CAT CCA transfer plans to twins

Deliverable 3.19

28 January 2025

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1 Introduction

The deliverable aims to provide a detailed plan for transferring the CCA solutions from the RESIST Leading region Catalonia (Spain) to the Twinning Baixo Alentejo (Portugal) and Puglia (Italy) regions. It briefly presents the motivation for the CCA solutions required in these three regions, the background of the RESIST solutions, the selected transfer solutions to the twinning regions, and the key expertise in the solution-providing region (Section 1). Sections 2 and 3 focus on the transfer plans describing the challenges and needs of the climate adaptation solutions in Baixo Alentejo and Puglia, respectively. The plans also describe the customised solutions, barriers, costs and resources, and the tentative timelines until the end of the project.

1.1 Motivation

Catalonia has been continuously affected by climate and extreme weather events of floods, heat waves, forest fires, and droughts (Fig. 1). Civil Protection plays a crucial role in providing action plans and coordinating resources in natural risk disaster management as presented in the RESIST need assessments deliverables D1.1 and D1.11.

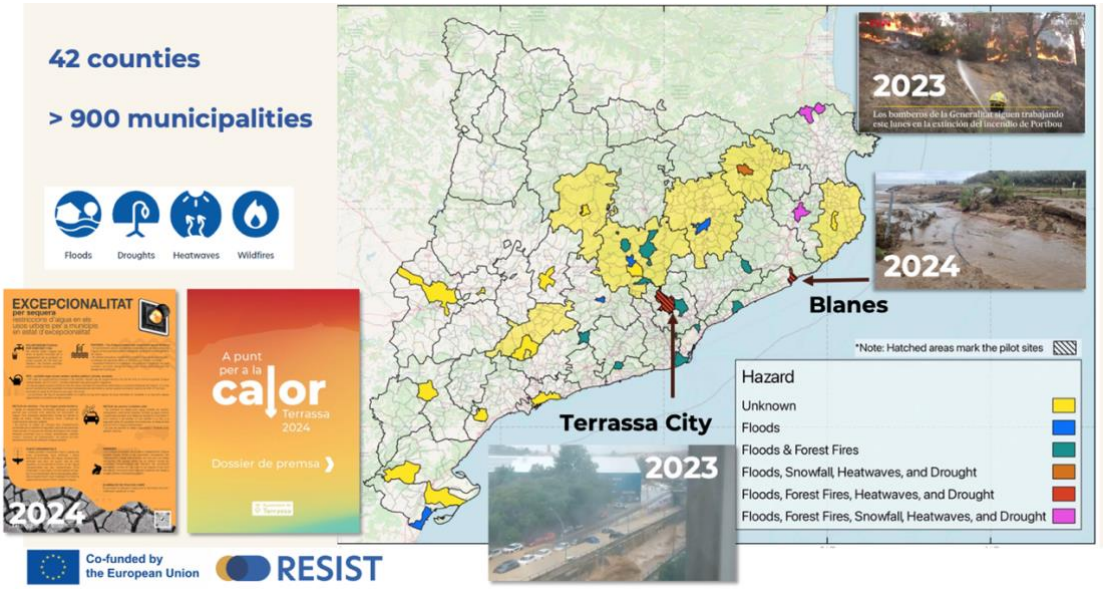

Figure 1: Climate Challenges in Catalonia

As shown in the Fig. 1, in 2023, severe forest fires affected northern Catalonia. Terrasa City, one of the RESIST pilot sites, faced disastrous flash floods triggered by short-lasting rainfalls for a few hours. In early 2024, Catalonia declared a drought emergency, asking the public for limited water use, while floods affected some areas, such as Blanes, another RESIST pilot site. During the summer, extreme heat waves have been an issue in multiple municipalities, including Terrassa.

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In Early 2023, the Government of Catalonia approved the new Strategic Reference Framework for Climate Change Adaptation in Catalonia for Horizon 2030 (hereafter EACACC30, endorsed by the IPCC Fifth Assessment Report). ESCACC30 newly includes the sector of "Natural Risks and Civil Protection" to reduce vulnerabilities in socio-economic spheres (Table 1) and to improve CCA strategies with the government operational (directional) goals (Table 2). However, Catalonia currently consists of 42 counties and more than 900 municipalities, and the emergency action plans coordinated by the local and regional civil protection still need to be better defined to reach the potentially affected people from extreme weather and climate events, particularly before the events hit them.

Within the RESIST project **Task 3.3**, the regional Civil Protection INT has identified more than 20 municipalities exposed to various natural hazards (shown in Fig.1) seeking adaptive solutions.

Table 1: Impacts and risk in the sector of "Natural risks and civil protection" (ESCACC 30)

Climate hazards	Impacts	Exposure	Vulnerability	Risk
• **Floods** • **Droughts** • **Forest Fires** • **Land slides**	Damaged to people, goods, services and ecosystems.	High in densely populated areas with goods and services.	Dependence on the magnitude of the climate hazard. Nevertheless, Catalonia has a wide range of civil protection plans in place to deal with natural and climate risks.	Loss of life and economic loss. Increased repair costs for major infrastructures. Increase in the price of energy services.

Table 2: Operational goals of CCA in "Natural risks and civil protection" sector (ESCACC 30)

NATURAL RISKS AND CIVIL PROTECTION
• Integrate climate change impacts into Civil Protection weather-risk planning and sectoral socio-economic risk plans (for floods, droughts and forest fires). • Promote the prospective assessment of meteorological risks (heatwaves, cold, snowfall, frost, extreme rainfall, etc.), social-natural risks (floods, droughts and forest fires) and geological risks (landslides and avalanches), taking into account climate change projections and scenarios. • Expand and strengthen observation, early warning, communication and education systems for natural hazards and severe and very rapidly changing events, and define the financing for these systems (Climate Fund and redirection of the existing civil protection tax to climate change adaptation measures) • Integrate active risk management into spatial, urban and sectoral planning

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Therefore, aligned with ESCACC 30, the large-scale demonstrator in Catalonia (LSD3) focuses on enhancing pre-emergency management at the local city or municipality level by achieving better coordination among the first and second responders (e.g., local police, forest managers, social workers, red-cross, etc.). This also includes improved communication channels between regional and local civil protection. Secondly, LSD3 aims to raise better risk awareness for the self-protection actions by communities and citizens. With these goals, six partners of RESIST LSD3 have developed three solutions that are being demonstrated in Terrassa and Blanes. The lessons learned from the first-runner pilot cities will help the replication of the solutions to other municipalities in Catalonia and other regions in Europe, particularly Baixo Alentejo (Portugal) and Puglia (Italy), the RESIST twining regions of Catalonia (LSDT3, Fig. 2), that are facing the following challenges.

Figure 2: Large-Scale Demonstrator in the Twinning regions (LSDT3, Catalonia, Baixo Alentejo, and Puglia, adapted from a map provided by REVOLVE*).*

Baixo Alentejo is one of the most problematic regions regarding the effects of climate change in Portugal. Both minimum and maximum temperatures will rise significantly in the region until the end of the century. An increase in the number of hot days is further expected. Total annual precipitation is expected to decrease by the end of the century over the entire region. However, given projected rising annual temperatures and decreasing annual total precipitation, more arid climatic conditions might nevertheless be expected in the region by the end of the century. Thus, the following five climatic trends are identified as having the highest potential for negative impacts on the region under future climatic conditions: 1) increase in average temperature, 2) more frequent heatwaves, 3) more frequent heavy precipitation events, 4) decrease in annual average precipitation, 5) overall more arid conditions. Therefore, the climatic trends are prioritised as bearing most risks for the region as: increase in average annual temperature; increase in the frequency and intensity of heat waves; increase in the frequency and intensity of droughts.

The region is susceptible to heatwaves and extreme temperatures, particularly during the summer months. Climate change increases the frequency and intensity of heatwaves, posing risks to public health, agriculture, and infrastructure.

Climate change is expected to have a significant impact on the population's quality of life and health, both in terms of extreme weather events and gradual changes in living conditions and land characteristics. Population characteristics such as age, health, physiology, living conditions, among

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others, are factors that condition the population's vulnerability to climate change and, consequently, its ability to adapt. The climate impacts being addressed are associated with heatwaves. The social groups affected by those impacts are the civil protection sector, municipalities, parish councils, fire brigades and civil society (specifically vulnerable groups such as the elderly).

The required support for the RESIST initiative in the Baixo Alentejo region is multifaceted (D1.11 for more details on the need assessment). Key aspects revolve around utilising technology and ensuring their effective application, for instance, for supporting adaptation actions in small, rural villages and supporting vulnerable groups.

Puglia, the region in Italy, is known for its hot and Mediterranean summers, is experiencing an increase in average temperatures and longer periods of extreme heat, especially in the peak summer months. Heat waves represent a high potential risk for both the resident community and temporary travellers, presenting serious health risks. The most vulnerable people, such as the elderly, children and people with chronic diseases who live or travel in the affected areas, are most at risk.

Tourism is an extremely important industry for the economic, social and cultural growth of the Puglia region (D1.11 for more details). Particularly, summer and coastal tourism still plays a dominant role in the region's tourist flows, even if, in recent years, there has been a gradual lengthening of the summer season, with a broadening of the range of experiences on offer in the shoulder ones.

Puglia's beaches, historic cities and unique landscapes attract millions of visitors every year, providing significant employment and revenue. However, the increase in heat waves is becoming a considerable threat to this sector. In perspective, it may cause visitors to choose some of the most exposed areas of the region as their holiday destination, but also, from the point of view of the internal organisation of the destination, to revise destination strategies, adapting the tourism offer.

Focusing on the relationship between heat waves and the tourist industry, this extreme phenomenon causes an increase in temperatures of well over 40°C perceived (also considering the absence of winds and high humidity in the interior highlands or large cities), making it difficult for tourists to enjoy the experiences offered by the area in the best possible way, to practice outdoor activities, explore cultural sites or even relax comfortably on the beach. Heat-related illnesses, including heat exhaustion and heat stroke, can pose a serious health risk, especially for tourists who may not be fully prepared or aware of the necessary precautions. Extreme heat can lead to reduced comfort, health problems and lower visitor satisfaction, affecting Puglia's overall attractiveness as a summer destination. Consequently, high temperatures may push tourists to reduce their stay, to seek cooler destinations or to avoid Puglia altogether during the hottest periods of the year.

To counter these harmful scenarios for the Puglia economy, preserve the environment and the health of the resident population, and ensure comfortable experiences for travellers, adapting to the

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challenges posed by climate change will involve both policy actions and the implementation of increasingly sustainable actions that each economic operator, especially in the tourism sector, will have to carry out to make its own significant contribution to mitigating some negative impacts.

From a strategic point of view, the Puglia Region is decisively pursuing the discourse related to the protection of the territory against the effects of climate change, through the Regional Strategy for Adaptation to Climate Change (SRACC), which identifies, in its territorial analysis section, the following priority hazards: floods; landslides; droughts; fires; water safety; heat waves; and coastal erosion.

1.2 Overview of planned transfers within RESIST for all regions

The RESIST project addresses climate-related challenges and needs of twelve climate-vulnerable regions in Europe, each with distinct socioeconomic profiles. These regions are Southwest Finland (Finland), Central Denmark (Denmark), Catalonia (Spain), Central Portugal (Portugal), Normandy (France), Eastern Macedonia and Thrace (Greece), Blekinge (Sweden), Zemgale (Latvia), Puglia (Italy), Baixo Alentejo (Portugal), Vesterålen (Norway), and Extremadura (Spain).

As part of the project, adaptation solutions developed by RESIST regions are transferred to other “receiving” project regions. The original project structure organizes the regions into four clusters, each consisting of one more advanced region, known as a Large-Scale Demonstrator Region, and two Twin Regions. Each cluster is referred to as an “LSDT”. While the Large-Scale Demonstrator Regions — namely Southwest Finland, Central Denmark, Catalonia, and Central Portugal — were pre-selected as providing regions, any region within the project could choose to offer solutions for transfer. Fig. 3 shows an overview of all planned transfers, which will be implemented within the remaining project time (2025-2027).

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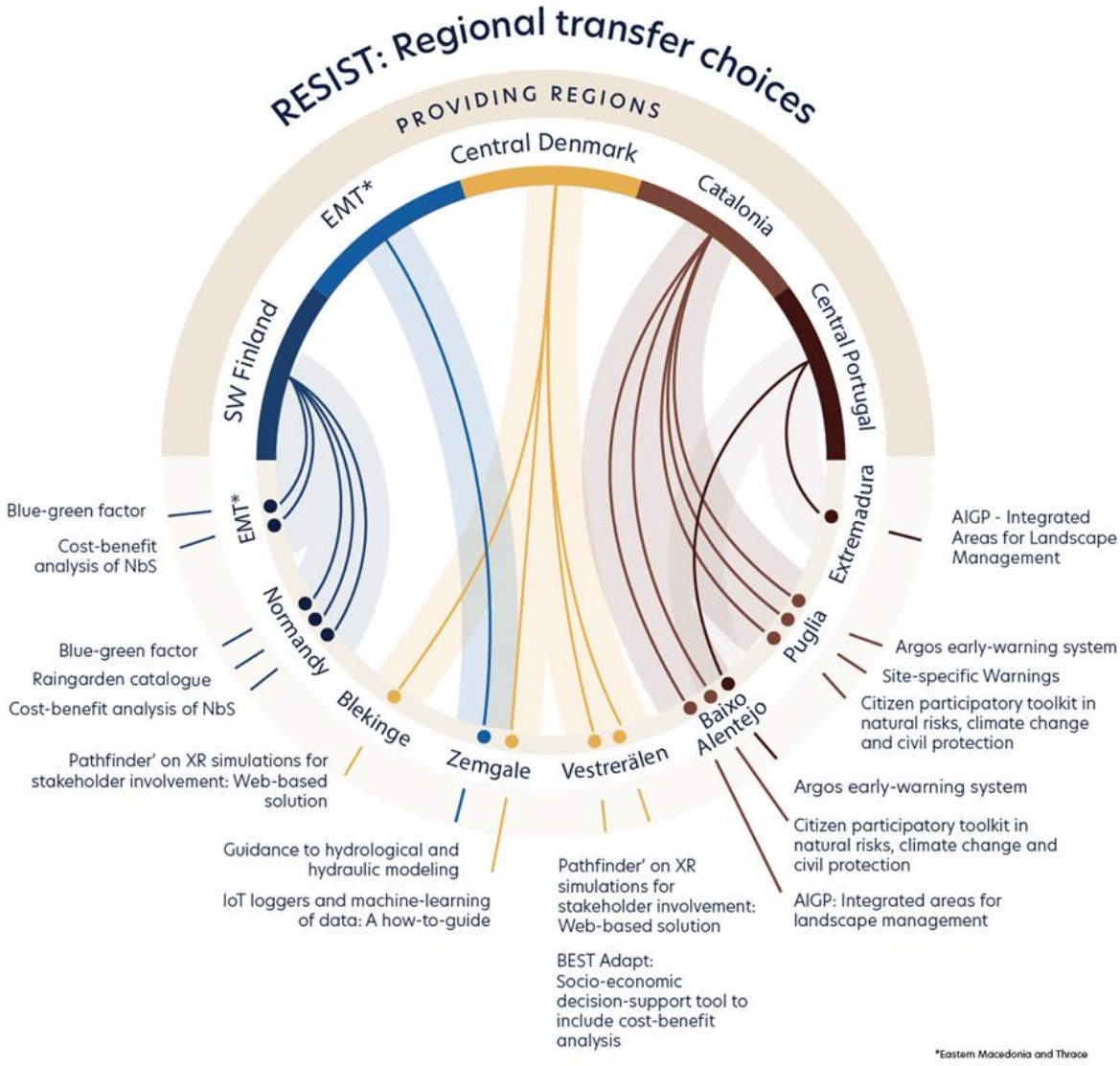

Figure 3: Overview of transfers between the regions.

