PIISA

Piloting Innovative Insurance Solutions for Adaptation

D4.7 Report Title: Replicability Roadmap

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Summary

Deliverable D4.7 – Replicability Roadmap is the final output of Task 4.5 under Work Package 4 (WP4) of the PIISA project. Its objective is to assess and structure how the results generated by the PIISA pilots can be replicated, transferred, or adapted to other European contexts beyond the original pilot locations, while remaining aligned with local regulatory, market, and institutional conditions.

The roadmap builds on a comprehensive replicability assessment carried out across five WP3 pilots covering agriculture, forestry, wildfire risk, urban nature-based solutions, and household exposure to climate risks. Replicability is analysed through a harmonised framework encompassing four dimensions: technical feasibility, policy and regulatory fit, market readiness, and operational scalability. This assessment is informed by structured questionnaires completed by pilot leaders, technical and market deliverables produced under WP1 and WP3, and an update phase conducted in October–November 2025.

In addition, the roadmap integrates insights from the first PIISA exploitation workshop held on 5 December 2025, during which partners jointly identified emerging exploitable results, exploitation pathways, barriers and enablers, and concrete priority actions. These inputs ensured that the roadmap is grounded in pilot realities and reflects the maturity level reached by each solution at the end of the project.

The analysis confirms that PIISA pilots follow differentiated replication logics rather than a single scaling pathway. While pilots such as food and agriculture insurance and forest insurance demonstrate relatively strong potential for service or model replication, others, such as green roofs insurance and the Clay Shrink Swell Building Damage Assessor, are more suited to knowledge transfer, awareness-raising, and policy-intelligence-driven replication. The wildfire insurance pilot occupies an intermediate position, with solid technical foundations but significant market and cost constraints.

The Replicability Roadmap is presented at two complementary levels. At project level, it identifies cross-cutting strategic priorities, common enabling conditions, and shared barriers affecting replication across sectors and regions. At pilot level, it defines post-project replication pathways, outlining the replication focus, priority actions, key dependencies, and indicative time horizons after March 2026. These pathways were validated with pilot leaders in early 2026 through targeted validation rounds.

Rather than constituting an implementation plan, the roadmap provides a strategic reference framework for partners, policymakers, insurers, and future initiatives seeking to build on PIISA results. It clarifies what forms of replication are realistic, under which conditions, and over what timeframe, while preserving flexibility for future institutional, policy, or funding developments.

Keywords

Climate adaptation; innovative insurance; replicability; exploitation; parametric insurance; nature-based solutions; wildfire risk; agricultural insurance; forest insurance; climate services; risk assessment; policy alignment; Horizon Europe.

Abbreviations and acronyms

Acronym	Description
BSC-CNS	Barcelona Supercomputing Center – Centro Nacional de Supercomputación
CAS	Climate Adaptation Services
CDI	Climate Dryness Index
CINEA	European Climate, Infrastructure and Environment Executive Agency
CSS	Clay Shrink–Swell
CSSBDA	Clay Shrink Swell Building Damage Assessor
DestinE	Destination Earth
ERA5	ECMWF Reanalysis v5
EU	European Union
FMI	Finnish Meteorological Institute
GA	Grant Agreement
KER	Key Exploitable Result
LGI	LGI Sustainable Innovation
NbS	Nature-Based Solutions
PIISA	Piloting Innovative Insurance Solutions for Adaptation
PO	Project Officer
R&I	Research and Innovation
SEAS5.1	ECMWF Seasonal Forecast System v5.1
SFO	Sustainable Finance Observatory
WPEI	Wind Power Exposure Index
WP	Work Package

1 Introduction

Purpose of the deliverable

Deliverable D4.7, the Replicability Roadmap, is the final outcome of Task 4.5 and has a clear purpose; to assess and document how the pilots carried out within PIISA can be replicated in other European contexts and how their results can be exploited to deliver lasting impact. Replication is understood here as more than copying a pilot from one location to another. It is about translating innovations into new institutional, economic, and social environments, while ensuring that they remain technically sound, financially viable, and aligned with local adaptation needs. The Roadmap is conceived as both a strategic reference and a practical guide, offering stakeholders a structured view of what is needed to move from demonstration results to broader deployment.

The deliverable is anchored in the objectives of Work Package 4, which is responsible for exploitation and uptake of PIISA results. WP4 connects the technical advances of the pilots in WP3 with the market insights generated in WP1 to build a coherent strategy for impact. In this context, the Replicability Roadmap is a bridge between pilot-level testing and the long-term scaling ambitions of PIISA. It defines how individual solutions can be transferred across regions and sectors, while also identifying common enabling conditions that can accelerate systemic uptake.

PIISA and its wider context

PIISA is funded under the Horizon Europe climate adaptation mission and addresses one of the mission's central challenges, to create actionable pathways for reducing climate risks by combining physical, organizational, and financial measures. The project's distinctive contribution lies in linking innovative insurance and risk-sharing mechanisms with concrete adaptation practices. As highlighted in the Grant Agreement, PIISA aims to "develop and deploy a range of insurance innovations that incite households and firms to adapt proactively, while also supporting public authorities in creating adaptation-promoting conditions".

The pilots span diverse contexts: agriculture in Spain and Finland, green roofs in the Netherlands, wellbeing-focused adaptation in Germany, forest resilience and wildfire insurance solutions developed with AXA Climate in Portugal and beyond, and the climate adaptation dashboard in France. Each of these pilots addresses real and pressing hazards, from floods and droughts to fires and biotic risks, and each offers insights into how insurance-linked adaptation measures can be made operational in practice.

These pilots form a portfolio of demonstrators that are not only sector-specific but also cross-cutting in terms of actors, governance structures, and policy relevance.

Scope of the roadmap

The scope of D4.7 is directly aligned with the description of Task 4.5. The task runs from Month 18 to Month 34 of the project and is designed to be completed once pilot demonstrations have reached maturity. By timing the roadmap to the later stages of PIISA, the consortium ensures that the replication analysis draws on complete and validated pilot results, rather than on preliminary assumptions. This timeline strengthens the robustness of the roadmap and increases its credibility with external stakeholders.

Furthermore, the roadmap is informed by multiple inputs. It incorporates market intelligence and insurance innovation analyses from WP1, particularly the focused market reviews (D1.4) and the report on the role of insurance in adaptation (D1.1). It integrates pilot findings from WP3, covering both technical performance and social acceptance. It also reflects structured replicability assessments carried out using a dedicated framework, and insights from an exploitation workshop that brought together the consortium to validate findings and identify enablers and barriers.

Framework for replication

Replication is assessed along four dimensions:

- Technical feasibility, meaning the capacity of solutions to operate under different biophysical and infrastructural conditions,
- Policy and regulatory fit, ensuring alignment with national frameworks and EU directives,
- Market readiness, addressing demand, affordability, and willingness of the financial sector to adopt the solutions, and
- Operational scalability, looking at whether delivery models, partnerships, and organizational capacities can support expansion.

This framework makes it possible to evaluate not only whether pilots can be replicated, but also what adaptations will be required. These adaptations may include adjustments in technical design, reconfiguration of technical or insurance processes, or targeted policy measures to create an enabling environment.

Contribution to exploitation and uptake

The Roadmap explicitly addresses the exploitation dimension of WP4. Replicability is treated as a pathway for market uptake, meaning that the analysis moves beyond feasibility and highlights how results can be transformed into tangible opportunities for insurers, policymakers, municipalities, and citizens. The deliverable identifies technical and process adaptations that must be undertaken, and sets out policy recommendations that can support adoption across different European contexts. Thus, it ensures that the pilots are not isolated experiments but stepping stones towards scalable solutions for climate adaptation.

Outcome orientation

D4.7 is not simply an analytical report. It is an action-oriented roadmap that defines the necessary steps to achieve replication and exploitation of PIISA results. It outlines a set of concrete actions at both the pilot and cross-cutting levels, structured into phases and timelines, and assigns responsibilities for follow-up. By doing so, it provides a shared reference for consortium partners and external stakeholders, guiding how the knowledge and innovations generated in PIISA can contribute to broader European adaptation efforts after the project ends.

2 Replicability versus upscaling: Clarifying the focus of this deliverable

In the context of climate adaptation projects, two terms are often used simultaneously but carry different meanings, replicability and upscaling. In the paragraphs below, the aim is to clarify their difference as it is important to set the scope of this deliverable.

On one hand, replicability refers to the application of a solution in a new location, sector, or institutional context. It is about understanding whether a pilot can be adapted to different regions, users, or regulatory frameworks. The key question is: can this work elsewhere? Replicability depends strongly on local policy conditions, data availability, and contextual fit. In PIISA, replicability assessments directly inform this Replication Roadmap (D4.7).

On the other hand, upscaling, in contrast, is about expanding the reach or intensity of a solution within the same or a very similar context. It involves amplifying coverage, investment, or the number of users. The guiding question is: can this work at scale here? Upscaling relies on operational capacity, resources, and sustained demand.

Within PIISA, upscaling is relevant for long-term sustainability and impact, but it is not the primary focus of Task 4.5.

To make this distinction more concrete, Table 1 below summarises the main differences between replicability and upscaling, highlighting their respective definitions, focus, dependencies, and relevance for PIISA.

Table 1 Distinguishing replicability from upscaling in the PIISA context.

Aspect	Replicability	Upscaling
Definition	Applying a solution in a new location or context	Expanding the reach or intensity of an existing solution
Focus	Adaptation to different regions, sectors, or users	Amplification of coverage, users, or investment in the same or similar context
Example	Transferring a climate insurance pilot from Finland to Italy	Expanding the same insurance product across all municipalities in Finland
Key question	Can this work elsewhere?	Can this work at scale here?
Dependencies	Local policy, data availability, context fit	Operational capacity, resources, demand
PIISA relevance	Core to the Replication Roadmap (D4.7)	Supports long-term sustainability and impact

The two concepts are closely connected but not interchangeable. Replicability often provides the foundation for upscaling. This means that solutions must first demonstrate that they can function in diverse contexts before they can be scaled broadly. Pilots that prove replicable are also more likely to be sustainable in the long term. In this sense, replicability and upscaling form a continuum of adaptation pathways.

Task 4.5, and therefore this deliverable, is specifically responsible for assessing replicability. Its role is to examine whether and how pilots can be adapted to new geographic, institutional, or sectoral contexts, to identify the technical, policy, and process changes that may be required, and to highlight which regions or sectors hold the highest potential for successful replication.

3 Overview of pilots

The PIISA pilots form the backbone of Work Package 3, providing real world contexts where innovative insurance concepts for climate adaptation are being developed and tested. Each pilot focuses on a specific sectoral or geographic challenge, ensuring that the project's findings reflect Europe's diverse risks and policy environments. Together, they create a portfolio of approaches that inform the Replicability Roadmap presented later in this deliverable.

3.1 Green roofs insurance pilot

- Lead partner(s): IVM/VU in collaboration with Climate Adaptation Services (CAS), FMI, LocalTapiola, Tyrsky and POLIMI
- Sector and challenge addressed: Urban adaptation and Nature based Solutions, with a focus on green roofs and insurance incentives.
- Target users: Insurance companies, with indirect benefits for municipalities and homeowners.

This pilot explores how insurance products can stimulate the adoption of green roofs as a form of climate adaptation in cities. It examines existing incentives, such as those offered by Dutch insurers and municipalities, and investigates how insurers can integrate NBS into their products. The pilot also considers contextual differences across Europe by extending its analysis to Nordic and Mediterranean regions, where climatic and structural conditions diverge significantly from those in the Netherlands.

This work is implemented through a three-loop structure, enabling the consortium to test, adapt, and validate the model in progressively diverse contexts. Each loop builds on the findings of the previous one, moving from local experimentation in the Netherlands toward broader European replication, as detailed below:

1. **Loop 1 – Netherlands**
    a. Business model development and pilot testing with Interpolis (Dutch insurer) and municipalities to incentivize policyholders to install and maintain green roofs.
    b. Focus: Product co-design, stakeholder engagement, and data collection on pluvial flood risk reduction, costs and co-benefits.

2. **Loop 2 – Boreal/Nordic region**
    a. Survey and assessment of wider uptake potential in European Nordic climates (Finland, Norway).
    b. Focus: Assessment of barriers and enablers to green roofs being adopted by insurers in colder and wetter conditions; through engagement of local insurers and municipalities (e.g. Helsinki, Turku, Tampere).

3. **Loop 3 – Mediterranean region**
    a. Survey and assessment of green roof insurance applicability in warmer and drier climates.
    b. Focus: Assessment for barriers and enablers to green roofs adaptation strategy under Mediterranean conditions; identification of regulatory or market enablers for replication.

3.2 Food and agriculture insurance pilot

- Lead partner(s): Barcelona Supercomputing Center (BSC CNS) in collaboration with LocalTapiola, AXA Climate, FMI, POLIMI, AMIGO, and CMCC
- Sector and challenge addressed: Agricultural insurance innovation, focusing on drought-sensitive crops and the use of climate services to close gaps in traditional risk-transfer mechanisms.
- Target users: Farmers, agricultural insurers, and public authorities involved in agricultural risk management.

The Food & Agriculture pilot 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.

Its main goal is to test how climate services and remote-sensing information can strengthen agricultural insurance design and improve farmers' resilience to drought and other weather extremes.

The pilot follows a three-loop structure, allowing the consortium to refine the approach across contrasting agro-climatic regions. Each loop builds on previous findings, progressing from design and co-development in Finland to validation and demonstration in Mediterranean contexts, and finally toward a European proof of concept, as detailed below:

1. **Loop 1 – Finland (Boreal Case)**
    a. Focus: Exploring the market potential of climate insurance, including parametric insurance, for Boreal agriculture, in collaboration with LocalTapiola and the Finnish Meteorological Institute (FMI).
    b. Farmer survey and market analysis were conducted to assess perceptions of climate risks, and climate insurance, including new insurance models, particularly willingness to adopt parametric products.
    c. The loop also examined regulatory and subsidy frameworks influencing agricultural insurance in Finland and comparable northern EU regions.

2. **Loop 2 – Spain (Mediterranean Case)**
    a. Focus: Co-development of an index-based insurance solution tailored to the southern European context, particularly Andalusia (Spain), where climate (drought) sensitivity and insurance protection gaps are pronounced.
    b. Active collaboration with farmer association and direct farmer engagement, along with the use of high-resolution climate data enabled the testing of model transferability in a co-design tool.
    c. Surveys and workshops explored markets gaps, feasibility, and operational integration of parametric tools in traditional insurance markets in Spain and Italy.

3. **Loop 3 – European Proof of Concept**
    a. Focus: Consolidation of insights from the Nordic and Mediterranean loops into a European-wide framework for climate-service-based agricultural insurance.
    b. This stage gathers continental datasets, stakeholder feedback, and cross-country comparisons to define guidelines for replicability and scalability across diverse EU agricultural systems.

3.3 Germany forest insurance pilot

- Country: Germany (Bavaria)
- Lead partner(s): AXA Climate.
- Sector and challenge addressed: Forest management and insurance for climate related risks, particularly windstorm damage.
- Target users: Forest owners, insurers, and forestry stakeholders.

The German Forest Insurance pilot develops both indemnity and parametric models for forest risks. It integrates forest inventory data, meteorological records, topography, and soil information to design vulnerability indices and pricing structures. The pilot is situated in Bavaria but is designed with transferability in mind, recognising that windstorm risk and forestry adaptation are common challenges across Europe.

3.4 Portugal wildfire insurance pilot

- Country: Portugal (Central region)
- Lead partner(s): AXA Climate.
- Sector and challenge addressed: Wildfire risk and the integration of adaptation measures into insurance instruments.
- Target users: Forest owners, local communities, policy actors, and insurers.

