalized and reported in deliverables D2.1 and D2.2. Efforts intended to support and demonstrate DDR and CCA within the RWLs (Task 2.3) are proceeding in parallel across all RWLs, with their scope being iteratively reinterpreted as implementation progresses. The initial outputs of this task are outlined in Milestone M10 (interoperability fact sheets), which provisionally summarize the emerging aspects of interoperability without yet stabilizing their final form.

### 5.1.3 Work Package 3

Works in WP 3 are all on schedule. Deliverable 3.3 (Policy brief on risk governance in the context of DRR and CCA) is being completed. Interviews with RWL hosts and stakeholders are partially completed and will inform Deliverable 1.4 (Outcomes from RWL in multi-risk governance) and Deliverable 3.4 (Guidance on good practices regarding interoperability of governance mechanisms and recommendations for institutionalising project outcomes and the interoperable platform into existing systems) in the joint Tasks 1.3 and 3.3. Furthermore, the refined Risk-Tandem Framework (Milestone 14) is being used to develop policy briefs for each RWL in the local language as part of Deliverable 3.4. In addition to the Milestones and Deliverables to be met in WP 3 according to the DoA, it is planned to enhance the legacy of DIRECTED by hosting a web interface of the Risk-Tandem Framework on the RIFS/GFZ website. This will further ensure the sustained use and development of the Risk-Tandem Framework.

## 5.1.4 Work Package 4

Works in WP 4 are all on schedule. The capacity development modules for Phase 1: Foundations and 2 Phase 2: Co-explore have been finalized, reported in D4.1, and delivered online (<https://weadapt.org/tandem>). The remaining phases (Co-design, Integrate) will be co-developed in response to emerging RWL needs and the results of coding analysis (e.g. D3.2). Activities supporting DRR and CCA in the RWL workshops are ongoing. Interim results from the co-production process have been documented in Milestones M15–M17 (the latter captured in D4.1), with a final update in M18. Co-production outcomes (M5) are captured in Deliverable D4.2, which has been submitted in draft form and will be finalized by M48.

## 5.1.5 Work Package 5

Work package 5 needed to deviate considerably from the timeline originally proposed to react to the RWL availability and needs. The major change incorporated a model switch from a predominately waterfall implementation as initially outlined in the proposal's work plan towards an agile, sprint based development with frequent feedback from RWL hosts and stakeholders after bilateral consultation or workshops. This was necessary, as updates and requests of the RWLs still emerged - as part of the Risk-Tandem co-production and user engagement in general - even after the Data Fabric was commissioned in December 2024. Due to the wealth of features and ideas, a prioritization together with RWLs has identified the most important features to showcase the benefits of improved interoperability. The agile approach has allowed the Data Fabric to accommodate some of these key change requests until the last moments of its deployment. New real-time data was for example requested by RWL 2 from another provider than initially foreseen, and the identification of an advanced wildfire propagation model. As a consequence, tasks 5.2 and 5.3 took about 6 months longer to complete than originally planned. Intensified discussions also impacted the financial resources, leaving only very limited resources in WP5 for further feature development. In order to ensure use- and sustainability of the developed solution, emphasis will be put on documentation and the development of training material.

A public back-log will be kept to further inform developments also beyond the project's life. It entails valuable ideas and insights into needs and requirements of the stakeholders that go beyond the project's core objectives and scope for action.

A last minute change during the Grant Agreement preparation phase, which replaced the intended partners from QOMPLX with 52N rendered some parts of the proposal inapplicable. This affects the exploitation strategy, as 52N is fully committed to open source solutions supporting the sustainability of solutions, reusing existing open source code and allowing any interested party to contribute, enhance and use the solution developed in DIRECTED. As a result, the revised and primary strategy for going to market is to leverage

the advantage in offering services for adapting and using the Data Fabric or parts of it. Hence, the Data Fabric is designed in a modular way applicable to use cases beyond CCA and DRM, where geospatial and time series data needs to be managed and provided as easily accessible and comprehensive information likewise for experts and non-experts.