South-West Finland (LSDT1) is transferring five innovative solutions. These include the "Blue-green factor", a policy instrument used to increase blue- and green infrastructure in urban areas, and "Cost-Benefit analysis of NbS", which provides a systematic method for identifying the benefits and costs of Nature-based Solution (NbS) projects over their lifetime. Both solutions are transferred to the regions of Normandy (LSDT1) and Eastern Macedonia and Thrace (LSDT1). Additionally, South-West Finland transfers the “Raingarden catalogue” to Normandy. This catalogue provides valuable insights into raingardens, promoting sustainable water management in residential areas. All three regions belong to LSDT1, no transfers outside the original LSDT are performed by South-west Finland.

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Eastern Macedonia and Thrace (LSDT1), a region that joined RESIST as a twin-region, is also contributing a solution to the transfer process. The "Guidance to Hydrological and Hydraulic Modelling" solution is transferred to Zemgale (LSDT3). This solution provides comprehensive guidance for hydrologic and hydraulic modelling, enhancing water management and increasing resilience to flood-related hazards.

Central Denmark (LSDT2) is sharing its expertise with Zemgale (LSDT2) through the solution "IoT Loggers." The solution facilitates the deployment and use of IoT groundwater loggers, supporting effective data collection and analysis. Furthermore, Central Denmark transfers "BEST Adapt: Socio-economic Decision-Support Tool to Include Cost-Benefit Analysis" to Vesterålen (LSDT4). This tool integrates socio-economic factors to enhance informed decision-making in climate adaptation efforts, particularly focusing on flood-related hazards. Additionally, Central Denmark provides the "Pathfinder on XR Simulations for Stakeholder Involvement – Web-Based Solution," an online tool designed to support the selection and implementation of XR solutions for immersive stakeholder engagement. This solution is transferred to both Vesterålen and Blekinge (LSDT2). Central Denmark, therefore, facilitates solution transfers both within and beyond its LSDT.

Catalonia (LSDT3) contributes the "Argos Early-Warning System," an early-warning and decision-support tool designed to assist emergency managers and other stakeholders in anticipating impacts and managing weather-related emergencies more effectively. It also offers the "Citizen Participatory Toolkit in Natural Risks, Climate Change, and Civil Protection," which is a compilation of various formats and methods for engaging citizens in climate adaptation, tailored to different social groups. Both solutions are transferred to Baixo Alentejo (LSDT3) and Puglia (LSDT3). Additionally, Catalonia transfers the "Site Specific Warnings" solution to Puglia, which integrates site-specific warnings into the Argos early-warning system. Catalonia does not transfer solutions outside of LSDT3.
Central Portugal (LSDT4) shares the "AIGP – Integrated Areas for Landscape Management", a comprehensive approach aimed at promoting the collective management and utilisation of agroforestry spaces in smallholdings and areas with high fire risk. This approach is grounded in an integrated territorial strategy that addresses the need for effective landscape planning and management. It aims to increase the area of managed forest at a scale that enhances resilience to fires, boosts natural capital, and in a way that supports the rural economy. This solution will be transferred to Extremadura (LSDT4) and Baixo Alentejo (LSDT3).

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1.3 LSDT-3: Parties and content of the transfer plans

LSDT3 comprises the Large-Scale Demonstrator of Catalonia (Spain) with Twinning Regions in Baixo Alentejo (Portugal) and Puglia (Italy). The LSD3 Catalonia proposes three solutions, namely

1. Multi-Hazard Early Warning System (short name Argos),
2. Impact-based Site-specific warning,
3. Citizen Participatory Toolkit

The first two real-time digital solutions (led by HYDS and UPC, respectively) have been implemented locally in the RESIST pilot cities in Catalonia, with available local sensors, risk maps, and information on critical points, producing impact warning forecasts. The third solution, Citizen participatory toolkit (led by INT and UOC), includes a set of public survey questionnaires and guidelines based on current social perspectives on climate change related natural hazards, risk information and communication with vulnerable groups (such as the elderly, children, people with disabilities, and socially excluded), thereby enhancing emergency preparedness.

Following the need assessments of the twinning regions (Section 1.1 of this deliverable and D1.11) and the RESIST transfer methodology (D1.2), the LSDT3 partners identified and listed the selected solutions for their transfer plans (Table 3).

Table 3. An overview of selected solutions in Baixo Alentejo and Puglia

Solution selected for transfer	Recipient region	Key project partners involved	
• Multi-Hazard Early Warning System (Argos) • Citizen Participatory Toolkit in Natural Risks and Climate Change (Civil protection)	Baixo Alentejo	Solution-providing region • HYDS • INT • UOC	Solution-receiving region • CIMBAL • ITECONS
• Multi-Hazard Early Warning System (Argos) • Impact-based site-specific warnings • Citizen Participatory Toolkit in Natural Risks and Climate Change (Tourism)	Puglia	Solution-providing region • HYDS • UPC • INT • UOC	Solution-receiving region • Puglia region • Tecnopolis

Hence, LSDT3 aims to assess the added values of the adapted solutions in

- **Catalonia** for local and regional Civil Protection by improving the preparedness and tools for disaster risk and emergency management.
- **Baixo Alentejo** for the network of 13 municipalities in collaboration with regional and local Civil Protection by improving risk analysis triggered by high-temperature and heat waves and updating the intermunicipal CCA actions and measures.
- **Puglia** for the tourism operators and tourists by improving the preparedness and tools supporting policy-making and problem-solving due to heatwaves and high temperatures.

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1.4 Solution-providing region: Strengths and expertise

1.4.1 Key regional expertise in the field of climate resilience and climate change adaptation

The RESIST LSD3 Catalonia proposes solutions specialised for (pre)emergency management with the decision support digital tools and inclusive risk communication and citizen participation in Civil Protection, aiming to enhance capacity building on natural risk awareness and proactive preparedness in emergency management due to extreme weather and climate risks.

The regional emergency management in Catalonia uses a real-time early warning system built with forecasting algorithms and products, which is helpful in overviewing and coordinating regional actions. However, regarding emergency management at the city or municipal levels, local adaptation planning requires better guidance and communication with regional civil protection and local decision-makers, including the first and second responders, to help as many affected citizens as possible in an emergency.

The local Civil Protection, including from the Terrassa and Blanes RESIST pilot sites, stressed that it is still lacking effective communication on natural risk information for vulnerable groups (e.g., the youngest and oldest people, retired, and those with low-level educations, immigrants, people with disabilities), not to mention of lacking understanding and promoting self-protection actions by the general public.

The RESIST LSD3 solutions have been developed through an interdisciplinary collaboration (Fig. 4) based on the quintuple helix approach among six partners with expertise in:

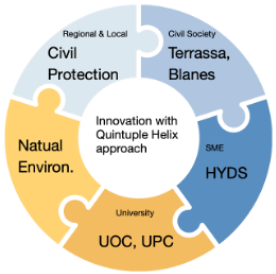

Figure 4: Key collaboration for the LSD3 solutions

- Emergency management, Citizen participatory activities for raising risk awareness (Civil Protection of Ministry of Home Affairs and Public Safety **- INT**),
- Technological development of real-time Early Warning algorithms and tools, hazard assessments and risk analysis (**UPC**),
- Social aspects and Inclusive risk communication (**UOC**),
- Technological development of decision-making supporting platform and implementation to run in real-time (**HYDS**),
- **Terrassa CC** – Demonstration pilot sites (medium size), Smart city,
- **Blanes** – Demonstration pilot sites (small size), Touristic city.

The LSD3 solutions are innovative, including both digital and sociological methodologies and operative practices (Fig. 5). More detailed documentation on methodologies and the resulting case studies will be compiled in the coming Deliverables (D3.14, D3.15, D3,16 and D3.17 in Month 36, D3.18 in Month 48, and D.3.27 in Month 60).

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Figure 5: Transformative Innovation features of LSD3 solutions in Catalonia

1.4.2 Overview of solutions available for transfer

The LSD3 has implemented three transformative solutions (Table 4) in the cities of Terrassa and Blanes. Currently, the solutions are being tested for improved adaptation to climate change in the natural risk and civil protection sector. However, these solutions can also adapt to other sectors or partly apply to meet the needs of the end-users.

Table 4: Overview of solutions shortlisted by Catalonia

Solution shortlist		
Name of solution	**Solution type**	**Short description**
Argos Early Warning System	Digital	Argos is an Early Warning System and a Decision Support Tool (digital platform) to help emergency managers and other stakeholders anticipate the impacts and better manage the weather-related emergencies that climate change is bringing (more often, more extreme). It centralises all related information (hazard products in real-time and vulnerability elements), provides hyperlocal tailored early warnings on the specific critical points and infrastructures, and assists in situation management.

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Impact-based Site-Specific Warning	Digital	Site-Specific Warning is a tool providing tailored information on risks that helps trigger action protocols or decisions for better managing the extreme weather-related emergency preparedness by different end-users at the local and community levels. It integrates the local data and knowledge at a specific vulnerable area, group, or infrastructure associated with extreme weather and climate events for tailored risk assessment and evaluation.
Citizen participatory toolkit in natural risks, climate change and civil protection	Practices and Methodologies	Its short name is Citizen Participatory Toolkit This toolkit is designed with a citizen-centric approach, aiming to strengthen communities by fostering inclusive participatory processes and social action addressing natural hazards, climate change and civil protection participation. This toolkit is built upon three fundamental pillars, each serving as a complementary lane of work to achieve our goal: 1) New methodologies and formats; 2) Inclusive risk communication guide; 3) Citizen dialogues methodology. In Catalonia, it is particularly intended for use by municipal civil protection teams or local decision-makers committed to promoting its implementation. However, it is also applicable at different levels of governance and within a diverse array of social organisations, regardless of their size or structure.

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2 Transfer Plan –Catalonia to Baixo Alentejo

2.1 Solution-receiving region: Challenges and needs and climate adaptation solutions

2.1.1 Key regional needs in the field of climate resilience and climate change adaptation

Baixo Alentejo region (NUTS III) is part of the Alentejo region (NUTS II). It is composed of 13 municipalities: Aljustrel, Almodovar, Alvito, Barrancos, Beja, Castro Verde, Cuba, Ferreira do Alentejo, Mertola, Moura, Ourique, Serpa and Vidigueira. The region covers an area of 8,542.72 km², corresponding to 9.26% of the country's territory, with a population of 126,692 residents and a low population density of approximately 14 inhabitants per km^2. The demographic structure of Baixo Alentejo is mainly characterised by a downward trend in population, with about a 6% drop in the last decade. In 2015, the ageing index reached 186.9, while in Portugal, this index was 144 in the same year, following the trend of inversion of the population pyramid in this region.

The major climate-related risks are extreme heat and water scarcity. The region is regularly exposed to extreme heat periods, and the situation is getting more serious recently, negatively impacting the regeneration capacity of ecosystems, loss of biodiversity, water scarcity, soil erosion and other key elements of the local ecosystem. This situation is forcing the geographical displacement of species, namely affecting wine-growing activity, as some grape varieties must be replaced by heat-resistant ones. The same happens on the plantations of cork oaks that have been drying out due to the high heat, threatening one of the most important economic activities of the region, i.e., cork production.

Baixo Alentejo falls into the "high susceptibility" risk class. Droughts are recurrent climatic events in the region due to long periods of low precipitation, creating phytosanitary problems, concentration of pollutants in water bodies and desertification. Investments made in the last years created water storage systems to cope with the scarcity, but more investments must be promoted in order to face future challenges.

The temperature rise registered in the last decades has also impacted the number of consecutive days of extreme heat, increasing the risk of forest fires. It is expected that the problem will get worse over time with the future rise in temperature.

Baixo Alentejo Intermunicipal Climate Change Adaptation Plan (PIAAC-BA) was launched in 2018 and is currently being implemented. One of the main weaknesses identified was the lack of data on the identified risks. For monitoring and studying historical events purposes, it is important to have available specific tools capable of mapping the risks across the territory and creating the means to

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collect data on these risks. This will enable the monitoring of the main regional risks and develop and adapt specific PIAAC-BA measures and actions according to the region's needs.

Another need that has been identified and that the transferred solutions can address is to promote a better response from civil protection services to the needs of the vulnerable population and adaptation plans at various levels to be better aligned.

2.1.2 Solutions chosen for transfer

In addressing the challenges and needs, namely regarding heat waves as the first problem to be tackled, Baixo Alentejo can benefit from the Argos Early Warning System digital solution to be transferred from Catalonia. The Argos platform will be the tool transferred and applied to the needs of the region in order to analyse past events to better identify the vulnerable areas and adapt measures and actions of PIAAC-BA.

CIMBAL and its target users intend to use it focused on **high temperature and heat waves**. The target users are the working group of local civil protection and forest managers within Baixo Alentejo Intermunicipal Community (CIMBAL) and its 13 municipalities and will use some specific functionalities of Argos (e.g., historical information platform excluding warning parts).

Furthermore, the region would benefit from the experience developed by the “Citizen Participatory Toolkit in Civil Protection”. CIMBAL intends to use it focused on high temperature and heat waves and dedicated to the working group of both local civil protection and forest management within the CIMBAL network, Civil Societies and other relevant public entities.

The solution will focus on strengthening civil protection capacities for better cooperation, increasing knowledge and raising awareness among civil society in order to update the specific measures and actions of the PIAAC-BA. It will also generate information that will be shared with the Alentejo management authority to update the regional plan. After implementation, the solution can be extended to a larger target group as addressing vulnerable population groups and gender-sensitivity are key priorities.

Table 5: Overview of selected transfer solutions from Catalonia to Baixo-Alentejo

Name of solution	Solution type	Short description
Argos Early Warning System	Digital Solution	Argos is an early warning system and decision support tool (digital platform) for emergency managers and other stakeholders to anticipate impacts and better manage the climate-related emergencies that climate change is bringing.

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		It centralises relevant information and provides tailored information to specific critical elements, together with assistance in managing the situation. It is a tool mainly focused on extreme heat-related risks. The target users from the Baixo Alentejo region will be the civil protection and forest management teams within the CIMBAL network, Civil Societies and other relevant public entities. Argos will be adapted to focus on high temperature and heat waves and will be applied to better analyse past events, better identify vulnerable areas, and plan specific PIAAC-BA actions and measures updates.
Citizen participatory toolkit in natural risks, climate change and civil protection	Practices and Methodologies	Designed with a citizen-centred approach, this solution aims to strengthen communities by promoting inclusive participatory processes and social actions that address natural hazards, climate change and civil protection participation. This solution can be applied at different levels of governance and within a wide range of social organisations, regardless of their size or structure. As in Catalonia, in Baixo Alentejo, in the first phase, will be specifically intended for protection and forest management within the CIMBAL network, Civil Societies and other relevant public entities. The solution will focus on the capacity building of civil protection for better cooperation, increase of knowledge and raising risk awareness and self-protection. After implementation, the solution can be extended to a larger target group in order to promote citizen involvement processes and generate new behaviours to be adopted as climate change adaptation or mitigation.

2.1.3 Additional activities and solutions being developed within the receiving region

The receiving region, Baixo Alentejo, will also benefit from additional solutions provided by LSDT4, namely AIGP. Furthermore, ITECONS and CIMBAL are conducting capacity-building initiatives focused on climate change resilience. These actions aim to enhance the knowledge and skills of local stakeholders, as well as to engage them to receive ARGOS platform training. Table 6 provides a summary of the additional solutions developed for the Baixo Alentejo region.

Table 6: Overview of additional solutions developed within the recipient Baixo-Alentejo

Name of solution	Solution type	Short description
AIGP - Integrated Areas for Landscape Management - Chosen transfer solution from Centro Region (LSDT4) to Baixo Alentejo	Process and management practice	Increase the landscape's resilience to wildfires and climate change impacts through fuel management and land use and occupation changes through an integrated territorial approach in a continuous territory. See D3.24

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Capacitation actions by ITECONS and CIMBAL	Capacitation	Project partner ITECONS will support CIMBAL in the capacity-building actions and will continue conducting capacity activities with Municipalities and other regional stakeholders' capacitation actions, which are already being developed, focusing on fire safety, energy efficiency and the sustainability of the built environment. These actions are also relevant to engage local stakeholders for future capacitation on “how to work with ARGOS platform”. Note that some budget for the development of the capacitation actions by CIMBAL and a budget for and equipment acquisition (66.950,00€). The equipment will be used for pilot demonstration for all digital technologies in RESIST, including Argos and GDT applied in Baixo-Alentejo. The equipment will be essential for the use of the LSD adaptation tool in the Baixo Alentejo region. This equipment must be acquired by CIMBAL since the entities, to whom the equipment will be made available, do not have any equipment that can be made available.
Development and implementation of participatory actions	Implementation (regional for 13 municipalities by CIMBAL)	Participatory actions development taking into consideration the specificities of the regions and synergies whit other actions. The participatory actions will be implemented by an expert taking into consideration the existing experience of CIMBAL. This also includes supports to produce specific materials, surveys, and translation and for the adaption of the methodology to the territory planning. These participatory actions also support LSDT4 solution and capacitation actions.