The Portugal pilot examines how wildfire adaptation measures can be embedded into insurance design, with a particular emphasis on parametric approaches. It works closely with national and regional authorities to align with Portugal's adaptation strategies and fire management guidelines. Simulation models are applied to high risk areas in central Portugal, supported by fire history and land use datasets.

3.5 Clay Shrink Swell Building Damage Assessor (CSSBDA) pilot

- Country: France (Lyon for pilot, national rollout in later loops)
- Lead partner(s): Sustainable Finance Observatory (SFO), with contributions from FMI and Amigo
- Sector and challenge addressed: Household vulnerability to clay shrink swell (CSS) and insurance coverage gaps.
- Target users: Homeowners, property stakeholders, and local authorities.

The Climate Adaptation Dashboard, also known as the Clay Shrink Swell Building Damage Assessor, is an online platform designed to inform households of their financial exposure to CSS related damage. It combines public property datasets with climate indices to create user friendly risk information. The pilot builds on the French context but is also exploring opportunities for replication at the national and European levels, depending on data availability and insurance frameworks.

Taken together, the seven pilots demonstrate the breadth of contexts in which PIISA operates, from urban infrastructure and wellbeing to agriculture, forestry, wildfire prevention, and household property risks. They represent a mix of northern, southern, and central European settings, with diverse policy environments and sectoral dynamics.

This diversity is intentional, ensuring that the Replicability Roadmap does not rely on a single case or sector, but instead reflects the variety of adaptation challenges faced across Europe.

The overview presented here provides a foundation for the next section, where the methodology for assessing replicability is introduced and applied systematically across all pilots.

To provide a concise reference, Table 2 below summarises the five pilots, highlighting their geographic focus, lead partners, sectoral scope, and target users.

Table 2 Overview of PIISA WP3 pilots with country, lead partner, sectoral focus, and target users.

Pilot	Country	Lead partner(s)	Sector and challenge addressed	Target users
Green Roofs Insurance Pilot	Netherlands (Loop 1); Nordic / Mediterranean regions (Loops 2–3)	IVM/VU & Climate Adaptation Services (CAS), with FMI, LocalTapiola, Tyrsky & POLIMI	Urban adaptation and Nature-Based Solutions (NBS) integrated into insurance products; promoting uptake of green roofs through insurer and municipal incentives	Insurers, homeowners, municipalities
Food & Agriculture Insurance pilot	Finland (Loop 1); Spain / Italy / Portugal (Loops 2–3)	Barcelona Supercomputing Center (BSC CNS) with LocalTapiola, AXA Climate, FMI & CMCC	Parametric and data-driven insurance for drought-sensitive crops and weather-related agricultural losses	Farmers, agricultural insurers, public authorities
Forest Insurance Pilot	Germany (Bavaria)	AXA Climate with FMI & CMCC	Climate-risk-sensitive insurance models for forest owners; addressing windstorm, drought, and pest damage	Forest owners, insurers, forestry authorities
Wildfire Insurance Pilot	Portugal (Central)	AXA Climate with FMI & CMCC	Parametric wildfire insurance integrating Nature-Based Solutions and prevention measures into policy design	Forest owners, communities, insurers, policy actors
CCSBDA Pilot	France	Sustainable Finance Observatory with FMI & Tyrsky	Digital dashboard to raise household and municipal awareness of climate-related property risks (e.g. shrink–swell soils) and link to insurance value	Homeowners, insurers, local authorities

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4 Replicability assessment framework and methodology

The purpose of the replicability assessment is to provide a structured and transparent approach for evaluating how the seven PIISA pilots can be transferred, adapted, and scaled across different European contexts. The framework ensures consistency across pilots while remaining sensitive to sectoral and geographic specificities. It balances technical analysis with stakeholder insights and is closely linked to the broader exploitation objectives of WP4.

4.1 Dimensions and criteria

Replicability is understood as a multi-dimensional concept. Four core dimensions were selected, based on both the project description in the Grant Agreement and early discussions within WP4:

- Technical feasibility: This dimension examines whether the underlying tools, models, or datasets used in a pilot can function in other contexts without major redesign. It also considers dependencies such as local data availability, climatic conditions, or infrastructural requirements.
- Policy and regulatory fit: Replication depends heavily on the presence of enabling legal and policy frameworks. This criterion assesses alignment with national insurance regulation, climate adaptation policies, and EU directives. It also considers whether local authorities and regulators are supportive of insurance-based adaptation measures.
- Market readiness: Successful replication requires demand from potential users and willingness of insurers and financial actors to provide or underwrite products. This dimension evaluates levels of awareness, user acceptance, affordability, and the maturity of national insurance markets.
- Operational scalability: Finally, replication requires that delivery mechanisms, institutional capacities, and partnerships are available in new settings. This includes the ability of insurers, public authorities, or intermediaries to implement, monitor, and sustain the solution at larger scale.

These four dimensions provide a holistic picture of replicability, moving beyond purely technical transferability to include institutional, financial, and social enablers.

4.2 Rationale and scoring methodology

The assessment framework applies a semi-quantitative scoring approach. Each pilot is assessed against the four dimensions using a three-point scale ranging from “low replicability potential” to “high replicability potential”, as follows here: 1 = Low replicability potential; 2 = Medium replicability potential; and 3 = High replicability potential. These scores are complemented by qualitative explanations that capture contextual nuances, barriers, and enabling factors.

The rationale for this scoring approach is threefold:

1. **Comparability :** A standardised scale allows results across pilots to be compared systematically, highlighting relative strengths and weaknesses.
2. **Transparency :** Explicit scoring criteria and narrative explanations ensure that stakeholders can understand why a pilot scored in a particular way.

3. **Flexibility :** While the scoring provides structure, it does not oversimplify complex realities. Narrative context remains central to interpreting scores, avoiding the risk of reducing replicability to a purely numerical exercise.

The scoring process was carried out iteratively, with draft assessments shared among WP3 pilot leads, WP1 partners, and WP4 coordinators. Feedback loops, including exploitation workshops, were used to validate and refine the assessments.

To illustrate how the assessment framework was applied in practice, Figure 1 presents an example of a pilot scoring profile, showing the criteria grouped under each replicability dimension.

It must be noted that for certain criteria such as training and capacity-building requirements, a high score reflects low barriers to replication (e.g., limited training needs due to intuitive design), rather than high training intensity. In this context, a high score indicates that the solution can be adopted with minimal additional effort or specialised expertise.

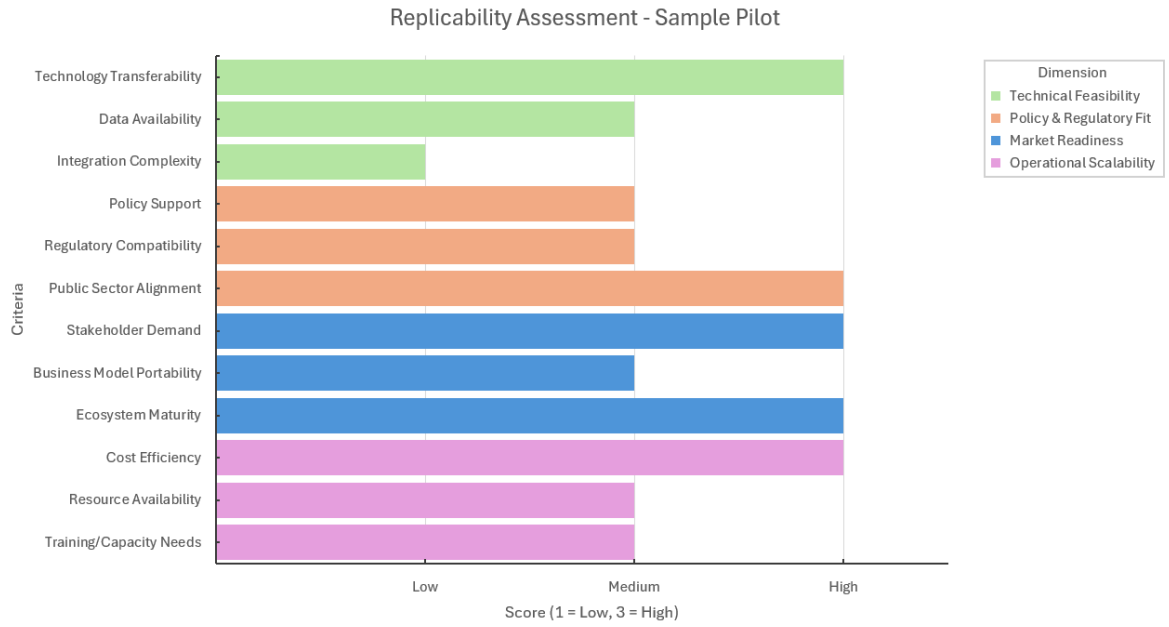

Figure 1 Example of replicability assessment results for a sample pilot, with scores organised across technical, policy and regulatory, market, and operational dimensions.

4.3 Input sources

The replicability framework draws on multiple data sources, ensuring that both technical evidence and stakeholder perspectives are represented.

A central tool for gathering harmonised data across pilots was the WP3 replicability questionnaire (Annex 1), which was designed and implemented by LGI in close collaboration with pilot leaders. The purpose of this questionnaire was to assess the replicability potential of each WP3 pilot across Europe and provide structured input for this deliverable. The questionnaire was completed by all WP3 pilot leaders, ensuring direct input from those managing design, implementation, and stakeholder engagement. As shown in more detail in Annex 1, the questionnaire was organised into six thematic sections aligned with the replicability assessment matrix. Table 3 below summarises the structure of the questionnaire and provides examples of the guiding questions used.

Table 3 Structure and guiding questions of the WP3 replicability questionnaire.

Section	Example questions
Pilot summary	What is the core goal of the pilot? Who are the main end users and stakeholders? Are enabling policies in place?
Implementation context	Where is the pilot implemented? What local enablers (e.g. regulation, subsidies, data access) support it?
Technical setup	What tools, platforms, or data are used? Can they be reused in other regions with minimal change?
Results & feedback	What outcomes or user feedback have emerged so far?
Replicability potential	What changes would be required to adapt the pilot to another region or country? Are there anticipated policy, data, or market barriers?
Additional insights	What factors are most critical for replication? Which regions appear particularly suited or unsuited for replication?

The responses collected through this instrument were systematically analysed and mapped against the four replicability dimensions introduced in Section 4.1 (technical feasibility, policy and regulatory fit, market readiness, and operational scalability). This ensured that the scoring presented in Section 4.2 was not only consistent across pilots, but also grounded in detailed and comparable information provided directly by the pilot leads.

Moreover, other input sources that fed into the replicability roadmap are presented in the points below:

- WP1 market and insurance reviews: Deliverables such as D1.1 (role of insurance in climate adaptation) and D1.4 (focused market reviews) supplied essential background on national insurance landscapes, market gaps, and regulatory frameworks. These inputs helped contextualise pilot findings within broader European trends.
- WP3 pilot deliverables and documentation: Technical reports and outputs from WP3 provided detailed descriptions of pilot design, data use, and stakeholder engagement. These were essential for understanding operational requirements and feasibility.
- Workshops and bilateral exchanges: Exploitation workshops and targeted discussions with pilot leads and partners ensured that the scoring process was grounded in stakeholder perspectives and adjusted where necessary to reflect practical realities.

By triangulating these sources, the assessment methodology achieves both consistency and depth. Each pilot is evaluated on comparable criteria, while the qualitative inputs ensure that local specificities and contextual enablers are not lost.

5 Replicability analysis

The analysis presented in this section is based on the structured replicability questionnaire that was sent to all WP3 pilot leaders. Responses were collected and consolidated between May 2025 and September 2025, providing harmonised information on technical, policy, market, and operational dimensions of replicability. The results summarised here reflect the perspectives of pilot leaders as of that period and form the first consolidated view of replication potential across the PIISA pilots.

5.1 Green roofs insurance pilot

The Green Roofs pilot explores how insurance products can stimulate the uptake of nature based solutions in urban contexts, specifically through incentives for homeowners to install green roofs. The replicability assessment highlights both enabling factors and significant constraints when considering transfer to other European regions.

When it comes to the four dimensions selected for the assessment, the results for the pilot can be summarised as follows:

1. Technical feasibility was assessed as low to moderate. The pilot relied primarily on interviews and qualitative analysis, as no operational platform or dedicated system has yet been developed. While a climate service is planned, it remains at an early stage and is not yet transferable. Existing datasets are region-specific to the Netherlands and cannot currently support replication in other climatic contexts without significant adaptation. Overall, the concept is technically sound in principle, but replication would require the development of harmonised data, transferable tools, and validated indicators of NBS effectiveness.

2. Policy and regulatory fit was found to be mixed. In the Netherlands, the policy environment is favourable, supported by municipal subsidies and insurance incentives such as the Interpolis model. These enablers provide a strong foundation for integrating nature-based solutions into insurance products. However, such conditions are not yet mirrored elsewhere in Europe. Nordic regions face technical and climatic barriers (e.g. snow-load concerns), while Mediterranean cities operate under different building codes and regulatory priorities. Consequently, policy and legal compatibility beyond the Dutch context remains limited, and broader replication would require alignment of national and municipal frameworks.

3. Market readiness was evaluated as low to moderate. Insurer engagement remains cautious, reflecting uncertainty about the commercial viability of NBS-linked insurance products. Although stakeholder awareness and dialogue have increased through surveys and workshops, the business case remain limited as the conditions haven’t been met yet. Market ecosystems are moderately mature in countries such as the Netherlands, Germany, and France, but insurer demand and consumer uptake in other regions remain weak. Broader deployment will depend on clearer economic evidence, more consistent data on risk reduction, and dedicated incentives for insurers.

4. Operational scalability was considered moderate. The pilot demonstrates conceptual scalability, as the approach could be adapted to other urban contexts with suitable enabling conditions. No major technical obstacles were reported, but the cost structure, resource requirements, and training needs are not yet defined. Implementation in new regions would

therefore require capacity-building, local data collection, and awareness-raising among insurers and municipalities. With stronger policy backing and a proven business case, replication at scale would become feasible.

The assessment matrix presented in Figure 2 below illustrates the scoring profile of pilot across all four replicability dimensions.

Each bar in the matrix corresponds to a specific criterion, scored on the three-point scale described in Section 4.2 (1 = low, 2 = medium, 3 = high). The figure highlights the pilot's uneven performance across the four assessment dimensions. Technical feasibility remains limited, with low scores for technology transferability and data availability, reflecting the absence of a developed platform and harmonised datasets. Policy and regulatory fit performs slightly better, as strong municipal and insurer incentives exist in the Netherlands, but regulatory alignment and public-sector coordination are still modest outside this context. Market readiness continues to lag behind: stakeholder demand and business-model portability are weak, while ecosystem maturity is only moderate in a few countries such as the Netherlands, Germany, and France. By contrast, operational scalability shows comparatively stronger results, indicating that the concept could be replicated in similar urban contexts if supported by training, adequate resources, and clearer cost structures.