## 5.1.6 Work Package 6

### **D6.6 Communications and Dissemination Report (Year 2)**

Delivery of this report was affected by a combination of factors, including initial unforeseen personal circumstances and subsequent scheduling constraints linked to the main WP 6 partner's (and lead author's) commercial commitments. As the coordinating SME (Oasis) is required to pre-finance its contributions several months in advance (under Innovate UK), prioritisation of revenue-generating activities was temporarily necessary to maintain operational cash flow of this partner. These issues have since been resolved, and reporting is now back on track.

### **Deliverable D6.9 (Legacy document on the capacity/skills for risk and adaptation management)**

The delivery date of this deliverable has been amended in the Grant Agreement from M36 to M46 (31st July 2026). This deliverable is the result of Task 6.5 which runs from M30 to M45, and therefore it was not realistic to have this in M36 as originally indicated in the Grant Agreement. This amendment further ensures that the recommendations around capacities and skills emerge from the co-design of the e-Learning content (Task 6.4/ D6.4 due M45), as well as all the other relevant tasks/ deliverables across work packages, including the Data Fabric user training per role in WP5 (D5.7 extended to M41). As such, the legacy document will draw on as much evidence as possible (across all WPs) from the breadth of the training and capacity development in the project.

## 5.1.7 Work Package 7

After the first review, WP7 coordinated the revision of six deliverable reports (D1.1, D1.2, D3.1, D6.1, D6.3, D7.4) and prepared plans for advancing the submission of five reports to month 32 upon request by the reviewers and the PO. Additionally, deliverables from WP 5 connected to the development of the Data Fabric were submitted as drafts ahead of schedule to be included in the interim review. This process has caused considerable additional work for much of the consortium and has led to delays in the submission of a few deliverables during RP2.

With the end of RP2, the project has unfortunately lost RegionH (Capital Region of Denmark) as a partner. Due to unexpected circumstances (see under WP 1), RegionH was forced to withdraw from participation in DIRECTED. Their withdrawal was prompted by a new

governmental directive that prohibits Danish Regions from engaging in climate-related activities, effective from January 15, 2026. As a result, RegionH's involvement in the project ended on September 30, 2025.

RegionH in close coordination with the project coordinator recognized the impact its withdrawal could have on the project and the consortium, and therefore has committed to fulfilling all contractual and administrative obligations prior to leaving. Specifically, it has:

- Submitted all outstanding financial reports, cost claims, and deliverables before exiting the project.
- Facilitated the orderly transfer of its assigned tasks to the Technical University of Denmark (DTU), as agreed upon by the consortium.
- Ensured that any intellectual property or results it has contributed are handled in line with project agreements.

To support the continued progress of the project, RegionH has towards the end of RP2 reassigned all of its outstanding tasks and remaining budget to DTU. These changes were reflected in an amendment to the Grant Agreement. RegionH has at all times readily assisted in coordinating the handover process and has been supporting the consortium and the European Commission to minimize disruption caused by its withdrawal.

## 5.1.8 Work package 8

Work package 8 was implemented upon request by the project officer in line with Horizon Europe guidelines to comply with ethical standards in research and stakeholder interactions. The integration of WP8 into the work plan of the project happened late in the grant application phase, after all work and budget plans were finalised. This led to an underdevelopment of WP8 in the initial Grant Agreement. Requirements for the ethics advisor to be a specialist in AI and machine learning were not defined optimally for the needs of the project. After changing these requirements, an external advisor – Jessica Romo, Nexus Evaluation – was brought in to review the completed and ongoing work to advise the project on ethical dimensions (D8.1). The delay in identifying and contracting a suitable advisor caused the initial ethics report to be delayed in RP1. To provide sufficient time for the advisor's work and for project partners to implement recommendations given in the first report, all of the following ethics deliverables were rescheduled in consultation with the project officer. The original Grant Agreement's lack of effort allocation to WP8 was corrected with the latest amendment, in which all partners agreed to contribute 0.5 person months to WP8. This change allows partners to justify effort spent on ethical considerations of their work more easily and underscores the commitment to ethical work practices. It is important to note that this change in PMs will not affect the budget of any of the partners or the project overall.