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2.1.4 Systemic perspective on regional adaptation efforts

The region is covered by the regional and by the intermunicipal adaptation plan (PIAAC-BA) launched in 2018. PIAAC-BA aims to create the conditions for the territory and its stakeholders to be better prepared for the effects of climate change. To realise this objective, the following specific objectives have been defined, among others:

- Deepen existing knowledge of climate change, including extreme weather events, their additional impacts and natural and technological risks;
- Identify and select adaptation actions to be implemented;
- To concretise and detail concrete actions and measures to adapt to the most relevant climate impacts;
- Identify the operational means and the necessary financial framework; Integrate adaptation actions into the current activities of regional organisations and their sectoral policies, instruments and plans;
- Empowering regional stakeholders and CIMBAL and its municipalities, and ensuring the necessary technical assistance to facilitate assertive action and to inform decision-making processes;
- Involve and raise awareness of all local, regional and national stakeholders, as well as the general population, ensuring mobilisation around the Plan's objectives;
- Communicate, promote and disseminate knowledge about impacts and vulnerabilities, especially by involving stakeholders and organisations in drawing up the strategy;
- Promote more efficient management of infrastructures, resources and services in line with current and projected vulnerability to climate change;
- Contribute to making informed strategic decisions based on concrete data and credible forecasts, with a view to adapting more effectively to the perceived impacts of climate change.

The solutions to be transferred respond to these objectives, particularly regarding deepening existing knowledge, adapting and detailing concrete actions and measures to adapt to the most relevant climate impacts and involving, mobilisation and raising awareness among all local, regional and national players, as well as the general population, ensuring their mobilisation.

PIAAC-BA will strongly benefit from the selected solutions because they will provide valuable inputs for the update of PIAAC-BA specific measures and actions. Also, the Alentejo region adaptation plan can be updated to better consider heat waves based on Baixo Alentejo feedback.

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2.2 Planned transfers

2.2.1 Transfer 1: Argos Early Warning System

2.2.1.1 Solution description and transfer goals

As mentioned in the previous chapter, Argos is an Early Warning System and a Decision Support Tool to help emergency managers and other stakeholders anticipate the impacts and better manage the weather-related emergencies that climate change is bringing (more often, more extreme).

It centralises all related information and assists in situation management.

Baixo Alentejo has identified heat waves as the main climate change issue. Therefore, the decision was taken to adapt the Argos tool, proposed by Catalonia, to better analyse past events so as to better identify the vulnerable areas and plan future prevention actions and identify the regional locations most at risk due to their characteristics. This represents a high customisation since in Baixo Alentejo case is not possible, due to national rules and guidelines, to implement its standard use and include the hyperlocal tailored early warnings.

2.2.1.2 Measures to overcome barriers and customization needs

The barriers initially identified and the measures to overcome these are summarised in the following Table 7.

Table 7: Measures to address barriers and customization needs

NAME OF THE SOLUTION: **Argos Early Warning System**			
Type of barrier	**Barrier description**	**How can the barrier be overcome?**	
		Measure to address barrier	**Customisation of solution**
Data availability	One of the main weaknesses identified was the lack of regional and local historical meteorological data. It is important to feed the tool in order for it to be capable of mapping risks associated with high temperatures on the territory and create the means to collect data on these risks.	The datasets needed will be identified and listed at the beginning, and a request for the data to the specific institutions will be made.	The system will include national and Pan-European datasets (Copernicus) meanwhile local data access is requested to the specific organisations.
Language	The system must be in Portuguese	Translate the system	Argos will be automatically translated to Portuguese using an AI system trained in the topic of Climate change and emergency management and this

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			translation will be reviewed by CIMBAL.
Limited functionalities on the historical viewer for this specific use-case	This use-case is focused on working on historical events to analyse them and extract conclusions. Current Argos' capabilities might be limited for this use case.	After an initial training with the current Argos version, users will identify and rank the missing capabilities they need.	New needed functionalities will be evaluated and implemented following the ranking done by the users.

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Table 8: Solution profile for Argos Early Warning System, customised to Baixo-Alentejo

NAME OF SOLUTION: **Argos Early Warning System**		
Short description of the adaptation solution Data integration: Collects, stores and visualises all weather-related data needed for the analysis of past events and vulnerable areas and to perform a weather-related impact evaluation. Provides a single-entry point to all the available European and specific regional and local data to better identify the vulnerable areas and plan future prevention actions and to identify the regional location locations most at risk due to their characteristics.	**Type of solution** Digital platform	**Solution provider region** Catalonia
VALUE PROPOSITION		
Target group Civil protection: From Municipal to regional civil protection. Responders at different levels (firefighters, police, environment departments, etc.).	**Main benefits for the target group (purpose)** Improved knowledge regarding historical high temperature and heat waves events of events, combined with updates to the specific measures and actions identified in PIAAC-BA will empower civil protection and other responders to stay one step ahead in their management and decision-making. This will enable them to anticipate and promote the protection of people and assets more effectively.	**Social and environmental co-benefits for target group and other groups** The anticipation in what regards risk analysis related to heat waves and high temperatures events will allow to anticipate problems regarding o population level of risk due to weather-related hazards is a direct benefit. Also, reduction of climate-related impacts on assets and infrastructure, given revised adaptation planning based on the tool's results can also promote other benefits such as costs reduction related to emergencies. The tool helps to strengthen community resilience by improving preparedness and response capabilities.
SOLUTION DETAILS		
Climate impacts addressed High temperature and heat waves	**Delivered results**	**Spatial scope** Regional but data availability will set the limits. A pilot area is under determination.

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	Historical mode developed in the Argos system to review past events and learn from them for multi-level coordination (municipal-regional)	
VALUE CREATION AND DELIVERY		
Key resources Hazard data: From Global (like Copernicus, ECMWF) to national, regional and local datasets. This includes meteorological observations, local stations, NWP models, etc. The service will be adapted to the existing data. Vulnerability and exposure data: Critical infrastructure, vulnerable people's location, and other local critical elements. Local and regional collaboration with other organisations.	**Key activities** Data acquisition; Integration of data in Argos system; Select pilot area; Capacity building; Monitoring; Evaluation; Gather feedback	**Project owner and key partners** Argos is owned by HYDS. HYDS, CIMBAL, and ITECONS are key partners in ensuring the successful implementation of this tool. After receiving training from Catalonia partners, they will validate the new functionalities and monitor relevant data to facilitate capacity-building efforts for local and regional civil protection departments. The impact analysis and documentation of lessons learned will be critical for disseminating the tool to other regions
COSTS AND PLANNING		
Estimated costs (implementing and operating) The estimated costs include personnel costs (15 PM´s - CIMBAL and 8 PM´s - ITECONS) Acquisition and processing of regional data sets by expert 49.950,00€ (by CIMBAL). Stakeholder meetings and capacity building actions 3.750,00€ (by CIMBAL).	**Revenues/monetised benefits** No monetised benefits.	**Time frame for planning and implementation until fully functional** See the timeline until 2027
CONTEXT		
Necessary prerequisites Data (observations, forecasts, warnings). Information about local vulnerability (critical infrastructure, local critical elements, etc).	**Success factors** The involvement and cooperation of the local authorities and organisations involved in emergency management	**Limiting factors** The lack of local data

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2.2.1.3 Resources and costs

Initial evaluation of the efforts related to the Argos' use case in Baixo Alentejo brings the following list of activities:

1. Implementation effort of Argos into the CIMBAL municipalities.
2. Implementation of new data sources in Argos.
3. Datasets costs.
4. Fine tuning of the system for CIMBAL municipalities.
5. Argos' new functionalities for the specific use-case.

HYDS budget with RESIST will cover activities 1,2,4 and 5. Functionalities needed in 5 will be ranked to ensure focusing on the most important/needed at the beginning to ensure efficient use of resources. The expected costs are estimated in Table 9 and Table 10. In case new datasets are needed, the cost will be evaluated by CIMBAL, and a common decision will be taken.

Table 9: Planned personnel resources

	Providing region	**Receiving region**
Person Months (PMs) planned for transfer Argos	7 (HYDS)	17 (CIMBAL); 8 (ITECONS)
Person Months (PMs) total RESIST WP3	88 (HYDS)	110 (CIMBAL); 18 (ITECONS)

Table 10: Other costs in the receiving region

	Amount (Euro)	**Short cost description**	**Further information**
Acquisition and processing of regional data sets by expert	49.950,00€	Collection and processing of regional data by experts for the adaptation of the tool to the territory	One-time costs and no maintenance are being considered.
Stakeholder meetings and capacity building actions	3.750,00€	Support for meetings and capacity building actions – room rental, meals, etc	No maintenance is being considered.

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2.2.2 Transfer 2: Citizen Participatory Toolkit

2.2.2.1 Solution description and transfer goals

Designed with a citizen-centric approach, this solution aims to strengthen communities by fostering inclusive participatory processes and social action, addressing natural hazards, climate change and civil protection participation.

CIMBAL intends to use it focused on high temperature and heat waves and dedicated to the working group of both local civil protection and forest management within the CIMBAL network, Civil Societies and other relevant public entities.

The Citizen Participatory Toolkit will be adapted to focus on empowering civil protection for better cooperation and increased knowledge, and civil society to increase risk awareness and self-protection. Its aim is to identify and test a method for providing information to enable better reaction in the event of heatwaves, with the ultimate goal of reaching all the population. This objective will be achieved through a participatory process involving all relevant stakeholders.

In addition, adaptation solutions will be debated by political decision-makers in a participatory manner, so that the measures and actions contained in the municipal plans and in PIAAC-BA are adapted, thus generating new solutions to be in the future included at both regional and local level and to provide feedback to the Alentejo region's adaptation plan.

2.2.2.2 Measures to overcome barriers and customization needs

The barriers initially identified and the measures to overcome these are summarised in the following Table 11.

Table 11: Measures to address barriers and customization needs

NAME OF THE SOLUTION: **Citizens Participatory Toolkit**			
Type of barrier	**Barrier description**	**How can the barrier be overcome?**	
		Measure to address barrier	**Customisation of solution**
Institutional and Cultural Resistance to Innovation	Stakeholders (e.g., municipal workers or local organisations) may prefer traditional approaches and show resistance to adopting innovative participatory methodologies.	Promote awareness, pedagogy, and training to policymakers and practitioners to highlight the value of inclusive risk communication and participatory methodologies through practical, evidence-based examples.	Incorporate locally relevant examples and testimonials into training materials, ensuring the methods feel approachable and necessary for regional contexts.
Lack of Local Facilitators or Human Resources	A shortage of trained facilitators or human resources in Baixo-Alentejo may hinder solution deployment due to low	All materials for the transfer are designed with adaptability in mind. The Methodological Guide developed to facilitate the	Materials can be translated if necessary to ensure accessibility. Additionally, comprehensive support and

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	capacity, budget constraints, or geographical challenges.	transfer of the solution will offer several options so that the participatory approach to climate change adaptation can be implemented even if the interested administration can allocate few resources to it. The materials utilise clear and straightforward communication and provide step-by-step instructions to facilitate the implementation of new formats, citizen dialogues, and strategies for enhancing and achieving inclusive risk communication.	training can be provided to facilitators or internal human resources, equipping them with the knowledge and skills needed to successfully implement the solution.
Misalignment between Governance Structures	Variations in centralisation levels, administrative frameworks, jurisdictional boundaries, and local government practices can present substantial challenges to transferring and adapting the solution effectively.	Establishing clear and consistent dialogue, along with coordinated efforts between the region providing the solution and the receiving region, is essential to overcoming these barriers.	This process may require engaging new stakeholders or adjusting the roles and responsibilities of existing participants to ensure the solution aligns with the governance structures and operational needs of the receiving region.
Differing Risk Perception or Lack of Knowledge of Local Hazards	Citizens in Baixo-Alentejo may have a different understanding of risks compared to those in Catalonia.	A thorough assessment of local risk perceptions is necessary.	Based on the findings of the assessment, the focus of the solution can be adjusted to better align with the specific needs and awareness levels of residents.
Diverse demographic context	Differences in demographic composition may influence the prioritisation of target groups. Moreover, if the solution is implemented across various municipalities, even within the same region, demographic diversity must be considered and appropriately addressed.	A thorough assessment of the demographic context in which the solution is applied is essential.	Based on this assessment, the content, communication channels, and overall approach may need to be adapted to ensure the solution effectively reaches and engages the specific groups within each municipality.
Time Constraints among Participants	Stakeholders in the receiving region may face challenges in allocating sufficient time to discuss, learn, adapt, and implement the solution.	Effective coordination and the establishment of clear deadlines will be essential to manage time constraints.	Proposing realistic and flexible timeframes and ensuring commitment to meeting these deadlines will help facilitate the successful implementation of the solution while considering stakeholders' availability and capacity.

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Table 12: Solution profile for Citizen Participatory Toolkit, customised to Baixo-Alentejo

NAME OF SOLUTION: **Citizens Participatory Toolkit** in Natural Risks and Climate Change and Civil Protection		
Short description of the adaptation solution Designed with a citizen-centred approach, this solution will allow to promote inclusive participatory processes and promote the development of new social actions that address natural hazards, climate change and civil protection participation. The Citizen Participatory Toolkit will be adapted to focus on empowering civil protection for better cooperation and increased knowledge, and civil society to increase risk awareness and self-protection. Its aim is to identify and test a method for providing information to enable better reaction in the event of heatwaves, with the goal of reaching all the population. This will also determine PIAAC-BA actions and measures that need to be updated, taking into consideration new solutions that can be identified through specific discussions.	**Type of solution** Practices and methodologies	**Solution provider region** Catalonia
VALUE PROPOSITION		
Target group In a first phase will be specifically intended for Civil Protection and forest management within CIMBAL network, Civil Societies and other relevant public entities.	**Main benefits for the target group (purpose)** The solution will focus on the capacity building of civil protection for better cooperation, increase of knowledge and raising risk awareness and self-protection. It aims to enhance their preparedness and awareness, while also encouraging their active participation in civil protection efforts.	**Social and environmental co-benefits for target group and other groups** Reinforcing the resilience of the region communities and promote awareness of citizens and vulnerable groups.
SOLUTION DETAILS		

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Climate impacts addressed High temperature and heat waves	**Delivered results** Number of persons from CIMBAL that attended capacity building Number of civil protection departments which received capacity building Number of implemented stakeholder engagement activities Number of participants Number of municipalities and other regional organisations experiment with one or more of the proposed activities. Number of new solutions identified that support the updated regional adaptation plan of PIAAC-BA.	**Spatial scope** Regional
VALUE CREATION AND DELIVERY		
Key resources Political commitment to prioritise the social and democratic dimension of climate change adaptation, with an emphasis on self-protection measures against natural risks. Skilled human resources capable of adapting and implementing the solution. If such resources are unavailable, a non-technical figure with a strong willingness to engage and adapt to the task as much as possible. The adaptability and empathy of the team or individuals involved, ensuring that citizen participation is central to the process. Focus on practicality, ensuring the solution remains simple yet feasible for implementation.	**Key activities** 1. Target group identification 2. CIMBAL capacity building kick-off – Discussion with INT and UOC on how to work with the toolkit 3. Capacity building for local and regional civil protection departments by CIMBAL – how to work with the toolkit 4. Gather feedback from civil protection officers. 5. CIMBAL gives feedback to Alentejo managing authorities regarding necessary changes in Alentejo adaptation plans. 6. Update of regional adaptation plan of BA.	**Project owner and key partners** In the transfer process, CIMBAL will be the project owner since it will adapt and translate the toolkit and guides, will organise, whit relevant regional, the capacitation actions and will implement and promote the solutions. INT and UOC will participate, but on a lower scale.

