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Research and Innovation

CORDIS Results Pack on disaster resilience

Protecting citizens and strengthening crisis response

A thematic collection of innovative EU-funded research results

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Editorial

Europe faces increasing threats from natural hazards, climate extremes and complex emergencies that pose significant risks to lives, infrastructure and societal stability. This CORDIS Results Pack showcases 10 EU-funded projects building societal resilience and citizen engagement, with the shared aim of better anticipating, managing and recovering from such crises.

Europe is confronted by multifaceted hazards and threats, which present a challenge to traditional responses and approaches. There is an urgent need for holistic solutions that improve anticipation, prevention and response, through innovations such as advanced early warning systems and more robust decision-making support. Furthermore, it is critical that such solutions actively involve communities and strengthen the capabilities of first responders.

The EU is taking action to ensure these pressing needs are met. The EU's preparedness union strategy for example places strong emphasis on societal resilience and citizen engagement, while the European Disaster Risk Management framework integrates policies focused on prevention and the reduction of disaster risks. The Union Civil Protection Knowledge Network meanwhile is all about connecting researchers and policymakers with practitioners on the ground. Similarly, the CERIS network brings together the security research community to identify opportunities, such as the growing role of digital- and space-related solutions as enablers of resilience.

Together, these and other strategies are enhancing the EU's preparedness and readiness for future crises and helping to ensure that all actors are capable of responding quickly and effectively if needed. This CORDIS Results Pack highlights 10 EU-funded projects that are actively contributing to these overarching aims.

These research projects integrate science, technology and community engagement, to strengthen information sharing and improve the efficiency of crisis response. Many have been funded through Horizon Europe's Cluster 3, a programme that aims to build a safer and more secure Europe. To help achieve this, some projects have developed advanced tools, technologies and frameworks to improve early warning systems, while others have strengthened decision-making mechanisms and empowered citizens to take a more active role in preparedness and response.

By presenting these insights, this Results Pack serves as a valuable reminder that innovation and social engagement can bring concrete benefits. The results also underline Europe's capacity to protect its citizens and build a shared commitment to disaster preparedness.

Community-centred approach to disaster management

Local knowledge and community participation have been integral to the development of new multi-hazard risk prediction and planning tools.

Climate change and rapid urbanisation are exacerbating Europe's vulnerability to natural hazards such as floods, wildfires and heatwaves. Current disaster management systems are struggling to cope.

"Fragmented data, top-down decision-making and limited community involvement all reduce the effectiveness of current systems during complex, multi-hazard events," explains Cenk Gureken from Sampas, host of the EU-funded C2IMPRESS project for which he was team leader.

To address this, C2IMPRESS has developed and validated tools designed to improve the prediction, planning and management of multi-hazard risks, with a focus on flooding, landslides and wildfires. Technological innovations were guided by a 'place- and people-centred' approach that integrated local knowledge and community participation.

Improving prediction, planning and management

A fully operational modularised platform known as the System-of-Systems for Multi-Hazard Risk Intelligence Networks (SoS4MHRIN) is central to C2IMPRESS's approach. SoS4MHRIN combines Earth system models, such as Copernicus, with artificial intelligence tools, to simulate how natural hazards can interact, cascade or occur simultaneously, sometimes in unforeseen ways.

The simulations simplify complex long-term climate trends and short-term extreme events, providing forecasts and insights (for example about impacts on the built environment) at regional to local scales. The platform is currently being accessed by a team at Meteoceanics (its creators), who offer the information as a service to emergency managers, civil protection authorities and policymakers.

Mapping and modelling to evaluate risks

To develop the most appropriate emergency response, SoS4MHRIN links to the cloud-based C2IMPRESS platform. Here, hazard and response simulations can be mapped in real time, with users able to change inputs (such as rainfall levels) and assess the impact. There is also a social media tool that monitors and visualises disaster-related posts.

Additionally, a decision support tool (BPM-DSS), powered by big data, was specifically created for local authorities. This is hosted on a secure platform and links to the specific emergency response steps to be followed by each authority.

"C2IMPRESS uses mapping and modelling to evaluate risks and predict impacts under various response strategies," adds Gureken. "The dedicated policy-level decision support system meanwhile supports data-driven disaster management."

Co-design for effective preparedness, response and mitigation

The C2IMPRESS tools were co-developed through public-private-civic partnerships, citizen science initiatives and Living Labs, with technical teams, potential users and citizens all working together. These collaborations were undertaken through case studies conducted in Greece, Portugal, Spain and Türkiye.

Portugal focused on coastal flooding and maritime risks; Greece targeted multiple risks including heatwaves, monitoring climate data cascading impacts and citizen responses; Türkiye concentrated on flooding, placing early warning systems around Ordu, and vulnerability mapping; while Spain (Balearic Islands) emphasised flood and wildfire risk, with simulations informing early warning and resource allocation.

