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CORDIS Results Pack on

disaster-resilient societies

A thematic collection of innovative EU-funded research results

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Migration and Home Affairs

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Editorial

Mention 'disaster' in relation to society and the mind goes immediately to changing-climate–related events such as floods. However, there are many other types of catastrophe, including earthquakes and volcanic eruptions, space weather events, industrial disasters, crime and terrorism threats. The EU is working to reduce the loss of human life and material damage from all these sources of human misery.

Securing society against disasters is one of the central elements that enable any society to keep on functioning. There are hardly any societal functions that are not to some extent exposed to natural or man-made disasters and related resilience and security issues.

Drawing resources from a range of technologies

The challenges of EU security research are wide-ranging and consequently involve a broad span of technological development and management skills. Cybercrime and terrorism threaten vulnerable urban or protected areas and critical infrastructures such as harbours and transport and energy infrastructures. Development of a range of innovative solutions can help protect these vulnerable areas.

Research efforts at EU level in the disaster reduction area are primarily contributing to the implementation of international conventions such as the UN Sendai Framework for Action on Disaster Risk Reduction and EU regulations such the Union Civil Protection Mechanism and related policies (e.g. Flood Directive, CBRN Action Plan etc.). These generally aim to facilitate reinforced cooperation between the EU and the Member States and to promote coordination in the field of civil protection, to improve the effectiveness of systems for preventing, preparing for and responding to natural and man-made disasters. This policy framework has a direct impact on the way disaster risks are being managed in the EU, thus influencing first responders' operations.

Linking these services together is development of communications facilitating disaster management, connecting situational awareness and command centres. In all these scenarios, there are first responders, and EU projects are working on innovations to protect them in disaster situations. Last but not least, citizens are vulnerable, and new technologies and policies are increasing risk awareness and hence resilience among citizens, taking into account cultural specificities for different disaster scenarios.

Mitigating disaster with the work of eight EU projects

The ultimate purpose of the ANYWHERE project is to empower exposed responder institutions and citizens to enhance their anticipation and proactive capacity of response to face extreme and high-impact weather and climate events using a pan-European multi-hazard platform. Providing support in all the phases of an emergency incident in extreme weather and climate events, the main goal of beAWARE is to provide support in all the phases of an emergency incident in extreme weather and climate events. As societies become more complex, increasing scope and unpredictability of potential crises and faster dynamics of major incidents put increasingly stringent demands on CM.

European CM capabilities already constitute a mature system of systems, and wholesale redesign would often be too costly and might critically destabilise existing CM capabilities. Therefore, DRIVER+ focuses on augmenting rather than replacing existing capabilities. Applying the same principle through advanced cyber technologies I-REACT integrated existing services, both local and European, into a platform that supports the entire emergency management cycle by integrating a range of data from multiple sources – including information provided by citizens through social media and crowdsourcing. Using novel sensors and visualisation tools, INACHUS has worked to reduce time for rescue operations in crisis incidents that are invariably in difficult operating conditions.

For disasters involving toxin exposure and injury, distinctive technological attributes of TOXI-triage include: rapid non-invasive assessment of exposure/injury through monitoring metabolic markers of injury; managing and exploiting the semantic web; traceability by design; aptamer-based biosensing; casualty-to-discharge system integration; and integrated environmental and stand-off hazard designation.

With an emphasis on critical infrastructures, DARWIN worked to improve response to expected and unexpected crises that also embraces social structures. The project addressed the management of both man-made events (e.g. cyberattacks) and natural events (e.g. earthquakes). Lastly, for when the damage has occurred or is pending, the SMR (Smart Mature Resilience) project consortium has created a set of tools that will help EU cities achieve resilience through resisting, absorbing, accommodating and recovering from hazards or disasters.

Decision-support platform and innovative early warning products to better manage weather emergencies

Major progress and advances in understanding, monitoring and predicting weather-related disasters have been made. However, there's still much room for improvement in the development of tools, processes and best practices to effectively cope with such emergencies.

Overall, the EU-funded ANYWHERE project seeks to "empower exposed responder institutions and citizens to enhance their anticipation and proactive capacity of response in dealing with extreme and high-impact weather and climate events," says coordinator Prof. Daniel Sempere-Torres. To achieve this, ANYWHERE has developed solutions that support a new concept of emergency management that's able to improve the response capabilities of public protection and disaster relief actors across Europe and beyond.