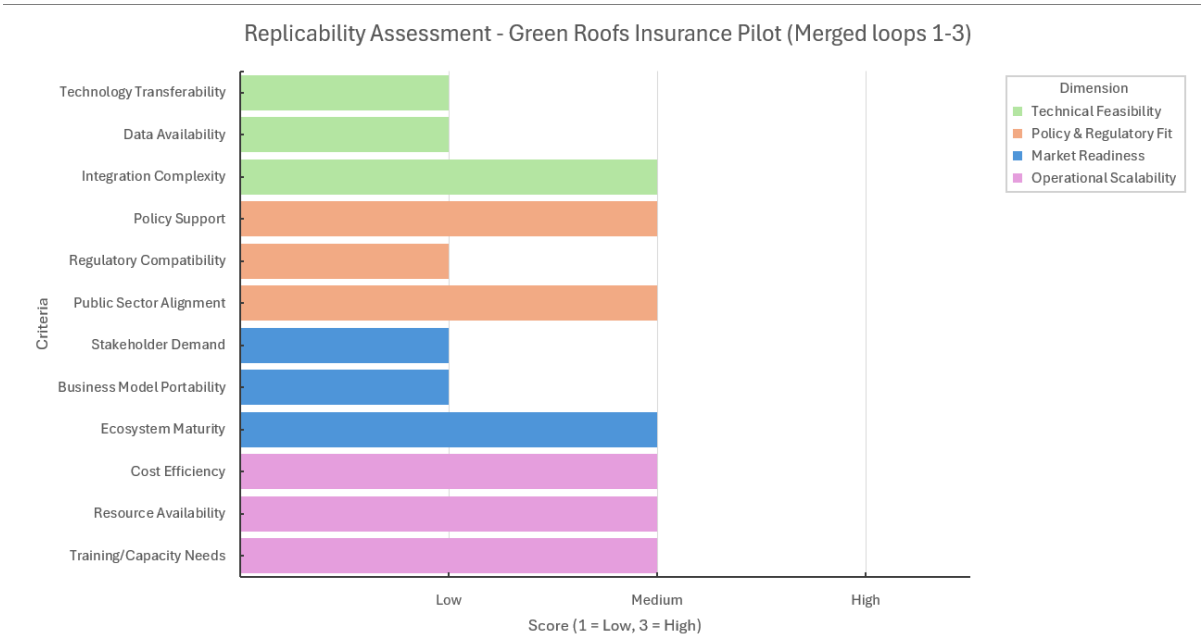

Figure 2 Replicability assessment matrix for the Green Roofs Insurance pilot

To conclude, the Green Roofs Insurance Pilot demonstrates moderate replicability potential, particularly in regions that share similar climatic conditions and policy frameworks with the Netherlands, such as Belgium, France, Germany, and Luxembourg.

It is worth mentioning that the replicability concerns the research tasks (assessing if barriers and enablers to green roof insurances vary between regions or not) rather than the climate service (which is rather a reaction to the research conducted here and includes elements from the loops detailed in section 3.1).

Its main success factors include the presence of municipal subsidies, proactive insurer engagement (e.g. the Interpolis example), and growing policy awareness of nature-based solutions as viable adaptation measures.

However, replication remains constrained by several barriers, mainly the lack of transferable technical tools and harmonised datasets, fragmented regulatory frameworks, and the limited perceived business value of green roofs in many European contexts.

To strengthen replication prospects, the roadmap recommends prioritising regions with existing NBS incentives, investing in localized data and benefit quantification, and promoting awareness and capacity-building among insurers and municipalities to develop robust, market-ready business models for green-roof insurance schemes.

5.2 Food and agriculture insurance pilot

The Food and Agriculture pilot focuses on the design of parametric insurance for drought-sensitive crops, particularly olive production in southern Spain, complemented by surveys conducted in Italy and Finland. By combining scalable climate datasets with local farmer engagement, the pilot tests how innovative insurance models can be tailored to address agricultural vulnerability under climate change.

When it comes to the four dimensions selected for the assessment, the results for the pilot can be summarised as follows:

1. Technical feasibility was assessed as moderate to high. The pilot makes use of open, scalable climate datasets such as ERA5 and CHIRPS, which provide EU-wide coverage and can be easily tailored to regional conditions. The index-based model is flexible, requiring only the adjustment of agroclimatic thresholds to match local crops and climates. While the Finnish loop focused mainly on survey-based concept testing, the Spanish case demonstrated practical application and stakeholder validation. Overall, the approach is technically robust and transferable, though full operationalisation depends on further tool development and integration with national data systems.

2. Policy and regulatory fit was rated as mixed. At the EU level, parametric insurance is recognised under agricultural and adaptation frameworks, but national regulatory acceptance remains uneven. In Finland, the legal framework still restricts index-based payouts, whereas in southern Europe, public and farmer associations (e.g. ASAJA Jaén) have actively supported innovation in this space. The regulatory environment is therefore favourable in some contexts and restrictive in others, and replication will rely on the progressive alignment of national insurance laws and public-sector engagement.

3. Market readiness was evaluated as moderate to high. Farmer interest is strong across both loops, with two-thirds of respondents in Finland expressing potential uptake and Spanish farmers demonstrating high enthusiasm based on previous positive experiences. Demand is particularly evident in drought-prone regions, where parametric insurance offers a valuable complement to traditional schemes. However, insurer engagement remains cautious, especially in conservative northern markets, indicating that continued awareness-raising and evidence of profitability will be key for wider adoption.

4. Operational scalability was considered moderate. The model is conceptually scalable across regions but requires localised engagement and capacity-building to define relevant thresholds and risk indicators. Implementation depends on collaboration with farmer associations, insurers, and reinsurance partners, while managing basis risk and cost structures remains a practical challenge. With proper training, data integration, and supportive policy frameworks, the approach could be deployed across multiple EU agricultural systems.

The assessment matrix in Figure 3 below illustrates the replicability profile of the Food and Agriculture Insurance Pilot across the evaluated criteria. The figure highlights strong performance in technical feasibility, particularly in technology transferability and data availability, supported by the use of open and scalable European datasets. Stakeholder demand also scores high, reflecting strong farmer interest and engagement in both northern and southern contexts. In contrast, policy and regulatory alignment remains uneven, with progress in some Member States but continued legal constraints in others. Operational aspects such as cost efficiency, resource availability, and training needs are assessed as moderate, indicating that replication is feasible but will require local capacity-building and institutional adaptation. Overall, the matrix provides a clear visual synthesis of partner feedback, showing that the pilot's approach is technically transferable and market-responsive, yet dependent on targeted regulatory and operational support for broader European uptake.

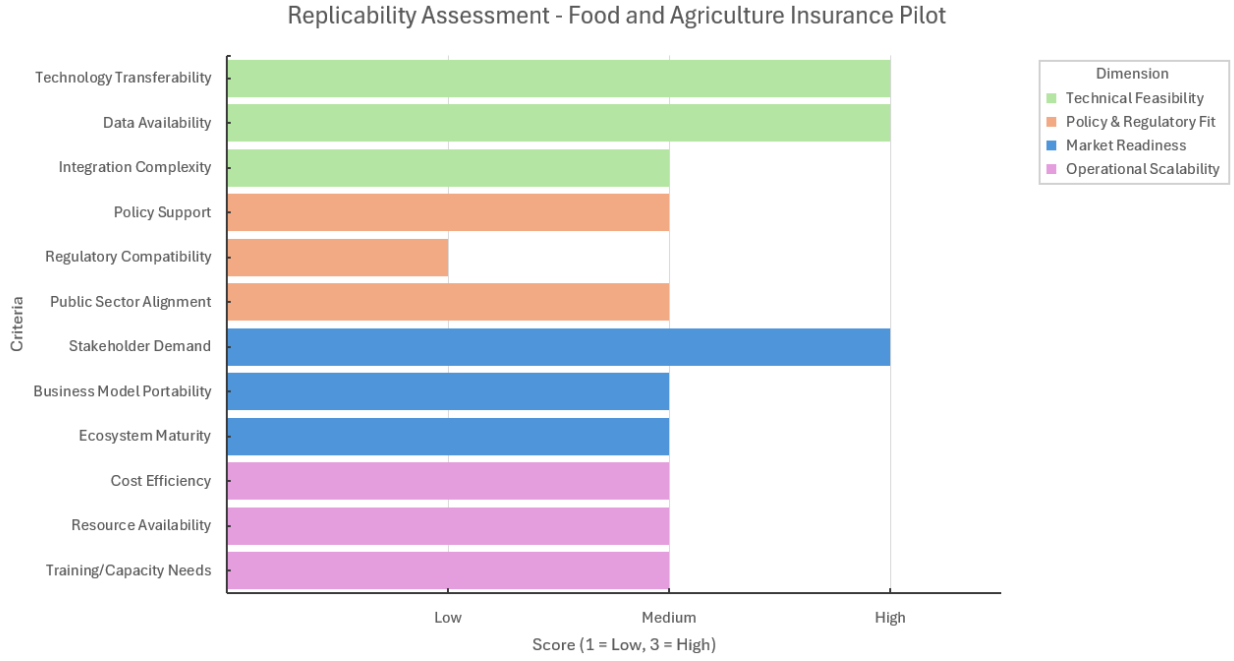

Figure 3 Replicability assessment matrix for the Food and Agriculture Insurance Pilot

To conclude, the Food and Agriculture Insurance Pilot demonstrates strong replication potential, particularly in southern European regions such as Andalusia, Italy, and Portugal, where climate-sensitive, drought-prone crops and supportive policy environments provide fertile ground for parametric insurance innovation.

Key success factors include the availability of open, scalable datasets (ERA5, CHIRPS), strong farmer engagement and demand, and a flexible, data-driven model that can be adapted to different agroclimatic contexts.

However, replication is still constrained by regulatory fragmentation, basis risk, and dependence on reinsurance mechanisms, as well as the need for capacity-building among insurers and public authorities.

5.3 Germany forest insurance pilot (AXA Climate)

The Germany Forest Insurance pilot, implemented in Bavaria, develops both parametric and indemnity insurance products to address climate-related risks in forestry, particularly windstorm damage. The pilot integrates detailed forest stand data, topography, soil characteristics, and meteorological records into vulnerability indices and storm weather models. The approach builds on AXA Climate's expertise and engages insurers as well as forest owners to test new product designs.

When it comes to the four dimensions selected for the assessment, the results for the pilot can be summarised as follows:

1. Technical feasibility was assessed as moderate to high. The models developed are transferable to other forested regions of Europe, provided they are regionally calibrated. Most of the underlying data are open source, including meteorological inputs, although some ground-truth calibration datasets remain confidential. Vulnerability mapping and index recalibration are required for replication, but these adjustments are technically feasible.

2. Policy and regulatory fit was considered moderate to high. Germany provides a supportive insurance policy framework for forests, creating enabling conditions for experimentation. Similar frameworks exist in several northern and central European countries, including Austria, France, and Poland. While public sector alignment is not uniformly strong, the policy environment in many regions provides a favourable basis for replication.

3. Market readiness was evaluated as moderate. Early feedback from insurers and forest owners has been positive, but the business model remains at an exploratory stage. Market interest is growing, but broader uptake will depend on demonstrating cost-effectiveness and scalability. Readiness also varies significantly by country, depending on the maturity of forest insurance markets.

4. Operational scalability was also rated moderate. Parametric insurance solutions for forests are generally costly, although costs may be reduced through improved forest management practices. Scaling requires both moderate levels of training and sustained engagement with insurers. Viability is highest in regions where local expertise and forest management practices are well developed.

The replicability assessment matrix in **Error! Reference source not found.** below provides a visual profile of the German Forest pilot across the four assessment dimensions. The figure highlights relatively high scores for technical feasibility and regulatory support, contrasted with more moderate values for operational and market dimensions. This pattern reflects the pilot's position as technically mature and policy-aligned, but still requiring additional steps to achieve wider market traction and scalability.

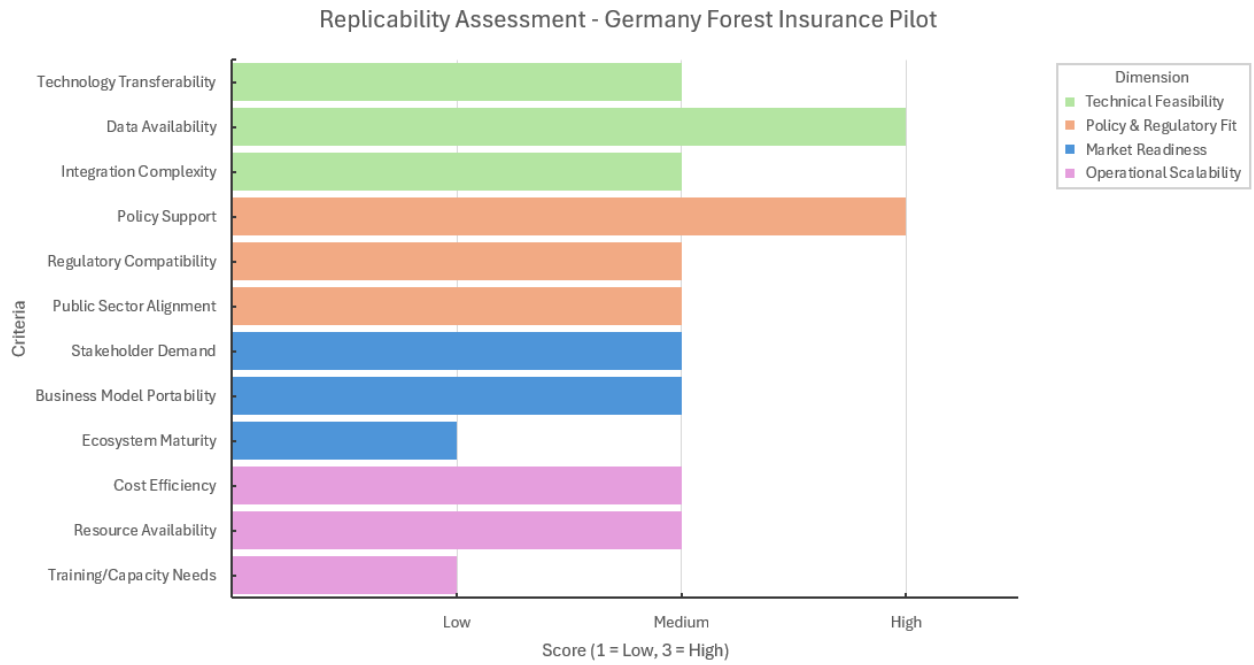

Figure 4 Replicability assessment matrix for the Germany Forest Insurance pilot (AXA Climate)

To conclude, the Germany Forest Insurance pilot demonstrates strong replicability potential in regions with similar forest structures and supportive policy frameworks, particularly in northern and central Europe.

Success factors include technically advanced models, open data availability, and favourable policy environments.

Barriers include the confidentiality of some calibration datasets, cost concerns, and variable regulatory acceptance across Europe.

Recommendations emphasise prioritising replication in countries such as Austria, France, and Poland, linking insurance design to forest management practices for cost-effectiveness, and reinforcing stakeholder engagement to build trust and demand.

5.4 Portugal wildfire insurance pilot (AXA Climate)

The Portugal Wildfire Insurance pilot focuses on developing parametric products that account for the role of adaptation measures in reducing fire risk. Implemented in central Portugal, the pilot works with national and regional authorities to align wildfire modelling with adaptation strategies such as fire breaks and fuel management, aiming to test how these interventions can be reflected in insurance pricing.

When it comes to the four dimensions selected for the assessment, the results for the pilot can be summarised as follows:

1. Technical feasibility was assessed as moderate. The wildfire simulation models are transferable but require local calibration with historical fire data, land use information, and adaptation strategies. While many EU countries maintain fire history databases, their quality and completeness vary, and technical portability is not a simple “plug-and-play” process. The approach is technically sound but demands significant localisation to ensure replicability.

2. Policy and regulatory fit was rated as moderate to high. Portugal benefits from a strong national adaptation framework, supported by the Integrated Rural Fire Management Agency (AGIF) and regional institutions such as CCDRC. This provides an enabling environment for experimentation with wildfire-linked insurance. Similar conditions exist in other Mediterranean countries with high wildfire risks, though alignment varies. Public sector engagement is a strong enabler for replication in contexts with comparable adaptation policies.