Participants tested the tools in workshops and field trials, and on digital platforms. For the HazardMonitor app, first responders across the pilots reported hazards, uploaded geolocated images and took part in operational exercises. This enabled them to validate warning triggers and assess alert notifications.

Multi-stakeholder involvement and feedback also benefited human behaviour and agent-based modelling, resulting in simulations of hazard scenarios and mitigation strategies tailored to each pilot. "By involving citizens in co-design, data collection and scenario testing, these technologies not only inform, but empower communities to anticipate, respond to and mitigate hazards," says Gureken.

By involving citizens in co-design, data collection and scenario testing, these technologies not only inform, but empower communities to anticipate, respond to and mitigate hazards.

The forecasting and early warning systems are now fully operational in the pilot sites, providing real-time, actionable alerts. Preliminary cost-benefit analyses have already indicated that they offer substantial socio-economic value.

The C2IMPRESS consortium now plans to continue developing guidance, roadmaps and governance frameworks relevant to EU strategies in this field. These include the Disaster-Resilient Society focus area, and the EU adaptation strategy.

PROJECT
C2IMPRESS – Co-creative improved understanding and awareness of multi-hazard risks for disaster resilient society

COORDINATED BY
Sampas in Türkiye

FUNDED UNDER
Horizon Europe – Civil Security for Society

CORDIS FACTSHEET
cordis.europa.eu/project/id/101074004

PROJECT WEBSITE
c2impress.com

Prioritising people-centred early warning systems

Early warning systems that focus on impact and are co-designed with communities can help to achieve safer and more resilient societies.

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Europe is the fastest-warming continent, according to the World Meteorological Organization. This is having devastating consequences, with extreme weather and climate events increasing in intensity.

For example, around 2 million people across central Europe were affected by flooding in 2024, followed weeks later by devastating flash floods in Valencia, Spain.

As a result, there is growing awareness of the need for anticipatory action. "The problem with existing early warning systems is that they are designed to detect hazards, not to provide actionable information or anticipate impacts," explains GOBEYOND project coordinator Daniel Sempere-Torres from the Polytechnic University of Catalonia.

Assessing geological and weather risks

To address this gap, GOBEYOND is developing an advanced 'Multi-Risk Impact-based Early Warning System' (MR-IEWS). This assesses geological and weather risks and identifies not only where and when a disaster will occur, but who and what will most likely be impacted.

This information is then fed into digital tools to support better decision-making by civil protection authorities and first responders.

"Rather than reinventing the wheel, MR-IEWS builds on existing solutions developed by earlier EU projects, such as ANYWHERE, which pioneered real-time weather impact forecasting and decision-support tools," says Sempere-Torres.

Real-world testing is already confirming that impact-based warnings lead to faster response and better situational awareness during critical events.

MR-IEWS was co-designed within Living Labs. Here, scientists, technology developers, civil protection authorities, first responders and communities (regional and local) worked together to define needs and test solutions.

"Converting diverse data into actionable information is very challenging," adds Sempere-Torres. "Local exposure and vulnerability datasets differ in detail and format, while geophysical and meteorological early warning algorithms differ in nature and timescales."

Testing impact-based warnings

Out of this work, two families of platforms have been created. The first provides European and Mediterranean forecasting coverage (EW4EU and EW4MED, respectively), while the other offers tailored regional/local decision support systems (DSSs).

The DSS platform connects impact-based forecasts with location-specific warnings about forthcoming events such as storms or floods, triggering predefined civil protection or evacuation protocols. The relevant authorities can access this information through a digital dashboard, while automatic alerts can also be sent to emergency managers.

The team is currently conducting real-time operational demonstrations of the DSS across five regional and five municipal pilot sites. These sites represent a variety of contexts and hazard profiles, including wildfires, flooding and drought.

"This real-world testing is already confirming that impact-based warnings lead to faster response and better situational awareness during critical events. By integrating real emergency workflows and working together with end users from day one, we are ensuring the solution is operationally practical, effective and fully scalable," notes Sempere-Torres.

People-centred and actionable information

A key milestone was reached in early 2025, with the first operational prototypes of the EW4EU and EW4MED platforms. "Since demonstrating the initial capabilities of these platforms, we continue to work closely with civil protection agencies and first responders," says Sempere-Torres. "For example, the local platform prototype was successfully used during a tsunami drill in Cádiz last November."

While continuing these 24/7 real-time pilot demonstrations, a Community of Practice is being established to build first responder capacity, complemented by hands-on training.

In tandem, partners are exploring commercialisation possibilities, with practical adoption options for authorities and operators, alongside interoperability and data governance guidance. The final suite of validated MR-IEWS platforms is planned for release in summer 2027 at GOBEYOND's final Workshop in Athens, open to all interested parties.