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Clear and effective communication between institutions, organisations formal or informal), and citizens, fostering smooth inter-institutional cooperation.		
COSTS AND PLANNING		
Estimated costs (implementing and operating) The estimated costs include personnel costs (10 PM´s), some budget for meetings (4.000,00 €)	**Revenues/monetised benefits** No monetised benefits.	**Time frame for planning and implementation until fully functional** See the timeline until 2027
CONTEXT		
Necessary prerequisites Commitment from the institution or organisation to implement parts or all of the solution, along with the readiness of local volunteers to participate or lead the process. Availability of human resources with strong communication skills, social empathy, and experience as social facilitators, ensuring effective leadership in implementing these actions. Social expertise is essential. Extensive networking capabilities within the municipality, alongside the trust and collaboration required to engage stakeholders effectively. Trust between institutions and organisations involved in fostering smoother coordination and a shared vision for the success of the solution. In-depth knowledge of the local population and the risk context of the municipality is needed to ensure the solution is tailored to address specific needs and vulnerabilities.	**Success factors** The fact that the components of this solution will be adapted to the territory and tested will provide valuable information on their practical usefulness and reduce the possible risk of implementation. In addition, due to its role in the region, CIMBAL already has experience in developing participatory activities involving citizens and institutional actors.	**Limiting factors** Varied contexts and complexities: The diversity in structures, social dynamics, and contexts can hinder the proper adaptation of the solution. There might be conflicting visions and objectives among stakeholders when implementing it. Disparities between municipalities: The differing sizes and resource capacities of the municipalities involved may result in unequal opportunities or challenges in disseminating and implementing the solution.

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2.2.2.3 Resources and costs

While the costs and resources required for implementation are yet to be fully detailed, a preliminary assessment suggests that there will be no direct economic costs associated with the transfer itself. The primary expenses will stem from the resources necessary to implement the agreed-upon actions.

- **New Methodologies and Formats**

The resource requirements for implementing new technologies and methodologies will depend on the scope of the planned actions. Primarily, the partners from the Baixo-Alentejo Region will need to allocate available human resources within the jurisdiction deemed most appropriate for optimising the benefits of the proposed solutions. There may also be some additional costs related to materials, transportation, or other logistical needs. However, these cannot be accurately estimated at this stage.

- **Inclusive Risk Communication**

The resources required to enhance inclusive risk communication will involve dedicating the work hours of personnel from the public administration. These individuals will integrate and adapt the recommendations into their daily activities to improve the inclusivity and effectiveness of risk communication for both the local population and tourists. The extent of these resource allocations will depend on the sector's capacity and priorities.

- **Citizen Dialogues Methodologies**

Based on the methodology transferred by UOC, it is technically feasible to conduct the citizen dialogue process using CIMBAL's existing human resources and existing communication tools. However, if internal expertise is insufficient or if it is deemed preferable to engage external specialists, a budget allocation may be necessary to hire temporary personnel with the requisite skills to facilitate these processes effectively.

Table 13: Planned personnel resources

	Providing region	**Receiving region**
Person Months (PMs) planned for transfer for the Citizens Participatory Toolkit	1 (INT+UOC)	13 (CIMBAL)
Person Months (PMs) total RESIST WP3	80 (INT-34 +UOC-46)	110(CIMBAL)

Table 14: Other costs in the receiving region

	Amount (Euro)	**Short cost description**	**Further information**
Other (Capacity building meetings to be developed by CIMBAL)	4.000,00€	Support for meetings and capacity building actions – room rental, meals, etc	No maintenance is being considered

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2.2.3 Planning the transfer in Baixo Alentejo

The process of planning the transfer solutions has been co-designed with the partners of the providing and recipient regions, following the **Logframe Matrix approach** (RESIST deliverable D1.2) identifying the objectives, purpose, results, and planned activities, i.e., Table 15 for Argos and Table 16 for Citizen Participatory Toolkit.

Table 15: Logframe Matrix for Argos Early Warning System (Catalonia to Baixo-Alentejo)

Overall objective	**Indicators**	**Source of verification**	**Assumptions**
More adaptive region to high temperatures	Number of health emergencies due to heat stress	TBD	NA
Purpose	**Indicators**	**Source of verification**	**Assumptions**
Alentejo adaptation plan is updated to better consider heat waves based on BA feedback.	Alentejo adaptation plan is updated based on BA feedback	Alentejo adaptation plan	Information provision works and is on time. Civil protection and other important actors (e.g. health sector, social services) work well together
Services of civil protection are better catered towards the needs of vulnerable population	Number of municipalities for which areas have been identified where vulnerable population lives in high heat risk zones	Report from civil protection	
Civil protection work is more effective by targeting high risk zones, based on historical data	Number of municipalities for which heat risk zones have been identified	Report from civil protection	
Emergency plans and adaptation plans at various levels are better aligned	Actions in the various plans are aligned	Emergency plans and report of changes in adaptation plans	
Results	**Indicators**	**Source of verification**	**Assumptions**
Argos platform is up and running that identifies historical heat events	Fully functional online. Number of municipalities for which Argos platform is implemented Number of heatwaves that occurred can be easily accessed through Argos	Project reporting and deliverables	Alentejo is interested in using project results and cooperates Information on vulnerable population is up-to-date and available

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Civil protection (municipal level) has updated emergency plans	Number of emergency plans updated	Civil protection meetings and documentations	
Regional adaptation plan of BA is updated	Actions/measures in BA adaptation plan are updated	Regional adaptation plan of BA	
Step-by-step activities			**Assumptions**
1. Data acquisition 2. Integration of data in Argos system 3. Select pilot area 4. CIMBAL and ITECONS capacity building by Catalonia – how to work with the platform 5. ITECONS and CIMBAL will validate the new functionalities and monitoring relevant data 6. Capacity building for local and regional civil protection departments by CIMBAL and ITECONS – how to work with the platform 7. Monitoring heatwaves and temperature changes 8. Evaluation of heatwaves and temperature changes 9. Gather feedback from civil protection officers 10. Identify necessary regional actions to combat heat waves and high temperatures – based on feedback from civil protection and current adaptation plans 11. CIMBAL gives feedback to Alentejo managing authorities regarding necessary changes in Alentejo adaptation plans 12. Update regional adaptation plan of BA 13. Impact analysis and documentation of lessons learnt based on feedback from civil protection (ITECONS and CIMBAL) 14. Promote dissemination to other regions (ITECONS and CIMBAL)			All necessary data can be bought from national authorities.

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Table 16: Logframe Matrix for Citizens Participatory Toolkit (Catalonia to Baixo-Alentejo)

Overall objective	Indicators	Source of verification	Assumptions
Increased awareness and knowledge among CIMBAL network in the region. Better planning documents that take climate (heatwaves) into consideration	Percentage of people who demonstrate a high level of awareness to heatwaves and possible solutions. Changes in times the CCA solutions are mentioned in the update of PIAAC-BA	Interviews or surveys in the municipalities Desktop study comparing old and new/updated documents.	NA
Purpose	**Indicators**	**Source of verification**	**Assumptions**
Alentejo adaptation plan is updated to better consider heat waves based on BA feedback	Alentejo adaptation plan is updated based on BA feedback	Alentejo adaptation plan	Information provision works and is on time. Effective involvement of important key stakeholders
To improve the work in the occasions of heatwaves using participatory tools	Feedback obtained from the regional and local entities using the tool	Project deliverable	
Stakeholders and population informed (through civil protection) regarding high temperature risks	Number of stakeholders and citizens actively engaged and participating in activities or participatory processes	Report from civil protection	
Emergency plans and adaptation plans at various levels are better aligned	Actions in the various plans are aligned	Emergency plans and report of changes in adaptation plans	
Results	**Indicators**	**Source of verification**	**Assumptions**
CIMBAL and local civil protection staff is capacitated to work with the participatory toolkit	Number of persons from CIMBAL that attended capacity building Number of civil protection departments which received capacity building	Capacity building documentation and project reporting	Alentejo is interested in using project results and cooperates Information on vulnerable population is up-to-date and available
Stakeholder engagement activities regarding heat risks have been	Number of implemented stakeholder engagement activities Number of participants	Stakeholder engagement documentation and project reporting	

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implemented in several municipalities.			
Step-by-step activities			**Assumptions**
1. Target group identification 2. CIMBAL capacity building kick-off – Discussion with INT and UOC on how to work with the toolkit with the examples implemented in Catalonia. 3. Capacity building for local and regional civil protection departments by CIMBAL – how to work with the toolkit 4. Gather feedback from civil protection officers 5. CIMBAL gives feedback to Alentejo managing authorities regarding necessary changes in Alentejo adaptation plans 6. Update regional adaptation plan of BA			All the target groups are involved

Timeline until 2027

The overview of Timeline is shown in Fig. 6, from 2025 to 2027. The different colours in closed ovals refer to the type of solutions to be transferred: Argos and Citizen Toolkit from LSD3 Catalonia (green), Other activities related to the digital twin by SINTEF and AugmentCity (blue), and other solutions such as the capacitation actions developed by ITECONS and CIMBAL (red)

Apart from bilateral meetings among HYDS, UOC, INT, CIMBAL, and ITECONS, the work progress will be presented and discussed through quarterly LSDT3 online meetings hosted by ERRIN, the consortium & executive board meetings, and other workshops.

In addition, more detailed documentation on methodologies and the resulting case studies from the transferred solutions will be compiled in the coming Deliverables (D3.14, D3.15, D3.16 and D3.17 in Month 36, D3.18 in Month 48, and D.3.27 in Month 60) where CIMBAL will lead dedicated sections, and Milestones M3.3 (led by ERRIN, in Month 48) and M4.3 (led by INOVA+, Month to present to be determined).

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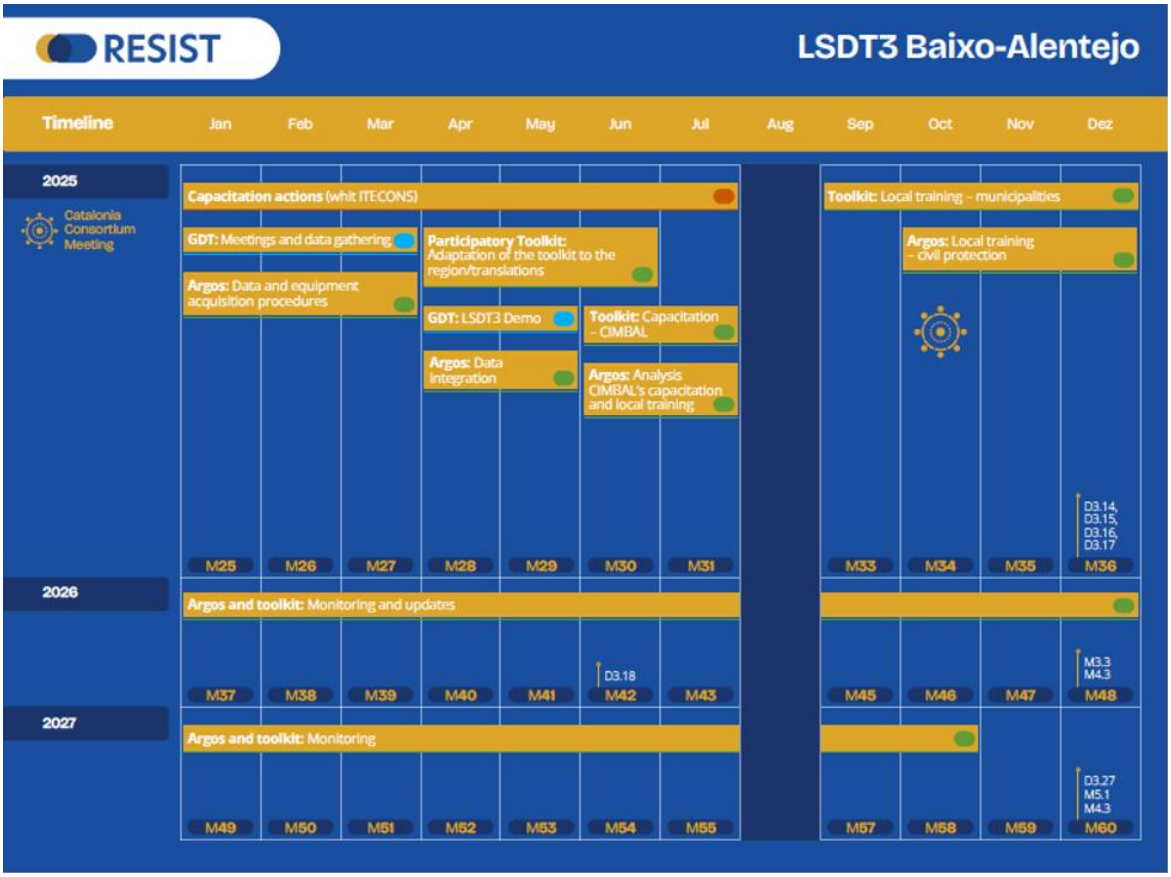

Figure 6: Timeline for the solution transfer from Catalonia to Baixo Alentejo.

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3 Transfer Plan – Catalonia to Puglia

3.1 Solution-receiving region: Challenges and needs and climate adaptation solutions

3.1.1 Key regional needs in the field of climate resilience and climate change adaptation

As part of its needs assessment, the Puglia Region has identified several critical climate risks to focus on in testing effective solutions. Many of these were identified through analysis and research in the process of writing the new Climate Change Adaptation Strategy (SRACC).
These risks include, among others:

- water scarcity and droughts;
- forest fires;
- extreme weather events such as heat waves and tornadoes;
- the potential for flooding;
- coastal erosion and loss of biodiversity.

To address these challenges, several measures were discussed with regional partners that have significant capacity to improve the region's resilience to climate change, with reference to extreme events. Moreover, given the chosen focus on adaptation to climate change in the tourism sector, specific questions and prompts pointing to climate-related hazards affecting tourism were included both in the questionnaire (completed by more than 300 tourism operators) and in the set of questions administered to 13 key stakeholders (mainly representatives of tourism industry organisations, public authorities, research institutes and civil society organisations).

The main areas of interest include the development of specific interventions to make Puglia's tourism sector more resilient to the impacts of climate change. This involves not only preserving the region's vital tourism industry, but also protecting the ecosystems that maintain the heritage for which tourism exists in Puglia and promoting sustainability in face of changing environmental conditions.

In addition, a transversal objective is to formulate innovative policies oriented towards the tourism sector in relation to these risks that could also reverse the positive trend of national and international arrivals and overnight stays of recent years. These policies will not only be designed to mitigate climate risks but will also seek to identify synergies and opportunities for collaboration with other participating regions.

To guide these efforts, there is a desire to develop comprehensive guidelines that consider the various climate-related risks affecting the tourism sector in Puglia. They will be used as an

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operational and application roadmap for stakeholders, ensuring that climate considerations are integrated into planning and decision-making processes. Knowledge sharing and capacity building of tourism stakeholders will be facilitated by the transfer of expertise from the LSDT and twinned regions, with a focus on topics such as land management, heat wave risk management and raising awareness among the community and tourists, as the behaviour of prosumers is also decisive in this regard.

To test and refine these measures, the Puglia region will undertake pilot projects in cooperation with specific pilot areas. The points were clearly expressed during the first phase of the stakeholder involvement activity carried out by the two project partners, the Puglia Region Department of Tourism, Cultural Economics and Territorial Development and Tecnopolis Science and Technology Park of the University of Bari A. Moro. Specifically, heatwaves are the main concern of tourism stakeholders, as surveyed by the partners through the questionnaire and semi-structured interviews (Fig. 7). Therefore, the combined implementation of the Argos platform and of the Impact-based Site-Specific Warning of the Argos tool has been identified as the priority solution to be transferred to inform tourist operators and other experts or administrators involved in tourism management, about extreme heatwaves and the location of cooling centres/facilities, with a specific focus on the urban areas most at risk due to the characteristics of the built environment.