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Optimised disaster management for weather-induced hazards

The ANYWHERE team has developed a pan-European platform – A4EU – for decision support concerning extreme climate risks. It identifies beforehand critical situations that could lead to fatalities and economic losses. "Such early warning should improve protection measures and, in the case of catastrophic events, enhance the coordination of rescue operations," notes Prof. Sempere-Torres.

A4EU serves as a decision-making tool for operational authorities when faced with a crisis situation and will provide state-of-the-art early warning systems to help exposed populations minimise impacts. It is adapted to provide multi-hazard early warning products and locally customisable decision-support services intended for the needs and requirements of national, regional and local authorities, as well as public and private operators of critical infrastructures. The platform automatically identifies in advance critical points to be affected, including their characteristics and location, allowing emergency response specialists to focus on local impacts.

ANYWHERE will transform emergency management and response from reactive to proactive. We envision the entire response chain reacting more rapidly to extreme climate and weather events, and better coping with the social, environmental and economic consequences related to these events.

Project partners have implemented, tested and demonstrated seven A4EU prototypes at civil protection command centres in six European countries. Representing different climate scenarios, these operational platforms support decision-making processes to better tackle weather-induced emergencies. "The prototypes running live at the pilot sites for a one-year demonstration period confirm the capability of the developed tools to work anywhere in Europe and be easily adapted to new locations or environments," explains Prof. Sempere-Torres.

Helping exposed populations avert disaster

The project team has also developed and implemented four self-protection tools for specific situations that both citizens and enterprises can use to effectively anticipate and respond to extreme weather-induced risks. A4Campsite increases self-protection at campsites located in the flood-prone areas of Catalonia, A4Snow predicts road impacts during severe snowfall in Catalonia, A4Schools boosts self-awareness to keep students safe at schools in Genoa when confronted with eventual flooding episodes, and A4Grid reduces storm-driven impacts on electricity transmission grids in Finland.

It will be a busy final few months before ANYWHERE ends in December 2019. A final workshop in Brussels will feature a hands-on demonstration of the products and services, highlighting their innovation and market potential. There will also be real-time exhibits of the prototypes. Several complementary actions will be performed, enabling potential end users to request their own adapted A4You service, or to integrate selected impact-forecasting products into their own systems. A new line of services for Portuguese and Spanish municipalities has been launched, and the A4Cities platform will soon be operational.

"ANYWHERE will transform emergency management and response from reactive to proactive," concludes Prof. Sempere-Torres. "We envision the entire response chain responding more rapidly to extreme climate and weather events, and better coping with the social, environmental and economic consequences related to these events."

PROJECT
EnhANcing emergencY management and response to extreme WeatHER and climate Events

COORDINATED BY
Polytechnic University of Catalonia, Spain

FUNDED UNDER
H2020

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/203293

PROJECT WEBSITE
anywhere-h2020.eu/

Enhanced situational awareness improves decision-making during extreme weather events

Currently, emergency management of severe weather events is largely decentralised, leaving local communities responsible to prepare for and deal with disasters. Innovative crisis management tools and technology should enable a fast and effective response, significantly decreasing loss of life and property.

The intensity, frequency and economic costs of extreme weather events are increasing with global climate change. As a result, flooding, droughts, heatwaves and wildfires are expected to be more common and more severe in the future.

The EU-funded beAWARE project developed a comprehensive communications and analysis platform to help decision-makers, first responders and citizens. It includes multilingual verbal and written communication analyses, multilingual report generation and emergency multimedia-enriched communication.

Smarter and faster feedback and decision-making at the local level

According to project deputy coordinator Dr Anastasios Karakostas: "In every disaster and crisis, time is the enemy. Getting accurate information about the scope, extent and impact of the disaster is critical to creating and orchestrating an effective disaster response and recovery effort. The main goal of beAWARE is to provide support in all the phases of an emergency incident."

The beAWARE knowledge base is the semantic foundation that provides the classification scheme and deduction rules and also analyses information and distributes outcomes. Information is



© Alto Adriatico Water Autority (AAWA)

obtained from local citizens, first responders, social media, local weather forecasts, sensors such as in situ static cameras to monitor water levels and even cameras on drones.

Citizens and first responders communicate with the beAWARE platform via the beAWARE mobile application. The social media monitoring module searches for and validates related social media content and then analyses it to perform spatiotemporal grouping of relevant posts.

