PIISA

Piloting Innovative Insurance Solutions for Adaptation

D3.2 Summary of lessons learned

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Summary

This report compiles lessons learned from the practical implementation of five pilots conducted within the Horizon Europe funded PIISA project (Piloting Innovative Insurance Solutions for Adaptation). PIISA aimed to reduce Europe's climate adaptation gap by developing and testing innovative insurance and risk sharing solutions that shift insurance from a reactive, compensatory mechanism toward a proactive driver of climate adaptation.

Piloting in PIISA followed the standard principles of small scale, resource efficient experimentation to test feasibility, identify barriers and enablers, and refine solutions before scaling. All pilots engaged stakeholders through structured co-creation activities. Despite the pilots focused on distinct hazards—urban flooding and heat, clay soil shrink–swell damage, agricultural drought, wind damage in forests, and wildfires—they shared an overarching goal of improving climate related risk management.

Regular surveys were conducted to gather feedback from both partners and stakeholders, allowing the pilots to adjust partner roles, clarify responsibilities, and refine development plans. Pilots also produced materials such as web tools, datasets, reports, peer-reviewed publications, Info Cards and organised webinars all accessible via the PIISA website.

Across the 30-month piloting period, several common challenges emerged. Early stakeholder surveys revealed mismatched expectations and limited understanding of pilot aims, highlighting the need for clear communication. Pilots experienced delays, partner turnover, or resource constraints, requiring task redistribution and prioritisation. Collaboration with external projects—such as SWIFTT, PRECILIENCE, and DestinE Climate DT—proved valuable for sharing knowledge, increasing relevance and visibility. In some cases, pilots strategically narrowed their scope, such as the Clay Soil Shrink–Swell pilot's decision to focus on replicating its tool within France due to regulatory and data related limitations.

Despite differences in context and methodology, the pilots generated shared insights. Successful piloting requires active stakeholder management, early understanding of regulatory environments, attention to local market dynamics, and realistic expectation setting—especially for novel insurance concepts such as index-based products. Agile development and design science approaches enabled iterative refinement of innovative solutions, while concrete use cases proved essential for demonstrating feasibility.

The report concludes with recommendations for future piloting efforts. These include encouraging constructive stakeholder feedback, preparing for flexible task reallocation, identifying opportunities for cross-project collaboration, and ensuring that pilots remain focused within resource constraints.

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Keywords

climate risk management, insurance protection gap, climate change adaptation, pilot project, co-creation, co-development, parametric insurance, index-based insurance, agriculture, clay soil, green roof, forest, wind damage wildfire

Abbreviations and acronyms

Acronym	Description
AXA Climate	AXA Climate
AGIF	Integrated Rural Fire Management Agency of Portugal (Agência para a Gestão Integrada de Fogos Rurais)
BSC	Barcelona Supercomputing Centre
CAS	Climate Adaptation Services
CSS	clay soil shrink-swell
CSSBDA	Clay Shrink Swell Building Damage Assessor
Climate DT	Climate Change Adaptation Digital Twin
CMIP6	Coupled Model Intercomparison Project Phase 6
DestinE	Destination Earth
EU	European Union
FMI	Finnish Meteorological Institute
IVM/VU	Institute for Environmental Studies, Vrije Universiteit Amsterdam
MTT	Minimum Travel Time
PRESILIENCE	Precision climate resilience for agriculture and forestry sectors in the European boreal regions
PIISA	Piloting Innovative Insurance Solutions for Adaptation
SWIFTT	Satellites for Wilderness Inspection and Forest Threat Tracking
SFO	Sustainable Finance Observatory
WISE	Wildfire Intelligence and Simulation Engine

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1 Introduction

Generally, piloting describes a small-scale, preliminary trial run of a research study, or a new product or service. Usually, a pilot is planned as a resource efficient, fixed length "sprint" with limited scope. It is conducted to test feasibility, evaluate procedures and uncover barriers and enablers before deciding to implement a full-scale project or product/service market rollout. It can be used to plan further research and development work, engage in advocacy and build strategic partnerships to navigate barriers, or abandon product/service development for the time being. Under any outcome, attentively performed piloting produces results and experiences for informed decision making, and offers important learning opportunities, potentially improving future innovation efforts.

PIISA (Piloting Innovative Insurance Solutions for Adaptation) was a Horizon Europe funded project working to reduce the climate adaptation gap (i.e. the difference between the recognised need for adaptation and the implemented adaptation activities) by developing and piloting new insurance and risk-sharing concepts to address mounting climate risks in Europe. The project sought to extend insurance from purely compensatory, post-damage mechanisms to proactive instruments that incentivise farmers, households, businesses and public authorities to enhance risk management and adopt climate adaptation measures.

The PIISA project has developed new innovative concepts, products and services through a piloting process that utilised co-creation with stakeholders and potential users. PIISA pilots focused on three areas: (a) Cities and well-being; (b) Agriculture; and (c) Forests.

The PIISA project pilots fell under the general category of piloting. Section 2 of this report gives concise information on five PIISA pilots and include links for more detailed information. In PIISA project, piloting results were also used for preparing a strategic Replicability Roadmap in Work Package 4 "Dissemination, exploitation, and communication". The roadmap provides a structured and forward-looking synthesis on how the results generated by PIISA pilots can be replicated, transferred or adapted beyond their original implementation contexts. It can be used to support decision-making by project partners, public authorities from local to EU level, insurers, and future initiatives seeking to build on PIISA results. (Lameh, 2026)

The aim of this report is to collect experiences from practical, hands-on implementation of the five PIISA pilots to derive lessons learned related to operation of the pilots. This PIISA deliverable is not to be mistaken as study on barriers and enablers for wider uptake of solutions developed in pilots, but simply compilation of answers to questions on what worked well, what did not work and what were decisions and reactions to potential problems and new opportunities.

The authors envisage this qualitative study to be of service for those experts interested in or planning piloting research study, or product/service development and testing. Likewise, organisations utilizing piloting results, or funding or commanding piloting could find this report useful. Based on experience from the project, this "Lessons learned" report identifies what requires improvement to prevent the same issues from arising in future pilots (e.g. bottlenecks in communication or problems in engaging stakeholders). By improving the functionality of piloting, organisations continue to enhance efficiency over time, leading to positive outcomes and reducing time and resource usage.