Finally, by focusing more on impact assessments than hazard assessments, GOBEYOND is helping to implement the objectives of a range of EU initiatives. These include the Union Civil Protection Mechanism, EU preparedness union strategy and EU climate adaptation strategy. The project is also in line with the aims of the UN's Sendai Framework for Disaster Risk Reduction.

PROJECT
GOBEYOND – GeO and weather multi-risk impact Based Early warning and response systems supporting rapid deploYment of first respONders in EU and beyonD

COORDINATED BY
Polytechnic University of Catalonia in Spain

FUNDED UNDER
Horizon Europe – Civil Security for Society

CORDIS FACTSHEET
cordis.europa.eu/project/id/101121135

PROJECT WEBSITE
gobeyond-project.eu

Natural hazard alerts strengthened through shared experiences

Early warning systems for natural hazards can be significantly strengthened through regions facing similar challenges sharing their experiences and knowledge.

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Extreme weather and climate events are becoming more frequent and intense, putting lives and livelihoods at risk. This has further heightened the need for more robust forecasts and early warning systems. The EU-funded MEDEWSA project was launched to help achieve this aim, through identifying and addressing gaps in coverage from northern Europe to northern Africa (Egypt) and eastern Africa (Ethiopia).

"Our aim is to build on existing early warning systems, bringing together regions facing similar hazardous events to provide actionable impact and financial forecasts," explains project member Elena Xoplaki from the Euro-Mediterranean Centre on Climate Change, Italy.

Twinning regions with similar climatic challenges

Central to this approach was the concept of twins. This involved pairing regions with different geographic and climatological contexts that faced similar challenges and hazardous events.

The aim was for these twins to exchange knowledge and develop new tools together, resulting in more accurate warnings.

The Attica region in Greece and three national parks in Ethiopia for example worked together to develop wildfire early warnings, based on shared monitoring and forecasting tools. Italy's Venice was twinned with Alexandria in Egypt's Nile Delta, as both face threats from coastal flooding and sea level rise.

Meanwhile, the Košice region in Slovakia joined forces with Tbilisi in Georgia, as both are highly exposed to flash floods and landslides. Finally, Catalonia, Spain was twinned with Sweden, as both have experienced a strong increase in wildfire activity in recent years, through a combination of drought and excessive heat.

"In each of these four twins, we began by identifying what early warning systems are out there, and what areas are currently being covered and where potential gaps are," says Xoplaki. "From there, we identified, through a co-design and co-creation approach, the unmet monitoring needs of key users and stakeholders. This included decision-makers as well as first responders and citizens."

Movement of technology and knowledge

A wide range of useful tools has emerged from this highly cooperative approach. Project partners, for example, have published a handbook of best practices and warning messaging templates relating to natural hazards. This will help authorities to select relevant messaging for specific end users such as, say, farmers or fishermen, in the event of an identified threat.

Additionally, MEDEWSA has produced numerous publications covering topics including strengthening early warnings with artificial intelligence and machine learning-based tools. Analyses of the impacts on and damage to European and African forests from heat and drought have also been published. Training and learning activities are freely accessible online.

"Our twinning approach has encouraged the movement of technology and knowledge," notes Xoplaki. "New monitoring methods from Athens have been picked up by Ethiopia for example." New methods of analysing heatwaves have also been applied in the Po River basin in Italy.

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Socio-economic impacts of hazard events

The MEDEWSA project, which runs until October 2026, is currently working to finalise the development of a decision support and dissemination system (DSDS). This will incorporate socio-economic impacts of forecast hazard events, as well as early warnings. "The idea is to prepare a system that can be easily used, and through which information can be shared with everyone to save lives and protect critical infrastructure," adds Xoplaki.

A follow up EU-funded project, named ARTEMis, is currently under way. This project will focus more on providing alerts for cross-border hazards and move towards standardised risk and vulnerability assessments.

Our aim is to build on existing early warning systems, bringing together regions facing similar hazardous events.

In this way, the MEDEWSA project will play a central role in contributing to and achieving the UN's Early Warnings for All initiative aim of ensuring that everyone worldwide is protected from hazardous weather, water or climate extremes through early warning systems by the end of 2027.

PROJECT
MEDEWSA – Mediterranean and pan-European forecast and Early Warning System against natural hazards

COORDINATED BY
Justus Liebig University Giessen in Germany

FUNDED UNDER
Horizon Europe – Civil Security for Society

CORDIS FACTSHEET
cordis.europa.eu/project/id/101121192

PROJECT WEBSITE
medewsa.eu

Anticipating multi-hazards strengthens disaster resilience

Tools that turn complex, multi-hazard situations into practical, evidence-based choices can strengthen Europe's disaster response capabilities.

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Europe's disaster risk management systems still rely largely on single-hazard assessments that fail to capture how natural hazards interact, cascade and amplify one another. Floods can trigger landslides, earthquakes can damage flood defences, and climate change is increasing the frequency and intensity of these multi-hazard events.