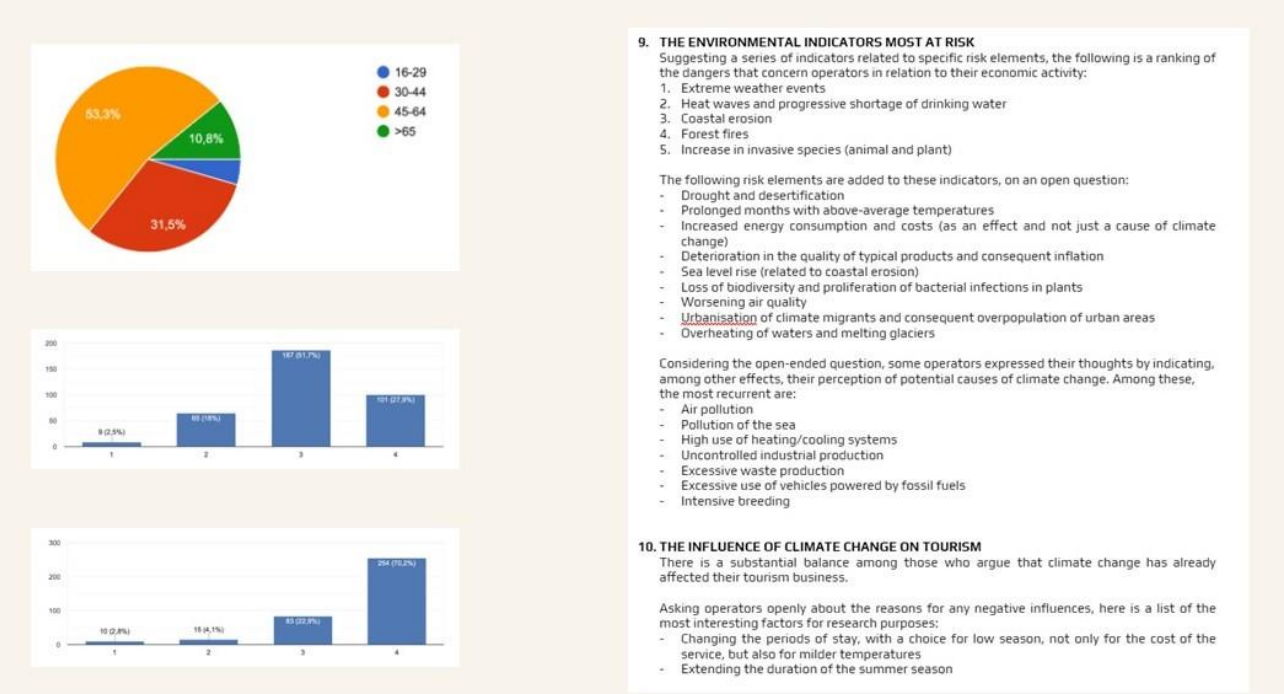

Figure 7: Results of interviews

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The second challenge is to reach out to the tourist population as a whole with information on heatwave risks and solutions, including those who may not have access to the digital application for technical, cultural or economic reasons. This requires a stakeholder engagement process aimed at creating a network of local actors to raise awareness among tourists and operators and to spread knowledge on the topic. In this regard, the most suitable tool is the "Citizen Participation Toolkit in Civil Protection" proposed by Catalonia.

Stakeholder involvement is crucial not only for raising awareness, but also for finding solutions. Collaborating with stakeholders to find solutions for adaptation to climate change would be beneficial for both the stakeholders and the political actions of the regional administration, not only in relation to policies, but also to implement concrete measures to create guidelines for solutions, for municipalities and other stakeholders, related, for example, to the protection of ecosystems.

In this scenario, adaptation solutions distinct from those proposed by Catalonia could be employed, focusing specifically on the involvement of policymakers and institutional stakeholders. These solutions would be studied in the context of heatwave-related adaptation, ensuring the direct participation of public administrators and other key actors responsible for implementing such measures.

To wrap up the key regional needs in the field of climate resilience and climate change adaptation, partners of Puglia region and Tecnopolis have identified three target levels for RESIST's research and innovation activities in the Puglia region, and linked them to the most relevant stakeholders to be involved:

- **structural measures** - both guidelines for physical, nature-based solutions (at the municipal level) and recommendations for policy realignment (especially in terms of the integration between tourism and climate change adaptation regional strategies) (involving regional and local policymakers and the representatives of the relevant stakeholder groups in business and civil society);
- **organisational measures** - concerning the implementation of soft but systemic changes in the management of tourism activities (e.g., data sharing policies and communication protocols between off-site and on-site managers)
- **behavioural measures** - addressing tourists and tourism workers directly or indirectly (counting on frontline staff such as tour guides, travel agents, destination representatives and transportation staff) to promote adaptation actions that leverage on the structural and organisational measures.

This multilevel target will be tested according to the transfer plan for the three solutions that have been identified, with specific reference to extremely high temperatures and heatwaves, while aiming to learn lessons and draw recommendations on climate resilience and climate change adaptation processes regarding other hazards (e.g., flooding).

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3.1.2 Solutions chosen for transfer

Following an in-depth discussion with several public and private stakeholders, through questionnaires and in-depth interviews, the three solutions selected by the Puglia Region are the Multi-Hazard Early Warning System (short name Argos) including impact-based site-specific warnings (SSW), and the "Citizen Participation Toolkit in Natural Risks, Climate Change".

The test pilot will be the city of Bari (the capital of the Puglia Region and one of the main destinations in terms of arrivals and overnight stays in the region) since it is one of the cities in Puglia where the relationship between heat waves and the exponential growth of tourist overnight stays could have adverse effects on the stay and tourist experiences.

Argos and SSW will be tested locally to provide the information that the local stakeholders will receive, or be able to consult, in finding shelter, during the warmest periods of the day, or in case of extreme weather events, inside venues for cultural activities and heritage buildings in the city, or in the green areas, or in churches and other places of worship, which attract visitors from all over the world every day.

The relationship between climate shelters, knowledge of extreme weather conditions, and the availability of a widespread and diversified tourist-cultural heritage in a fairly circumscribed territorial area, such as that of the city of Bari, will thus be the basis of the digital application solution that will be implemented through Argos in the Puglia Region.

The two partners of the RESIST project for the Puglia Region identified heat waves as the first problem to be tackled by the digital solution transferred from Catalonia within LSDT3. The Argos platform will be the tool transferred and applied to the needs of the region to test problem-solving on tourism.

It is envisaged the realisation of an application focused on cultural and seaside tourism, tested on a specific and circumscribed pilot area, identified in the city of Bari, the regional capital and destination on the rise in the regional panorama, with a positive trend in constant growth in terms of tourist and cultural arrivals and overnight stays.

The app developed will aim to inform tourists and citizens about the extreme weather events of heat waves, highlighting the urban areas most at risk due to higher temperatures, and recommending cooler areas, in other words, climatic shelters related to the area's tourist, cultural and natural heritage, as well as providing information on the location of cooling centres and facilities.

The other solution, the citizen participatory toolkit, will be essential to deepen the concept of knowledge, awareness, comparison and dialogue between public and private operators in the area.

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By means of a cutting-edge digital solution for active participation processes, the Puglia Region would pursue the work that the two partners have already started up and begin a specific pathway that will lead to the implementation of practical strategies useful for better protection of the environment (necessary, in terms of tourism, to maintain the qualitative offer of the territory), a more adequate social and cultural knowledge and action, and adaptation and mitigation solutions by the tourism industry.

It also aims to address the challenge of reaching the widest section of the tourist population - including those who may not have access to information for technical, cultural or economic reasons - with clear and useful information on the risks of heat waves and the remedies to be adopted in the short, medium and long term by means of structural, organisational and behavioural measures.

After having listened to the initial impressions of the public and private stakeholders involved during the first phase of the listening and involvement process carried out as part of the RESIST project, the active involvement of stakeholders is considered essential in order to create a network of local actors to raise awareness among tourists and operators and spread knowledge on the subject.

In this regard, the 'Citizen Participation Toolkit in Civil Protection', due to its characteristics, seems to be a very interesting solution to adapt. Stakeholder involvement is crucial not only for raising awareness but also for finding bottom-up solutions and collaborating with stakeholders to find solutions for climate change adaptation that would be beneficial both for operators and for the political actions of the regional administration. The stakeholder engagement activities could be tested not only in the city of Bari but also in additional pilot areas. This approach would enable an exploration of contexts beyond urban centres, addressing different aspects and tourism segments, but also enabling participation activities tailored to diverse objectives.

Table 17: Overview of selected transfer solutions from Catalonia to Puglia

Name of solution	Solution type	Short description
Argos Early Warning System and Impact-Based Site-Specific Warnings (SSW)	Digital Solution	Argos is an early warning system and decision support tool (digital platform) for emergency managers and other stakeholders to anticipate impacts and better manage the climate-related emergencies that climate change is bringing. It centralises relevant information and provides hyperlocal early warnings tailored to specific critical elements, together with assistance in managing the situation. It is a tool particularly focused on extreme heat-related risks. The target users are tourism operators in the city of Bari. Argos will be adapted to focus on urban areas at risk due to high temperatures, based on available European data (e.g. Copernicus). Depending on the availability of local data (to be communicated by the

		Apulian partners), high-resolution hazard or risk maps generated by the site-specific warning tool (SSW) can be linked and displayed in the Argos platform, together with static information on the location of cooling centres and facilities. Given the data and local knowledge of a specific vulnerable area/group/infrastructure associated with extreme weather and climate events, the Site-Specific warning (SSW) tool can provide customised risk information (the combination of hazard, exposure and vulnerability) and facilitate the efficient dissemination of action protocols or warnings to ensure a constant state of preparedness. The output of warning levels or associated actions can be displayed via the Argos platform. Alternatively, a real-time stand-alone application or web (with a dashboard tool and geographical maps for quality monitoring) may also be available.
Citizen Participatory Toolkit in Climate Change in Civil Protection	Practices and Methodologies	Designed with a citizen-centred approach, this solution aims to strengthen communities by promoting inclusive participatory processes and social actions that address natural hazards, climate change and civil protection participation. This solution can be applied at different levels of governance and within a wide range of social organisations, regardless of their size or structure. While in Catalonia it is intended explicitly for municipal civil protection teams or local leaders engaged in promoting its implementation, in Puglia, it will be used for the implementation of bottom-up stakeholder, citizen involvement processes in order to generate new solutions related to strategies to be applied in the tourism sector, to easily convey information in the mixed community of residents and tourists, and to convey new behaviours to be adopted as climate change adaptation or mitigation.

3.1.3 Additional activities and solutions being developed within the receiving region

Table 18: Overview of additional solutions developed within the recipient Puglia

Name of solution	Solution type	Short description
Designing Climate-Resilient Urban Spaces: Collaborative Nature-Based Solutions for Heat Stress in Puglia	Practices and Methodologies	The solution focuses on the collaborative design of nature-based solutions (NbS) to overcome heat stress and mitigate urban heat island effects in tourist areas in Puglia. It will involve a diverse range of stakeholders (urban planners, environmental scientists, architects, local government officials, community members, tourist operators and even tourists) integrating both local knowledge and technical expertise thus promoting a holistic approach to develop strategies for adapting tourist areas (especially urban areas) making them more resilient to increasing summer temperatures. It will involve some informal support from the CoP (i.e. from Normandie, one of the regions in RESIST),

3.1.4 Systemic perspective on regional adaptation efforts

The Puglia region is developing the Regional Climate Change Adaptation Strategy (RCCAS) to The National Climate Change Adaptation Strategy (NCCAS), which was completed by the Italian government in July 2014 and approved by the State-Region Conference in October 2014.

Currently, the National Plan for Adaptation to Climate Change (PNACC) is in its last phase of the approval process after the draft was published in December 2022. It contains measures such as defences for the population and infrastructures from sea level rise. The PNACC also includes a national observatory for climate change adaptation for monitoring and updating the adaptation plans (Moraca, 2023). Also in 2022, the Ministry of Environment and Energy Security launched a National Platform on Climate Change Adaptation "(…) *to promote the exchange of information between the central administration, local authorities and all stakeholders, starting from citizens, with respect to the issue of adaptation to climate change (…).*" (MASE 2023b).

Apart from that, the Puglia region applied to the European Commission to serve as the Territorial Coordinator of the Covenant of Mayors for Climate & Energy in 2018. The aim is to establish a "Climate Pact" with the mayors of Puglia municipalities, assisting them in implementing a common strategy and in planning coordinated actions to deal with the potential impacts of climate change and mitigation policies.

Since January 2022, Puglia has been supporting its municipalities in the drafting process of the SECAP, the Sustainable Energy and Climate Action Plan, which Puglia's municipalities will have to adopt. In addition, the Puglia Region will fund the SECAPs and acknowledge contributions from the municipalities in drafting the plans.

The Puglia Region is also developing the Regional Climate Change Adaptation Strategy (RCCAS) to identify appropriate measures to strengthen the resilience of territories and to improve their ability to respond positively to the stresses caused by climate change. It's being developed by an external agency which will include some climate change projections for the next 15 and 30 years, together with risk sheets for each municipality in Puglia. The strategy is expected to be completed and approved in the upcoming months. Additionally, a strategic document has been prepared in the framework of the Interreg project ADRIACLIM, focusing on coastal areas. This document features a special focus on tourism.

The proposed solutions align perfectly with the region's adaptation efforts, as inferred from the RCCAS. In particular, cultural tourism, due to the increase in heatwaves, and beach tourism, owing to changes in the desirability of destinations resulting from altered climatic conditions, are identified as sectors potentially impacted by climate change.

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On the other hand, the forementioned AdriaClim project recognises that “high temperatures, linked to more intense and persistent heat waves in the Mediterranean area (Hooyberghs et al, 2017), could make the pursuit of many tourist activities in the open environment (terrestrial or marine) unsustainable, an aspect that may directly affect travel behaviour. More intense and frequent extreme weather events can also directly affect tourism demand”. In parallel, the project RESPONSe has developed an online platform (*Climate Menu for Adriatic Regions*), including a set of actions that local policy-makers can undertake in different fields to adapt to or mitigate the effects of climate change at the local, regional and national level, which can also benefit the outputs from the proposed solutions.

Furthermore, the solutions proposed are in line with the PNACC in that they can lead to complementary actions, such as the development of guidelines for local authorities on heat island management and monitoring.

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3.2 Planned transfers

3.2.1 Transfer 1: Argos Early Warning System

3.2.1.1 Solution description and transfer goals

The Puglia Region has identified heat waves as the main climate change issue that could affect tourism in Puglia. Therefore, the decision was taken to adapt the Argos tool, proposed by Catalonia, to inform tourists and citizens about heat wave events, the urban areas most at risk due to their characteristics, and the location of cooling centres/structures.

The Argos platform will be adapted to focus on urban areas at risk due to high temperatures, based on available European data (e.g. Copernicus) and local data (to be communicated by the Apulian partners). The data integration will be in real-time and visualises all weather-related data needed for Early Warning and weather-related impact evaluation. It provides a single-entry point to all information, from national and international datasets to local data and knowledge.

High-resolution hazard or risk maps generated by the Site-Specific Warning tool (SSW warnings and see more in Section 3.2.2) can be linked and displayed in the Argos platform, together with static information on the location of cooling centres and facilities.

The platform will also include a viewer link or functionality for specific warnings-protocols and notification service providing a link between the early warnings on the different elements and the anticipatory actions (protocols) to be triggered to mitigate the impact of the weather-related events.

3.2.1.2 Measures to overcome barriers and customization needs

The Argos tool for Puglia will be adapted to inform tourists and citizens about heat wave events, showing the urban areas most at risk due to their characteristics, and the location of cooling centres/structures. Given the different scope, it will imply different kind of data sets and different kind of modelling.

The barriers initially identified and the measures to overcome these are summarised in the following Table 19.