Information for this document was compiled from PIISA pilot partners and from pilots' co-creation and other stakeholders. Experiences have been compiled from 30-month operation period (August 2024 – March 2026) of PIISA Work Package 3 "Pilots".

All PIISA pilots explored and co-created insurance motivated solutions to improve weather-related risk management and enhance climate change adaptation. Nonetheless, it is important to note that in many respects the pilots were worlds apart. Four prominent examples of different approaches and perspectives in pilots are: (1) both top-down and bottom-up approaches were applied; (2) efficient agile development method[1] common in software applications, and scientific and practical contributions requiring design science research methodology[2] were used; (3) initial pilot development environment's biogeographical, regulation and other socio-economic conditions varied; and (4) different risk contexts were addressed: urban floods and heat, building damage due to clay soil shrinkage and swelling, agricultural drought, wind damage to forest, and wildfires.

Since all five pilots — including development, testing and feasibility examination — differ greatly from one another, it is interesting to identify the common problems they faced and the solutions to those problems. On the other hand, five very different development projects are likely to reveal unique problems that arise from their specific contexts.

[1] Agile development is an approach to creating products or solutions through iterative, incremental work, where development team(s) deliver new (small) feature or element, learn from feedback, and continuously improve, i.e. development in small pieces.
[2] Design Science Research is a methodology centered on the creation and evaluation of innovative artifacts intended to solve real-world problems while simultaneously contributing to scientific knowledge. Method emphasizes the dual responsibility of producing practical utility and theoretical advancement by systematically designing artifacts—such as models, frameworks, tools, or prototypes—that address relevant challenges.

2 PIISA piloting arrangements

PIISA project operated five pilots to develop innovative concepts, advanced products and services (henceforward "solutions" in this report) that were co-created with stakeholders and potential users against physical climate risks. Each pilot addressed an acute, real-world protection gap accompanied with needs to enhance climate change adaptation. Solutions developed were insurance concepts or products, or services supporting development and wider use of climate-sensitive insurances.

A common, fundamental activity for all pilots was to identify barriers and enablers for wider uptake of solutions piloted. These findings were input to Task 4.5 which assessed and structured how the results and solutions generated by the PIISA pilots can be replicated, transferred, or adapted to other European contexts beyond the original pilot location and context (e.g. regulation, markets, institutions, climate). (Lameh, 2026)

PIISA piloting work and results are described in project deliverables as well as in other reports and peer-reviewed publications (some published, some in preparation or under review)[3]. PIISA has organised, or co-organised, several webinars on themes of pilots, and their recordings are available. In addition, pilots have been co-producing Info Cards and writing blog texts. PIISA pilots have developed Web tools and data sets relevant for risk management. All these tools and materials are available from the PIISA web site.

2.1 Description of PIISA pilots

This section presents a condensed overview of the five PIISA pilots starting with their descriptive title and task number. The participating partners in each pilot are listed - with leading and co-leading partners in bold. Overview tables contain hazards/risk addressed, pilot aims and target groups. Short descriptions of each development cycle (Loop) key activities are given. PIISA deliverables (see Appendix 1), reports, scientific articles (contained in References) and other communication materials/events are listed, if they were known at the time of writing this publication. It is important to note that all PIISA web tools are mentioned in the table cell "Aims" containing link to access the tool via PIISA web site.

[3] Status of peer-reviewed scientific articles in May 2026.

Green roofs insurance pilot Task 3.2.1	Partners: **IVM/VU**, **CAS**, FMI, Tyrsky, POLIMI, LocalTapiola
Hazards/risks: urban flooding, roof damages, heat stress, biodiversity loss	
Aims: To explore how insurance innovations and behavioural interventions can incentivize individual homeowners to implement an adaptation measure (green roof). To examine the economic viability of green roofs in societal cost-benefit analyses. To investigate the barriers and enablers of green roof adoption. To explore how insurers can develop and supply these insurance innovations and products most effectively. To develop a **web tool for insurers**.	
Target groups: insurance companies, authorities, urban planners, technical experts	
Loop 1 Theme continued through all loops in the Netherlands	Economic valuation survey, and design of household surveys testing financial incentives for green roof adoption with Interpolis (Dutch insurer). The surveys aim to evaluate how to incentivize policyholders to install and maintain green roofs, and what their willingness to pay are for the various private and societal benefits of green roofs. Assessment of barriers and enablers for stimulating green roof adoption by insurers was further explored in interviews with insurers and other societal stakeholders. The pilot further focused on pluvial flood risk reduction modelling to provide input to cost-benefit analysis.
Loop 2 Finland, Norway, Sweden	Survey and assessment of wider uptake potential in cold and wet conditions (Nordic region). Assessment of barriers and enablers to green roof adoption stimulated by insurers; through engagement (interviews) of local insurers and municipalities.
Loop 3 Italy, Greece, Spain, Portugal	Survey and assessment of green roof insurance applicability in warm and dry conditions (Mediterranean region). Focus on assessment for barriers and enablers to green roofs adaptation strategy and identification of regulatory or market enablers for replication via a workshop and interviews.
Publications and other communication materials	
Deliverables: D3.11, D3.4, D3.3 **Report:** "Barriers and Enablers for Nature-based Solutions: Insights from European insurers" **Info Card 3:** "Barriers and opportunities for Natural Risk Insurance" **Blogs:** - Dutch insurers need best practices and partnerships to incorporate nature-based solutions into their products - Incentivizing Green Roof adoption through insurance **Events:** Adapting to climate risks through green roofs: insights from the Netherlands, 30 Jan 2025 **Scientific articles:** - The state of the art and future of climate risk insurance modeling by Ingels et al. (2024) - Behavioural public policy for natural disaster preparedness and the role of economic experiments by Robinson and Botzen (2025) - Assessing effects of nature-based and other municipal adaptation measures on insured heavy rain damages by Ooms et al. (2025) - Pro-social versus pro-self motivations for green roof adoption: Evidence from a discrete choice experiment by Farina et al. (2026)	