"Decision-makers lack tools to understand such interconnections, quantify compound risks and evaluate adaptation options across physical, social and economic dimensions," says MEDiate project coordinator Abdelghani Meslem from NORSAR in Norway.

Forward-looking resilience strategies

The EU-funded MEDiate project was launched to bridge this gap by developing an integrated, multi-hazard decision support framework. The aim was to enable authorities and critical-infrastructure operators to anticipate cascading impacts, assess vulnerabilities, and plan more coherent, forward-looking resilience strategies at local and regional scales.

"Our ambition was to move beyond isolated hazard models and create a decision support system (DSS) that integrates physical, social and economic dimensions of risk and resilience," explains Meslem. "We wanted to develop practical tools to test 'what-if' scenarios, compare mitigation and adaptation options, and make informed, evidence-based decisions."

The approach supports fair, inclusive decision-making, prioritising those most exposed or least able to cope.

To achieve this, MEDiate worked with end users and innovation leaders in four European regions that all face urgent problems relating to interacting natural hazards. These were Oslo in Norway, Nice in France, Essex in the United Kingdom and Múlaþing in Iceland. Essex for example faces flooding and heatwaves, while Múlaþing faces avalanches, landslides and mudflows.

"We began by identifying key needs through participatory research, and translated these into system requirements and use cases," notes Meslem. "In parallel, research teams developed methods to model interacting hazards and cascading impacts, and defined risk and resilience metrics aligned with policy and operational practice."

Multi-criteria decision analysis tool

These components were then integrated into a web-based DSS that lets authorities create scenarios, simulate impacts on buildings and critical services, and compare mitigation/adaptation options. In practice, users load or select a regional baseline, choose single or combined hazard scenarios, simulate physical and social impacts (e.g. damage to buildings, disruption to roads and power, access to essential services), and compute risk and resilience metrics.

A built-in multi-criteria decision analysis module then compares mitigation and adaptation options, presenting ranked strategies with transparent assumptions and uncertainty bands. Results are visualised on maps and dashboards to support communication across departments.

"Across four European testbeds, end users and critical-infrastructure operators reported that the DSS improved actionability, transparency and comparability of options, and helped structure discussions between technical teams and decision-makers," adds Meslem. "Iterative testing via co-design workshops, games sessions and stakeholder exercises led to tangible usability and explainability improvements, validating the tool's readiness for pilot-scale operational uptake."

Revealing interactions and cascading impacts

By revealing interactions and cascading impacts and comparing mitigation/adaptation options transparently, the DSS can also help authorities to target cost-effective investments. Citizens stand to benefit through safer buildings and networks, and faster restoration of essential services such as roads, power and access to schools and hospitals.

"Because socio-physical vulnerability and access metrics are built in, the approach supports fair, inclusive decision-making, prioritising those most exposed or least able to cope," explains Meslem.

The consortium is now focused on bringing MEDiate into operational use by refining the DSS for deployment and long-term maintenance. A sustainability and exploitation plan led by NORSAR and partners sets out how the platform will evolve, with options for open access research use and subscription-based services for local authorities and critical-infrastructure operators.

"Next steps include expanding the system to new European regions, integrating near-real-time data streams, and connecting with EU Civil Protection and Copernicus initiatives," says Meslem. "The team will also pursue standardisation and training activities to embed multi-hazard approaches in decision-making routines."

PROJECT
MEDiate – Multi-hazard and risk informed system for Enhanced local and regional Disaster risk management

COORDINATED BY
NORSAR in Norway

FUNDED UNDER
Horizon Europe – Civil Security for Society

CORDIS FACTSHEET
cordis.europa.eu/project/id/101074075

PROJECT WEBSITE
mediate-project.eu

Toolkit for smarter, more timely emergency care during mass casualty incidents

Advanced triage technology set to transform emergency care by integrating artificial intelligence, wearables and real-time coordination for faster, safer disaster response across Europe.

Over the years we have witnessed an increase in disaster frequency around the world due to climate change, migration crises, pandemics as well as civilian casualties and terrorist attacks. These disasters are also becoming more complex and unpredictable, sometimes leading to mass casualty incidents (MCI).

Improved preparedness and management are sorely needed, from emergency medical services (EMS) to coordinated facilities for life-saving triage and care.

A smart toolkit for the field

The EU-funded NIGHTINGALE project set out to radically improve pre-hospital emergency responses using advanced, integrated technology. The key objective was to design a set of tools to support EMS in MCI, making Europe better prepared to respond swiftly, accurately and collaboratively. The toolkit, described in the Journal of Medical Internet Research, integrates

a combination of devices, applications and services. It brings together real-time triage technology, AI tools, interoperability frameworks and multi-agency coordination platforms.

By incorporating continuous user input and validation, we made sure NIGHTINGALE adapts to diverse emergency contexts, even under extreme conditions like network loss or power outages.