The smart algorithms analyse both visual and audio information. As Dr Karakostas explains, "the visual analysis module can define the type of crisis, detect relevant objects (for example, cars in a flooded area) and estimate the traffic." An automated speech recognition module transcribes audio messages received through the beAWARE mobile app or phone calls in four languages (English, Greek, Italian and Spanish).

"The Public Safety Answering Point (PSAP) is beAWARE's central command and control system," Dr Karakostas notes. "It receives information from citizens, first responders and social media, processes it through automatic reasoning engines and analytics services and generates automatic incident reports or enriches field reports with information based on multimedia, social media and sensor analytics."

Two field pilots validated the beAWARE platform: a heatwave simulation in Greece, and a flood simulation in the Italian Eastern Alps region. During the flood test, the mayor as decision-maker was supported by various offices of the municipality and region to staff the control room and act as first responders.

In every disaster and crisis, time is the enemy. Getting accurate information about the scope, extent and impact of the disaster is critical to creating and orchestrating an effective disaster response and recovery effort. The main goal of beAWARE is to provide support in all the phases of an emergency incident.

Increasing awareness of the platform and its utility for the public good

In addition to publications and participation in numerous conferences, beAWARE also organised the first-ever (2018) and second (2019) international workshops on Intelligent Crisis Management Technologies for climate events (ICMT) at the International Conference on Information Systems for Crisis Response and Management (ISCRAM).

Widespread implementation of the beAWARE platform at the local level should enable communities to take charge of crisis management. Community leaders, first responders and citizens alike will be able to address increasingly severe weather events more quickly and effectively, saving lives and livelihoods.

PROJECT
Enhancing decision support and management services in extreme weather climate events

COORDINATED BY
Centre for Research & Technology Hellas, Greece

FUNDED UNDER
H2020

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/207286

PROJECT WEBSITE
beaware-project.eu/

New set of guidelines bring crisis resilience to the next level

When dealing with crises, risk and resilience management are two of the most important challenges facing businesses and governments. But until now, they were pretty much on their own: no resilience guidelines were available to help them refine their strategies.

Disaster – natural or man-made – can impact us all, from individuals to private and public organisations, and even governments. It calls for a capacity to bounce back, which will often take the shape of crisis management plans and procedures.

DARWIN consortium members, however, argue that most existing strategies may need improvements. As Ms Ivonne Herrera, coordinator of the project on behalf of SINTEF, one of Europe's largest independent research organisations, points out: "Recent natural and man-made disasters have highlighted the limitations of these types of plans and procedures. At DARWIN, we believe that a more resilient approach is needed to prepare for, and deal with, both expected and unexpected events."

The EU-supported project believes more resilience essentially means taking the constantly growing scientific body of knowledge, bringing it together within a comprehensive set of resilience management guidelines and making it more tangible through a range of actionable knowledge/interventions through the use of serious games and simulation tools.

The tool proposes concrete interventions that could be implemented in organisations to enhance specific resilience capabilities.

DARWIN's set of guidelines is the first of its kind, according to Herrera. Instead of being purely prescriptive, it takes into account the fact that some organisations may already be applying the right resilience management approaches without even knowing it. It can rather be seen as a benchmark, enabling organisations to take a critical stance on their crisis existing management plans and enrich them with DARWIN guidelines.

The guidelines are also dynamic and user-friendly. "They cover a number of resilience management approaches using a total of 13 capability cards (CCs)," Herrera explains. "The tool proposes concrete interventions that could be implemented in organisations to enhance specific resilience capabilities." Each CC deals with a specific topic, from establishing networks to communication with the public.

A large community of 170 crisis management experts and researchers from 25 countries co-created and evaluated DARWIN's guidelines. They provided expert feedback and evaluation during each step of the process, thereby ensuring that the use of guidelines will be sustained over the coming years.

Applications in various fields

To investigate and test their approach's effectiveness, the project team decided to focus on healthcare and traffic management. They identified relevant interventions for both sectors as well as context-specific aspects for each critical infrastructure.

"Our research found ways to enhance a number of practices and methods. For example, inspired by the Resilience Engineering discipline, we reflected on 'what went well' and not only 'what went wrong' when learning from events. The triggering questions, methods and tools included in the capability cards can be used to survey current practices, strategies, procedures



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and guidelines. For example, based on our guidelines and capability cards, a manager from the air traffic management domain decided to revise their emergency preparation plans," Herrera says.