Clay soil shrink-swell pilot Task 3.2.2	Partners: **SFO**, FMI, Amigo
Hazards/risks: Building damage caused by clay soil shrink-swell (**CSS**) events	
Aims: To raise awareness of households on their exposure to financial risks related to inadequate insurance cover for CSS-related property damage. Co-develop a **web tool (Clay Shrink Swell Building Damage Assessor, CSSBDA)** to communicate various information about the financial (and other) risks homeowners face from inadequate insurance cover in France. Analyse the CSS risk level and insurance framework in five other EU countries. Estimate future changes in occurrence of deep soil drought in Europe.	
Target groups: homeowners, property stakeholders, local authorities	
Loop 1 France	Background research on the CSS phenomenon and the insurance position in France. A review of public data sources (e.g. soil and real estate transactions) which could be used in the CSSBDA web tool. Develop the preliminary specification for the CSSBDA and articulate the methodology and data to be used in the CSSBDA.
Loop 2 City of Lyon, France	Pilot testing of the online version of the CSSBDA in the City of Lyon in France from March to August 2025. Planning work activities to adopt feedback from pilot testing in Lyon. Preparing for scaling of the CSSBDA to the French national level.
Loop 3 France, (Finland, Germany, Luxembourg, Italy, Spain)	Implement the CSSBDA at the national level in France. Launch a Facebook Ad Campaign to reach a targeted audience. Explore the CSS risk level and insurance framework in five other EU countries. Based on CMIP6 climate models estimate future changes in the occurrence of deep soil (60-100cm) drought, which correlate with building damage caused by CSS events, across the European continent.
Publications and other communication materials	
Deliverables: D3.11, D3.6, D3.5 **Report:** "Risk Alert Briefing: Clay shrink–swell property damage and the increasing protection gap in Europe" **Blog:** Clay Shrink Swell causes property damage and financial risks for homeowners **Event:** Webinar: Clay shrink–swell property damage and the emerging insurance protection gap in Europe, 24 Apr 2026	

Agriculture insurance pilot Task 3.3	Partners: **BSC CNS**, LocalTapiola, AXA Climate, FMI, POLIMI, Amigo, CMCC
Hazards/risks: agricultural losses due to hydrometeorological hazards	
Aims: To develop parametric and data-driven insurance solutions for the agricultural sector, integrating high-resolution climate data, stakeholder input, and European-scale modelling capacities. Develop a **web tool for co-designing index-based insurance (Ibl) (tool named: CoDepi)**. and demonstrate **Shiny app tool on Seasonal Forecasts for the Olive Oil Sector in the Iberian Peninsula**.	
Target groups: farmers, agriculture experts, insurance companies, authorities	
Loop 1 Finland	Explore the market potential of parametric weather hazard insurance for cold climate agriculture. Conduct farmer survey to assess perceptions of climate risks and insurance, and willingness to adopt parametric products.
Loop 2 Spain, Italy	In-depth stakeholder engagement and co-development of an index-based insurance concept tailored to olive tree farmers against drought in Andalusia, Spain. Farmer surveys in Spain and Italy to understand climate risks/losses, coverage gaps, climate insurance use, Ibl awareness, as well as co-design related issues. Implementation of CoDepi tool for co-designing index-based insurance. This tool CoDepi, which is the key contribution of the pilot, visualizes how adapting key base index parameters such as the trigger thresholds, coverage, payout frequency, affect historical payouts and configures the parameters appropriately to match historical payouts to farmer- reported ”bad years” to minimise basis risk, which is the key limitation of Ibl. The purpose of the tool is to overcome this limitation to make an Ibl solution feasible.
Loop 3 Spain, Italy, Boreal region	Demonstration of seasonal forecast service based on the ECMWF seasonal prediction system, distributed through the Copernicus Climate Change Service (C3S) to provide early warning and support for farmers. Workshop for farmers, owners of large agricultural enterprises, and sector technicians active in olive cultivation in Bari region (Italy). Maturity and gaps study on seasonal prediction for Boreal and Arctic agriculture and food systems.
Publications and other communication materials	
Deliverables: D3.12, D3.8, D3.7 **Blogs:** - Majority of Finnish farmers recognise the impact of climate change, but lack tools to manage weather-based risks - The role of index insurance in Agriculture in the face of Climate Change **Events:** - Webinar: Farmers First: Insurance that works for farmers, 25 Mar 2025 - Webinar: Market Feasibility of Index-Based Climate Insurance for Mediterranean Agriculture: Results from the PIISA Food & Agriculture Pilot, 16 Apr 2026	

Forest windthrow insurance pilot Task 3.4.1	Partners: **AXA Climate**, Amigo, FMI, CMCC, Tyrsky
Hazards/risks: forest damage due to strong winds	
Aims: Examine indemnity and parametric climate-sensitive insurance concepts for forest damage. Co-develop parametric insurance products for windthrow damage. Integrate forest characteristics (such as species composition and stand structure) to create a forest vulnerability map and develop a Wind Power Exposure Index (WPEI), taking wind speed, wind direction, and storm duration into account. These two components can be used to enable estimation of expected storm damages at a forest-stand level, and support insurance product development and pricing.	
Target groups: forest owners and managers, insurers, forestry stakeholders	
Loop 1 Bavaria, Germany, France	Build strong partnerships with forest owners, insurers (AXA Germany) and technical experts (Arco-Zinneberg). Prioritize risks to forests and developed conceptual insurance models for multi-peril coverage, addressing abiotic and biotic threats including windthrow and wildfire risks. Develop a wind hazard model and identify data sources.
Loop 2 Germany, France, Ireland, Denmark	Expand the modeling beyond the initial pilot region and focus on testing its transferability in new contexts with available data. Vulnerability Model Validation and replicability testing with Eowyn storm in Ireland. Development of a new index for windthrow parametric structures: Wind Power Exposure Index (WPEI). Pricing comparisons between the parametric product and traditional covers to understand willingness to pay.
Loop 3 Atlantic, Continental and Boreal region	Consolidating the hazard modelling and pricing developments, validating insurance concepts relevance for stakeholders, strengthening climate service components, and defining a pathway for replication beyond the pilot region. Organisation of webinar, performing stakeholder validation and conducting a replicability assessment.
Publications and other communication materials	
Deliverables: D3.13, D3.9 **Info Card 3:** "Barriers and opportunities for Natural Risk Insurance" **Blogs:** "Quantification of forests adaptation measures for insurance application" **Events:** - Webinar: Adaptive Forest Management and Policy to Tackle Climate Risks (jointly with SWIFTT), 11 Sep 2025 - Webinar: Climate resilient natural resources management: simulation-based approaches, forest insurances and climate services (jointly with EU PRECILIENCE), 9 Feb 2026	