3. Market readiness was considered moderate. Forest owners and policymakers have shown interest in the pilot, but broader insurance market maturity remains limited. Penetration of forest insurance is generally low in wildfire-prone areas, willingness to pay is constrained, and insurers are often unfamiliar with parametric models. Building trust and acceptance among insurers and communities is therefore critical for replication.

4. Operational scalability was assessed as moderate. Training is required for both insurers and forest owners to understand the link between adaptation actions and insurance pricing. Costs remain high unless adaptation measures demonstrably reduce premiums, which is a key focus of the pilot. With adequate capacity-building and strong evidence of effectiveness, the model could scale across Mediterranean countries.

The replicability assessment matrix in Figure 5 below provides a visual representation of these findings. In line with the three-point scoring methodology outlined in Section 4.2, the figure shows relatively strong performance in policy and regulatory support, balanced by more moderate scores in technical feasibility, market maturity, and operational capacity.

The profile highlights that while institutional conditions are favourable, replication depends on market development and stronger links between adaptation and risk reduction.

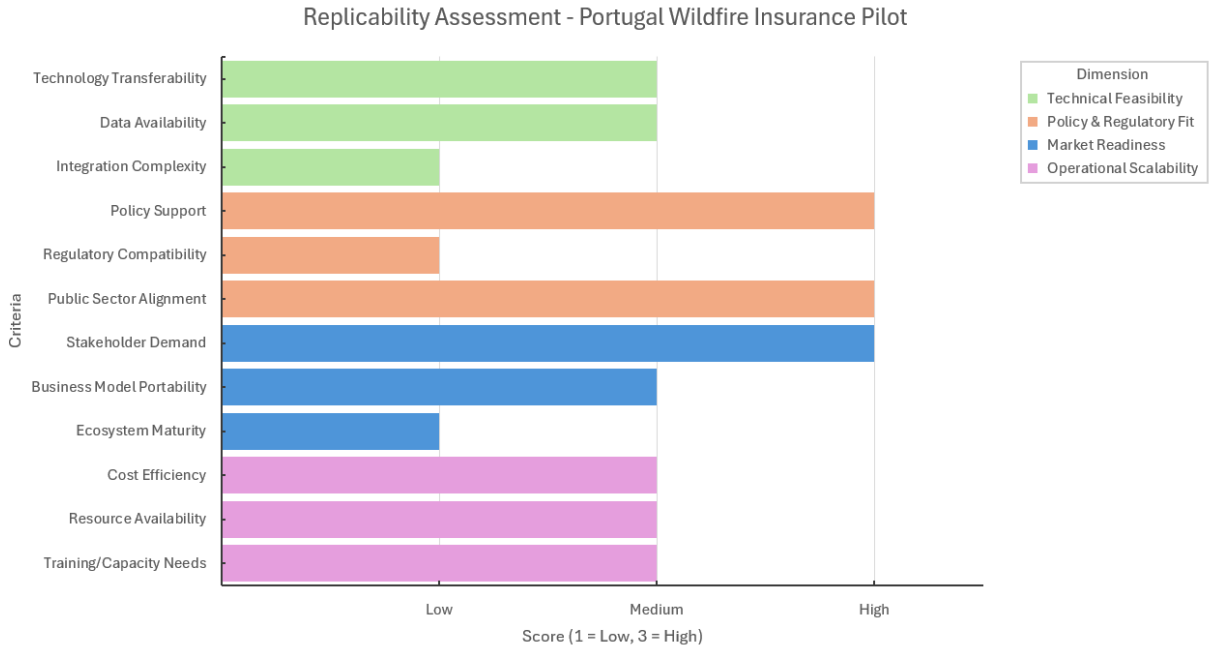

Figure 5 Replicability assessment matrix for the Portugal Wildfire Insurance pilot (AXA Climate)

To conclude, the Portugal Wildfire Insurance pilot has good replicability potential in Mediterranean countries with high wildfire exposure, such as Spain, Italy, Greece, and southern France.

Success factors include strong policy alignment, availability of relevant datasets, and active engagement of public agencies.

Barriers include market immaturity, lack of familiarity with parametric products, and sensitivity to costs within the forestry sector.

Recommendations emphasise prioritising replication in regions with existing fire adaptation strategies, pairing technical modelling with strong communication and training for both insurers and forest owners, and continuing to generate evidence linking adaptation measures to reduced premiums.

5.5 Clay Shrink Swell Building Damage Assessor (Sustainable Finance Observatory, France)

The Climate Adaptation Dashboard, also known as the Clay Shrink Swell Building Damage Assessor (CSSBDA), was developed as an online platform to inform French homeowners about their financial exposure to shrink–swell clay risks and associated insurance coverage gaps. The tool combines public property data with the Climate Dryness Index (CDI) to raise awareness of underinsured risks and guide adaptation and financial planning.

When it comes to the four dimensions selected for the assessment, the results for the pilot can be summarised as follows:

1. Technical feasibility was rated as low. The dashboard requires redevelopment for each region in which it is applied, as no plug-and-play transfer is possible. The CDI itself can be calculated across Europe, but integration with property datasets and insurance frameworks is highly dependent on local data availability, which varies widely by country. As a result, the platform is technically replicable in principle but requires significant redesign for each new context.

2. Policy and regulatory fit was assessed as low to moderate. Replication depends heavily on regional insurance regulations and whether national frameworks recognise clay shrink–swell damage. While partial alignment exists with broader adaptation priorities, no formal mandates currently require insurers to adopt such tools. Additional regulatory research is necessary to clarify replication potential in other EU Member States.

3. Market readiness was also evaluated as low to moderate. Awareness of clay shrink–swell risk among homeowners is modest, and market engagement with the tool remains limited beyond the French pilot region. The business model for replication outside France is not yet well defined, and partnerships with insurers are still emerging. The ecosystem is therefore relatively immature, with few established channels for mainstream uptake.

4. Operational scalability was considered moderate. Once developed for a region, the dashboard itself is straightforward to operate. The tool is designed to be intuitive and user-friendly, requiring minimal formal training for adoption. As a result, the training and capacity-building criterion scores high, reflecting the low operational barrier for replication. However, each replication involves moderate costs due to redevelopment needs, and the pace of replication

depends strongly on funding availability and the willingness of local insurers and public authorities to engage.

The replicability assessment matrix in Figure 6 below illustrates the pilot's scoring profile across the four dimensions. The figure shows consistently low to moderate scores across technical feasibility, policy fit, and market readiness, with somewhat higher values for operational scalability once redevelopment is achieved.

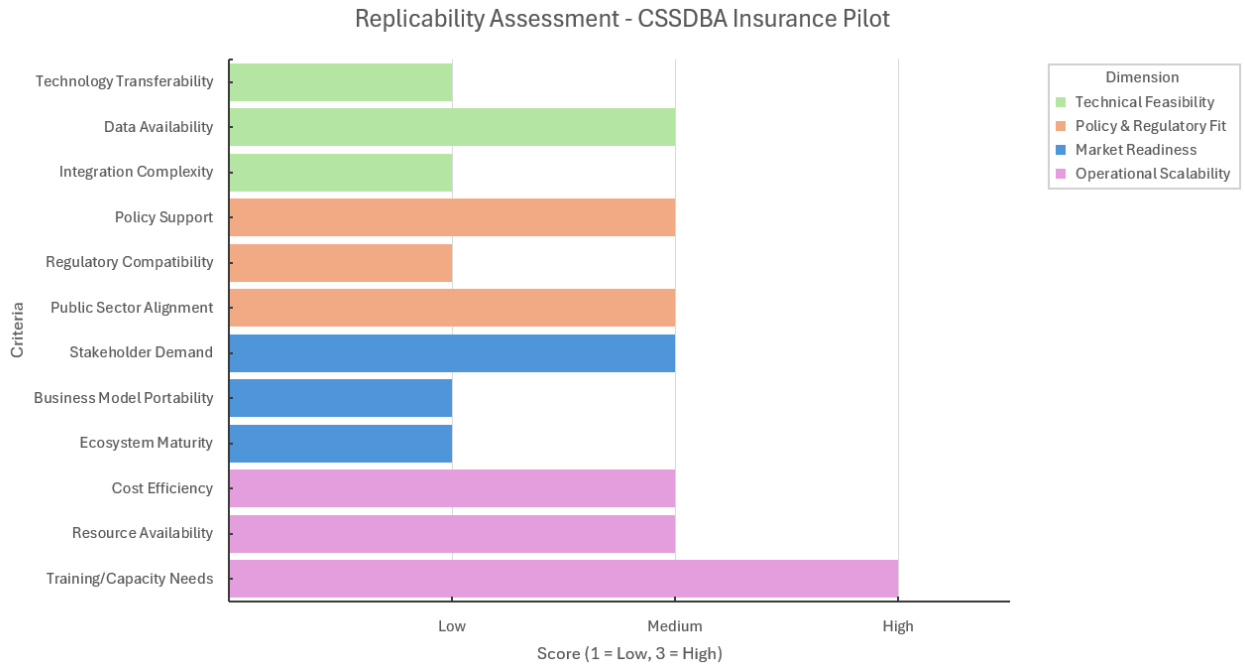

Figure 6 Replicability assessment matrix for the Climate Adaptation Dashboard pilot (SFO)

To conclude, the Climate Adaptation Dashboard has strong proof-of-concept value in France and demonstrates clear educational relevance for climate adaptation.

Success factors include the availability of high-quality public property datasets in the French context and the tool's ability to raise awareness of insurance gaps among homeowners.

However, replicability is constrained by low technical transferability, variable public data availability across Europe, and modest insurer engagement to date.

Recommendations include targeting replication in regions with similar public data systems and insurance frameworks (e.g., Belgium, Luxembourg), developing a modular platform architecture to reduce redevelopment costs, and establishing early partnerships with insurers, municipalities, and homeowner associations to build credibility and market uptake.

5.6 Cross-pilot replicability comparison

Pilot	Technical	Policy & Regulatory	Market Readiness	Operational Scalability
Green Roofs Insurance	1,7	2,0	1,7	2,0
Food & Agriculture Insurance	2,7	1,7	2,3	2,0
Forest insurance	2,7	2,0	1,7	2,0
Wildfire insurance	1,7	2,0	2,0	2,0
CSSBDA	1,7	2,0	1,7	2,3

Figure 7 Cross-pilot comparison of replicability scores

Figure 7 above presents the average replicability scores for each of the five PIISA pilots across the four assessment dimensions: technical feasibility, policy and regulatory fit, market readiness, and operational scalability.

The scores are expressed on the three-point scale introduced in Section 4.2, where 1 indicates low replicability potential, 2 moderate potential, and 3 high potential.

These values represent a consolidation of questionnaire responses and expert interpretation, reflecting the overall maturity, transferability, and scalability of each pilot's approach.

It is important to emphasise that the purpose of this comparison is not to rank pilots against one another, but rather to identify relative strengths and gaps across dimensions, helping determine where targeted measures or support will be needed to enable broader replication..

Several key patterns emerge from the analysis:

- The Food & Agriculture pilot (Finland, Spain, Italy) achieves the highest overall replicability, combining strong technical feasibility with solid market readiness. Its success is underpinned by open datasets (ERA5, CHIRPS), active farmer engagement, and a flexible index-based insurance model. Remaining challenges relate mainly to regulatory fragmentation and reinsurance dependencies.

- The Forest Insurance pilot (Germany) also scores well technically and conceptually, supported by mature climate-risk models and insurer expertise, though it faces limitations in market demand and scalability beyond its current regional focus.

- The Green Roofs Insurance pilot (Netherlands, Nordic, Mediterranean) shows lower technical and market readiness, reflecting the early-stage nature of NBS insurance products and the need for stronger municipal and insurer incentives. Nevertheless, its operational scalability is reasonable where local policy support exists.

- The Wildfire Insurance pilot (Portugal) occupies a moderate position, with good policy alignment and institutional interest but relatively cautious insurance markets and continuing training needs for implementation at scale.

- The CSSBDA pilot (France) remains in an experimental phase, showing limited technical transferability and modest market readiness due to its dependency on national datasets and insurance systems, though it can be easily replicated once fully developed.

Overall, the comparison indicates that replication potential is strongest in technically mature, data-rich sectors such as agriculture and forestry, while urban and household adaptation pilots still require further work to consolidate business models, secure regulatory alignment, and strengthen market uptake.

These findings directly inform the roadmap actions presented in the following section, which are designed to target the specific regulatory, operational, and market gaps identified across pilots.

5.7 Summary of pilot replication potential

To complement the cross-pilot comparison presented above, the pilots were also categorised into three broad groups of replication potential: high, moderate, and low.

The summary presented in Table 4 below provides a consolidated view of where replication appears most feasible in the short term, and where more significant challenges need to be addressed.

The categorisation is based on the average scores across the four replicability dimensions (technical feasibility, policy and regulatory fit, market readiness, and operational scalability) and the qualitative insights gathered from pilot leaders.

Table 4 Categorisation of pilots by replication potential and underlying rationale.

Replication potential	Pilot	Rationale
High	Food & Agriculture Insurance (Finland, Spain, Italy – BSC, LocalTapiola)	Strong farmer demand and stakeholder engagement; proven use of open, scalable datasets (ERA5, CHIRPS); adaptable parametric model tested across diverse climates; positive past experience supports market trust and replicability.
Moderate	Forest Insurance (Germany – AXA Climate)	Technically mature models and data availability; strong institutional capacity and policy support; replication limited by market conservatism, regional fragmentation, and varying forest-risk regulation.
	Wildfire Insurance (Portugal – AXA Climate)	Solid policy alignment and stakeholder buy-in; promising concept for parametric wildfire insurance and NBS integration; replication constrained by reinsurance dependencies and need for capacity-building among land managers.
	Green Roofs Insurance (Netherlands, Nordic, Mediterranean – IVM/VU, CAS)	Demonstrates local feasibility and insurer collaboration (Interpolis); moderate scalability where municipal incentives exist; replication limited by climatic variability, lack of standardised datasets, and cautious market interest.
Low	CSSBDA (France – SFO, FMI, Tyrsky)	Conceptually strong citizen-facing tool, but depends heavily on national datasets and insurance frameworks; modest insurer engagement and limited policy portability outside the French context.

6 Replicability analysis update – October/November 2025

Building on the first replicability analysis conducted between May and September 2025, this section presents an updated overview of pilot progress ahead of the first Exploitation Workshop (December 2025). A short follow-up questionnaire was circulated in October 2025 to all WP3 pilot leaders to capture any new insights, confirm the validity of earlier assumptions, and identify areas requiring further clarification during the workshop.

The purpose of this update is:

- consolidate the latest information from pilots that have advanced their testing, user engagement, or market validation activities,
- pinpoint aspects of replicability that remain under assessment or where additional partner input is needed, and
- provide a common evidence base to support discussions and validation during the upcoming exploitation workshop.

As of November 2025, updated responses were received from all 5 pilots:

1. Green Roofs Insurance Pilot
2. Food and Agriculture Insurance Pilot
3. Germany Forest Insurance Pilot
4. Portugal Wildfire Insurance Pilot
5. Clay Shrink Swell Building Damage Assessor (CSSBDA) Pilot

These pilots have shared valuable updates on the technical, policy, and market dimensions of replicability, which complement the initial analysis presented earlier in this report. Their feedback offers early signals on transferable design features, enabling conditions, and potential barriers to replicate.