"NIGHTINGALE is delivering novel, affordable tools tailored to the needs of first responders an innovative suite of medical response tools that are not only novel and affordable but also customised to the operational needs of first responders," explains project coordinator Angelos Amditis who is research and development director at the Institute of Communication and Computer Systems, Greece.

The training material of the toolkit supports rapid victim identification and assessment through digital triage tags, augmented reality glasses, wearables, and even earplug sensors. A mobile app and triage dashboard allow responders to visualise vital signs instantly and in real time.

The toolkit integrates powerful AI components to improve situational awareness, optimize resources, and support patient prognosis and decision-making. Unmanned aerial vehicles and mobile systems enable rapid scanning and remote detection of vital signs, providing critical insights even before responders arrive.

Co-designed by users for users

The NIGHTINGALE team involved a wide range of stakeholders throughout the design and testing phases including EMS and non-medical civil protection agencies from 11 EU member states and associated countries. This collaborative approach ensured the tools directly addressed real-world challenges. The system was validated through extensive lab testing and full-scale deployment trials simulating major crises.

"By incorporating continuous user input and validation, we made sure NIGHTINGALE adapts to diverse emergency contexts, even under extreme conditions like network loss or power outages," highlights Amditis.

The NIGHTINGALE toolkit was designed to bring together disconnected emergency systems and integrate into existing EMS systems. It incorporates advanced data fusion and XML messaging to facilitate communication across different authorities. A central interoperable data lake collects, stores and analyses information from the field. It also includes a scenario builder, the SWAPP App, a next generation public safety answering point, and a social media service to enhance public communication and response coordination.

Real-time collaboration is further enhanced through the command, control, coordination and incident management system (C3I/IMS), which works alongside other public nodes for faster and accurate emergency communication between responders and public.

Implementation across Europe

With development complete, NIGHTINGALE is now preparing for wide deployment. Plans include finalising business models, developing training programmes for EMS personnel, and supporting policy and standardisation initiatives at both national and EU levels.

"We're confident that the NIGHTINGALE toolkit will become a core component of next-generation EMS systems across Europe, helping to save lives and improve coordination when it matters most," concludes Amditis.

PROJECT
NIGHTINGALE – Novel InteGrated toolkit for enhanced pre-Hospital life support and Triage IN challenGing And Large Emergencies

COORDINATED BY
Institute of Communication and Computer Systems in Greece

FUNDED UNDER
Horizon 2020 – SECURITY

CORDIS FACTSHEET
cordis.europa.eu/project/id/101021957

PROJECT WEBSITE
nightingale-triage.eu

Helping first responders prepare for emergencies

Cloud-based solutions could help emergency services prepare for, respond to and recover from multi-hazard events.

Natural disasters do not respect national borders. Nor do they act alone. As a case in point, one need look no further than the devastating 2023 Turkish earthquakes.

Not only did multiple earthquakes impact both Turkey and Syria, they also triggered fires, landslides, floods and even a tsunami – all of which exacerbated the initial devastation, hindered rescue efforts and worsened an already dire humanitarian crisis.

"Unfortunately with climate change, such multi-hazard events will become the norm, not the exception," says Cees van Westen, a professor of Multi-Hazard Risk Dynamics at the University of Twente.

A cloud-based suite of solutions

Helping emergency first responders better prepare for this new reality is the EU-funded PARATUS project. "Our goal is to both increase the preparedness of authorities to respond to multi-hazard events while also reducing the risks such complex disasters pose to various sectors," explains van Westen, who serves as the project coordinator, together with his colleague Funda Atun.

To achieve this goal, the project is turning to the past to inform the future. "We're first developing tools to help us learn from the past and understand the dynamic and interactive conditions of risks," adds van Westen. "This understanding is then used to develop future scenarios of multi-hazard events and to learn how current hazards and risks may change."

The result of this approach is a cloud-based suite of solutions that authorities can leverage to better prepare for, respond to and recover from a natural disaster.

One of those solutions is FastFlood, an online tool for the rapid assessment of flood hazards. Offering a global reach, the innovative tool uses global datasets or, when available, detailed local data, to assess a location's overall flood risk.

FastFlood has been incorporated into FastHazard, a spin-off company created to further develop the PARATUS solutions and incorporate them into global flood early warning initiatives.

Other key solutions include an open-source RiskChanges tool that international projects and emergency training providers can use for multi-hazard risk assessments, along with a stress test methodology for short- and long-term decision-making and planning.

Serious games support engaged learning

The PARATUS project also developed several serious games. For example, the PARATUS Systemic Risk Board Game incorporates the various methodologies developed during the project and helps players see how they can be used to enable systemic risk assessments across different sectors.

"The game helps players discuss and analyse cause-and-effect relationships and changing risk dynamics across the emergency response space and sectors and to develop scenarios and risk mitigation options together," notes van Westen.

Practical solutions that ultimately benefit citizens

While the project's solutions are already having an immediate impact on local disaster risk planning, its work also supports such long-term priorities as the European Green Deal, preparedness union strategy and European Disaster Risk Management framework.