Many participating experts, such as critical infrastructure crisis managers, have already begun implementing the DARWIN guidelines in their respective associations. The consortium hopes to 'keep the momentum going' and is currently looking for new funding opportunities at both national and EU level.

PROJECT
Expecting the unexpected and knowing how to respond

COORDINATED BY
Sintef, Norway

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H2020

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/194846

PROJECT WEBSITE
h2020darwin.eu/

Enhancing European resilience and response to threats and crisis situations

After devastating floods that forced thousands of evacuations and the recent spike in wildfires across Europe, how can crisis management practitioners become more resilient in preventing and fighting unpredictable threats? This is the challenge the EU-funded DRIVER+ project is addressing.



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The EU is exposed to an array of potential crises and disasters, such as those associated with climate change or caused by terrorist attacks or failures in critical infrastructure. Effective crisis management hinges on, amongst other factors, developing new socio-technological solutions, and enhancing cooperation amongst citizens, organisations and authorities.

The EU-funded DRIVER+ project has been established to enhance European resilience in the face of crisis situations. The initiative is bringing together practitioners, relief agencies, policymakers, technology suppliers and researchers from across Europe. These crisis management professionals are jointly testing innovative solutions that will aid emergency services in managing major crises more effectively.

The required capabilities and identified gaps are the drivers for innovation and developing new solutions. "Solutions may include a new piece of software or a training approach, a new item of equipment or a new way of working together. However, practitioners need to know that any new solution has been tried and tested and proven to be valuable in a realistic and challenging environment," notes Marijn Rijken (TNO), the DRIVER+ project director.

Sustainable innovation solutions

The consortium is organising simulation trials in four European cities to improve their region's crisis management capabilities in case disastrous events such as earthquakes, floods, forest fires or massive release of chemical agents should ever occur. "Although there are many innovative management solutions practitioners could come up with, they have to assess each one objectively and test how the solution works together with operational systems already in use," states Marcel van Berlo (TNO), the DRIVER+ technical coordinator. "To this end, DRIVER+ has developed a robust and practitioner-driven test-bed which is used to systematically assess crisis management solutions." One important part of this test-bed is the 'Trial Guidance Methodology', describing how to prepare and evaluate trials.

DRIVER+ has also developed the test-bed infrastructure – an open-source toolbox with software components that helps setting up and managing a trial. In this virtual space, practitioners, researchers, policymakers and citizens can work jointly and evaluate new tools, processes and organisational solutions. In addition, a web-based 'Portfolio of Solutions' is being developed to further strengthen the crisis management capabilities in Europe. This online catalogue is open for all solution providers and lets experts find everything they need to know about a solution, including experiences from practitioners.

DRIVER+ has developed a robust and practitioner-driven test-bed which is used to systematically assess crisis management solutions.

Key activities

The two key dimensions of DRIVER+ – the test-bed and the Portfolio of Solutions – are complemented by a third one: sharing a common understanding of crisis management across Europe. For that reason, the Crisis Management Innovation Network Europe (CMINE) community of practice has been established, open to every interested stakeholder. CMINE links several networks and projects and facilitates the exchange of good practices and new ideas, fostering innovation in crisis management.

Annual 'I4CM - Innovation for Crisis Management' events, policy research roundtables and several CEN Workshop Agreements further contribute to building a shared understanding in crisis management across Europe. In February 2020, a final conference will be organised in Brussels to communicate project results.

Project partners have also developed a framework to assess the societal impact of crisis management solutions. For example, it will help you assess under which circumstances it is acceptable to use a drone that provides a live camera view over flooded areas. Preventing negative and promoting positive societal impact is part of assessing the potential value of crisis management solutions.

PROJECT
DRiving InnoVation in crisis management for European Resilience

COORDINATED BY
Atos, Spain

FUNDED UNDER
FP7-SECURITY

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/188608

PROJECT WEBSITE
driver-project.eu/

New technology and tools to improve urban search and rescue operations

The EU-funded INACHUS project has unveiled ground-breaking solutions to increase situational awareness of first responders and aid them in the detection and localisation of trapped victims during urban search and rescue (USAR) operations.