## 5.2 Use of resources

The project's second reporting period covered a duration of 20 months. This reporting period concludes at the point when 75% of the project has been completed. Thus, the reference baseline for the deviations observed in the consortium budget and PM expenditure has been taken to be approx. 75% of the budget allocated to each partner and WP correspondingly. Justifications have been provided below for partners reporting deviations of more than 10% from this linear consumption of budget has been explained for each partner and WP within the consortium.

### Justifications on deviations in budget expenditure

**TUBS** has used 61% of its planned budget until the end of RP2. While personnel cost expenditure is according to plan, not all costs incurred for travel undertaken for the project has been reported. This is due to a delay of about 6 months in processing times of the travel claims at the university, which was communicated to all employees. On top of this, many requests for claim to the TUBS subcontracting budget have been made and will be reported in RP3. The remaining budget allocated to TUBS will be spent in RP3. TUBS also adjusted its report for RP1. This adjustment is related to licence and domain hosting costs of the DIRECTED project website. These costs were booked as normal OGWS costs, however, shortly after the end of RP1 it was clarified that they should be booked as Equipment because according to TUBS usual accounting practices, licences are booked as equipment and have a depreciation period of x years, depending on the type of licence. Furthermore, equipment is only allowed to be reported with depreciated costs for the DIRECTED project according to the Grant Agreement. Therefore, this adjustment was deemed necessary as TUBS will not manage to claim all costs until the end of the project. As the error was recognized shortly after RP1 reporting ended, it has now been corrected along with the RP2 reporting ensuring complete transparency and to mirror the corrections in our TUBS internal records. Additionally, these are unforeseen costs as there are no equipment costs planned in the TUBS budget.

As the calculation of personnel costs in Horizon Europe projects changed after RP1, **GFZ** also had to adjust their internal calculation. With this adjustment, they compensated for non-eligible personnel costs incurred under the latest EU regulations.

Meanwhile, **DTU** has formally used 73% of its PMs expenditure until the end of RP2, but only 47% of its adjusted budget (including the budget transferred from Region H) due to a lack of experienced staff working on the project at the beginning of RP2, where the principal DTU investigator and one of the main DTU contributors to DIRECTED was shifted to internal rather than project funding. In the second half of RP2, additional staff have been slowly employed to work on the project, leading to more PM expenditure but lower personnel costs due to the resulting lower salaries of the early stage researchers. Already now, DTU has

booked even more people working on the project in RP3 for their own tasks as well as the tasks they took over from our terminating partner RegionH, and therefore fully plan to compensate for the underspending in RP1 and RP2.

In addition, **UCC** also spent 55% of their total budget but plan on using the leftover budget for additional travel to RWLs to support the RWL hosts/stakeholders in knowledge co-production workshops and evaluation (T1.3 / T3.3), and collating content and feedback for Learning co-design (T6.4/T6.5).

**G&C** spent only 50% of their planned budget until the end of RP2 due to unforeseen resignations of several employees for whom project hours have been allocated during the planning phase of the project. This has led to reduced staffing and consequently the personnel cost as well as PM expenditure. Additionally, despite having a planned budget in the SME owner category, G&C only reported actual personnel costs. This is because, as of February 2024, there were no SME owners working on the project, leading to no SME owner costs being incurred for RP2.

**IIASA** is also underspending by a small amount due to the fact that an increased activity for updating and expanding the framework based on the experiences made within each Real World Lab is planned in the remaining project period (year 4).

**52N** spent 95% of their allocated budget up until the end of RP2 towards the development of the Data Fabric amounting to about 60 PMs. The key result 52N is responsible for, is the prototypical development, deployment and operation of the Data Fabric, consisting of back- and front-end components interoperably accessing global to local data sources, integrating models and providing tailored information products. The Data Fabric was released in version 1.0 on the Open Telekom Cloud running in Kubernetes cluster with the closure of RP2 according to the original project schedule, showcasing the added benefit of improved interoperability. The co-design approach chosen by the DIRECTED project relies on an intense collaboration with RWL hosts, stakeholders and users to develop the tailored information products needed. Hence, next to pure software design, development, deployment and operations in the cloud, a major share of the work conducted was invested into the user requirement engineering and co-development of solutions facilitated through hosting and moderating dedicated task forces per RWL. These task forces started off with mapping the status quo, identifying needs and developing detailed user stories and interoperability use cases for each RWL. To gain a joint understanding, first wireframes, mock-ups and early prototypes have been developed, shared and discussed through the task forces and at times validated through the RWL stakeholders and future users. The task forces also steered the development of features through development sprints based on an agile methodology. Throughout the co-development, new use case ideas emerged from discussions with stakeholders and repeatedly new assessments regarding available data and models have been put forward that at times slowed down the development process, but ensured to converge to the best suited solution for each RWL.