"PARATUS helps protect the European way of life by addressing safety, vulnerability and other challenges and by providing practical solutions that ultimately benefit citizens," concludes van Westen.

With climate change, multi-hazard events will become the norm, not the exception.

The PARATUS project's work has inspired other projects and activities, including the ESA-funded EO4MULTIHAZARDS project and the DG ECHO-funded project on development of a Master course on disaster management for professionals in Europe (EUMA), amongst others.

PROJECT
PARATUS – Promoting disaster preparedness and resilience by co-developing stakeholder support tools for managing the systemic risk of compounding disasters

COORDINATED BY
University of Twente in the Netherlands

FUNDED UNDER
Horizon Europe – Civil Security for Society

CORDIS FACTSHEET
cordis.europa.eu/project/id/101073954

PROJECT WEBSITE
paratus-project.eu

Empowering first responders during emergencies

Digital tools can help first responders adapt to and overcome the challenging conditions they encounter every day.

Besides calling them heroes, is there a way to make the job of first responders – firefighters, police officers and paramedics – easier, safer and more efficient? According to the EU-funded RESCUER project, with the right digital solutions, the answer is 'yes'.

Access to real-time information

"Digital tools give first responders access to real-time information, better communication and clearer situational awareness, allowing them to make faster decisions, stay safer in the field and better coordinate command and control," explains Federico Álvarez, RESCUER's project coordinator.

Of course, for these tools to be useful, they must function reliably even in harsh and unpredictable operational conditions. To help fill this gap, the RESCUER project has developed a suite of cutting-edge technologies, including sense augmentation, infrastructure-less positioning, and cognitive support interfaces.

Integrating cognitive load measurement

One of those technologies is the enHanced nEw eRa first respOnder (HERO) concept. First responders increasingly use augmented reality interfaces such as holographic displays to visualise critical data. The HERO concept takes this one step further by integrating cognitive load measurement.

Digital tools give first responders access to real-time information, better communication and clearer situational awareness.

"What this means is that the system adapts information to one's stress levels, preventing overload and supporting better decision-making," says Álvarez. "This combination of real-time situational data and cognitive insights enables faster, safer and more informed actions in complex emergencies."

The RESCUER toolkit is also designed as an integrated system. "This allows information from different sources to be visualised together, enabling command-and-control teams to track events in real time and make better-informed decisions," notes Álvarez.

Unpredictability of real-world emergencies

Nonetheless, bringing cutting-edge technologies to the frontline remains challenging. "While the convergence of artificial intelligence, robotics and sensor technologies holds promise, introducing these technologies in the field of emergency response can be difficult," adds Álvarez.

That's because real-world emergencies are unpredictable, and technology must be adaptable and resilient. Furthermore, compatibility issues, user interface complexities and the need for tools to function in harsh environments also pose obstacles.

To ensure its tools were fit for real-world applications, RESCUER followed a rigorous validation process, including pilot exercises designed to test the technologies in the field. Álvarez remarks: "Pilot exercises in emergency-centred research projects are complex and time-consuming events due to the necessary planning, preparation and flexibility to conduct them successfully and overcome setbacks."

RESCUER organised 10 field trials, seven training sessions and six pilots, testing the toolkit's components in diverse scenarios. The project also developed detailed evaluation methodologies to assess the performance of each tool, accounting for technical limitations such as battery life, which limited scenario duration to 45 minutes.

The pilots provided researchers with valuable insights, enabling them to refine the tools and ensure they met actual first responder needs.

Stronger, more reliable crisis response

By providing access to real-time information and enabling better communication and clearer situational awareness, digital solutions such as those developed by the RESCUER project help first responders make faster, better decisions while also keeping them safer in the field.

"RESCUER helps Europe be better prepared by giving both first responders and command-and-control teams clearer awareness of what's happening on the ground, even in infrastructure-less environments," concludes Álvarez. "This means they can react faster, coordinate more effectively and act in a safer manner – ultimately leading to a stronger, more reliable response during a crisis."

The project consortium is in discussions with industrial partners and companies interested in converting its technologies into products that could be available to first responders within the next two to three years. The ambition is to turn RESCUER's innovations into practical, regulated tools that can be widely adopted by emergency services across Europe.

PROJECT
RESCUER – first RESponder-Centered support toolkit for operating in adverse and infrastrUcture-less EnviRonments

COORDINATED BY
Polytechnic University of Madrid in Spain

FUNDED UNDER
Horizon 2020 – SECURITY

CORDIS FACTSHEET
cordis.europa.eu/project/id/101021836

PROJECT WEBSITE
rescuerproject.eu

Matching risk perception with disaster preparedness

Citizens and civil protection authorities have come together to co-create solutions for enhancing disaster resilience.