Wildfire insurance pilot Task 3.4.2	Partners: **AXA Climate**, FMI, CMCC, Tyrsky
Hazards/risks: wildfires	
Aims: Integrate adaptation measures into parametric wildfire insurance design, allowing risk reduction efforts to be explicitly modelled and priced, focusing on a pilot region in Central Portugal. Develop methodology to simulate burn probabilities with fire spread models under different fuel management scenarios to reduce fire risk, and using that to develop an insurance framework, showcasing price reductions linked to the adaptation measures.	
Target groups: forest owners and managers, insurers, local communities, authorities	
Loop 1 Central Portugal	Select pilot areas with local stakeholders (AGIF). Gather key datasets to map current wildfire risks. Perform a systemic review and assessment of AGIF's planned adaptation and mitigation plans based on Portugal's National Adaptation Plan, which were used to develop various wildfire mitigation scenarios.
Loop 2 Central Portugal	Calibration and comparison of two fire spread models (MTT and WISE). Simulation of burn probabilities under different fuel management scenarios. Building the insurance framework. Construction of exposure layers for forests and buildings. Estimation of premium reductions under different adaptation scenarios.
Loop 3 Portugal, Boreal region	Consolidating technical results, validating them with stakeholders, and exploring pathways for replication and operational development. Plan for continuing development and implementation of WISE fire spread model to the Destination Earth's Climate Change Adaptation Digital Twin.
Publications and other communication materials	
Deliverables: D3.13, D3.10 **Blogs:** "Quantification of forests adaptation measures for insurance application" **Events:** - Webinar: Adaptive Forest Management and Policy to Tackle Climate Risks (jointly with SWIFTT), 11 Sep 2025 - Webinar: Modelling as a tool to understand wildfire risk and risk reduction potential (jointly with DestinE Climate Change Adaptation Digital Twin), 13 Nov 2025 - Webinar: Climate resilient natural resources management: simulation-based approaches, forest insurances and climate services (jointly with EU PRECILIENCE), 9 Feb 2026	

2.2 Guidance for setting up and operating pilots

WP3 Pilots started in month 4 (August 2024) of the project with preparation of guidance for pilots D3.1 "Guidance on setting up Pilots, living documents and coordinated approach for surveying" (Trentini et al. 2024). Guidance was put into practice with partners and in targeted co-design meetings between WP3 leads and pilot leads. Detailed Loop 1 plans for each pilot were developed in so-called "living documents" which were also used to report progress and achievements, obstacles and their solutions. Piloting was organised into segments, which provided a common framework for all pilots while remaining flexible and adaptable to the specific needs of each Pilot. WP3 "Pilots" lasted 30-months (August 2024 – March 2026) which consisted of 2-month set-up, 27-month operation and 1-month reporting periods.

Co-creation was one of the key development methods used in piloting (Soini et al. 2023). In PIISA, co-creation mainly consisted of three types of activities:

- Co-design: the process of working with stakeholders to design the objectives, activities and scope of the pilot.
- Co-development: the process of working with stakeholders to develop new knowledge, tools, products or other solutions jointly. This phase includes iterative collection and taking into consideration the feedback from the stakeholders/users.
- Co-delivery: the process of collaborating with stakeholders and end-users to apply and test aspects of the created solution. Depending on the maturity level of the solutions, they were tested and validated in controlled to operational environments.

Figure 1 presents PERT diagram of WP3 Pilots from the PIISA Grant Agreement containing development phases (Loops) and timetables. As piloting progressed it became necessary to adjust the timetable, partners roles and work as well as internal and external communication. The adjustments were based on feedback compiled from stakeholders and users during the piloting period and due to co-operation opportunities arisen.