Emergency situations such as natural disasters and terrorist attacks, or even incidents that have the potential to become more serious – can damage infrastructure, cause injury or loss of life, and trap people in debris. An immediate life-saving response by USAR teams is required to rescue those who are trapped and evacuate survivors. Statistics show that an efficient USAR technology can reduce accident losses to 9 %.

Composed of 20 partners, the INACHUS consortium succeeded in developing a holistic platform that provides wide-area situational awareness, thereby enhancing the detection and localisation of trapped victims. The platform is assisted by simulation tools that allow USAR teams to predict structural failures and a holistic decision-support mechanism that incorporates operational procedures and resources of relevant actors. "The INACHUS methodology is as user-centric as possible: Based on end-user insights and needs, INACHUS carefully designed and evaluated an integrated platform that provides the appropriate tools to first responders and USAR teams to effectively and quickly respond to various emergency events," notes project manager Evangelos Sdongos.

Snake robots crawling to the rescue

The INACHUS robot is a snake-like robot prototype designed to aid rescue teams in finding and communicating with victims under a collapsed building. An operator can remotely control the robot and drive it under the rubble by entering very small openings. The robot detects human presence through a mounted radar sensor, an electronic nose (which also detects dangerous gases) and an infrared camera. It can automatically track its position based on a real-time locating system. Furthermore, an embedded two-way audio communication system allows the rescue team to communicate with the victims under the rubble. The robot prototype comes with a case containing the power supply, an industrial-grade PC and the necessary communication devices. The case is tethered to the robot via a power and communication cable.

Sensors in and around the worksite

The RobotRadar is a miniaturised radar system, one of several sensors integrated in the snake robot. The robot can crawl into the rubble and get closer to the trapped victims, increasing the chance to find deeply buried humans and save more lives. Another similar tool is the ground-based seismic sensor system that detects and locates knocking signals from victims trapped in debris heaps.

The INACHUS methodology is as user-centric as possible: Based on end-user insights and needs, INACHUS carefully designed and evaluated an integrated platform that provides the appropriate tools to first responders and USAR teams to effectively and quickly respond to various emergency events.

Decision-making and visualisation tools

The INACHUS modelling tools assist emergency teams to understand and assess the integrity of collapsed structures so that they can appropriately plan their interventions. Modelling data are complemented and augmented with airborne services:

Airborne equipment such as small and large unmanned aerial vehicle systems gather visual, thermal and laser data which are represented by point clouds. These offer a rich set of information to the USAR concerning debris, openings, or dangerous locations.



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The common operational picture

All previous data are conveyed to the common operational picture platform through a resilient, ad hoc communication system. It provides a comprehensive map-centric view on the site of an incident. Its rich 3D visualisation capabilities should increase the overall situational awareness and aid rescue teams in the decision-making process on strategic as well as tactic and operational levels.

PROJECT

Technological and Methodological Solutions for Integrated Wide Area Situation Awareness and Survivor Localisation to Support Search and Rescue Teams

COORDINATED BY

Institute of Communication and Computer Systems

FUNDED UNDER

FP7-SECURITY

CORDIS FACTSHEET

cordis.europa.eu/project/rcn/192570

PROJECT WEBSITE

inachus.eu/

Crowdsourcing emergency management services

As climate change increases the number of extreme weather events, the EU-funded I-REACT project is developing an innovative tool that integrates a range of data from multiple sources – including information provided by citizens through social media and crowdsourcing.

Over the past 30 years, the number of climate-related disasters around the world has reached an unprecedented level. Only in the last 10 years, extreme weather events have caused 700 000 deaths and meant more than EUR 1.5 trillion in losses worldwide. And it's only getting worse: Thanks to climate change, extreme weather events will increase in frequency and will last even longer.

"Greater evaporation will lead to increased water vapour in the atmosphere, producing more intense precipitation that – together with rapid snow melt – increases the likelihood of floods," says Fabrizio Dominici, project coordinator of the EU-funded I-REACT project. "Higher temperatures will also increase the frequency of wildfires, as well as other disasters."

According to Dominici, currently available risk management systems have limited effectiveness when applied to large-scale climate-related disasters. "Despite technological progress and the availability of large amounts of data, no platform provides real-time integration and analysis of all the available data that can be used to improve the prediction and management of disasters," he says.



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The I-REACT project is the first European-wide platform that integrates a range of data (i.e. Copernicus Earth observation, weather and climate services) coming from multiple sources, including information provided by citizens through social media and crowdsourcing. This multi-pronged approach means critical information can be produced faster. It also allows citizen involvement to be used by civil protection services and policy makers to effectively prevent and/or react against disasters.