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Table 19: Measures to address barriers and customization needs

NAME OF THE SOLUTION: **Argos Early Warning System**			
Type of barrier	**Barrier description**	**How can the barrier be overcome?**	
		Measure to address barrier	**Customisation of solution**
High-resolution surface temperature data	Catalonia uses a prediction model dataset at the EU level (approx. 9 km), regional warnings, and local station observations. Puglia is interested in information at much higher resolution (less than 30 m), which has not applied to Terrassa and Blanes.	Feasibility test is needed.	UPC can explore free data (e.g., from satellite Landsat 8), but it will not be the primary input for the temperature or heatwave hazard. Alternatively, HYDS has offered to talk further with an external data provider of Urban Heat Island intensity map at high-resolution (at 10 m) within the RESIST project.
Modelling of urban hot spots	Argos does not include such an algorithm.	Contributions from the partners/stakeholders from Puglia	TBD
Lacking local data and extra data processing	Argos does not include the local data curation algorithm, which requires information on data format and time to process further, if necessary.	Contributions from the partners/stakeholders from Puglia and use of large-scale products Feasibility test is needed.	Private high-resolution data providers will be explored. The system will be adapted to these data and global free datasets
Time horizons for temperature warnings (or hot /cool spot) unclear	Leadtime depends on the availability of the input forecasting temperature product	It can be assessed once the basic version of Argos is set.	TBD
Lacking the will or vision on the use of this tool	Argos has not been applied to the user groups in Puglia (whose adaptation actions or policies are related to tourism), which is different from the application done in Catalonia.	Contributions from the partners/stakeholders from Puglia	Include the recipient end-users in the design of the output. Case demonstration Training materials
Language	The system must be in Italian	Translate the system	Argos will be automatically translated to Italian using an AI system trained in the topics of Climate change and emergency management. Human feedback will be introduced as needed.
Limited functionalities on Argos for the use-case	Current Argos' capabilities might be limited for this use-case.	After an initial training with the current Argos version, users will identify and rank the missing capabilities they need.	New needed functionalities will be evaluated and implemented following the ranking done by the users

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Table 20: Solution profile for Argos Early Warning System, customised to Puglia

NAME OF SOLUTION: ARGOS Early Warning System		
Short description of the adaptation solution Data integration: Collects in real-time, stores and visualises all weather-related data needed for Early Warning and weather-related impact evaluation. Provides a single-entry point to all information, from national and international datasets to local data and knowledge. Impact-based Early Warning link and visualisation: Crossing real-time hazard information with local vulnerability and exposure knowledge, provides an impact-based early warning on the elements that might be impacted in the weather-related events. Warnings-protocols link and notification service: Provides a link between the early warnings on the different elements and the anticipatory actions (protocols) to be triggered to mitigate the impact of the weather-related events.	**Type of solution** Digital. Service (SaaS) provided to the end users	**Solution provider region** Catalonia
VALUE PROPOSITION		
Target group - Regional and local policymakers and representatives of relevant stakeholders in business and civil society. - Off-site and on-site operators in the tourism sector. - Tourists and frontline staff in tourism (e.g. tour guides, travel agents, destination representatives) and related sectors (health, transport, etc.).	**Main benefits for the target group (purpose)** The intended outcome for each target group is briefly described in the following list, in terms of support to the implementation of different adaptation measures: - Policy makers: both guidelines for physical, CCA solutions (at the municipal level) and recommendations for policy realignment especially in terms of the integration between tourism and climate change adaptation regional strategies and involving regional and local policymakers and the	**Social and environmental co-benefits for target group and other groups** - Safeguard the health and well-being of tourists and frontline tourism workers - Strengthen the competitiveness of Puglia as a tourist destination in the face of increasing climate-related risks.

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	representatives of the relevant stakeholder groups in business and civil society. - Operators in the tourism sector: concerning the implementation of soft but systemic changes in the management of tourism activities (e.g., data sharing policies and communication protocols between off-site and on-site managers) - Tourists and frontline staff in tourism: addressing tourists and tourism workers directly or indirectly (counting on frontline staff such as tour guides, travel agents, destination representatives and transportation staff) to promote adaptation actions and behavioural changes in particular.	
SOLUTION DETAILS		
Climate impacts addressed Heat waves and the urban heat island effect.	**Delivered results** Argos platform is up and running, customised to meet regional needs, with key data sets fully integrated and data practices and procedures agreed - Hyper-local, dynamic, and tourism-focused scenarios on hazard and exposure conditions for heat-related risks have been discussed with relevant stakeholders - policy makers, local administrators and representatives of the tourism industry (entrepreneurs and workers) - Successful tests have been run with intended users (frontline staff in tourism (e.g. tour guides, travel agents, destination representatives) and related sectors (health, transport, etc.) -	**Spatial scope** The solution will be tested for the municipality of Bari.
VALUE CREATION AND DELIVERY		

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Key resources	**Key activities**	**Project owner and key partners**
Hazard data: From Global, like ECMWF, Landsat 8 (Thermal Infrared Sensor - TIRS), VIIRS (Visible Infrared Imaging Radiometer Suite), ECOSTRESS (ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station), Sentinel-3 (SLSTR - Sea and Land Surface Temperature Radiometer) to national, regional and local datasets. This includes meteorological observations, weather radar, hydrological observations, land use/land cover and urban morphology data, etc. The Service will be adapted to the existing data. Locations of climate shelters (including green areas, venues for cultural activities and heritage buildings). Local collaboration of all the involved organisations. Hosting services (e.g. AWS, Azure…).	1. Preliminary data scouting and acquisition 2. Puglia capacity building by Catalonia – how to work with the platform 3. Involvement of relevant stakeholders in the pilot area 4. Integration of data into the Argos system 5. Co-design of action protocols with the intended users (frontline staff in tourism (e.g. tour guides, travel agents, destination representatives) and related sectors (health, transport, etc.) 6. Discuss heat stress scenarios with relevant stakeholders to prioritise organisational and structural adaptation measures (i.e. nature-based solutions) 7. Interactive discussion with UPC for integrating SSW into the Argos platform 8. Monitoring, evaluating the results, revision of scenarios or platform components 9. Scaling out the use of the platform to other pilot areas/municipalities	Argos is owned by HYDS and exploited through SaaS under an access fee. Key partners: Puglia Region – Department of Tourism, Cultural Economics and Territorial Development, Tecnopolis STP, and UPC (CRAHI)
COSTS AND PLANNING		
Estimated costs (implementing and operating) Estimated personnel resources: HYDS (6 PMs), UPC (0,5 PMs) Puglia Region (6 PMs), Technopolis (10 PMs) Other costs TBD	**Revenues/monetised benefits** TBD	**Time frame for planning and implementation until fully functional** The implementation is gradual, and 4-6 months are needed for an initial service. From that, depending on the data availability and the stakeholder needs the system is iteratively improved. We estimate that the solution will be fully functional in 12 months.
CONTEXT		
Necessary prerequisites	**Success factors**	**Limiting factors**

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Sufficient resources and skills for modelling and data processing For changed tourism practices based on Argos outputs: depends crucially on the participation of frontline workers in tourism (e.g. tour guides, travel agents, destination representatives) and related sectors (health, transport, etc.).	Local stakeholders' willingness to help and interest in the project have already been assessed and could prove key to successful implementation. Limiting factors.	The intermediate steps in the workflow (modelling and data processing) may prove to be more time and skill intensive than expected.

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3.2.1.3 Resources and costs

As of 19 November 2024, the two partners for the Puglia Region are waiting to know the timeframe for the completion of the digital transfer and the related costs, so as to understand which resources to draw on and how much to allocate for implementation and possible maintenance.
Initial evaluation of the efforts related to the Argos' use case in Puglia brings the following list of activities:

1. Implementation effort of Argos into the Bari.
2. Data acquisition and implementation of new data sources in Argos.
3. Datasets costs, like HR urban temperature maps and forecasts
4. Fine-tuning of the system for Bari
5. Argos' new functionalities for the specific use-case.
6. Involvement of the stakeholders of the pilot area;
7. Capacity building;
8. Gather feedback;
9. Spreading the knowledge of the platform to other pilot areas/municipalities

HYDS budget with RESIST will cover activities 1,2,4, 5, 7, and 8. Functionalities needed in 5 will be ranked to ensure focusing on the most important/needed at the beginning to ensure efficient use of resources. Local partners in Puglia budget will cover the remaining activities costs. The expected costs are estimated in Table 21 and Table 22.

In case new datasets are needed, the cost will be evaluated by Puglia region and Technopolis and a common decision will be taken. In an initial exploration of HYDS with meteoblue, this company is offering the extremely-high resolution maps and forecasts at a 50% discount for RESIST use-case research, that is, 3.000€/year during the duration of the project (Heat-Maps "PRO" package).

Table 21: Planned personnel resources

	Providing region	**Receiving region**
Person Months (PMs) planned for transfer ARGOS	6 (HYDS), 0,5 (UPC)	6 (Puglia Region),10 (Tecnopolis)
Person Months (PMs) total RESIST WP3	88 (HYDS), 102 (UPC)	38,6 (Puglia Region), 51,8 (Tecnopolis)

Table 22: Other costs in the receiving region

	Amount (Euro)	**Short cost description**	**Further information**
License or Subcontracting or Other (please specify)	TBD		

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3.2.2 Transfer 2: Impact-based Site-Specific Warnings

3.2.2.1 Solution description and transfer goals

The Impact-based Site-Specific Warnings (SSW) at critical (vulnerable) points provided by UPC-CRAHI is a risk-informed decision-supporting tool. The tool contains several algorithms for collecting and analysing different hazards (e.g., floods, forest fire, heatwaves, the alerts or warnings from the official regional/national authorities, real-time observations at the local/regional/EU scales, forecasts based on numerical weather models at the EU scale). The tool includes the risk assessment for the optimal crossing of the hazards, local vulnerability, and exposure knowledge. As a result, it provides tailored risk information or a place-based impact early warning (given the forecast of hazard input data) over the vulnerable points or areas. This output can be integrated and displayed as warnings (or risk indicators) on the Argos critical points within the RESIST project.

Note that Argos is a system that can collect any input information (e.g., meteorological observation and forecasts, local exposure data, tailored products such as the warning results triggered by SSW algorithms) and visualize it through a platform and an app viewer.

The Puglia Region has identified heat waves as the main climate challenge affecting tourists and residents. Early warning tools that help trigger action plans, such as SSW, can be an approach to reduce risks during heatwaves. The heatwaves SSW implemented in Catalonia focuses on improved risk awareness and communication together with local Civil Protection to promote self-protection (e.g., informing of climate shelters) given forecast products and warnings at a coarse resolution in space and time. Puglia, however, is interested in high-temperature products or heatwaves for assessing risks at high spatial resolution for the tourism sector operators and policymakers and citizens living in Bari City and visiting as tourists.

In this context, the transfer goal of SSW is to adapt the impact-based early warnings over the vulnerable/critical points in Bari with tailored risk assessments, providing thresholds triggering effective action plans, evaluation, and revision of the warning outputs (e.g., a risk indicator of heatwaves or days of high temperature which are not implemented in Catalonia). The SSW information will be integrated into Argos, which will support different decision-making managers in the tourism sector (e.g., in managing cooling structures, climate shelters, and beach managers) to better communicate with tourists and citizens in vulnerable areas and enhance preparedness.

3.2.2.2 Measures to overcome barriers and customization needs

Because the target user group (e.g., tourism operators Bari city facing high temperature-induced extreme hazards) is different from the user groups of Catalonia (Civil Protection, first and second responders facing multiple hazards), the real-time SSW algorithm may require modification or adaptation given available local and regional data. Unlike Catalonia, Puglia needs i) urban-scale risk information based on a high-resolution surface temperature dataset that may require further data processing or modelling, ii) a local-scale heatwave warnings to complement to national and regional

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heat stress warning systems (which are applied at the municipal level without intra-city variations), tourist use cases should be modelled, taking into account the user-specific status, the desired activity risk profile, and the trip, and iii) improvements on adaptation actions (e.g., water supply targeting the tourists, communication with tourists) or policies in tourism sector. Some barriers identified and key customisation points are detailed in Table 23.

Table 23: Measures to address barriers and customisation needs

NAME OF THE SOLUTION: **Impact-based Site-Specific Warnings (SSW)**			
Type of barrier	**Barrier description**	**How can the barrier be overcome?**	
		Measure to address barrier	**Customisation of solution**
High-resolution surface temperature data	Catalonia uses a prediction model dataset at the EU level (approx. 9 km), regional warnings, and local station observations. Puglia is interested in information at much higher resolution (less than 30 m), which has not applied to Terrassa and Blanes.	Feasibility test is needed.	UPC can explore free data (e.g., from satellite Landsat 8), but it will not be the primary input for the temperature or heatwave hazard. Alternatively, HYDS has offered to talk further with an external data provider of Urban Heat Island intensity map at high-resolution (at 10 m) within the RESIST project.
Modelling of urban hot spots	SSW does not include such an algorithm.	Contributions from the partners and stakeholders from Puglia Feasibility test is needed.	UPC and Tecnopolis will explore a potential methodology with the Tourist Use Cases, considering the user-specific status (age, health conditions, etc.), the desired activity risk profile (location, implied level of physical activity, duration, etc.) and the trip (travel time, means of transport, etc.).
Extra processing of local data	SSW does not include the local data curation algorithm, which requires information on data format and time to process further, if necessary.	Contributions from the partners and stakeholders from Puglia Feasibility test is needed.	Contributions from the partners and stakeholders from Puglia. Higher resolution land surface temperature datasets are available from global or regional providers (Landsat 8 Thermal Infrared Sensor-TIRS, VIIRS-Visible Infrared Imaging Radiometer Suite, ECOSTRESS-ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station), while other high-resolution land use/land cover, vegetation and urban morphology datasets are available from national or local providers. Local exposure data are available in the form of occupancy rates of tourist accommodation and visitor turnover at tourist sites and commercial facilities (restaurants, bars, cultural venues, etc.). Given that tourists and frontline workers in the tourism

			industry and other relevant sectors are a highly variable population, vulnerability could be considered in the design of the data practice, depending on the stated characteristics of the actual users (age, health conditions, etc.).
Temperature warnings (or hot /cool spot) at which time horizon	Leadtime depends on the availability of the input forecasting temperature product	It can be assessed once the basic version of Argos is set.	TBD
Lacking will or vision to fully use this tool	SSW requires more local information on adaptation actions or policies related to tourism.	Contributions from the partners and stakeholders from Puglia	Include the recipient end-users in the design of the output. Case demonstration Training materials

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Table 24: Solution profile for Impact-based Site-Specific Warning, customised to Puglia

NAME OF SOLUTION: IMPACT-BASED SITE-SPECIFIC WARNING (SSW)		
Short description of the adaptation solution The Puglia Region has identified heat waves (high temperature) as the main climate challenge affecting tourists and residents. SSW aims to adapt the site-specific impact-based early warning algorithms over the vulnerable/critical points (e.g., hotspots from the high-resolution temperature maps) in Bari City with tailored risk assessments, providing thresholds triggering effective action plans (e.g., shelter information to be more dynamic) and evaluation (e.g., collecting feedback from end-users). The output of the warning levels and associated actions can be shown through Early Warning Systems, e.g., the Argos City platform (at the critical points in the municipal version implemented in RESIST) or other available platforms. Alternatively, a real-time stand-alone app or web (with a dashboard tool and geo-maps for quality monitoring) can also be used, targeting specifically vulnerable locations, communities, or sectors possibly affected by extreme events.	**Type of solution** Digital. It is a risk-informed decision supporting tool. The algorithm can be integrated from the existing systems, tools, and local datasets.	**Solution provider region** Catalonia
VALUE PROPOSITION		
Target group Regional and local policymakers and representatives of relevant stakeholders in business and civil society.	**Main benefits for the target group (purpose)** Supporting decision-makers for adaptive action plans or protocols in the tourism sector facing heat waves.	**Social and environmental co-benefits for target group and other groups** Safeguard the health and well-being of tourists and frontline tourism workers.