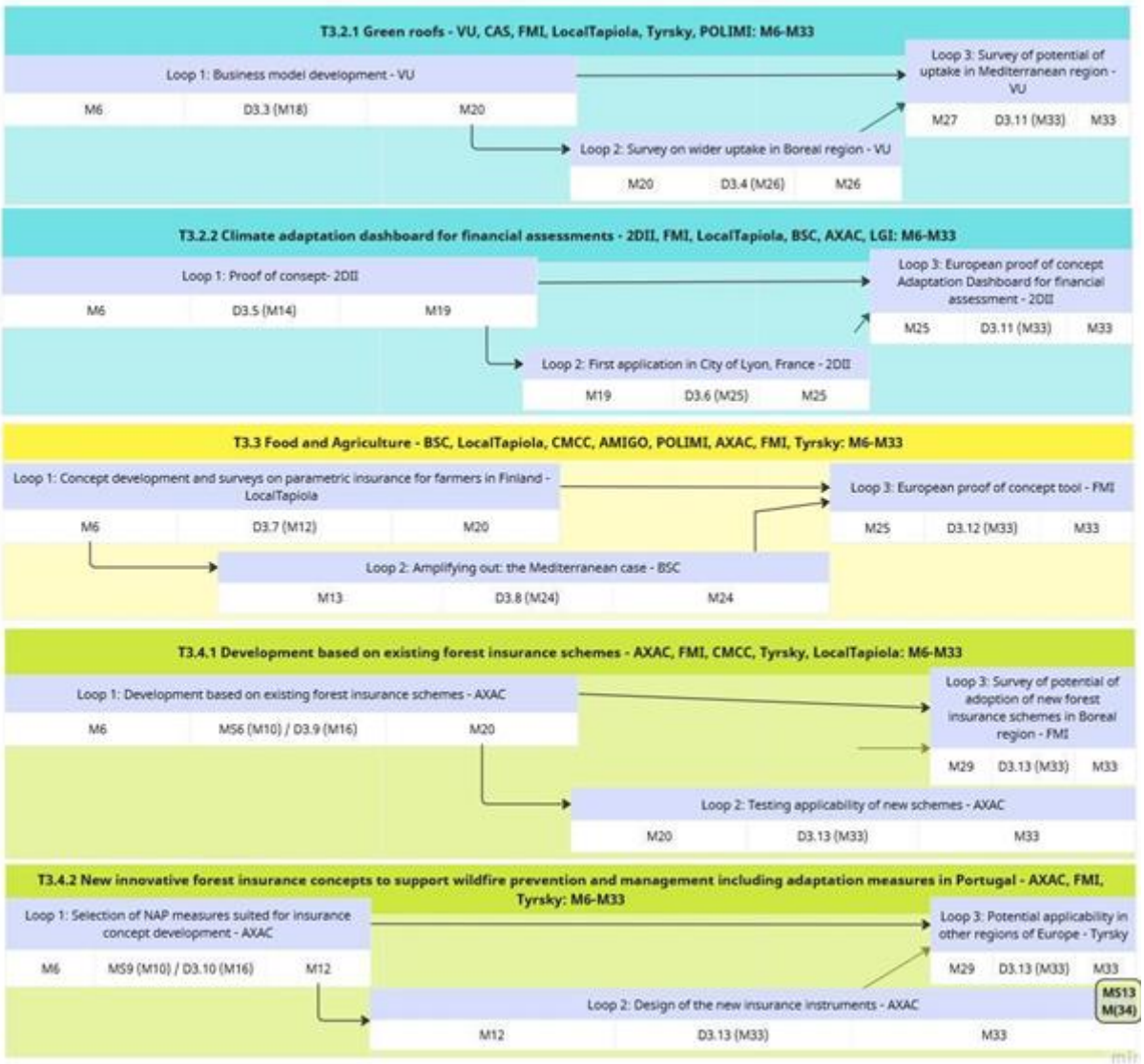

Figure 1 Original PERT diagram for pilots from the PIISA Grant Agreement. Shown are sub-tasks of WP3 that perform piloting in three Loops, start and end-months of Loops, and Deliverables (D) and Milestones (M) accomplished. Sustainable Finance Observatory (SFO) was formerly Asso 2° Investing Initiative (2DII).

2.3 Procedures for pilots' "End of Loop Surveys"

The PIISA project was conducted in close interaction between partners and key stakeholders and/or users to ensure a dynamic exchange of information and an effective exploitation of results. A regular survey to collect feedback from all five pilots was organized. Four questionnaires were used to survey pilot advancement and gather feedback. In the beginning of piloting, questionnaire on expectations, and later, three questionnaires after each Loop. Survey contained both multiple choice and open-ended questions. Main purpose of questionnaires was to collect feedback on how the piloting was progressing and what could be improved for the next Loop. Pilot surveys were sent to 1) experts leading and participating pilots, and 2) stakeholders and/or end-users of pilots. Surveys contained 10-13 questions for all, and in addition ca. 10 questions for pilot partners and 3 for stakeholders.

The questions were modified according to the experiences during the previous Loops and needs arising during the project. Within the rounds of the surveys, questionnaires were similar for all five pilots. Questionnaires are documented in three versions of PIISA deliverable "Survey for mapping Loop feedback for collecting iteration needs" (Reports can be provided by the author upon request).

In the following section, we discuss the main challenges and obstacles encountered during piloting and those that rose from the surveys as well as reactions to solve or get around them. For analysis we utilise survey responses complemented with input from the key partners of the pilots.

3 Main obstacles and opportunities encountered and their reactive measures in PIISA pilots

Material and their analyses in this section are organized in chronological order to replicate how things actually unfolded. We will not present a comprehensive analysis of what went right and wrong at each stage of the piloting process. Instead, we identify key negative and positive issues for consideration related to operation of pilots (e.g. the co-creation activities, external and internal communication, and co-operation activities) which required reactive measures and/or decision-making during the piloting phase. Those measures were performed by WP and pilot leads, sometimes in consultation with other pilot partners. There were usually several contributing factors that triggered reactive measures, such as challenges identified by partners, feedback (e.g. from end-of-loop surveys, presentations, tool testing, PIISA Advisory Group), and opportunities encountered outside PIISA.

The main findings of survey responses and other challenges or opportunities identified by pilot partners are summarised in the following sub-sections which are organised in chronological order under sub-headings of loops. A more detailed analysis of the replies to survey questionnaires followed also roughly the timeline of the end-of-loop surveys. It is presented in table-style format in Appendix 2.

3.1 Pilot expectations survey

In the beginning of piloting, stakeholders were not totally familiar with pilots' aims and workplans. They had expectations which were clearly out of the scope for PIISA piloting. Feedback revealed also stakeholder needs that solutions under developments were going to address. This gave confirmation that the plans and aims of pilot were moving in the right direction. No major adjustments were made to the planned work at this stage.

3.2 Key challenges and actions: loop 1

A general comment across pilots was that time for pilot work was considered suitable. Answers included also input from stakeholders which signalled that engagement had been meaningful and not too extractive (Gudek et al. 2025). An issue, soon solved by project management, was that some project partners had difficulties accessing the joint project platform in Teams. A need for co-operation with other wildfire projects was noted. In general, pilots started searching for collaboration with other projects and/or engage more stakeholders. Some confusion was in roles and tasks of partners in pilots. Pilot leads and co-leads were named. Partners roles in each loop were clarified.

Preparation of pilot Roadmaps

To communicate PIISA partners and stakeholders how the pilots will operate to obtain desired outcomes, all PIISA pilots prepared Roadmaps. They were used as strategic planning tools

(rather than a fixed document that captures all details) to define goals and major steps to reach them. Roadmaps helped coherently organise project resources to contribute to the overall aims of the PIISA project.

Narrowed focus for the clay soil shrink-swell pilot

In the clay soil shrink-swell pilot, based on experience from the development of the preliminary specification for the CSSBDA and articulating the methodology and data to be used in the CSSBDA as well as feedback from testing the preliminary version of the web tool in the City of Lyon, it was decided that the next steps during Loop 3 needed to primarily focus on replicating the tool in other cities or regions in France. Two principal reasons were:

1) The web tool synthesised information about the French state catastrophe naturelle framework and how this state framework working with commercial home insurance cover may leave gaps in insurance cover for French homeowners. This information is French specific and shapes a lot of the user journey. Therefore, it is crucial to focus on producing a functional web tool that can be tested with large numbers of users.