From earthquakes to wildfires, terrorism to pandemics, risks are becoming increasingly complex and interconnected. Yet, despite a growing need to enhance disaster resilience, Europe remains inadequately prepared.

"There are significant gaps between how we perceive risks and how prepared we are to react to such risks," says Maike Vollmer, senior researcher at the Fraunhofer Institute for Technological Trend Analysis INT.

Helping to close this gap is the EU-funded RiskPACC project.

Introducing the risk perception-action gap

According to Vollmer, who served as the project coordinator, there is often a mismatch between risk perception and subsequent actions. While this mismatch is particularly pronounced in an individual's preparedness, there's also a difference in how citizens and civil protection authorities (CPAs) view risk and preparedness.

"In addition, expectations between citizens and authorities are often not aligned," explains Vollmer. "Citizens tend to expect support from CPAs that the CPA simply cannot fulfil, while CPAs expect a certain level of preparedness from citizens that does not reflect reality."

These mismatches are what RiskPACC calls the risk perception-action gap (RPAG) and are what the project focused on.

Bringing together citizens and civil protection authorities

With the goal of narrowing the RPAG, the project looked to advance our understanding of not only why these gaps exist, but also what drives citizen engagement.

"Recent disasters underline the need to develop collective and individual resilience to increasingly complex systemic risks," remarks Vollmer. "To achieve this, strengthening citizen risk awareness and preparedness, as well as communication between citizens and CPAs, is indispensable."

To facilitate such engagement and communication, the project brought together both CPAs and citizens to identify needs and co-developed technical and non-technical solutions designed to answer these needs.

"The RiskPACC collaborative framework helps guide citizens and CPAs in understanding the context of a risk, sharing knowledge and risk perceptions and expectations, creating relationships of trust, and building collaborative solutions to enhance communication and resilience," adds Vollmer.

A better prepared and more disaster-resilient Europe

Using the collaborative framework, the project came to some interesting conclusions about risk perception versus risk preparedness. One of those conclusions is that the characteristics of a specific location shape how its citizens perceive risks and the actions they take to prepare and respond.

"Understanding the local context is essential to developing risk communications that are tailored to real experiences," notes Vollmer.

Based on these new findings, the project created several innovative solutions, including a board game designed to help municipalities identify their most relevant RPAGs, as well as the right strategic, conceptual and technical solutions to address these gaps.

There are significant gaps between how we perceive risks and how prepared we are to react to such risks.

The project also developed digital communication tools. For example, the crowdsourced AEOLIAN app enables the dissemination of timely bidirectional information such as early warnings, as well as photos and videos, between citizens and CPAs. HERMES, on the other hand, is a social network-like web application where citizens can create and receive useful emergency information.

All solutions were tested in dedicated case studies, ensuring practical relevance from the outset.

"By fostering communication between citizens and CPAs, the RiskPACC project has delivered practical solutions that help close the risk perception-action gap and, in doing so, create a better prepared and more resilient Europe," concludes Vollmer.

PROJECT
RiskPACC – Integrating Risk Perception and Action to enhance Civil protection-Citizen interaction

COORDINATED BY
Fraunhofer Institute for Technological Trend Analysis INT in Germany

FUNDED UNDER
Horizon 2020 – SECURITY

CORDIS FACTSHEET
cordis.europa.eu/project/id/101019707

PROJECT WEBSITE
riskpacc.eu

Addressing multi-hazard risks related to climate change

Effective communication and strong decision support can help societies to better prepare for natural climate-related disasters.

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In the last two decades alone, climate-related disasters have almost doubled around the world. Such catastrophes are predicted to grow more intense and frequent as our weather systems are transformed. A key concern is that impacts from disasters, ranging from forest fires to landslides, may overlap and present heightened dangers.

The HuT, an EU-funded project, set out to develop solutions to help us to better prepare for climate-related disasters. The aim of the project was to create a set of risk management tools and solutions that draw on these experiences, to be used across Europe in as many situations as possible.

"Multi-hazard risk scenarios must be addressed considering the interaction among the different hazards," explains project coordinator Michele Calvello from the University of Salerno in Italy. "On top of that, the transdisciplinary approach we are pursuing in The HuT project is also an attempt to overcome the domain-specific 'silos' within which many researchers too often operate."

Demonstrators for climate-related disaster assessments

The team developed 10 demonstrators (DEMs) to assess the potential for multi-hazard disasters associated with climate extremes. These were designed to incorporate views and experiences from a range of scientific and technical fields, as well as from policymakers and local communities.

"The DEMs are to be considered test areas within which different project activities are conducted," says Calvello.

Some DEMs focused on modelling, for example in forecasting droughts and heatwaves in Valencia, Spain. In Italy's Lattari mountains, another tested a network of low-cost sensors to monitor variables related to climate- and weather-driven phenomena. Others focused on the active engagement of stakeholders, including assessing the social tolerance to heavy rains in Vilnius, Lithuania.