The rest of the beneficiaries have spent the expected amount of their budget (i.e. around 75% within the deviation of less than +/- 10%) based on their allocated budget.

## Justifications on deviations in PM expenditure

**TUBS** recorded a slight overspend in PMs, primarily within **WP7**. This resulted from several coordination activities undertaken immediately after the RP1 review. First, the coordination team organised the consortium's response to the reviewers' recommendations and managed the submission of revised deliverables to the portal for the requested interim review. Soon after this review, TUBS prepared and coordinated the amendment process related to the termination of the Danish partner RWL, RegionH, working closely with the Project Officer throughout the procedure. These additional tasks, carried out alongside TUBS's standard coordination responsibilities, resulted in extra PM utilisation. However, this did not translate into increased personnel costs, as the work was largely undertaken by part-time early-career researchers.

**ARSTPC-ER** overspent in PMs because staff with different qualifications, who receive different compensations, were employed to complete the action task allocated to ARSTPC-ER.

**52N** did a considerable amount of work towards the prototypical development, deployment and operation of the Data Fabric in RP2 as mentioned above and recording in **WP5**. The corresponding PMs are much higher than planned as the PM estimated from the grant agreement have been falsely based on a wrong monthly rate originating from a different company. As the salaries for the personnel of 52N are on average much lower than in the original calculations, 52N has been in the advantageous situation to dedicate more PMs to the DIRECTED project and engage more intensively with the RWLs.

Due to unforeseen reduced staff at **G&C** during RP2 (as explained in the previous section), they only spent 56% of their PMs until the end of RP2.

**WP4** was efficient in its time expenditure in RP2 and completed all their planned tasks within the timeframe of the reporting period. There are many workshops and interactions (e.g. Climate Festival) planned in RP3, and the rest of the remaining PMs are planned to be used by the end of the project. Additionally, RWL collaboration time was also spent in WP1 by many partners, which has led to further underspending in WP4.

During the reporting period, several partners carried out communication, dissemination, and exploitation (CD&E) activities that contributed directly to the project's progress and to the achievement of **WP6** milestones. In some cases, these activities were booked under other Work Packages due to their thematic relevance, even though the outputs supported WP6 objectives as defined in the Grant Agreement. For example, DTU delivered a parliamentary presentation, exploitation activities, and academic publications; SEI contributed blogs, tool dissemination, conference participation, papers and exploitation, etc.; and IIASA participated in key dissemination events such as the ECCA conference. To ensure full alignment with

Horizon Europe requirements, partners will be reminded to report all relevant CD&E tasks under WP6 in RP3, even when the work simultaneously contributes to other WPs. This will help maintain clarity in relation to the Grant Agreement's legal obligations regarding mandatory dissemination and communication activities. Looking ahead, the final project year foresees intensified CD&E and training efforts, including webinars, policy briefs, a climate festival, press releases, exploitation advancement, and preparation of training materials. Clear coordination and correct attribution of these activities under WP6 will ensure full compliance and visibility of the work performed across the consortium.

As per the project officer's request in Mar 2025, each partner was also requested to report 0,5 PMs in WP8, as explained in [section 5](#), Work Package 8 chapter. The beneficiaries that actively worked in WP8 in RP2 reported their PMs in RP2 in this WP, while the rest of the beneficiaries will report their PMs in this WP in RP3.

Table 20: Person Month expenditure per WP per partner.