The discussions held helped validate the insights presented in this update and fill any remaining information gaps, ensuring that all pilot inputs are fully integrated into the final Replicability Roadmap (March 2026).

The following subsections summarise the updated findings per pilot, highlighting new developments since the September 2025 analysis and identifying the themes to be explored further during the workshop.

6.1 Green roofs insurance pilot update

The Green Roofs Insurance Pilot investigates how insurance products can incentivise the uptake of nature-based solutions (NBS) in urban environments by offering financial mechanisms for homeowners to install and maintain green roofs.

The first replicability analysis (May–September 2025) identified moderate replicability potential, with uneven performance across the four assessed dimensions. Technical feasibility and market readiness were rated low to moderate, while policy and regulatory fit, as well as operational scalability, showed comparatively stronger results within the Dutch context.

Between October and November 2025, a short follow-up questionnaire was circulated to pilot leaders to verify whether new developments had occurred since the first assessment and to capture additional

feedback from ongoing regional engagement. The updated results confirm that the pilot remains in a conceptual and exploratory phase, with limited new technical or market advances. However, some emerging insights contribute to a clearer picture of future replicability conditions, particularly through ongoing interviews with insurers in new regions.

6.1.1 Technical feasibility

No new technical tools, datasets, or operational services have been developed since the first assessment. The climate service planned under WP2 is still under development and has not yet reached a stage where it can support replication. However, the pilot team has collected new qualitative data from insurers and policymakers in the Boreal region on barriers and enablers for green roof uptake (as reflected in D3.4). These insights will inform the forthcoming climate service to be developed by CAS.

While the overall technical feasibility rating remains low to moderate, this new dataset represents a small but meaningful step toward more evidence-based transferability. Research on green roof performance under different climatic conditions (e.g. snow load or Mediterranean heat) has not yet been undertaken, though interviews with Mediterranean insurers are planned to better understand regional applicability.

6.1.2 Policy and regulatory fit

The policy and regulatory environment has seen no major changes since the initial assessment. No new municipal or national subsidy schemes for green roofs have been introduced in the pilot or target regions. Nevertheless, the pilot team highlights the 2024 Nature Restoration Regulation, which includes an “urban ecosystems” target for 2030 that explicitly references green infrastructure and nature-based solutions. Although this regulation does not yet translate into concrete incentives, it may gradually improve the policy environment for replication across EU cities.

Some pre-existing municipal subsidy schemes were identified in the Boreal region during interviews, but overall alignment of regulatory frameworks across Europe remains limited. Therefore, the pilot continues to demonstrate mixed policy fit, with strong local enablers in the Netherlands but weak transferability beyond that context.

6.1.3 Market readiness

Market conditions remain largely unchanged since September 2025. Insurer engagement remains cautious, as there are still few incentives to integrate NBS into insurance products. Insurers continue to perceive the benefits of NBS (e.g. risk reduction at household level) as uncertain and difficult to quantify. A few Dutch insurers maintain an interest in the project’s work on barriers and enablers for NBS-based insurance products, and several participated in an Insurance Roundtable workshop in October 2025, signalling ongoing stakeholder dialogue even if no commercial uptake has yet occurred. Surveys with Mediterranean-based insurers are underway, which could yield additional market insights in early 2026. For now, market readiness remains low to moderate, constrained by limited demand, absent pricing models, and insufficient quantitative evidence of green roofs’ risk-mitigation value.

Operational scalability

No new partnerships or implementation frameworks have been established since the first analysis. The pilot leaders note that municipalities continue to act as the main promoters of green roof uptake, while

insurer engagement remains weak. However, they see opportunities to increase impact by reframing the pilot's outcomes as guidance for municipalities, rather than focusing solely on insurance products. This shift could facilitate broader adoption of green roofs, indirectly supporting future insurance-linked schemes.

The team also recognises the need for awareness-raising and training among insurers regarding climate risks to home insurance and the potential role of NBS in adaptation and prevention. Operational scalability therefore remains moderate, with potential improvement contingent on expanding engagement to new stakeholder groups and reframing the pilot's communication strategy.

6.1.4 Summary and outlook

Table 5 Summary of replicability developments for the Green Roofs Insurance Pilot (May–September vs October–November 2025)

Dimension	Status in May–September 2025	Update (October–November 2025)
Technical feasibility	Concept technically sound but no operational platform; region-specific datasets limited transferability.	No new tools or datasets; qualitative interviews added in Boreal region; Mediterranean insurer engagement just beginning.
Policy and regulatory fit	Strong local enablers in the Netherlands; limited alignment in other regions.	Largely unchanged; Nature Restoration Regulation (2024) provides a new EU-level policy signal; minor local subsidies identified.
Market readiness	Low insurer engagement; limited business case; cautious market interest.	Still limited insurer activity; some continued Dutch interest and insurer roundtable planned; Mediterranean survey ongoing.
Operational scalability	Concept scalable in principle; resource and training needs undefined.	No new partnerships; potential reframing as municipal guidance identified; need for insurer awareness-raising highlighted.

In summary and as show in Table 5 above, the October–November 2025 update confirms that the replicability profile of the Green Roofs Insurance Pilot remains stable since the previous assessment. While technical development and market traction are still limited, new qualitative data and the broader EU policy context (notably the Nature Restoration Regulation) offer concrete progress toward long-term transferability. The pilot's current strengths continue to lie in its conceptual robustness and strong policy awareness within the Netherlands. Barriers remain tied to the absence of transferable tools, lack of insurer incentives, and regional differences in policy frameworks.

These aspects were revisited in the December 2025 Exploitation Workshop, particularly to:

- validate the relevance of insurer interviews from the Boreal and Mediterranean regions,
- assess how reframing the pilot as municipal guidance could improve uptake, and
- identify next steps for developing the climate service as a transferable tool for replication.

6.2 Food and agriculture insurance pilot update

The initial assessment (May–September 2025) identified strong replicability potential, supported by robust technical design and high farmer interest, but limited by uneven regulatory conditions and insurer hesitancy.

This updated analysis consolidates new inputs, reflecting progress achieved through additional datasets, climate service integration, and renewed stakeholder engagement. Developments remain geographically uneven, with notable technical refinement in Spain and continued regulatory constraints in Finland.

6.2.1 Technical feasibility

Progress has continued primarily within the Spanish loop. The pilot has advanced its data integration by incorporating ECMWF SEAS5.1, ERA5, and CHIRPS datasets into the climate-service-based index insurance model. Thresholds have been validated directly with farmers and agricultural associations (ASAJA), strengthening the model's contextual reliability. The resulting climate service is broadly applicable across European regions, whereas the insurance model itself remains location-specific, requiring field workshops and co-design to adapt thresholds and risk parameters. A guidance document is under preparation to facilitate replication in other Mediterranean contexts.

In Finland, no live modelling tools or new datasets have been tested, as regulatory barriers continue to prevent the domestic development of parametric products. While technical capacity exists, its operationalisation remains blocked. The overall feasibility rating therefore remains moderate to high, with meaningful progress in Spain offset by stagnation in Finland.

6.2.2 Policy and regulatory fit

The regulatory environment remains the main limiting factor for replication across Europe. In Finland, legal restrictions still prevent national insurers from offering parametric insurance directly to farmers, though they may distribute foreign products. Encouragingly, insurers have expressed interest in revisiting the parametric approach, suggesting early openness to future reform.

In Spain, no new national or EU-level frameworks have emerged since September. Parametric products continue to fall under the same regulations as conventional agricultural insurance. ASAJA's active role at national and European levels supports broader advocacy but has not yet translated into tangible regulatory change. The overall policy fit remains mixed, with favourable conditions in southern regions and persistent barriers in northern ones.

6.2.3 Market readiness

No new engagement rounds with farmers or insurers have occurred in either loop since September 2025. Farmer interest remains high but insurer participation continues to lag. In Spain, Agroseguro's initial feedback indicates low willingness among traditional insurers to co-design index-based products, though the first Food and Agriculture webinar generated renewed discussion and moderate optimism. A second webinar planned for early 2026 will assess whether this interest evolves into concrete collaboration.

In Finland, no new surveys have been conducted since the previous phase, and market perceptions remain unchanged. Overall, market readiness remains moderate, sustained by farmer demand but limited by insurer caution and regulatory uncertainty.

6.2.4 Operational scalability

Scaling remains challenged by context specificity and the high resource demands of local engagement. In Spain, the index insurance model must be recalibrated for each replication site based on crop type, climatic conditions, and stakeholder input. This process is resource- and data-intensive, requiring ongoing collaboration with local actors.

Surveys and market analyses in Italy have been conducted to assess potential replication in more favourable regulatory settings. However, several barriers persist, notably differences in national legislation, reinsurance costs, and basis risk. Reinsurers often apply a high uncertainty margin, increasing premiums for farmers. The pilot partners propose a more integrated approach, linking climate scientists, insurers, and reinsurers, to improve model confidence and reduce uncertainty. Developing tailored products for homogenous farmer groups and leveraging reliable local weather data cross-validated with satellite records were identified as key enablers for future scalability.

6.2.5 Summary and outlook

Table 6 Summary of replicability developments for the Food and Agriculture Insurance Pilot (May–September vs October–November 2025)

Dimension	Status in May–September 2025	Update (October–November 2025)
Technical feasibility	Strong use of scalable datasets (ERA5, CHIRPS); technically robust and transferable model.	Spain: integrated SEAS5.1, ERA5, CHIRPS datasets and validated thresholds with farmers; guidance for replication under preparation. Finland: no new tools due to regulatory block.
Policy and regulatory fit	Favourable in Spain and Italy; restrictive in Finland.	Largely unchanged; Finnish legal constraints persist but insurer interest growing; no new EU or Spanish regulatory progress.
Market readiness	High farmer demand; cautious insurers; positive southern engagement.	No new surveys; continued farmer interest; limited insurer uptake; early renewed dialogue via webinars.
Operational scalability	Feasible with local capacity-building; moderate challenges with basis risk and reinsurance.	High localisation requirements confirmed; barriers include reinsurance costs and legal differences; surveys in Italy explore expansion opportunities.

As show in Table 6 above, the pilot continues to demonstrate high technical potential and strong end-user relevance, particularly in southern Europe, while structural barriers persist in the north. Spain has achieved tangible methodological progress through validated thresholds and improved dataset integration, while Finland remains constrained by legislation. Market engagement has plateaued, though upcoming dissemination actions may reignite interest. Operational replication across regions remains feasible but depends on local co-design capacity, reinsurance collaboration, and national regulatory alignment.

These aspects will be discussed further during the December 2025 Exploitation Workshop, with focus on scaling strategies, regulatory advocacy, and the design of replicable guidelines to be integrated into the final Replicability Roadmap (D4.7, March 2026).

6.3 Germany forest insurance pilot update

The Germany Forest Insurance Pilot, led by AXA Climate, focuses on the development and validation of parametric and indemnity models for windstorm-related forest risks, with the objective of using these models to inform the design of innovative insurance products. The initial replicability analysis (May–September 2025) identified the pilot as technically advanced and policy-aligned, with strong potential for replication in northern and central Europe. This update integrates new evidence shared by AXA Climate, particularly regarding cross-country validation and model refinement, while also acknowledging that training, market assessment, and operational scaling fall outside the pilot's direct scope.

6.3.1 Technical feasibility

Substantial progress has been achieved on the technical front. AXA Climate has extended its model testing beyond Germany, conducting validation exercises in Ireland, France (including southern regions), and Denmark. The development of a wind power exposure index, incorporating thousands of data points, has provided consistent results with client observations in Scotland and Ireland. This validation across multiple environments strengthens model reliability and supports future European applications.

While access to local forest calibration data remains uneven, these cross-country results demonstrate high transferability potential. Given the pilot's focus on model development rather than deployment, technical feasibility remains strong, with the new exposure index marking a key replicability milestone.

6.3.2 Policy and regulatory fit

No significant policy or regulatory changes have occurred since September 2025. The general framework for forest insurance in Europe remains stable and moderately supportive, particularly in Germany, Austria, and France, where forest risk management policies already encourage insurance-based solutions. As the pilot's activities are primarily technical and exploratory, its alignment with existing policy frameworks remains appropriate and sufficient for current objectives. Broader policy engagement will be more relevant during later exploitation phases involving stakeholders and insurers.

6.3.3 Market readiness

Although the pilot does not include direct market deployment, initial client validation exercises have produced encouraging feedback. AXA Climate's new model, which calibrates return periods according to client risk appetites, has been well received by clients in Scotland and Ireland, increasing confidence in its outputs.

However, no commercial uptake or market testing is foreseen within the PIISA timeframe, consistent with the pilot's design phase scope. The findings nonetheless support future market development by providing a technically validated foundation for insurers and reinsurers to assess feasibility. Market readiness can therefore be considered conceptually improving, though not yet tested in practice.

6.3.4 Operational scalability

Operational rollout activities, including training of forest managers or large-scale implementation, fall outside the pilot's defined remit. Instead, AXA Climate has focused on awareness-raising through webinars, policy briefs, and expert outreach to build understanding of forest parametric insurance and climate risk modelling. In parallel, the reinsurance design component has advanced through application of the new windthrow index across several European test regions. These actions contribute

indirectly to scalability by building technical credibility and sectoral awareness. Operational scalability remains moderate, appropriate to the pilot's development-focused mandate.

6.3.5 Summary and outlook

Table 7 Summary of replicability developments for the Germany Forest Insurance Pilot (May–September vs October–November 2025)

Dimension	Status in May–September 2025	Update (October–November 2025)
Technical feasibility	Technically mature model; transferable with regional calibration; reliant on open datasets.	Expanded testing to Ireland, France, and Denmark; developed wind exposure index consistent with client data; strong validation within modelling scope.
Policy and regulatory fit	Supportive frameworks in Germany and neighbouring countries; moderate to high alignment.	No major policy changes; frameworks remain stable and suitable for current modelling objectives.
Market readiness	Positive early feedback; limited market activity; exploratory business model.	Client validation in Scotland and Ireland shows confidence in model performance; no commercial uptake expected within project scope.
Operational scalability	Moderate scalability; engagement and training required for future rollout.	Training and deployment not within scope; awareness raised via webinars and policy briefs; reinsurance modelling further advanced.

As show in Table 7 above, the October–November 2025 update confirms that the Germany Forest Insurance Pilot remains technically mature and on track within its modelling and validation scope. Key progress includes multi-country testing, validation of a wind exposure index, and positive early client feedback. While no regulatory or market shifts have occurred, the pilot continues to build the technical foundation for future replication across European forest regions.

6.4 Portugal wildfire insurance pilot update

The Portugal Wildfire Insurance Pilot, also coordinated by AXA Climate, focuses on developing parametric wildfire models and insurance products that integrate adaptation measures such as fuel management and fire breaks into risk modelling. The initial replicability assessment (May–September 2025) recognised strong policy alignment in Portugal and moderate to high replicability potential across Mediterranean regions.

This update consolidates new technical progress achieved through collaboration with FMI and AGIF, while reflecting that market testing, reinsurance design, and operational scaling fall outside the immediate scope of the pilot.

6.4.1 Technical feasibility

Technical progress has been substantial over the past period. With Loop 2 now completed, the pilot has finalised the processing and calibration of wildfire models, developed in collaboration with FMI and Portugal's AGIF (Integrated Rural Fire Management Agency). The final models incorporate high-

resolution fire data and simulate the effect of adaptation strategies, such as vegetation management and fire protection zones, on risk reduction.

While replication in other Mediterranean regions (e.g. Spain, Italy, Greece) has not yet begun, the completion of the modelling phase marks a key technical milestone. These validated models can now serve as a foundation for future replication and product design, maintaining the pilot's moderate to high technical feasibility within its modelling and validation scope.