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Off-site and on-site operators in the tourism sector. Tourists and frontline staff in tourism (e.g. tour guides, travel agents, destination representatives) and related sectors (health, transport, etc.).	Providing tourists and tourist operators with a tool to better behave in the occasions of heatwaves	
SOLUTION DETAILS		
Climate impacts addressed Heat waves and the urban heat island effect.	**Delivered results** - SSW is fully integrated into the Argos platform - Tailored action protocols to prevent or mitigate the effects of heat stress on tourists and residents have been co-designed and reviewed, including relevant indicators or warning thresholds - Site-specific vulnerability to extreme heat events has been mapped in the pilot area, according to different dimensions of vulnerability (urban microclimates, distribution of prevention and response facilities, etc.) - Key outdoor recreational activities classification (according to type, intensity, duration) and user sensitivity profiles (as influenced by age, previous health conditions, etc.) have been elaborated	**Spatial scope** The solution will be tested in the City of Bari.
VALUE CREATION AND DELIVERY		
Key resources Hazard data: From Global, like ECMWF, Landsat 8 (Thermal Infrared Sensor - TIRS), VIIRS (Visible Infrared Imaging Radiometer Suite), ECOSTRESS (ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station), Sentinel-3 (SLSTR - Sea and Land Surface Temperature Radiometer) to national, regional and local datasets. This includes	**Key activities** 1. Data acquisition 2. Exploration of new data sources for SSW in Bari. 3. Development of adapted indicators or warning levels with available datasets for SSW 4. Feasibility tests. 5. Interactive discussion on the produced indicators or warnings among UPC, Puglia regions, and Tecnopolis for	**Project owner and key partners** Impact-based Site-Specific Warning is owned by UPC and exploited through SaaS under an access fee. The owner of transferred outputs will be determined at the end of the project when the solution is transferred, considering the degree of contribution and following the Consortium Agreement.

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meteorological observations, weather radar, hydrological observations, land use/land cover and urban morphology data, etc. Locations of climate shelters (including green areas, venues for cultural activities and heritage buildings). Local collaboration of all the involved organisations.	vulnerable locations (or critical points), outdoor recreational activities classification, user sensitivity profiles, past impact data, and the location of prevention and response facilities (cooling centres, etc.) 6. Implementation of SSW algorithms including risk assessments at vulnerable locations (or critical points). 7. Co-design of tailored action protocols to prevent or mitigate the effects of heat stress with frontline staff in tourism and related sectors 8. Interactive discussion with HYDS for aligning SSW to be shown in the Argos platform. 9. Gather feedback from frontline staff in tourism and related sectors, incoming tourists and local residents, policy makers, local administrators and representatives of the tourism industry (entrepreneurs and workers) 10. Monitoring, evaluating the results, revision of warning (or indicator). 11. Scaling out the use of the SSW tool to other pilot areas/municipalities.	Key partners: UPC (CRAHI), Puglia Region (Tourism Department) and Tecnopolis STP
COSTS AND PLANNING		
Estimated costs (implementing and operating) Estimated personnel resources in PMs: UPC (9,5 PMs) Puglia Region (6 PMs) Tecnopolis (10 PMs)	**Revenues/monetised benefits** TBD	**Time frame for planning and implementation until fully functional** The implementation is gradual, and 4-6 months are needed for an initial service. From that, depending on the data availability and the stakeholder needs the system is iteratively improved.
CONTEXT		
Necessary prerequisites	**Success factors**	**Limiting factors**

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- Access to the National and regional heat stress warning ooutputs (which are applied at the municipal level without intra-city variations) and other local products or channels to communicate to tourism operators to align with the SSW implemented in Bari. - Local exposure and vulnerability data (if possible, digitized and geolocated) gathered from frontline workers in tourism (e.g. tour guides, travel agents, destination representatives) and related sectors (health, transport, etc.).	Synergies will be sought with the existing multi-channel alert system ("Bariallerta") operated by the local government. Local stakeholders' willingness to help and interest in the project have already been assessed and could prove key to successful implementation.	The intermediate steps in the workflow (modelling and data processing) may prove to be more time and skill intensive than expected.

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3.2.2.3 Resources and costs

The costs include personnel costs and probably travel costs in both regions. It is impossible to provide an exact estimate at this stage, as the time needed will depend on the depth of implementation. Initial evaluation of the efforts related to the SSW brings the following activities:

1. Exploration of new data sources for SSW in Bari.
2. Development of adapted indicators or warning levels with available datasets for SSW
3. Feasibility tests.
4. Implementation effort of SSW algorithms including risk assessments at vulnerable locations (or critical points) providing thresholds triggering effective and timely action plans.
5. Interactive discussion on the produced indicators or warnings with the partners (i.e., HYDS for aligning SSW to be shown in the Argos platform, Puglia regions and Tecnopolis for gathering the feedback from identified user-groups).
6. Monitoring, evaluating the results, revision of warning (or indicator) to reflect to the notification tools through either Argos or other available visualisation tools.

Table 25: Planned personnel resources

	Providing region	**Receiving region**
Person Months (PMs) planned for the transfer of Impact-based Site-Specific Warning (SSW)	Up to 9,5 (UPC)	6 (Puglia Region) 10 (Tecnopolis)
Person Months (PMs) total RESIST WP3	102 (UPC)	38,6 (Puglia Region) 51,8 (Tecnopolis)

Table 26: Other costs in the receiving region

	Amount (Euro)	**Short cost description**	**Further information**
License, Subcontracting, or Other (please specify)	TBD		

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3.2.3 Transfer 3: Citizen Participatory Toolkit

3.2.3.1 Solution description and transfer goals

The 'Citizen Participatory Toolkit in Civil Protection' solution is designed with a citizen-centred approach and aims to strengthen communities by promoting inclusive participatory processes and social actions addressing natural hazards, climate change and participation in civil protection.

This solution can be applied at different levels of governance and within a wide range of social organisations, regardless of their size or structure.

In Puglia the Citizen Participatory Toolkit will be adapted to **tourism sector** with the aim of identifying and testing a method to provide tourists and tourist operators of information to better behave in the occasions of heatwaves in a complementary way to the two other solutions, with the aim of reaching the widest possible segment of the tourist population - including those who may not have access to information for technical, cultural or economic reasons (Inclusive Risk Communication Guide). This will be achieved through a participatory process involving all relevant stakeholders.

Moreover, also in an additional pilot area, adaptation solutions in the tourism sector for policymakers and tourist operators will be identified in a participated manner, thus generating new solutions ready to be adopted both at an institutional level (both regional and local) and by tourist operators.

3.2.3.2 Measures to overcome barriers and customisation need

The barriers initially identified and the measures to overcome these are summarised in the following Table 27.

Table 27: Measures to address barriers and customisation needs

NAME OF THE SOLUTION: **Citizens Participatory Toolkit**			
Type of barrier	**Barrier description**	**How can the barrier be overcome?**	
		Measure to address barrier	**Customisation of solution**
Different Area of Implementation	The solution was developed in Catalonia within the framework of emergency management. While designed to be flexible and applicable across different areas, it must be customised to fit the unique needs and objectives of Puglia, particularly its emphasis on tourism.	Foster smooth dialogue and collaboration between Catalonia and Puglia to identify sector-specific needs and adjust the solution to local contexts.	This could involve focusing on key pillars of the tourism sector, such as hotels, campgrounds, travel agencies, and related businesses. Additionally, it may include integrating strategies for climate shelters to address the specific needs of the region. Further details and scope will need to be defined

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			collaboratively with local stakeholders.
Institutional and Cultural Resistance to Innovation	Stakeholders (e.g., municipal workers or local organisations) may prefer traditional approaches and show resistance to adopting innovative participatory methodologies.	Promote awareness, pedagogy, and training policymakers and practitioners to highlight the value of inclusive risk communication and participatory methodologies through practical, evidence-based examples.	Incorporate locally relevant examples and testimonials into training materials, ensuring the methods feel approachable and necessary for regional contexts.
Lack of Local Facilitators or Human Resources	A shortage of trained facilitators or human resources in Puglia may hinder solution deployment due to low capacity, budget constraints, or geographical challenges.	All materials for the transfer are designed with adaptability in mind. The Methodological Guide developed to facilitate the transfer of the solution will offer several options so that the participatory approach to climate change adaptation can be implemented even if the interested administration can allocate few resources to it. The materials utilise clear and straightforward communication and provide step-by-step instructions to facilitate the implementation of new formats, citizen dialogues, and strategies for enhancing and achieving inclusive risk communication.	Materials can be translated if necessary to ensure accessibility. Additionally, comprehensive support and training can be provided to facilitators or internal human resources, equipping them with the knowledge and skills needed to successfully implement the solution.
Misalignment Between Governance Structures	Variations in centralisation levels, administrative frameworks, jurisdictional boundaries, and local government practices can present substantial challenges to transferring and adapting the solution effectively.	Establishing clear and consistent dialogue, along with coordinated efforts between the region providing the solution and the receiving region, is essential to overcoming these barriers.	This process may require engaging new stakeholders or adjusting the roles and responsibilities of existing participants to ensure the solution aligns with the governance structures and operational needs of the receiving region.
Differing Risk Perception or Lack of Knowledge of Local Hazards	Citizens in Puglia and may have a different understanding of risks compared to those in Catalonia. Additionally, tourists visiting these regions, who may come from various places,	A thorough assessment of local risk perceptions is necessary, and in Puglia, it may also be crucial to evaluate how tourists perceive these risks.	Based on the findings of the assessment, the focus of the solution can be adjusted to better align with the specific needs and awareness levels of local residents and tourists.

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	could have distinct perceptions of risk or may be entirely unaware of local hazards.		
Diverse demographic context	Differences in demographic composition may influence the prioritisation of target groups. Moreover, if the solution is implemented across various municipalities, even within the same region, the demographic diversity must be considered and appropriately addressed.	A thorough assessment of the demographic context in which the solution is applied is essential.	Based on this assessment, the content, communication channels, and overall approach may need to be adapted to ensure the solution effectively reaches and engages the specific groups within each municipality.
Time Constraints Among Participants	Stakeholders in the receiving region may face challenges in allocating sufficient time to discuss, learn, adapt, and implement the solution.	Effective coordination and the establishment of clear deadlines will be essential to manage time constraints.	Proposing realistic and flexible timeframes and ensuring commitment to meeting these deadlines will help facilitate the successful implementation of the solution while considering stakeholders' availability and capacity.
Language Diversity	When targeting tourists, a language barrier may arise.	It is essential for the receiving region to assess the language needs of tourists visiting Puglia, considering the countries of origin and the languages spoken.	Based on this assessment, the solution may need to be adapted by incorporating additional languages to ensure more effective implementation and better communication with diverse tourist groups.

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Table 28: Solution profile for Citizen Participatory Toolkit, customised to Puglia

NAME OF SOLUTION: **CITIZEN PARTICIPATORY TOOLKIT IN NATURAL RISKS, CLIMATE CHANGE**		
Short description of the adaptation solution In Puglia, the Citizen Participatory Toolkit will be adapted with the aim of identifying and testing a method to provide tourists and tourist operators of information to better behave in the occasions of heatwaves in a complementary way to the two other solutions. This will be achieved through a participatory process involving all relevant stakeholders. Moreover, even in an additional pilot area, adaptation solutions in the tourism sector for policy makers and tourist operators will be identified in a participated manner.	**Type of solution** Practices and methodologies	**Solution provider region** Catalonia
VALUE PROPOSITION		
Target group With the aim of reaching the widest possible segment of the tourist population - including those who may not have access to information for technical, cultural or economic reasons - with clear and useful information on the risks of heat waves and the remedies to be adopted in the short, medium and long term, in Puglia it will be applied for the implementation of bottom-up stakeholder and citizen involvement processes, including policymakers, tourist operators and institutional stakeholders.	**Main benefits for the target group (purpose)** The aim of the transfer is to generate new solutions concerning: A) strategies to identify adaptive solutions related to heatwaves to be applied in the tourism sector both at an institutional level (both regional and local) in a participated manner. B) to easily transmit information about the heatwaves in the combined community of residents and tourists, and to identify and transmit new behaviours to be undertaken as adaptation or mitigation to climate change.	**Social and environmental co-benefits for target group and other groups** 1) Reinforcing the resilience of communities about the heatwaves 2) Promoting awareness of tourists and other stakeholders fostering collaboration between different actors and different institutional levels. 3) Raising environmental consciousness and deepening the understanding of the challenges posed by climate change. 4) Promoting more sustainable behaviours by tourists and citizens

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SOLUTION DETAILS		
Climate impacts addressed Heatwaves	**Delivered results** 1. Local stakeholders map 2. Guidelines for participatory methods 3. Adapted inclusive risk communication guide	**Spatial scope** Pilot area of Bari Possible other pilot areas with different characteristics (to be defined).
VALUE CREATION AND DELIVERY		
Key resources 1) Political commitment to prioritise the social and democratic dimension of climate change adaptation, with an emphasis on self-protection measures against natural risks. 2) Skilled human resources capable of adapting and implementing the solution. If such resources are unavailable, a non-technical figure with a strong willingness to engage and adapt to the task as much as possible. 3) The adaptability and empathy of the team or individuals involved, ensuring that citizen participation is central to the process. 4) Focus on practicality, ensuring the solution remains simple yet feasible for implementation. 5) Clear and effective communication between institutions, organisations (formal or informal), and citizens, fostering smooth inter-institutional cooperation.	**Key activities** 1. Puglia capacity building by Catalonia – how to work with the toolkit 2. Target groups identification 3. Local Stakeholder mapping 4. Adaptation of participatory methods 5. Development of a detailed plan 6. participatory process implementation 7. Adaptation of the Inclusive risk communication guide 8. Results evaluation Although all these components contribute to the shared goal of enhancing community resilience and preparing for natural hazards and climate change impacts, it is important to distinguish between them. Each component requires specific actions and efforts, which may vary depending on the context. Additionally, some regions may choose to focus on or implement only one component, based on their unique needs or priorities. This flexibility allows for tailored approaches that best suit the circumstances of each region, ensuring that the solution can be adapted effectively.	**Project owner and key partners** The implemented solution will be owned by Puglia region- Department of Tourism, Cultural Economics and Territorial Development Key partners: Tecnopolis STP, INT, UOC.
COSTS AND PLANNING		

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Estimated costs (implementing and operating) INT and UOC – together 1 PMs Puglia Region (8 PMs) Tecnopolis (10 PMs) Primary cost will be personnel hours, but it may also include material expenses and travel costs.	**Revenues/monetised benefits** No monetised benefits. Public or private bodies may fund this implementation and operability as a grant, which could provide the institution/organisation with additional human and material resources.	**Time frame for planning and implementation until fully functional** See the timeline in Fig. 8. Please note that this solution is not the kind of solution that can be measurable fully functional or not. But through the project milestones and deliverables, the demonstration results can be updated.
CONTEXT		
Necessary prerequisites 1. Commitment from the institution or organisation to implement parts or all of the solution, along with the readiness of local volunteers to participate or lead the process. 2. Availability of human resources with strong communication skills, social empathy, and experience as social facilitators, ensuring effective leadership in implementing these actions. Social expertise is essential. 3. Extensive networking capabilities within the municipality, alongside the trust and collaboration required to engage stakeholders effectively. 4. Trust between institutions and organisations involved, fostering smoother coordination and a shared vision for the success of the solution. 5. In-depth knowledge of the local population and the risk context of the municipality, to ensure the solution is tailored to address specific needs and vulnerabilities.	**Success factors** The opportunity to test components of this solution in the pilot sites of Bari provides valuable insights into its practical usefulness. This allows us to assess how well the actions stemming from it are implemented and to identify areas for improvement, where adaptations or modifications may be necessary. Puglia Region and Tecnopolis have already carried on participatory activities involving citizens and institutional actors. Involvement of external experts in the field will help in coordinate with UOC team and in implementing the participatory activities.	**Limiting factors** 1) Varied contexts and complexities: The diversity in structures, social dynamics, and contexts can hinder the proper adaptation of the solution. There might be conflicting visions and objectives among stakeholders when implementing it. 2) Resource limitations: The lack of sufficient resources, whether financial, human, or political, can prevent the full, partial, or even single-component implementation of the solution at the local or regional level. This is especially problematic if the conclusion of the project means these actions cannot be sustained. While it is generally possible to find the necessary resources, it is essential to assess the specific availability at the regional or local level.

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3.2.3.3 Resources and costs

While the costs and resources required for implementation are yet to be fully detailed, a preliminary assessment suggests that there will be no direct economic costs associated with the transfer itself. The primary expenses will stem from the resources necessary to implement the agreed-upon actions.

– **New Methodologies and Formats**

The resource requirements for implementing new technologies and methodologies will depend on the scope of the planned actions. Primarily, the partners from Puglia Region will need to allocate available human resources within the jurisdiction deemed most appropriate for optimising the benefits of the proposed solutions.

There may also be some additional costs related to materials, transportation, or other logistical needs. However, these cannot be accurately estimated at this stage.