Partner	WPs								PMs executed	Progress of PMs until	Progress (%) until RP2
	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8			
<b>1 – TUBS</b>	<b>10</b>	<b>6</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>6</b>	<b>22</b>		<b>56</b>	<b>48,88</b>	<b>87%</b>
RP1	1,81	1,06	0,95	0,53	0,67	1,20	14,40		20,62		
RP2	2,53	1,91	1,42	1,22	1,21	2,39	17,34	0,24	28,26		
<b>Total RP1 &amp; RP2</b>	<b>4,34</b>	<b>2,97</b>	<b>2,37</b>	<b>1,75</b>	<b>1,88</b>	<b>3,59</b>	<b>31,74</b>	<b>0,24</b>			
<b>2 – PIK</b>	<b>14,00</b>	<b>12,00</b>	<b>2,00</b>	<b>2,00</b>	<b>4,00</b>	<b>4,00</b>			<b>38,00</b>	<b>24,37</b>	<b>64%</b>
RP1	3,92	3,80			0,04	0,62			8,38		
RP2	3,80	3,33	1,83	1,44	4,18	1,36		0,05	15,99		
<b>Total RP1 &amp; RP2</b>	<b>7,72</b>	<b>7,13</b>	<b>1,83</b>	<b>1,44</b>	<b>4,22</b>	<b>1,98</b>	<b>0,00</b>	<b>0,05</b>			
<b>3 – DTU</b>	<b>16,00</b>	<b>18,00</b>	<b>2,00</b>	<b>2,00</b>	<b>4,00</b>	<b>4,00</b>			<b>46,00</b>	<b>33,71</b>	<b>73%</b>
RP1	6,50	6,50	0,75	0,75	1,00	0,84			16,34		
RP2	6,28	7,66	0,61	0,20	2,62				17,37		
<b>Total RP1 &amp; RP2</b>	<b>12,78</b>	<b>14,16</b>	<b>1,36</b>	<b>0,95</b>	<b>3,62</b>	<b>0,84</b>	<b>0,00</b>	<b>0,00</b>	<b>33,71</b>		
<b>4 – GECCO</b>	<b>24</b>	<b>16</b>	<b>2</b>	<b>6</b>	<b>16</b>	<b>6</b>	<b>2</b>		<b>72</b>	<b>57,50</b>	<b>80%</b>
RP1	8,00	5,00		1,00	5,00	2,00			21,00		
RP2	12,00	8,00	1,00	3,00	8,00	3,00	1,00	0,50	36,50		
<b>Total RP1 &amp; RP2</b>	<b>20,00</b>	<b>13,00</b>	<b>1,00</b>	<b>4,00</b>	<b>13,00</b>	<b>5,00</b>	<b>1,00</b>	<b>0,50</b>			
<b>6 – UCC</b>	<b>12,00</b>	<b>2,00</b>	<b>24</b>	<b>8,00</b>		<b>12,00</b>	<b>2</b>		<b>60</b>	<b>39,40</b>	<b>66%</b>
RP1	2,20		6,50	1,40		3,80	0,50		14,40		
RP2	5,00	1,40	9,30	4,20		4,30	0,60	0,20	25,00		
<b>Total RP1 &amp; RP2</b>	<b>7,20</b>	<b>1,40</b>	<b>15,80</b>	<b>5,60</b>	<b>0,00</b>	<b>8,10</b>	<b>1,10</b>	<b>0,20</b>			
<b>7 – REGIONH</b>	<b>20</b>						<b>4</b>		<b>24</b>	<b>19,12</b>	<b>80%</b>
RP1	7,67						0,36		8,03		
RP2	9,96						1,12	0,01	11,09		
<b>Total RP1 &amp; RP2</b>	<b>17,63</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>1,48</b>	<b>0,00</b>	<b>0,01</b>			
<b>8 – ARSTPC-ER</b>	<b>10,00</b>						<b>4,00</b>		<b>14</b>	<b>14,40</b>	<b>103%</b>
RP1	6,50						0,90		7,40		
RP2	6,30						0,60	0,10	7,00		
<b>Total RP1 &amp; RP2</b>	<b>12,80</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>1,50</b>	<b>0,00</b>	<b>0,10</b>			
<b>9 – G&amp;C</b>	<b>14,00</b>	<b>1</b>	<b>1</b>	<b>1</b>			<b>3,00</b>		<b>20</b>	<b>11,20</b>	<b>56%</b>
RP1	6,33	0,01	0,02	0,06			0,03		6,45		
RP2	4,17		0,24	0,10			0,14	0,10	4,75		
<b>Total RP1 &amp; RP2</b>	<b>10,50</b>	<b>0,01</b>	<b>0,26</b>	<b>0,16</b>	<b>0,00</b>	<b>0,17</b>	<b>0,00</b>	<b>0,10</b>			
<b>10 – IIASA</b>	<b>4</b>		<b>18</b>	<b>2</b>			<b>2</b>		<b>26</b>	<b>16,82</b>	<b>65%</b>