6.4.2 Policy and regulatory fit

No new regulatory developments have been reported since the previous analysis. The pilot continues to operate under the current Portuguese National Adaptation Plan, which already integrates measures related to fire breaks and protection zones. To account for implementation variability, AXA Climate will simulate different risk-reduction scenarios under varying policy assumptions.

While policy alignment in other Mediterranean countries has not yet been analysed, the Portuguese institutional context remains exemplary for replication due to AGIF's strong coordination role and consistent policy support. The dimension therefore remains moderate to high, fully adequate for the pilot's technical objectives.

6.4.3 Market readiness

Market engagement and insurer perception are not a current focus of this pilot's scope. AXA Climate notes that, globally, insurer appetite for wildfire-related products has declined due to increasing perceived risks, particularly in markets such as California. Within the Portuguese context, the pilot has not yet reached a stage where willingness-to-pay (WTP) or pricing analysis can be meaningfully assessed, as the insurance product design is still being finalised.

Accordingly, market readiness remains moderate in potential but untested in practice, pending later-stage discussions once the parametric framework is complete and demonstrable case evidence becomes available.

6.4.4 Operational scalability

Operational and training activities are beyond the pilot's current scope, which centres on model and framework design.

AXA Climate has begun discussions with AGIF to potentially develop awareness materials for forest owners and local communities, supporting the dissemination of adaptation-linked insurance concepts. The team is also initiating work on a first conceptual insurance framework that formally integrates adaptation measures into wildfire risk modelling.

These preparatory steps lay groundwork for future operational phases but do not yet constitute replication or scaling actions. Operational scalability remains moderate, consistent with the pilot's research and model-development remit.

6.4.5 Summary and outlook

Table 8 Summary of replicability developments for the Portugal Wildfire Insurance Pilot (May–September vs October–November 2025)

Dimension	Status in May–September 2025	Update (October–November 2025)

Technical feasibility	Sound model architecture; transferable but requires local calibration and adaptation data.	Final wildfire models completed with FMI and AGIF; validated adaptation scenarios; replication in other regions not yet started.
Policy and regulatory fit	Strong policy support via AGIF and National Adaptation Plan; favourable Mediterranean alignment.	No policy changes; continued use of current National Adaptation Plan; simulations to test risk-reduction under variable implementation.
Market readiness	Moderate interest among stakeholders; limited insurer familiarity with parametric wildfire products.	Market assessment not within scope; insurers globally less open to wildfire products due to rising risks; product design ongoing.
Operational scalability	Moderate scalability with training needs for insurers and forest owners.	Operational activities not in scope; initial discussions with AGIF on awareness materials; first insurance framework integrating adaptation now under development.

As show in Table 8 above, the October–November 2025 update confirms that the Portugal Wildfire Insurance Pilot has achieved its main technical objectives, completing calibrated wildfire models that quantify the impact of adaptation measures on risk levels. The institutional setting remains highly supportive, while market and deployment aspects will follow in later project stages.

As with the Germany Forest pilot, AXA Climate clarifies that its primary contribution lies in model and product design, validation, and early testing across regions, with operational scaling, training, and market assessments to be addressed in future phases.

These results informed the December 2025 Exploitation Workshop, where discussion focused on:

- leveraging model outputs for replication in other Mediterranean regions,
- aligning national adaptation policies with parametric insurance design, and
- integrating wildfire risk modelling into the final Replicability Roadmap (D4.7, March 2026).

6.5 Clay Shrink Swell Building Damage Assessor pilot update

The Clay Shrink Swell Building Damage Assessor (CSSBDA), developed under the Climate Adaptation Dashboard, helps quantify the exposure of French homeowners to clay shrink–swell risks and associated insurance gaps.

The initial replicability analysis (May–September 2025) highlighted strong conceptual value but limited transferability beyond France due to data, regulatory, and market constraints. The following update integrates new developments shared by the Sustainable Finance Observatory (SFO), reflecting expanded national deployment and preparatory work for European-level research through the planned Risk Alert Briefing.

6.5.1 Technical feasibility

Significant progress has been achieved at the national level. The CSSBDA is now ready for deployment across all of France, covering the entire territory rather than the initial pilot region. This represents a substantial step in scaling technical operations within one national context.

While no redeployment has been conducted outside France under PIISA, SFO is preparing a Risk Alert Briefing to identify countries where both clay shrink–swell risk and insurance coverage gaps coincide.

This briefing will help target potential replication opportunities in Member States such as Finland, Germany, Italy, Luxembourg, and Spain, where similar conditions may justify a new CSSBDA-type tool.

The Climate Dryness Index (CDI) remains technically adaptable to new contexts, but its integration with local property and insurance datasets remains the main challenge. Technical feasibility has therefore evolved from low to moderate, reflecting expanded national readiness and structured planning for international replication.

6.5.2 Policy and regulatory fit

There have been no formal regulatory changes in recent months regarding clay shrink–swell insurance coverage. However, the upcoming Risk Alert Briefing will include comparative legal research on the insurance frameworks of the above-mentioned countries, mapping where coverage gaps exist.

Although this does not represent a direct policy advancement, it strengthens the pilot's regulatory intelligence base and supports a more informed approach to identifying replication enablers and constraints. Consequently, policy fit remains moderate, with improved understanding but no new institutional developments.

6.5.3 Market readiness

Market visibility of the CSSBDA is expected to improve with the planned national publicity campaign, which will include targeted Facebook advertisements aimed at raising awareness among French homeowners. Engagement with municipalities and insurers has not advanced since September, but the upcoming communication campaign represents the first coordinated effort to reach users at scale.

As the tool transitions from prototype to national deployment, market readiness is gradually improving, though sustained engagement with insurers and public authorities will still be required for replication beyond France.

6.5.4 Operational scalability

No new architectural redesigns or modularisation strategies have been developed to reduce redevelopment costs for new regions. The pilot team confirms that operational scalability outside France remains limited until such modular frameworks are defined.

Within France, the full national deployment marks a major step forward operationally. Additionally, discussions with AGIF-type institutions in other Member States are anticipated following the Risk Alert Briefing. Awareness activities are expanding, notably through the upcoming national social media campaign, which will strengthen domestic visibility.

Operational scalability remains moderate, reflecting substantial progress within France and early preparations for international knowledge transfer.

6.5.5 Summary and outlook

Table 9 Summary of replicability developments for the Clay Shrink Swell Building Damage Assessor (May–September vs October–November 2025)

Dimension	Status in May–September 2025	Update (October–November 2025)
Technical feasibility	Region-specific dashboard; low transferability beyond France.	Now ready for national deployment across France; planning Risk Alert Briefing to identify

		replication countries; CDI remains adaptable but data integration is context-dependent.
Policy and regulatory fit	Limited alignment; no mandates for insurers to adopt the tool.	No regulatory change, but legal research expanded to five EU countries; improved understanding of cross-country frameworks.
Market readiness	Limited engagement; awareness among homeowners and insurers modest.	National-level publicity campaign planned via social media; insurer partnerships unchanged but visibility increasing.
Operational scalability	Moderate; regional operation feasible but redevelopment costly.	Full national scalability achieved; no modular redesign yet; awareness activities expanding through communication campaign.

As seen in Table 9 above, the October–November 2025 update marks a decisive transition for the CSSBDA pilot, from regional proof-of-concept to full national readiness. The forthcoming Risk Alert Briefing extends the pilot's analytical reach to five additional EU countries, positioning the tool as a reference model for adaptation awareness and insurance gap analysis.

While no replication beyond France has yet taken place, SFO's approach, combining national deployment with targeted policy and risk intelligence, establishes a solid foundation for future adaptation of the tool.

These results fed into the December 2025 Exploitation Workshop, which focused on:

- reviewing the CSSBDA's national rollout and communication strategy,
- assessing legal comparability across the identified countries, and
- identifying pathways for data harmonisation and modular development for cross-country replication.

7 Cross-cutting insights

The updated replicability assessments across all five PIISA pilots reveal a number of main trends, enablers, and systemic barriers that shape the feasibility of scaling climate-risk insurance innovations across Europe. While each pilot operates in a distinct context, the October–November 2025 updates confirm a clear set of common patterns. These insights provided an essential analytical foundation for the December 2025 Exploitation Workshop and the Replication Roadmap (D4.7).

7.1 Trends and patterns across pilots

A consistent finding across all pilots is that replication requires significant localisation. Whether dealing with drought indices, wildfire modelling, windstorm exposure, green-roof incentives, or clay-shrink-swell damage assessment, no pilot offers a fully transferable turnkey model. Even the most technically advanced initiatives, such as the forestry, wildfire, and agriculture pilots, require calibration to local climatic conditions, stakeholder needs, legal frameworks, and available data sources.

Across sectors, data availability and interoperability remain decisive. Pilots relying on open European-scale datasets (e.g., ERA5, CHIRPS, SEAS5.1, wildfire archives) demonstrate smoother technical transferability, while those dependent on property-level datasets (CSSBDA) or municipal programmes (green roofs) face larger barriers. This is particularly evident where climate services developed in WP2 are effectively operationalised within WP3 pilots.

Parametric insurance continues to emerge as a high-potential yet structurally unfamiliar instrument, with growing technical readiness but persistent regulatory and cultural barriers in several Member States. The updated responses show cautious interest among insurers but limited material uptake to date.

7.2 From climate services to pilot implementation: the WP2–WP3 connection

A central insight emerging from the PIISA pilots is the critical role of climate services and risk indicators as a bridge between climate science and operational implementation. Within the project structure, WP2 generates advanced climate data, modelling outputs, and hazard-related analytics, while WP3 translates these into concrete pilot applications in insurance, adaptation planning, and decision-support tools.

The risk indicators developed and refined within PIISA, such as drought-related indices and thresholds, wildfire risk metrics, windstorm exposure indicators, and clay shrink–swell (CSS) indicators, serve as the operational interface between these two layers. Rather than remaining purely analytical outputs, these indicators are embedded within pilot solutions, informing parametric insurance triggers, vulnerability assessments, risk dashboards, and adaptation strategies across sectors.

This connection illustrates a key replication mechanism: while pilot applications are context-specific and require localisation, the underlying logic of transforming climate data into actionable risk indicators is transferable across regions. In this sense, replication does not only concern the transfer of pilot solutions, but also the transfer of the data-to-service pipeline that enables their development.

The Risk Data Hub plays a central enabling role in this process by supporting the harmonisation, accessibility, and reuse of climate datasets and derived indicators across pilots.

It strengthens the capacity to operationalise climate intelligence in new contexts, facilitating the transition from research outputs to scalable services and improving the potential for future risk alert systems across pilots (e.g. drought alerts, wildfire risk monitoring, windstorm exposure assessment).

7.3 Comparative strengths and enabling factors

Despite differing levels of maturity, several enabling strengths appear consistently across the pilots:

1. Technical maturity is progressing steadily, especially in the AXA Climate pilots and the agriculture pilot. Recent updates confirm multi-country model validation (forestry), finalised wildfire models (Portugal), and refined index thresholds (Spain), indicating increasingly robust technical foundations.
2. Policy support remains a strong driver, particularly where national institutional structures actively support adaptation (Portugal's AGIF; Germany's forest insurance frameworks). Furthermore, the Nature Restoration Regulation (2024) also offers a new enabling signal for urban NBS pilots.
3. End-user engagement continues to be a central enabler of replication. Examples include:
    a. Spanish farmer validation through ASAJA
    b. Client feedback supporting forestry model calibration
    c. Municipal interest in green roof adaptation programmes
    d. National-level communication plans for the CSSBDA
4. Validated pilot track records strengthen future replication prospects, particularly where models have been tested across regions (Ireland, France, Denmark for forestry; Portugal for wildfire; Spain for parametric agriculture).

7.4 Shared barriers and needs

The updated assessments also reinforce a series of cross-cutting challenges:

- Regulatory misalignment remains the single most significant barrier, especially for parametric models. Finland continues to prohibit index-based payouts; other Member States present regulatory uncertainty, slowing adoption.
- Market readiness is uneven, with limited insurer willingness to adopt innovative models, particularly in wildfire contexts where rising risks reduce insurer appetite.
- Capacity-building needs remain high, especially for innovative insurance instruments or multi-risk tools. While AXA Climate's pilots do not include training within their scope, several pilots identify the need for awareness-raising among insurers, forest owners, municipalities, and homeowners.
- Cost and reinsurance challenges persist, especially for wildfire and forestry insurance. High uncertainty margins applied by reinsurers and basis-risk concerns highlight the need for closer collaboration between climate scientists, insurers, and reinsurers.
- Dependence on local datasets has been shown to limit scalability. This is particularly true for CSSBDA, where property-level datasets differ greatly between Member States.

7.5 Sectoral and geographic differences

Replication conditions differ significantly across sectors and geographies:

- Agriculture shows the strongest near-term replication prospects, especially in Mediterranean regions (Spain, Italy, Portugal), where drought exposure, farmer demand, and supportive policy environments converge.
- Forestry presents robust replication opportunities in Central and Northern Europe, supported by favourable insurance frameworks and proven model transferability (Germany, Austria, France, Ireland, Denmark).
- Wildfire insurance has promising technical foundations but faces challenging market dynamics. Mediterranean regions remain the most likely candidates for future replication once insurers' risk appetite stabilises.
- Urban nature-based solutions (green roofs) continue to face structural barriers linked to market readiness, lack of transferable tools, and uneven municipal incentives.
- Homeowner-focused tools such as CSSBDA show strong national scalability in France and emerging potential for targeted replication in countries with comparable datasets and insurance systems.

7.6 Enablers vs. barriers across pilots

On one hand, and based on the assessment update above, the following were identified Cross-cutting enablers include:

- availability of open, high-quality climate datasets;
- early and sustained involvement of end-users (farmers, clients, municipalities);
- stable and supportive policy frameworks;
- technical validation across multiple regions;
- strong national institutional partners (e.g., AGIF, ASAJA).

On the other hand, several barriers were also identified:

- regulatory resistance to parametric models;
- low or uncertain insurer appetite;
- limited or inconsistent data availability;
- absence of modular technical architectures;
- cost and reinsurance constraints;
- insufficient awareness and understanding of innovative products among end-users.

7.7 Overall insight

Taken together, the updated assessments show that replication readiness is advancing unevenly across the pilot portfolio.

The most mature and replication-ready pilots remain those in agriculture and forestry, supported by strong technical foundations and favourable policy environments. However, pilots such as wildfire insurance are technically ready but face significant market constraints. Also, green roof insurance and clay shrink-swell risk tools require more foundational work, particularly technical modularisation, policy engagement, and awareness-raising, before large-scale replication is feasible.

Therefore, these updated insights have directly informed the design of the December 2025 Exploitation Workshop presented in the sections below, and the prioritisation of the Replicability Roadmap (D4.7). They ensured that recommendations reflect the current maturity, constraints, and opportunities across the full pilot portfolio.

8 Exploitation

This section introduces the exploitation approach adopted in PIISA, clarifies how exploitation is understood within the context of a Horizon Europe innovation project, and explains why exploitation is strategically important for the five climate-risk insurance pilots developed under Work Package 3 (WP3). It also outlines the methodological foundations that will inform the first exploitation workshop (5 December 2025) and the subsequent development of the Replication Roadmap.

8.1 Rationale and purpose of exploitation in PIISA

In Horizon Europe projects, exploitation refers to the set of activities that ensure project results continue to generate value beyond the project duration. Exploitation involves identifying, developing, and supporting the use of project outputs, whether scientific, technical, methodological, or service-oriented, so that they can inform policy, support innovation, contribute to market uptake, or enable further research after the project ends.