2) Replicating the web tool in other countries will require public databases to be available in the relevant country OR different methodological assumptions – both of which will be too time intensive and costly for the pilot resources.

3.3 Key challenges and actions: loop 2

There had been changes in experts on the BSC team. New BSC experts were included in the team and the workplan was reorganised. In some pilots, Loop 2 tasks took longer than planned, therefore, remaining tasks were prioritized.

Strengthening co-operation with other projects

Forest windthrow insurance and Wildfire insurance pilots deepened the co-operation with the SWIFTT (Satellites for Wilderness Inspection and Forest Threat Tracking) project. To increase the interest in the project outcomes, projects jointly arranged webinar, including high-level forest policymakers and short presentation from other forest projects, titled “Adaptive Forest Management and Policy to Tackle Climate Risks”. To link with the wider wildfire research and development work in Europe, Wildfire insurance pilot co-organized with the Climate Change Adaptation Digital Twin (Climate DT) initiative a joint webinar on wildfire modelling.

Reaching out to public and experts

Furthermore, pilots wrote three blogs and co-authored an Info Card which are available at the PIISA website. In addition, two blogs were published in 2024. PIISA pilots were presented in several webinars and conferences. (Berninger et al. 2026)

3.4 Key challenges and actions: loop 3

Communication and engagement to increase uptake and impact of pilot tools and results

Forest pilots organized jointly with PRECILIENCE (Precision climate resilience for agriculture and forestry sectors in the European boreal regions) project a webinar covering climate change adaptation in forests, focusing on insurance options and introduced new insurance concepts for wind and wildfire damage. Participants also shared their climate service needs for improved risk management.

To open impact pathways for pilot tools and results the Agriculture Insurance pilot organised an event on “Market Feasibility of Index-Based Climate Insurance for Mediterranean Agriculture”. The clay soil shrink-swell pilot held a webinar to draw attention to this emerging risk and protection gap to support informed discussion on the implications of climate-driven CSS property damage for housing resilience, insurance markets and climate adaptation. The webinar was also used to launch a Risk Alert Briefing on CSS. PIISA webinar “From Pilots to Practice: Replicating Climate Adaptation Solutions for Insurance Markets” presented key results from all five pilots to insurance professionals, public authorities, climate service providers, researchers, and stakeholders interested in scaling climate adaptation solutions.

Reaching out to public, experts and academia

Five peer-reviewed scientific articles related to pilots have been published or are under review at the time of writing this report.

4 Recommendations and Discussion

In this section we present a compilation of observations and recommendations for piloting grouped under three sub-categories. The list includes also suggestions for improvements and solutions for future projects. To conclude, we discuss briefly the data underlying the recommendations.

Stakeholders (including potential end-users)

- At the beginning of the piloting stakeholders may not have a comprehensive understanding of the aims of the pilot and planned work. Some of the out-of-scope pilot expectations can be appreciated as topics for further work.
- It is important to encourage stakeholders to provide constructive feedback and to find out if they believe the planned work will facilitate collaboration.
- Reliance on just one stakeholder is a risk as the stakeholder may suddenly withdraw from the pilot.
- Stakeholder engagement is a key success factor. Ensuring active contribution from consortium partners to engagement work is valuable, especially if the partners are based in different European regions.
- If all stakeholders cannot be engaged in the pilot, prioritise one group.
- Not all stakeholders can be engaged at the same level, however, even those with low level of participation may provide valuable feedback.
- Having local organisations responsible for implementing risk reduction measures and authorities developing adaptation policies active in co-creation was very important for the success of the wildfire pilot in Portugal.

Pilot leaders and managers

- Pilot leaders should be prepared to redistribute tasks and responsibilities, if piloting does not progress according to plan. Versatile expertise of partners can be an asset.
- Provide aid, if project partners can't use project or pilot platform.
- Co-operation with related projects and activities has proved to be useful in many ways. On the other hand, time and resources are limited during piloting, so prioritization is needed.
- In general, resources are limited and they may not allow all planned sub-tasks to be implemented.
- Piloting is intensive, therefore, if ways to improve piloting practices are discovered, share and use them.
- It is important to share recognition for the work among partners.

How to improve piloting (based on insurance related experiences)?

- Understand the legal and regulatory landscape early, before designing the pilot.
- Plan the focus of the activities in the study regions according to preliminary analyses on maturity level of solution being piloted.
- Pilot products targeting multinational markets have more potential testing regions if piloting is performed well. Pilots will increase knowledge and capabilities to lead and perform piloting in future projects, even if the pilot didn't reach maturity for the market.

- Targeted funding maybe needed for non-commercial piloting to reach wider uptake and impact.
- For novel solutions, a bottom-up approach is often more appropriate than top-down to ensure demand-driven design.
- Account for existing market dynamics, including local competition, which can both influence and be influenced by new solutions.
- Complement survey insights with additional, richer data, especially when sample sizes are limited.
- Expect variation in pilot design and outcomes across regions due to differences in data availability, scope and stakeholder engagement.
- Developing a concrete use case during piloting helps demonstrate feasibility and improves stakeholder understanding of the solution.
- Desing science approach in piloting was useful because practical solutions required innovation (e.g., new algorithms, model development, web tools).
- Agile development improved efficiency through iterative, incremental work and learning from feedback to continuously improve solutions.
- Managing expectations early is key. For example, index-based insurance will not match all perceived loss events and users must tolerate some basis risk.
- It is important to continuously communicate with the insurance industry throughout a project that focuses on insurance. Not only does this add valuable insights to the research carried out, but it also allows for more effective, meaningful and demand-driven results.

Discussion

In the PIISA project, including pilots, diverse elicitation techniques were used (e.g. surveys, interviews and workshops) for collecting data and input into service and product design (e.g. views, requirements, feedback, contacts) from many stakeholders and potential end-users. However, the number of replies to the end-of-loop surveys was not large and varied a lot (Table 1).