RP1			1,60				0,10		1,70		
RP2			14,95	0,17					15,12		
<b>Total RP1 &amp; RP2</b>	<b>0,00</b>	<b>0,00</b>	<b>16,55</b>	<b>0,17</b>	<b>0,00</b>	<b>0,10</b>	<b>0,00</b>	<b>0,00</b>			
<b>11 – EV</b>	<b>20</b>	<b>6</b>		<b>6</b>			<b>4</b>		<b>36</b>	<b>24,00</b>	<b>67%</b>
RP1	12,00								12,00		
RP2	6,00	2,00		2,00			1,50	0,50	12,00		
<b>Total RP1 &amp; RP2</b>	<b>18,00</b>	<b>2,00</b>	<b>0,00</b>	<b>2,00</b>	<b>0,00</b>	<b>1,50</b>	<b>0,00</b>	<b>0,50</b>			
<b>12 – ZSRT</b>	<b>11</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>		<b>2</b>		<b>20</b>	<b>16,40</b>	<b>82%</b>
RP1	7,50	0,70	0,80				1,00		10,00		
RP2	4,20	0,50	0,54	0,46	0,40		0,30		6,40		
<b>Total RP1 &amp; RP2</b>	<b>11,70</b>	<b>1,20</b>	<b>1,34</b>	<b>0,46</b>	<b>0,40</b>	<b>1,30</b>	<b>0,00</b>	<b>0,00</b>			
<b>13 – ARPAAE</b>	<b>6</b>						<b>4</b>		<b>10</b>	<b>8,46</b>	<b>85%</b>
RP1	3,07						1,34		4,41		
RP2	2,29						1,56	0,20	4,05		
<b>Total RP1 &amp; RP2</b>	<b>5,36</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>2,90</b>	<b>0,20</b>			
<b>14 – GFZ ( incl. RIFS)</b>	<b>16</b>	<b>24</b>	<b>26</b>	<b>10</b>	<b>4</b>	<b>4</b>	<b>4</b>		<b>88</b>	<b>58,90</b>	<b>67%</b>
RP1	1,60	7,90	5,40		0,50	0,30	0,30		16,00		
RP2	10,80	7,10	17,50	2,50	2,40	1,60	1,00		42,90		
<b>Total RP1 &amp; RP2</b>	<b>12,40</b>	<b>15,00</b>	<b>22,90</b>	<b>2,50</b>	<b>2,90</b>	<b>1,90</b>	<b>1,30</b>	<b>0,00</b>			
<b>15 – 52N</b>	<b>4</b>	<b>5</b>	<b>2</b>	<b>5</b>	<b>22</b>	<b>1</b>	<b>1</b>		<b>40</b>	<b>58,41</b>	<b>146%</b>
RP1	0,75	1,94	0,01	0,01	11,19	0,19	0,03		14,12		
RP2	6,18	6,78	1,09	2,21	24,95	1,24	1,30	0,54	44,29		
<b>Total RP1 &amp; RP2</b>	<b>6,93</b>	<b>8,72</b>	<b>1,10</b>	<b>2,22</b>	<b>36,14</b>	<b>1,43</b>	<b>1,33</b>	<b>0,54</b>			
<b>16 – ETH-Z</b>	<b>6</b>	<b>18</b>							<b>24</b>	<b>20,50</b>	<b>85%</b>
RP1	2,00	6,00							8,00		
RP2	4,00	8,00						0,50	12,50		
<b>Total RP1 &amp; RP2</b>	<b>6,00</b>	<b>14,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,50</b>			
<b>17 – OASIS</b>	<b>5</b>	<b>2</b>					<b>20</b>	<b>2</b>	<b>29</b>	<b>22,35</b>	<b>77%</b>
RP1	0,78	0,05					7,93	0,83	9,58		
RP2	2,75	2,15					6,43	1,45	12,78		
<b>Total RP1 &amp; RP2</b>	<b>3,53</b>	<b>2,20</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>14,35</b>	<b>2,28</b>	<b>0,00</b>			
<b>18 – SEI</b>	<b>12</b>	<b>6</b>	<b>12</b>	<b>24</b>			<b>2</b>	<b>2</b>	<b>58</b>	<b>40,70</b>	<b>70%</b>
RP1		1,85	0,45	14,17			1,33	1,60	19,40		
RP2	7,70	1,40	6,20	5,20			0,70	0,10	21,30		
<b>Total RP1 &amp; RP2</b>	<b>7,70</b>	<b>3,25</b>	<b>6,65</b>	<b>19,37</b>	<b>0,00</b>	<b>2,03</b>	<b>1,70</b>	<b>0,00</b>			
PMs executed	164,59	85,04	71,16	40,62	62,16	48,17	40,45	2,94			
PMs planned in project	204,00	118,00	95,00	72,00	55,00	82,00	35,00	8,50			
Total progress in Project	81%	72%	75%	56%	113%	59%	116%	35%			