DEMs also developed science-art narratives, with two public exhibitions held in Spain and Germany in 2025. Others explored the role of early warning systems for natural disasters and supported the development of innovative governance and policy measures.

Disaster risk awareness through art, science and games

The team highlights several key outcomes from the project, including a series of cultural explorations of natural hazards from science-art fusion activities to theatre performances.

The project also created decision support systems for municipalities across Europe, to help authorities and the general population prepare for climate-induced risks. "This includes knowledge transfer for better risk awareness, innovative monitoring and modelling activities and local data portals to share information," notes Calvello.

Multi-hazard risk scenarios must be addressed considering the interaction among the different hazards.

The HuT researchers also developed a serious board game – Safe Haven – with the aim of enhancing risk awareness. Players take on the role of municipal decision makers to help the mayor manage risks related to natural disasters caused by climate and weather, with available financial resources.

Helping Europe prepare for natural disasters

The team is currently creating three policy briefs. These are focused on integrating warnings within society, enabling nature-based solutions and scaling up disaster risk reduction solutions.

"A legacy advisory panel comprising representatives of internationally recognised networks is already expanding the boundaries of the consortium," adds Calvello. "Hopefully, it will help ensure the legacy of the project's innovations."

PROJECT
The HuT – The Human-Tech Nexus - Building a Safe Haven to cope with Climate Extremes

COORDINATED BY
University of Salerno in Italy

FUNDED UNDER
Horizon Europe – Civil Security for Society

CORDIS FACTSHEET
cordis.europa.eu/project/id/101073957

PROJECT WEBSITE
thehut-nexus.eu

Boosting citizen engagement with security technologies

Involving citizens in the design and development of security technologies can help to make societies safer.

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Security technologies – such as those designed to help citizens prepare for disasters or improve their cybersecurity – can boost social resilience and increase public safety. Yet without proper oversight, these technologies bring with them a range of potential ethical, social and political implications, and may even infringe human rights.

Integrating citizens into security technologies

In the EU-funded TRANSCEND project, researchers sought to address this by integrating citizens and civil society organisations (CSOs) into the design and deployment of security technologies.

New methods designed to boost their involvement were developed, then tried and tested with the help of academics, industry stakeholders and government officials.

"Involving citizens, CSOs and other societal stakeholders can bring enormous benefits to a project or to security research generally," explains Georgina Anderson from Trilateral Research and TRANSCEND project coordinator. "It facilitates a better understanding of societal concerns and interests, provides clarity on the problems security technologies are trying to solve, and aligns technology developers' and citizens' needs."

Toolbox to boost citizen engagement

To create the TRANSCEND toolbox, the researchers first carried out a literature review to identify state-of-the-art citizen engagement methods and reviewed impact assessment methodologies used in other research and innovation projects.

Involving citizens, CSOs and other societal stakeholders can bring enormous benefits to a project or to security research generally.

"We also determined how to integrate citizen engagement and impact assessment methods into the toolbox by piloting the methods across four security domains, engaging over 170 individuals and close to 20 CSOs," notes Anderson.

The team developed selection criteria to identify the most effective engagement methods for pilots, including: the potential for virtual, cultural, linguistic and geographic adaptation; the suitability for accommodating complex topics; and the promotion of open dialogue and discussion. They also created guidelines to target and ensure participation of specific groups and individuals.

For cybersecurity, pilots explored how AI can enhance security and assist law enforcement, and how tools can address cyber abuse, and tested a platform for cross-border security.

For disaster resilience, pilots involved citizen volunteers testing Team Österreich (website in German), an app for disaster preparedness. TRANSCEND worked with the Austrian Red Cross through a series of focus groups and workshops, testing and adapting the mobile app for disaster resilience.

Another pilot focused on fighting crime and terrorism, spurring dialogue between young people, local governments and law enforcement authorities about youth radicalisation.

The fourth pilot on border management incorporated citizen perspectives on the digitisation of border control, focusing on the use of facial recognition in airports and how CSOs can represent citizens' voices in security technology development.

Strengthening citizen engagement in security research

Beyond the toolbox, the project also created policy briefs related to each security domain based on the pilot experiences, and set up the TRANSCEND network comprising first responders, civil society and security technology end users, which will remain active going forward.

Several TRANSCEND partners have already put the methods to use in other activities (e.g., the KOBAN project), and all plan to use and promote citizen engagement, the toolbox and impact assessment methods in their work in the future.

"We are collaboratively exploring suitable funding opportunities to progress the work of TRANSCEND beyond its lifetime, possibly with a focus on strengthening CSO involvement in security technology research," says Anderson. "We want to ensure that tomorrow's security technologies are sensitive to, and informed by, citizens' needs."

PROJECT
TRANSCEND – Transdisciplinary methods for societal impact assessment and impact creation for security research technologies

COORDINATED BY
Trilateral Research in Ireland

FUNDED UNDER
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