There were four questionnaires in roughly two years, so stakeholder fatigue is one possible explanation. On the other hand, the stakeholders in the green roof pilot were mostly experts that were just consulted once (e.g. interviewed on their opinion and ideas on a topic). Perhaps, the loop surveys were therefore seen as a bit irrelevant for many of them. Such factors may partly explain the low numbers of responses. For the clay soil shrink-swell pilot the main efforts to collect feedback from users and stakeholders were performed during the testing of the Clay Shrink Swell Building Damage Assessor (CCSBDA) web tool during two testing periods in Loops 2 and 3. There may well be different reasons in the other pilots which we are not aware. Because all stakeholders were not engaged at the same level; therefore, the findings of the end-of-loop surveys may be interpreted differently.

The PIISA project involved key stakeholders in the work as early as the planning phase. Pilots had limited resources, and it was not possible to significantly enlarge service and product demonstrations outside pre-selected end-users – a notable exception being the CCSBDA web tool. To more thoroughly assess the potential for a wider uptake of pilots' solutions and ability to

enhance climate change adaptation, it would be central to continue demonstrations and engage stakeholders and users e.g. via MIP4ADAPT platform.

Table 1 Number of answers to each end-of-loop survey per pilot.

Number of answers	Green Roof Insurance	Clay shrink-swell pilot	Agriculture pilot	Windthrow insurance pilot	Wildfire insurance pilot
Expectations	7	3	14	6	5
Loop 1	4	8	2	3	6
Loop 2	7	1*	4	3	4
Loop 3	4	3**	5	2	5

* Main activity to compile feedback was done during the period from March to August 2025 from users of the beta-version of web tool “the Clay Shrink Swell Building Damage Assessor”.

** Main activity to compile feedback was done during the period from December 2025 to January 2026 from users of the beta-version of web tool “the Clay Shrink Swell Building Damage Assessor”.

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Appendix 1: PIISA pilot deliverables

PIISA Pilot deliverables with links

Number	Deliverable name	Link
D3.1	Guidance on setting up Pilots, living documents and coordinated approach for surveying	PDF
D3.2	Summary of lessons learned	This report
D3.3	Plan for evaluating barriers and enablers for green roof insurances in the Netherlands	PDF
D3.4	Results of survey on applicability in Boreal region	PDF
D3.5	Preliminary dashboard specifications	PDF
D3.6	Lessons learned from testing usage in Lyon, France	PDF
D3.7	Potential for agricultural insurance in Boreal region	PDF
D3.8	Insurance services for Mediterranean region	PDF
D3.9	Concept of climate change risk sensitized forest insurances	PDF
D3.10	Preliminary design of the new insurance instrument	PDF
D3.11	Pilots for Cities and well-being	PDF
D3.12	Pilots for Agriculture	PDF
D3.13	Pilots for Forests	PDF

Appendix 2: Analysis of the end-of-loop surveys

In the analysis of the end-of-loop survey replies, we identify outstanding issues for consideration related to the "co-creation activities", external and internal communication, and co-operation activities which required reactive measures and/or decision-taking during pilot period.

Table A1. Timing of end-of-loop surveys of five pilots (see text below for pilot "short names")

End of surveys	Green Roof	CSS	Agri	Wind	Fire
Expectations	Collection of answers: January 2024				
Loop 1	Collection of answers: October 2025				
Loop 2	Collection of answers: June 2026				
Loop 3	Collection of answers: April 2026				

Analysis is presented in the table below. Expectations and feedback from the end-of-loop surveys are on the left column and reactive measure and/or conclusion on the right. In this Appendix 1, we use the following "short names" for pilots:

- Green Roof: Green Roof insurance pilot (PIISA Task 3.2.1)
- CCS: Clay shrink-swell pilot (PIISA Task 3.2.2)
- Agri: Agriculture pilot (PIISA Task 3.3)
- Wind: Windthrow insurance pilot (PIISA Task 3.4.1)
- Fire: Wildfire insurance pilot (PIISA Task 3.4.2)

Pilot expectations survey

Expectation(s) expressed in survey	Reactive measure(s), conclusions
Green Roof: cover NBS solution development and technical aspects of green roofs and walls	Not topics of PIISA, not addressed
Green Roof: When asked about expectations related to running pilot, some partners raised worries related to sufficient engagement with local level stakeholders.	National and local stakeholders in Netherlands were engaged in Loop 1 and this continued throughout the piloting period
CSS: "When, and how, can a person participate or at least follow the piloting session"	Communication via PIISA channels when tool testing period starts
CSS: "how can I monitor CSS risk? Are there any early warnings for these? What can be done to avoid these risks during a dry season?"	Not addressed in pilot because the tool will be rather static, not operative. Noted as development idea for PIISA legacy.
CSS: "To get new business ideas"	Not deliberately addressed in pilot
Agri: "We need to co-identify the concrete demand from the users/insurance company,	Set-up a targeted case study.

in order to be able to define actual climate indices, thresholds, triggers, etc."	
Agri: "What is piloted? An index or a service. Where is the demonstration and when can that be seen and tested?"	Confirmation that a targeted case study is needed.
Agri: "Consequences of climate change, needs in adaptation in agriculture"	Not topics of PIISA, not addressed.
Agri: Developing insurance products and climate services that interests farmers (mentioned 3 times).	Reaction: prepare a focused use case for piloting and include agri-sector in WP1 survey
Agri: Can PIISA explore agricultural insurance and carbon capture? (7 answers)	Not addressed in pilot. Noted as a development idea for PIISA legacy.
Agri: "to gain new ideas how to direct the research that is related to agriculture and food production"	Innovation of research is not a core topic of pilots.
Wind: Learn about synergies of different forest usage and forested land as carbon storage. What kind of role could insurance have?	No resources to develop carbon capture insurance. Noted as a development idea for PIISA legacy.
Wind: Concerns about scalability: climate insurance and national / local emergency funds are quite linked, and we have no visibility on the different realities.	Pilot is not focusing on countries where emergency funds are used to cover forest damage
Wind: More inputs from WP1 needed on the forest markets regarding climate changes: the market challenges, financial risks and how insurance should be positioned as an alternative to emergency public fundings.	Pilot is not focusing on countries where the emergency funds are used to cover forest damage