– **Inclusive Risk Communication**

The resources required to enhance inclusive risk communication will involve dedicating work hours of personnel from the public administration and the tourism sector. These individuals will integrate and adapt the recommendations into their daily activities to improve the inclusivity and effectiveness of risk communication for both the local population and tourists. The extent of these resource allocations will depend on the sector's capacity and priorities.

– **Citizen Dialogues Methodologies**

Based on the methodology transferred by UOC, it is technically feasible to conduct the citizen dialogue process using the Puglia Region's existing human resources. However, if internal expertise is insufficient or if it is deemed preferable to engage external specialists, a budget allocation may be necessary to hire temporary personnel with the requisite skills to facilitate these processes effectively.

Table 29: Planned personnel resources

	Providing region	**Receiving region**
Person Months (PMs) planned for transferring the Citizen Participatory Toolkit	1 (INT and UOC)	8 (Puglia Region) 10 (Tecnopolis)
Person Months (PMs) total RESIST WP3	80 (INT-34 and UOC-46)	38,6 (Puglia Region) 51,8 (Tecnopolis)

Table 30: Other costs in the receiving region

	Amount (Euro)	**Short cost description**	**Further information**
License, Subcontracting, Other (please specify)	TBD		

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3.2.4 Planning the transfer in Puglia

The process of planning the transfer solutions has been co-designed with the partners of the providing and recipient regions, following the **Logframe Matrix approach** (RESIST deliverable D1.2) identifying the objectives, purpose, results, and planned activities, i.e., Table 31 for Argos, Table 32 for Impact-based side specific warnings (SSW), and Table 33 for Citizen Participatory Toolkit.

Table 31: Logframe Matrix for Argos Early Warning System (Catalonia to Puglia)

Overall objective	**Indicators**	**Source of verification**	**Assumptions**
Strengthening the adaptive capacity of local communities to heat stress for the benefit of both local residents and incoming tourists	Share of relevant stakeholders who believe that the implementation of Argos in the pilot area can significantly improve the adaptive capacity to heat stress	Survey of relevant stakeholders - policy makers, local administrators and representatives of the tourism industry (entrepreneurs and workers)	Relevant stakeholders are interested and willing to participate
Purpose	**Indicators**	**Source of verification**	**Assumptions**
To centralises all heat stress information	Number and relevance of action protocols and procedures whose information needs can be fully met by Argos	Report on self-assessment or third-party assessment process (TBD).	Action protocols have been co-designed and agreed
To provide hyper-local, dynamic, and tourism-focused scenarios on hazard and exposure conditions for heat related risks	Share of total municipal area covered by the tailored scenarios	Report (self-assessment)	Full integration of relevant data sets is feasible and has been done (meteorological observations, weather radar, land use/land cover and urban morphology, *etc*.)
Enabling frontline staff in tourism (e.g. tour guides, travel agents, destination representatives) and related sectors (health, transport, etc.) to help tourists and residents better cope with heat stress, based on diversified sensitivity	Net Promoter Score User Effort Score	Survey of frontline staff in tourism and related sectors	Map of cooling centres and information on least heat stress paths developed and available

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profiles (as influenced by age, previous health conditions, etc.)			
Results	**Indicators**	**Source of verification**	**Assumptions**
Argos platform is up and running, customised to meet regional needs, with key data sets fully integrated and data practices and procedures agreed	Web site uptime (%) Integrity of key workflows (defined sequence of URLs) Unique visitors	Web site analytics Report (self-assessment)	Hardware, software and data requirements for Argos deployment are fully met
Hyper-local, dynamic, and tourism-focused scenarios on hazard and exposure conditions for heat-related risks have been discussed with relevant stakeholders - policy makers, local administrators and representatives of the tourism industry (entrepreneurs and workers)	Spatial variability of heat stress metrics within the pilot area Number of relevant stakeholders participating in the heat stress scenario workshop	Report (self-assessment)	The selected data sets and modelling methods are suitable to differentiate heat stress conditions in the pilot area Relevant stakeholders are interested and willing to participate
Successful tests have been run with intended users (frontline staff in tourism (e.g. tour guides, travel agents, destination representatives) and related sectors (health, transport, etc.)	Number of intended users involved in the tests	Report (self-assessment)	Intended users are interested and willing to participate
Step-by-step activities			**Assumptions**
1. Preliminary data scouting and acquisition 2. Puglia capacity building by Catalonia – how to work with the platform 3. Involvement of relevant stakeholders in the pilot area 4. Integration of data into the Argos system 5. Co-design of action protocols with the intended users (frontline staff in tourism (e.g. tour guides, travel agents, destination representatives) and related sectors (health, transport, etc.) 6. Discuss heat stress scenarios with relevant stakeholders to prioritise organisational and structural adaptation measures (i.e. nature-based solutions) 7. Interactive discussion with UPC for integrating SSW into the Argos platform 8. Monitoring, evaluating the results, revision of scenarios or platform components 9. Scaling out the use of the platform to other pilot areas/municipalities			Hardware, software and data requirements for the set-up of Argos can be fully met Relevant stakeholders and intended users are interested and willing to participate

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Table 32: Logframe Matrix for Impact-based Site-Specific Warnings (Catalonia to Puglia)

Overall objective	**Indicators**	**Source of verification**	**Assumptions**
Building the capacity to cope with heat stress of tourists and local residents	Share of frontline staff in tourism and related sectors in the pilot area who believe that the implementation of Site-Specific Warning (as embedded in Argos) can significantly improve the capacity to cope with heat stress	Survey of frontline staff in tourism and related sectors	Frontline staff in tourism and related sectors are interested and willing to participate Tailored action protocols to prevent or mitigate the effects of heat stress on tourists and residents can be triggered by using the SSW tool
Purpose	**Indicators**	**Source of verification**	**Assumptions**
To foster the adoption of tailored action protocols to prevent or mitigate the effects of heat stress by tourists and residents	Willingness to adopt, and perceived effectiveness of, tailored action protocols to prevent or mitigate the effects of heat stress on tourists and residents	Survey of frontline staff in tourism and related sectors	Proposed action protocols fit well in the existing professional practices and routines
To help frontline staff in tourism and related sectors provide site specific warnings about extreme heat events in the pilot area, according to different dimensions of vulnerability (urban microclimates, distribution of prevention and response facilities, *etc*.)	Share of frontline staff in tourism and related sectors who believe that SSW has significantly improved their knowledge of vulnerability to extreme heat events in the pilot area	Survey of frontline staff in tourism and related sectors	Frontline staff in tourism and related sectors are interested and willing to participate
To help incoming tourists and local residents plan outdoor recreational activities (according to type, intensity, duration) and user sensitivity profiles (as influenced by age, previous health conditions, *etc*.), under heat stress conditions	Share of tourists and local residents who believe that SSW has significantly improved their awareness of the heat- stress vulnerability implications of different outdoor recreational activities) and user sensitivity profiles	Survey of tourists and local residents	Tourists and local residents are interested and willing to participate

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Results	Indicators	Source of verification	Assumptions
SSW is fully integrated into the Argos platform	Integrity of key workflows	Integrity test scripts	Deployments of Argos platform and SSW tool can be closely coordinated and fully operational simultaneously
Tailored action protocols to prevent or mitigate the effects of heat stress on tourists and residents have been co-designed and reviewed, including relevant indicators or warning thresholds	Number and diversity (with regard to outdoor recreational activities and user sensitivity profiles) of action protocols that have been developed	Report on self-assessment or third-party assessment process (TBD)	Expert advice is available from health professionals to review the proposed action protocols
Site-specific vulnerability to extreme heat events has been mapped in the pilot area, according to different dimensions of vulnerability (urban microclimates, distribution of prevention and response facilities, etc.)	Share of total municipal area covered by site-specific mapping of vulnerability to extreme heat events	Report (self-assessment)	Full integration of relevant data sets is feasible and has been done
Key outdoor recreational activities classification (according to type, intensity, duration) and user sensitivity profiles (as influenced by age, previous health conditions, etc.) have been elaborated	Number of key outdoor recreational activities that have been fully characterised Match of user sensitivity profiles to incoming tourists and local residents' sociodemographic	Report on self-assessment or third-party assessment process (TBD)	The partners involved (Puglia Region and Tecnopolis) collectively possess the necessary skills, and relevant white and grey literature is available
Step-by-step activities			**Assumptions**
1. Preliminary data scouting and acquisition 2. Exploration of new data sources for SSW in Bari 3. Development of adapted indicators or warning levels with available datasets for SSW 4. Feasibility tests 5. Interactive discussion on the produced indicators or warnings among UPC, Puglia regions, and Tecnopolis for vulnerable locations (or critical points), outdoor recreational activities classification, user sensitivity profiles, past impact data, and the location of prevention and response facilities (cooling centres, *etc.*)			Hardware, software and data requirements for the set-up of Argos can be fully met Relevant stakeholders and intended users are interested and willing to participate

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6. Implementation of SSW algorithms including risk assessments at vulnerable locations (or critical points) 7. Co-design of tailored action protocols to prevent or mitigate the effects of heat stress with frontline staff in tourism and related sectors 8. Interactive discussion with HYDS for integrating SSW into the Argos platform 9. Gather feedback from frontline staff in tourism and related sectors, incoming tourists and local residents, policy makers, local administrators and representatives of the tourism industry (entrepreneurs and workers) 10. Monitoring, evaluating the results, revision of warning (or indicators) 11. Scaling out the use of the SSW tool to other pilot areas/municipalities	

Table 33: Logframe Matrix for the planned transfer of Citizens Participatory Toolkit

Overall objective	**Indicators**	**Source of verification**	**Assumptions**
To strengthen communities (policymakers, operators and tourists) by promoting inclusive participatory processes and social actions addressing natural hazards, climate change and participation in tourism sector	Number of participatory processes activated	Project reporting or deliverables	NA
Purpose	**Indicators**	**Source of verification**	**Assumptions**
To identify adaptation solutions in the tourism sector for policy makers and tourist operators in a participated manner	number of adaptation solutions identified	Project reporting or deliverables	Information provision works and is on time. Effective involvement of f Policy makers and tourist operators
To provide tourists and tourist operators of methods to better behave in the occasions of heatwaves	Number of tourists and tourist operators informed	Project reporting and deliverables	
Results	**Indicators**	**Source of verification**	**Assumptions**
Puglia region/Tecnopolis staff is capacitated to work with the Participatory Toolkit	Number of persons from Puglia that attended capacity building	Capacity building documentation and project reporting	

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Local stakeholder map	Number of mapped stakeholders	Project reporting or deliverables	
Guidelines for participatory methods	Number of guidelines	Project reporting or deliverables	
Adapted Citizen dialogues methodology.	Number of Citizen dialogues methodologies	Project reporting or deliverables	
Adapted Inclusive risk communication guide	Number of risk communication guide	Project reporting or deliverables	
Report on adaptation measures identified in the participatory process	Number of adaptation measures	Project reporting or deliverables	
Evaluation	Number of feedback collected from the stakeholders	Project reporting or deliverables	
Step-by-step activities			**Assumptions**
1. Puglia capacity building kick-off – Discussion with INT and UOC on how to work with the toolkit with the examples implemented in Catalonia. 2. Target groups identification 3. Local Stakeholder mapping 4. Adaptation of participatory methods 5. Development of a detailed plan 6. participatory process implementation 7. Adaptation of the Inclusive risk communication guide 8. Results evaluation			Stakeholder availability to be involved

Timeline until 2027

The overview of Timeline is shown in Fig. 8 from 2025 to 2027. Apart from bilateral meetings among HYDS, UPC, INT, UOC, Puglia region, and Tecnopolis, the work progress will be presented and discussed through quarterly LSDT3 online meetings hosted by ERRIN, the consortium & executive board meetings, and other workshops.

In addition, more detailed documentation on methodologies and the resulting cases studies from the transferred solutions will be compiled in the coming Deliverables (D3.14, D3.15, D3.16 and D3.17 in Month 36, D3.18 in Month 48, and D.3.27 in Month 60) where Puglia region and Tecnopolis will lead

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dedicated sections, and Milestones M3.3 (led by ERRIN in Month 48) and M4.3 (led by INOVA+, Month to present to be determined, possibly in Month 43).

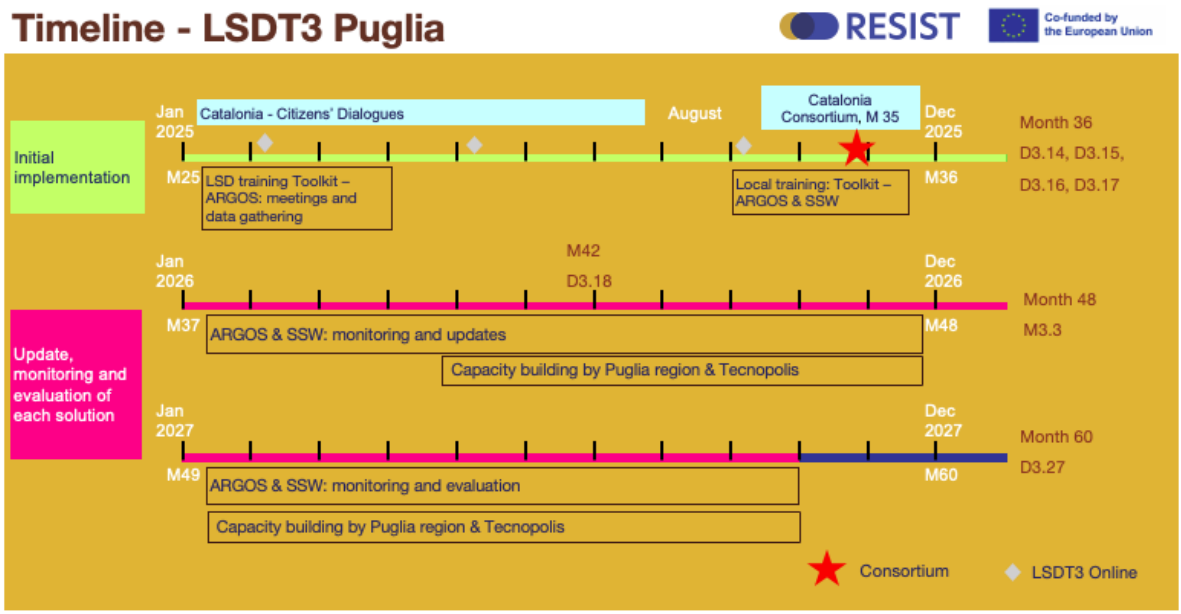
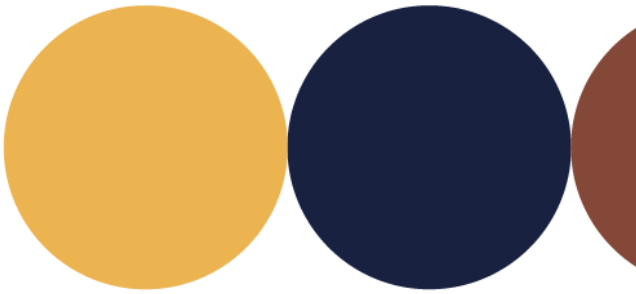
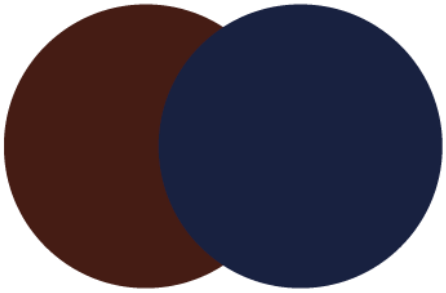
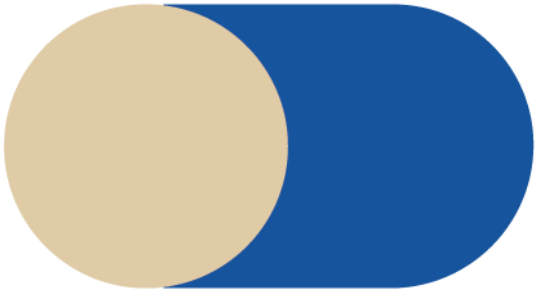


Figure 8: Timeline for the solution transfer from LSD3 Catalonia to Puglia

RESIST







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