In many European R&I projects, exploitation includes protecting and managing intellectual property (IP) such as patents, inventions, proprietary technologies, and other forms of background or foreground IP. However, PIISA does not generate IP-heavy outputs. Unlike technology-driven projects centred on prototypes or patentable algorithms, the PIISA pilots produce services, models, methods, datasets, risk indicators, guidelines, and policy-support tools. These results are not patentable technologies, but they nevertheless require careful planning to ensure they can be sustained, transferred, reused, or scaled after March 2026.

Exploitation in PIISA therefore focuses on:

- ensuring that each pilot's outputs continue to be used after the project ends;
- identifying who will use the outputs (e.g., insurers, municipalities, homeowners, forest owners, farmer associations, public agencies, policymakers);
- determining what services or tools each pilot can offer beyond PIISA; and
- clarifying how the pilots intend to deploy or further develop these outputs in the short and medium term.

In other words, PIISA's exploitation strategy is centred on the sustainability, uptake, and operational continuity of the pilots' methodologies and services rather than on the commercialisation of intellectual property.

8.2 What Exploitation means for PIISA

In Horizon Europe projects, exploitation typically includes a broad range of activities such as protecting intellectual property, licensing technologies, commercialising prototypes, or creating start-ups. However, PIISA's pilots do not generate patentable technologies, proprietary inventions, or commercial IP assets. Instead, the project produces services, models, methods, datasets, indicators, awareness tools, and policy-support resources, which require a tailored exploitation approach.

For PIISA, exploitation therefore focuses on ensuring that these outputs can be sustained, reused, transferred, or further developed beyond the project's end.

This includes identifying who will use the results (e.g., municipalities, insurers, farmers, forest owners, homeowner associations, public agencies), clarifying how they will be used, and defining concrete actions that pilot teams can take to support future uptake.

To distinguish between conventional IP-driven exploitation and PIISA's service- and methodology-driven results, the project adopts the following comparative framework, show in Table 10 below.

Table 10 What exploitation means for PIISA compared to standard Horizon Europe exploitation

Not relevant for PIISA (typical in IP-heavy Horizon projects)	**Relevant for PIISA (aligned with PIISA pilot outputs)**
Patents	Climate/insurance modelling services
Proprietary technical inventions	Parametric insurance design methods
Technology licensing	Modelling frameworks (windstorm, wildfire, drought, clay)
Background/foreground IP management	Risk indicators, datasets, maps, dashboards
Start-up creation based on proprietary IP	Guidelines and advisory materials for municipalities/insurers
	Capacity-building, communication, and partnerships
	Policy briefs and adaptation frameworks
	Awareness tools (e.g., CSSBDA national campaign)

Table 10 above reflects the specific nature of the PIISA pilots, whose value lies not in commercial IP but in knowledge services, decision-support tools, and applied methodologies that can strengthen climate adaptation and risk management practices across Europe.

Exploitation in PIISA therefore centres on:

- sustaining and maturing these services after March 2026;
- identifying pathways and partners for their operational use;
- supporting replication in relevant geographic and institutional contexts; and
- securing the long-term impact of PIISA's results through structured, non-IP-driven exploitation strategies.

8.3 PIISA Key Exploitable Results (KERs)

Based on the typology used in Horizon Europe but adapted to PIISA's specific context, the project recognises three categories of KERs:

1. Service-oriented exploitable results

These reflect the core products that can be taken forward by pilot partners after PIISA, including:

- Climate/insurance modelling services
- Parametric insurance design services
- Adaptation advisory services
- Risk assessment services

2. Non-commercially exploitable results

These outputs support replication, knowledge transfer, or policy impact, such as:

- Guidelines or handbooks
- Methodologies
- Replication toolkits
- Further research proposals
- Contributions to policy change
- Societal or policy-support activities

3. Non-exploitable results (Dissemination)

These play an indirect role in exploitation by raising awareness, building understanding, or disseminating knowledge:

- Publications
- Sharing results online
- Trainings
- Workshops
- Awareness materials (e.g., CSSBDA communication campaign)

PIISA's KER structure recognises that while the project does not create patentable innovations, it produces high-value services and knowledge assets that can be sustained and reused after project completion, contributing to climate adaptation and risk-prevention strategies across Europe.

8.4 Why Exploitation matters for PIISA

Exploitation is central to PIISA for several reasons:

- Ensuring continuity after March 2026: The pilots' climate services, insurance models, and methodologies must remain useful and actionable once EU funding ends.
- Strengthening policy relevance : Outputs such as wildfire modelling, drought-related parametric triggers, or clay shrink–swell risk assessments provide valuable insights for public authorities, adaptation agencies, and insurers.

- Supporting replication across Europe : The replicability assessments show that several pilots, especially agriculture, forestry, and wildfire, have potential for transfer to other regions. Exploitation planning ensures this transfer is structured and realistic.
- Building market and institutional uptake : Many pilots require increased engagement from insurers, municipalities, farmer associations, and public risk management agencies. Exploitation planning clarifies who needs to be involved, when, and how.
- Consolidating the project's long-term impact : Without structured exploitation strategies, PIISA's results risk remaining as research outputs. Through exploitation, they can become operational services, policy tools, or decision-support systems.

8.5 Exploitation workshop insights (December 5, 2025)

8.5.1 Workshop overview and participation

The first PIISA exploitation workshop was held on 5 December 2025, from 14:00 to 16:00 CET, in an online format, using Microsoft Teams for plenary discussions and MURAL as a collaborative workspace for interactive group work.

The workshop brought together 12 participants, including pilot leaders, WP3 partners, and representatives from LGI Sustainable Innovation, ensuring full coverage of the five PIISA pilots. All pilots were represented, allowing for a comprehensive discussion of exploitation perspectives across the different thematic areas addressed in the project (agriculture, forestry, wildfire, nature-based solutions, and household risk awareness).

The workshop was facilitated by LGI Sustainable Innovation, which guided participants through the agenda, presented the updated replicability assessments, and structured the collective discussion around exploitation using a dedicated MURAL template. The facilitation aimed to ensure a shared understanding of exploitation in the PIISA context, encourage cross-pilot reflection, and support partners in identifying concrete post-project exploitation pathways.

The objectives of the workshop were to:

- align partners on the meaning of exploitation within PIISA's service- and methodology-driven context;
- review the implications of the updated replicability assessments for post-project uptake;
- identify emerging products and services arising from each pilot;
- discuss potential exploitation pathways, key barriers and enablers, and required partnerships; and
- define priority actions to be undertaken before March 2026, feeding directly into the Replication Roadmap.

This workshop marked the first structured collective step toward consolidating PIISA's exploitation strategy and translating pilot-level results into actionable pathways for long-term impact.

8.5.2 Emerging pilot products and services (KER inputs)

Building on the discussions held during the first exploitation workshop, partners were invited to identify and clarify the emerging products and services arising from each PIISA pilot. Rather than focusing on traditional IP-driven outputs, this exercise aimed to capture concrete, service-oriented, and method-based results that could realistically be sustained, further developed, or deployed beyond the project's lifetime.

Table 11 below consolidates the emerging exploitable offers identified across all pilots, following a harmonised filtering approach. Only outputs with a clear potential for post-project use, a defined target user (e.g. insurers, farmers, municipalities, forest owners, homeowners, or public authorities), and a plausible pathway toward continuation or scaling were retained.

Table 11 Overview of emerging products and services identified across PIISA pilots during the first exploitation workshop

Pilot	Emerging product(s) / service(s)
Green Roofs	• Online awareness and advisory service targeting insurers and municipalities, highlighting how insurance incentives can stimulate green roof and nature-based solution uptake among homeowners. • Policy and market insight report synthesising barriers, enablers, and incentive structures influencing European insurers' engagement in green roof and NBS-related insurance schemes.
Food and Agriculture	• Climate service for agriculture, providing seasonal forecasts and agroclimatic indicators to support on-farm adaptation decisions. • Tailored index-based climate insurance design service, enabling the co-development of parametric drought insurance products aligned with local crops and farmer-validated thresholds. • Replication guidance for index-based agricultural insurance, documenting methodological steps, data requirements, and stakeholder engagement processes to support deployment in new regions.
Germany Forest Insurance	• Vulnerability map • Parametric insurance methodology for wind throw
Portugal Wildfire Insurance	• Adaptation fire measures modelling • Wildfire risk maps • Parametric insurance methodology for wildfire cover
CSSBDA	• National-scale online awareness tool highlighting clay shrink–swell risk and insurance coverage gaps (CSSBDA as a proof of concept). • Risk Alert Briefing combining analysis of clay shrink–swell risk and insurance framework gaps across EU countries.

8.5.3 Exploitation pathways and required partnerships

Building on the identification of emerging products and services, the exploitation workshop further focused on clarifying the exploitation pathways through which pilot results could be taken up, embedded, or scaled beyond the PIISA project.

Exploitation pathways refer to the concrete routes, mechanisms, and institutional entry points through which project outputs may be used by external actors, such as public authorities, insurers, or other stakeholders, after the end of the project.

During the workshop, partners discussed a range of potential actions and ideas. For the purpose of this report, only those elements that constitute credible and structured pathways for uptake and deployment, as opposed to dissemination activities or contextual enablers, have been retained and consolidated in Table 12 below.

Table 12 Exploitation pathways identified across PIISA pilots during the first PIISA exploitation workshop

Pilot	Exploitation pathways
Green Roofs	• Urban adaptation plans stipulating the use of green roofs for certain buildings, areas, or projects • Dissemination of policy briefs among insurers related to PIISA findings • Integration of (broad) green roofs as preferred solutions in Terms of Reference for urban design competitions • Publication of the service and results on professional and thematic platforms • Development of tailored versions of the service for other countries beyond the Netherlands
Food and Agriculture	• Application of the solutions in other regions through stakeholder workshops • Follow-up research to convert the insurance solution into end product(s) • Webinars for exploring and engaging interested insurers • Open access to the services and tools developed via the project website • Collaboration with sister projects to support wider uptake • Further development to integrate applications into C3S, DestinE, or national platforms
Germany Forest Insurance	• Testing the modelling and insurance approach in new regions (e.g. Boreal regions) • Vulnerability-based risk assessment of regions and forests to inform insurance design and decision-making
Portugal Wildfire Insurance	• Assessing wildfire risk levels and feasibility of applying the approach in other regions • Implementation of fire spread modelling as an application into DestinE
CSSBDA	• Risk Alert Briefing and related publicity to highlight countries with clay shrink–swell risk and insurance coverage gaps • Identification and engagement of stakeholders interested in raising awareness of clay shrink–swell risks (e.g. homeowner associations, local community groups) • Testing market appetite for awareness and risk alert tools in countries where both clay shrink–swell risk and insurance gaps are present

8.5.4 Barriers, enablers, and operational considerations

As part of the exploitation workshop, partners were invited to identify the key enablers and barriers influencing the exploitation, uptake, and scaling of pilot results beyond the PIISA project. Enablers refer to factors that facilitate deployment or replication, such as supportive policy frameworks, stakeholder engagement, or existing market demand. Barriers capture structural, regulatory, technical, or economic constraints that may hinder exploitation if not addressed.
This analysis represents an intermediate step in the workshop process, bridging the identification of emerging products and exploitation pathways with the subsequent discussion on priority actions and implications for the Replicability Roadmap. For the purpose of this report, inputs collected during the workshop have been consolidated in Table 13 and filtered to retain only those elements that directly affect post-project exploitation and replicability.

Table 13 Barriers, enables and partnerships identified across PIISA pilots during the first PIISA exploitation workshop

Pilot	Key enablers	Key barriers
Green Roofs	• Supportive municipal and legislative frameworks encouraging insurer involvement in climate adaptation • Availability of public procurement guidelines and design competitions promoting green roofs in housing projects • Existing insurer networks and willingness to engage (e.g. Dutch insurers involved during PIISA) • Growing demand for nature-based solutions in urban areas and increasing policy attention to green infrastructure • Potential for data sharing between insurers and municipalities to improve understanding of risks and benefits	• Limited scientific evidence on risk reduction at individual building level, constraining insurer uptake • Uncertainty regarding the financial pay-off of green roofs for homeowners • Mismatch between private costs for homeowners and broader public benefits • Limited financial incentives or subsidy schemes outside a few countries (e.g. Netherlands, Germany) • Legal and procurement constraints limiting the mandatory use of green roofs in some contexts • Risk of low transferability due to strong focus on the Dutch context
Food and Agriculture	• Strong demand for rapid and predictable payouts to support timely mitigation and recovery • Availability of high-quality climate datasets and opportunities for cross-verification • Use of local weather station data to develop locally relevant climate indicators • Engagement with farmer associations to raise awareness and support co-design • Co-development processes creating ownership and acceptance among end users • Interest from insurers to explore feasibility and co-design parametric insurance products	• Regulatory restrictions limiting the provision of parametric insurance in some countries (e.g. Finland) • Limited awareness and understanding of parametric insurance models among stakeholders • Resistance from incumbent insurance actors (e.g. Agroseguro in Spain) • Need for reinsurance to address covariate risks, increasing premium costs • Lack of standardised frameworks for quality assessment of index-based services • High resource intensity of tailoring solutions to local contexts, affecting scalability
Germany Forest Insurance	• Availability of forest vulnerability and storm damage data supporting risk assessment • Historical storm events creating demonstrable economic losses for forest managers • Information and awareness-raising campaigns highlighting the need for insurance and adaptation • Existing insurance subsidy mechanisms that can include parametric insurance for foresters • Public availability of PIISA results (e.g. Deliverable 3.13) supporting dissemination and credibility	• Existing wind damage security systems at national or local level reducing perceived added value of new insurance solutions • Low perceived risk among forest owners, limiting demand for insurance products • Fragmentation of forest ownership and management structures • Limited willingness to pay for insurance cover • High insurance premiums in high-risk areas, affecting affordability and uptake
Portugal Wildfire Insurance	• Existence of standardised practices and metrics for wildfire damage and risk quantification • Legislative and regulatory frameworks recognising adaptation measures and, in some cases, insurance requirements or incentives • Availability of DestinE HPC, data, and service resources supporting advanced wildfire modelling • Growing collaboration between insurers, planners, and forest managers on adaptation and risk reduction • Insurance subsidy mechanisms that can include parametric insurance for foresters • Cross-sector relevance of wildfire risk modelling beyond insurance (e.g. spatial planning, disaster risk reduction, forest management) • Public availability of PIISA results (e.g. Deliverable 3.13) supporting visibility and reuse	• Strong context-dependence of wildfire adaptation measures (especially NbS), limiting transferability • Limited trust in, and experience with, insurance, particularly parametric insurance in Portugal. • Low awareness of available adaptation options among forest managers • Complexity of insurance products, reducing understanding and uptake • Fragmentation of forest ownership and management structures • High insurance premiums in high-risk areas, affecting affordability • Data limitations (fuel data availability, quality, and compatibility) • Constraints in computing resources for large-scale or real-time modelling • Limited tools allowing users to input or customise local data • Fire adaptation measures not yet widely deployed in practice
CSSBDA	• Clay shrink–swell recognised as an emerging climate risk • Existence of national and EU-supported climate change adaptation activities • Communication, publicity, and stakeholder networks identified as the main drivers of success	• Difficulty ensuring sufficient publicity to the intended audiences • Challenge in reaching a critical mass of stakeholders aware of the issue to trigger change

8.5.5 Priority actions and implications for the roadmap

Building on the discussions held during the exploitation workshop, partners were invited to identify concrete priority actions to be undertaken before the end of the PIISA project and in the immediate post-project phase. These actions were not intended as exhaustive workplans, but rather as focused, realistic steps that could directly support the exploitation of pilot results and their potential replication beyond the original pilot contexts.