End-of-loop 1 survey

Feedback(s) from survey	Reactive measure(s), conclusions
Green Roof: roles of partners and organization the work were not clear	Reactions: Organise Green Roof pilot meetings with all partners contributing to Loop. Define leads and co-leads of pilot.
Green Roof: Need to compile wider stakeholder group in NL.	Engagement was widened.
Green Roof: It was a disappointment that there is very limited interest by insurers to include these types of incentives in their business strategy	Lack of awareness is a relevant factor. Solution: development of a web tool for insurers on green roofs
Green Roof: a more clear business case needs to be made for encouraging policyholder to adopt green roofs	Estimate economic, regulation and other conditions supporting adoption of green roofs
CSS: Roles of partners are clear	It has been possible to follow the workplan
CSS: Need to increase communication within PIISA partners	Reaction: pilot partner meetings and preparation of a roadmap resulting in a 1-mo delay in D3.5

CSS: External communication	Blog was prepared
Agri: some partners had no access to PIISA Teams.	Reaction: use also SharePoint links and email
Fire: Communication to and interaction with other EU projects working with wildfire risks	Reaction: organize a joint wildfire webinar with Climate Digital Twin, invite presenters outside PIISA, and distribute invitations widely
Fire: include more local actors in Portugal in the implementation and scaling phases.	Reaction: insurance concept was "discussed" with local stakeholders; scaling and implementation stage was not reached
Fire: AXA Climate plan was to operate with one fire spread model	Inclusion of the FMI fire model adds value to piloting and results
Fire: a lot of the local stakeholders are comfortable only in Portuguese, so it is difficult for many other stakeholders to be actively involved from the project	Development focuses on Portugal to achieve usable results. Pilot progress and results need to be communicated actively
Fire: Share the planning and the presentations before the meetings to boost discussion.	Reaction: this was mostly done during the following Loop
Fire: insurance products that build in price reductions due to adaptation measures are very new in the market, and can have very promising lead on effects if successful	Pilot is doing groundbreaking work

3.3 End-of-loop 2 survey

Feedback(s) from survey	Reactive measure(s), conclusions
Green Roof: Insurance companies in Finland showed relatively little interest.	Reactions: 1) complement webinar with make interviews (13 interviews were done) 2) survey other stakeholders (authorities, builders)
Green Roof: Compilation of obstacles and suggestions on how to advance green roof adoption in Boreal region	Reaction to results of pilot activities in Finland
Green Roof: Submitting the first paper to a peer-reviewed journal!	Reaching out to wider academia
Green Roof: more information is needed	Reaction: CAS web tool contains basic information to insurers
CSS: engage with decision-makers, businesses, government, citizen (organisations)	Conclusion: prepare awareness raising material inviting to informed discussion and wider action
CSS: feedback was collected from users of CSS web tool (beta version) in Lyon *NB: Feedback collection reported in D3.6*	*Reaction: feedback was utilized to develop version for the whole France in Loop 3*
Agri: there could have been 1-2 short meetings to discuss progress and challenges	Reaction: bilateral and pilot partner meetings were organized during Loop 3
Agri: We trust that a product will come out that is in-line with the needs of the market and the partners (reply in Spanish)	Conclusion: agriculture sector stakeholders crave insurance products tailored for agricultural production sector

Agri: this maybe an issue as there does not seem to be clear afterlife for pilot's results	Reaction: open access code for CoDepi tool
Wind: partnerships with Arco Z and AXA Germany (local partners) went well	Conclusion: Vulnerability maps and the identification of the new index resulted from co-development
Wind: developing indices and models to measure windthrow is harder than planned and is requiring a lot of troubleshooting due to data availability and harmonization issues.	Reaction: Originally the follow-up was planned to be in Germany but France and Ireland were used due to data availability issues
Fire: It might be difficult to implement the model developed in the pilot in other regions due to the complexity to run the models (more time than planned was used)	Reaction: WISE fire spread model used to calculate burn probabilities will be implemented into Climate Digital Twin of Destination Earth
Fire: model calibration took longer than planned	Reaction: on-site workshop in Portugal was cancelled which was undesirable
Fire: Adapting the US wildfire pilot for Europe is a great motivation!	David Jones (UCLA, US) appreciated the use of scenarios based on NAP in burn probability modelling

End-of-Loop 3 survey

Feedback(s) from survey	Reactive measure(s), conclusions
Green Roof: The work went generally well. The scientific contributions of the pilot are of good quality.	There was time to prepare scientific research articles.
Green Roof: Two biggest obstacles were: limitations in availability of insurance solutions and lack of market demand	See D4.7 Replicability Roadmap
CCS: A more ideal timeline would have been to contract developer at least 6 months ahead of the deadline, from a project management perspective.	A more flexible schedule makes project management easier.
CCS: A growing protection gap was identified in all six countries studied.	An alert briefing was prepared to raise awareness and initiate political debate.
Agri: Some of the potential insurance users responded that they are not familiar with pilot results.	Additional event was organized to present results and discuss with insurance companies about market feasibility.
Agri: Learned new things that I can apply in my work, gained new networks, Got new business ideas. Generally, the development of indexed insurance could be interesting.	There was interest in Ibl among insurers, but no concept was developed during the pilot in Spain.
Wind: Replicability in Boreal region was not pushed as far as expected due to lack of network.	There engagement to establish Boreal network relevant for pilot should have been started earlier.
Wind: Lots of awareness was raised. The publication of the deliverable makes it easily accessible for the insurance industry. Wind index is replicable and scalable across EU with transparent and open source data inputs.	Wind pilot reached “beta product” level and has good prospects for replicability in large parts of EU.

Fire: See the strong positive feedback made by the market when presenting the outputs, the innovation is really there, really felt like an important work achieved.	All the work done was presented in a meeting coordinated by the local patterner and feedback was asked.
Fire: Very well went engagement and coordination with AGIF and Portuguese government authorities, wildfire modeling, inclusion of adaptation into the insurance pricing with concrete differences and price reductions viewed.	The project was conducted as planned, with iterations on the methodology based on inputs from the local stakeholders. Establishing new networks was relevant.