## 5.2.1 Unforeseen subcontracting

The project didn't encounter any unforeseen subcontracting in this reporting period.

## 5.2.2 Unforeseen use of in kind contributions

The project did not receive any unforeseen in kind contributions during this reporting period.

## 6 Concluding remarks

The Real World Labs at the centre of the DIRECTED project have received tailored information services designed to support their specific decision-making processes and are currently actively testing and evaluating the Data Fabric. The solutions integrated into the Data Fabric have effectively lowered barriers and closed critical gaps in data and model access, successfully transforming availability into meaningful, actionable information for end-users. While there is already an abundance of data and information available, the project's success lies in its ability to bring these resources into practical use for the people who need them.

By uniting stakeholders through the use of Risk-Tandem methodology, the project has fostered a deeper understanding and appreciation of diverse perspectives from CCA and DRM actors. Through many workshops, meetings and real world exercises, bridges were built between existing silos in the RWLs. This validates the co-design process; while it is undeniably time-consuming, it has proven to be a highly valuable, educative, and rewarding approach for all parties involved.

On a structural level, inter- and intra-institutional communication has emerged as a key governance leverage point for improving the integration of CCA and DRM in the RWLs. However, to ensure regulatory coherence and transferability, these exchanges require clear structure and defined ownership. It is therefore crucial that engagement and exchange activities such as the tabletop exercises and workshops are continued and sustained through the stakeholders in the RWLs. The institutionalised emergency meeting ("WebEx meeting") in the Rhine-Erft RWL serves as a prime example of how such governance mechanisms can be effectively established and maintained.

Communication, dissemination activities and exploitation plans have already in RP2 led to successful uptake of DIRECTED innovations by users. During RP2, communication, dissemination and exploitation activities strengthened the visibility, accessibility and early use of DIRECTED outputs across the project and the Real World Labs. Communications work expanded the project's digital presence through website updates, increased social-media reach, publication of blogs and partner features, and new video content, alongside clearer formats for presenting governance, co-production and technical components. Dissemination activities included a wide programme of tool demonstrations across specialist and practitioner audiences, covering the Data Fabric, SaferPlaces, CLIMADA, the Danube Model, the Climate Connectivity Hub and Taxonomy, ABSOLUT, and the Citizen Flood Safety VR App, all shown in workshops, stakeholder meetings, conferences and public-facing events. These demonstrations, together with academic publications, conference presentations and media features, enabled RWL partners and external organisations to begin working directly with these tools in exercises, training contexts and operational discussions. Exploitation work in RP2 documented these emerging

use cases, updated the exploitation pathways for each KER, and refined value propositions and development routes to inform the D6.5 Business Development Plan. Training tools have been consulted on and designed and will be finalised in RP3 period.

# Partners