To ensure clarity and comparability across pilots, the actions collected through the MURAL exercise were consolidated in Table 14 below, refined, and synthesised into a limited set of priority actions per pilot. Each action reflects a tangible next step (e.g. service consolidation, stakeholder engagement, targeted dissemination or follow-up development) and is explicitly linked to its expected contribution to exploitation and replication, in line with PIISA's service- and methodology-driven exploitation approach.

Table 14 Priority actions identified during the exploitation workshop and their contribution to exploitation and replication across PIISA pilots

Pilot	Priority actions	Contribution to exploitation and replication
Green Roofs	• Finalise and structure the climate service targeting insurers, with a focus on raising awareness of Nature-Based Solutions (NBS). • Engage insurers in follow-up research activities and potential field experimentation to further test and refine the service. • Reach out to a broad range of potential partner groups (insurers, professional networks, sectoral platforms) to collect feedback on proposed service propositions. • Identify and engage professional platforms, insurer networks, and specialised magazines willing to disseminate and showcase the pilot results. • Involve actuarial students and academic actors in the design of insurance products supporting green roofs for new and existing buildings. • Present the climate service to relevant professional platforms and sectoral audiences.	These actions aim to move the green roofs pilot from a project result to a recognised, service-oriented offering by strengthening insurer engagement, increasing visibility among professional audiences, and gathering structured feedback. Together, they support both post-project exploitation and the potential replication of the service in other regions and insurance contexts.
Food and Agriculture	• Raise awareness of climate risk and the role of insurance solutions in addressing agricultural climate impacts. • Assess the business feasibility of the insurance solution developed during the pilot. • Develop a guidance document to support application and adaptation of the solution in other regions. • Improve understanding of regulatory and policy frameworks relevant to agricultural insurance across countries. • Continue research efforts to further refine climate services and indicators. • Identify and secure funding opportunities to sustain climate services and enable farmer-level adaptation beyond the project.	These actions focus on transitioning the pilot from a research-driven demonstration to a viable, transferable climate and insurance service. They support exploitation by clarifying market feasibility and regulatory conditions, while strengthening replication potential through guidance materials, sustained research, and funding pathways that enable uptake in other agricultural contexts.
Germany Forest Insurance	• Engage stakeholders through a dedicated workshop in the boreal region to discuss applicability and needs. • Test the forest risk and insurance model in additional regions beyond the initial pilot area. • Hold follow-up discussions with AXA Germany to explore climate services that could be relevant for their portfolio. • Collect feedback from potential Irish clients to assess willingness to pay for forest insurance solutions.	These actions aim to validate demand and applicability of the pilot beyond the initial German context. By combining stakeholder engagement, regional testing, insurer dialogue, and market feedback, they support exploitation through business validation and strengthen replication by assessing transferability to other forest and insurance contexts.
Portugal Wildfire Insurance	• Continue awareness-raising activities (e.g. webinars) targeting insurers, public authorities, and forest stakeholders. • Maintain engagement with local governments and forest associations to support uptake and relevance. • Quantify potential insurance premium reductions under different adaptation and wildfire management scenarios • Further model intermediate adaptation scenarios to assess their impact on risk reduction. • Continue co-development activities within DestinE to strengthen technical robustness and visibility. • Organise a dedicated workshop with PRECILIENCE to share knowledge and lessons from the pilot. • Assess local willingness to pay for wildfire insurance solutions.	These actions aim to consolidate exploitation by strengthening stakeholder awareness, technical evidence, and insurer engagement. Quantifying premium impacts and testing adaptation scenarios supports market validation, while continued co-development and workshops enhance replication potential across other wildfire-prone regions and European climate service initiatives.
CSSBDA	• Finalise and disseminate the Risk Alert Briefing, covering six countries, to identify where clay shrink–swell risk coincides with insurance coverage gaps. • Implement and amplify targeted publicity linked to the Risk Alert Briefing to raise awareness of the issue at European level. • Roll out national communication activities targeting homeowners, public authorities, and policymakers to increase visibility and understanding of clay shrink–swell risks.	These actions support exploitation by positioning the CSSBDA as an awareness-raising and policy-informing tool rather than a commercial service. The Risk Alert Briefing enables replication by identifying priority countries and contexts where similar tools could be relevant, while communication efforts aim to build stakeholder awareness and demand for future adaptation and insurance-related initiatives.

The priority actions identified during the exploitation workshop provide a concrete operational bridge between pilot-level exploitation planning and the broader Replicability Roadmap developed under PIISA. Rather than abstract recommendations, these actions translate pilot-specific insights into short-term, actionable steps to be pursued before March 2026, focusing on awareness raising, stakeholder engagement, further testing, regulatory understanding, and evidence generation.

Taken together, the actions highlight common leverage points across pilots, including the need to strengthen demand-side awareness, engage insurers and public authorities early, clarify regulatory feasibility across countries, and generate credible evidence linking adaptation measures to risk reduction and insurance outcomes. These elements directly inform the prioritisation logic of the Replicability Roadmap, helping to distinguish where replication efforts are most mature, where foundational work is still required, and which enabling conditions must be addressed to support scaling beyond the project duration.

As such, the outcomes of the exploitation workshop do not replace the Replicability Roadmap but rather operationalise it, ensuring that replication pathways are grounded in pilot realities, stakeholder feedback, and concrete post-project actions.

9 Replicability roadmap

9.1 Purpose and scope of the replicability roadmap

This Replicability Roadmap provides a structured and forward-looking synthesis of how the results generated by PIISA pilots can be replicated, transferred, or adapted beyond their original implementation contexts. It builds on the replicability assessments conducted under WP3, the outcomes of the exploitation workshop held on 5 December 2025, and the priority actions identified by pilot teams for the period up to March 2026.

The roadmap is strategic in nature. It does not constitute an implementation plan, nor does it assign binding responsibilities to partners beyond the project duration. Instead, it clarifies:

- the replicable elements emerging from each pilot,
- the conditions under which replication is feasible,
- the sequencing of actions over time, and
- the roles of key stakeholder groups involved in enabling replication.

The roadmap is intended to support decision-making by project partners, public authorities, insurers, and future initiatives seeking to build on PIISA results.

9.2 Replication logic and differentiated readiness across pilots

The replicability analyses and exploitation workshop discussions confirm that PIISA pilots do not follow a single replication trajectory. Differences in sectoral maturity, regulatory frameworks, market demand, and data availability result in distinct modes of replication, which can be summarised as follows:

- Service- and model-driven pilots (e.g. agriculture and forest insurance) show higher near-term replication potential, supported by transferable datasets, technical maturity, and identifiable user demand, subject to regulatory and market conditions.
- Condition-dependent pilots (e.g. wildfire insurance and green roof insurance) demonstrate replication potential where strong public-sector alignment, local calibration, and evidence of adaptation benefits are present.
- Awareness- and policy-intelligence pilots (e.g. the Clay Shrink Swell Building Damage Assessor) primarily support replication through knowledge transfer, comparative analysis, and targeted redevelopment rather than direct scaling.

Recognising these differences is essential to avoid a one-size-fits-all approach and to ensure that replication efforts are realistic, sequenced, and context-appropriate

9.3 Cross-pilot replicability roadmap framework

Table 15 presents the overarching Replicability Roadmap for PIISA, structured across three time horizons. It highlights common priorities and enabling actions across pilots, while allowing for pilot-specific pathways detailed in Section 9.4. All replication actions presented below are envisaged to take place after the formal end of the PIISA project (March 2026).

Table 15 PIISA Replicability Roadmap: cross-pilot strategic framework

Replication horizon after March 2026	Strategic focus	Key actions	Main stakeholder groups	Expected contribution
Short-term (0–12 months)	Consolidation and validation	• Consolidate pilot outcomes into clearly defined services, methods, or tools • Validate replication assumptions and priority actions with pilot teams • Strengthen targeted communication towards insurers and public authorities	Pilot leads; insurers; public authorities; research partners	Clear articulation of replicable elements and validated replication pathways
Medium-term (1–3 years)	Targeted replication and adaptation	• Adapt models and services to new regions through local calibration, including the transfer and recalibration of climate risk indicators developed in WP2 and operationalised within WP3 pilots • Strengthen the integration of climate services into pilot-level applications, enabling the development of improved risk alerts and decision-support tools across regions • Address regulatory feasibility through country-specific analysis • Develop guidance materials supporting third-party replication	Insurers; municipalities; national authorities; sectoral associations	Initial replication cases and reduced barriers to uptake
Long-term (3+ years)	Mainstreaming and policy alignment	• Integrate successful approaches into broader adaptation and insurance frameworks • Align outcomes with EU-level adaptation and insurance initiatives • Promote knowledge transfer to future projects and platforms	EU bodies; national governments; large insurers; knowledge platforms	Sustained replication pathways and systemic contribution to climate adaptation

9.4 Pilot-specific replication pathways

To complement the cross-pilot framework, Table 16 presents pilot-specific replication pathways, synthesising the exploitation workshop outputs and replicability analyses into concise, validation-ready pathways. The pilot-specific replication pathways were validated with pilot leaders in February 2026.

Table 16 Pilot-specific replication pathways

Pilot	Replication focus	Priority actions for post-project replication	Key conditions / dependencies	Replication horizon
Green roofs insurance	Awareness- and policy-led replication	• Consolidate findings on barriers and enablers for NBS insurance uptake • Reframe outputs as guidance for municipalities and insurers • Continue engagement with insurers through targeted dialogues • Translate pilot findings into evidence relevant for insurance regulators and supervisory bodies	Municipal incentives; insurer awareness; local policy alignment; Insurance-sector regulatory frameworks that incentivise climate adaptation and prevention	Medium–long
Food and agriculture insurance	Parametric insurance service solution replication	• Finalise and document index-based insurance logic • Produce guidance for adapting thresholds to new regions • Continue engagement with farmer associations	Regulatory feasibility of parametric insurance; reinsurer engagement; local data availability and local stakeholder engagement through workshops and interviews	Short–medium
Forest insurance (Germany)	Model transfer and product adaptation	**For Wind Power Exposure Index (WPEI):** Continue validation of wind models in additional regions	**For Wind Power Exposure Index (WPEI):** Integrate wind intensity and wind direction to reflect tree resilience to storm from open source Hourly ERA5 land data, available at worldwide level. The computation of historical hazard with WPEI can also be isolated as a climate service to help foresters understand their value at lost and calibrate the risk appetite	Short–medium
		For the vulnerability index: Output that integrates local characteristics (forest characteristics, soil, topography), scalable, and that can be improved with ground-truth calibration	**For the vulnerability index**: Testing historical storms in the client parcels to test the risk detection (modelled vs.	

			Historical) before going into the product contractualization	
		<u>For damage curve (vulnerability):</u> For insurance companies: integrate the WPEI and Vulnerability Index with their own pricing strategy.	**<u>For damage curve (vulnerability):</u>** Testing historical storms in the client parcels to test the risk detection (modelled vs. Historical) before going into the product contractualization.	
Wildfire insurance (Portugal)	Conditional replication linked to adaptation policies	• Re-calibrate models in other regions where there is need and interest • Assess applicability to other Mediterranean contexts	Strong public-sector alignment; adaptation policy frameworks, the design and implementation of the adaptation measures in practice.	Medium
Clay Shrink Swell Building Damage Assessor	Knowledge transfer and targeted tool replication	• Complete national rollout and communication activities in France • Finalise comparative Risk Alert Briefing across EU countries	Availability of property and insurance data; regulatory context	Medium–long

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9.5 Roles of key stakeholders in enabling replication

Replication of PIISA outcomes depends on coordinated action across stakeholder groups:

- Insurers and reinsurers play a central role in translating models and methods into viable insurance products and services.
- Public authorities and municipalities act as enablers through regulatory clarity, incentives, and alignment with adaptation strategies.
- Research and technical partners support data harmonisation, model adaptation, and methodological robustness.
- Intermediaries and sectoral associations facilitate engagement with end users and support contextualisation.
- EU-level initiatives and platforms provide strategic alignment and opportunities for wider dissemination and uptake.

The roadmap therefore emphasises collaboration and sequencing rather than isolated pilot-level action.

10 Conclusion and next steps

This deliverable has consolidated the final replicability analysis and replication pathways of the PIISA pilots, building on three years of iterative pilot development, structured assessment, and collective reflection. Through the WP3 replicability framework and the exploitation workshop held in December 2025, the project has moved from exploratory testing to a clear articulation of how pilot outcomes can be sustained, adapted, and transferred beyond the project lifetime.

The analysis confirms that PIISA pilots do not follow a single replication logic. Instead, they reflect a diversity of replication pathways shaped by sectoral context, regulatory conditions, data availability, and stakeholder readiness. Some pilots lend themselves to direct service or model replication (e.g. agriculture and forestry), while others are more suited to knowledge transfer, awareness raising, and policy-oriented replication (e.g. green roofs and CSSBDA). This diversity has been explicitly captured in the Replicability Roadmap, ensuring that expectations around scaling remain realistic and context-sensitive.

The Replicability Roadmap presented in this deliverable serves two complementary purposes. At project level, it identifies cross-cutting enablers and constraints that influence replication across pilots, including the role of public-sector alignment, data accessibility, regulatory acceptance, and stakeholder engagement. At pilot level, it provides structured post-project replication pathways, outlining the focus, conditions, and indicative horizons for each pilot after March 2026. Together, these elements form a coherent and actionable reference for partners, policymakers, and external stakeholders interested in advancing innovative insurance solutions for climate adaptation.

The validation rounds conducted with pilot leaders in early 2026 ensure that the proposed replication pathways accurately reflect the pilots' maturity and strategic direction at project end. This step reinforces ownership of the roadmap while preserving a stable analytical framework suitable for dissemination and longer-term use.

Looking ahead, the work carried out under PIISA lays a solid foundation for continued progress. While this deliverable focuses on replication pathways rather than implementation beyond the project, several pilots have identified trajectories that would benefit from longer-term follow-up, deeper institutional engagement, or extended geographic testing. The Replicability Roadmap therefore not only captures what is feasible immediately after PIISA, but also highlights where additional time, coordination, or future initiatives could further unlock replication potential.

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Annexes

Annexe 1 - Partner Questionnaire

PILOT NAME & CONTACT NAME:_____

1. Pilot summary

- What is the core goal of your pilot?_____
- Who are the main end users or stakeholders?_____
- Are there existing policies or incentives that supported your pilot?_____
- Would similar regulatory or legal conditions be found in other EU countries?_____

2. Implementation context

- In which country/region is the pilot being implemented?_____
- Are there any local enablers (e.g. regulation, data access) supporting your pilot?_____

3. Technical setup

- What tools, platforms, or data sources are you using?_____
- Were any custom developments made?_____
- Can the tools, models, or platforms used in your pilot be reused in other regions with minimal change?_____
- Are the key datasets used in your pilot available (or replicable) in other EU regions?_

4. Results & feedback

- What are the key outcomes or findings so far?_____
- Have users or stakeholders provided feedback?_____

5. Replicability potential

- What changes would be needed to replicate your pilot in another region or country?__
- Are there any barriers (policy, data, market readiness) you foresee?_____
- Would significant training or capacity building be required to replicate your pilot elsewhere?_____
- What are the key cost factors of your solution? Is it considered low or high cost?____

6. Additional insights

- What would you consider to be the most critical factor for replicating your pilot?____
- Are there any regions you believe are particularly suited (or unsuited) for replication?
- Please attach or link any relevant reports, visuals, or documentation._____