Increased awareness and citizen engagement

I-REACT aims to improve society's resilience to natural hazards by using novel, socio-technical approaches and cyber technologies. The system allows responders to integrate their existing systems with functionalities based on the analysis of large sets of European data and services. For example, with I-REACT, it is possible to create a European-wide risks computation, with high geographical resolution, that takes into account critical infrastructures, land-cover, natural hazards, weather forecasting and user-generated content from social media.

I-REACT provides the increased awareness and citizen engagement that is so critical to being able to deal more effectively with crises arising before, during and after emergency events.

"I-REACT integrates existing emergency management systems and multiple data sources, including Earth observation, social media, augmented reality, wearables, and drones," explains Dominici. "As a result, it provides the increased awareness and citizen engagement that is so critical to being able to deal more effectively with crises arising before, during and after emergency events."

The project also developed a mobile application (available on Google Play) that empowers citizens to report on natural events and hazards and to perform a first validation of community reports. To engage more people with the system, the application features several fun quizzes and a rewards programme. The application is also a powerful tool for alerting citizens of possible risks and providing them with emergency information.

Market-ready

Although still a work-in-progress, the project has already achieved a number of important results. "In about two years, we have designed, implemented, and delivered a very innovative and operational Emergency Management System that can be effectively exploited and marketed soon after the end of the project," adds Dominici.

PROJECT
Improving Resilience to Emergencies through Advanced Cyber Technologies (I-REACT)

COORDINATED BY
Istituto Superiore Mario Boella

FUNDED UNDER
H2020

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/203294

PROJECT WEBSITE
i-react.eu/

New tools co-created with cities to build resilience

Resisting, absorbing, accommodating and recovering from hazards or disasters is a difficult task that cities have yet to get to grips with. Conscious that the clock is ticking, the SMR project consortium has created a set of tools that will help EU cities achieve resilience.

As they grow bigger and more populated, and as climate change increasingly threatens their safety, cities need to become more resilient. This is a known concept, and even sort of a buzzword: A high resilience means higher capacity to stay on course in the face of disaster, to face it and to recover from it with the right tools and measures. The question is, how do we make European cities resilient?

Traditionally, disaster cases have been met with risk-management approaches: Crises managers foresee the risks they might face and allocate an independent probability to each of these risks. But whilst this works for common, one-disaster scenarios, such an approach starts posing problems when dealing with interconnected risks and unforeseen events.

"Recently, it's been much more difficult to foresee the crises that might happen and, due to complex cascading effects, the consequences of such crises," says Prof. Jose Maria Sarriegi of the University of Navarra.

Cities are now aware that it does not make sense to think they can single-handedly become resilient when other cities are not, and they know only cooperation can allow them to become truly resilient.

To be fully resilient, cities need systematic tools. And this precisely what the SMR project has been providing: a set of tools co-created with cities, allowing them to build up their resilience in an effective way.

"We have developed the European Resilience Management Guideline, which includes five tools," Prof. Sarriegi explains. "The central tool is a maturity model that presents the five stages (Starting, Moderate, Advanced, Robust and verTebrate, SMART) a city should go through to become resilient.

"The second is a repository of policies and best practices to illustrate the implementation of resilience policies by different cities. The third is a city resilience dynamics simulation model – so that cities can work on more quantitative aspects such as budget and time needed to implement defined policies.

"Then, our fourth tool is a risk systemicity questionnaire to explain the cascading effects cities are currently facing. Finally, as the development of city resilience requires the involvement of a significant number of stakeholders, our fifth tool is dedicated to engagement: it's the Resilience Information portal."

Over the course of the project, Prof. Sarriegi and his team worked closely with the cities of Glasgow, Donostia, Kristiansand, Riga, Rome, Vejle and Bristol to develop, test and finally use the project tools. These cities have not only acknowledged the value of the SMR framework, but also continue to use it to increase their resilience.

"We are really happy with the project results but if I had to pick one achievement that I am most proud about, it would be the initial constitution of the backbone of European Resilient cities,"

Prof. Sarriegi enthuses. "Cities are now aware that it does not make sense to think they can single-handedly become resilient when other cities are not, and they know only cooperation can allow them to become truly resilient."

Although the project is now completed, the consortium is pursuing its work. Their next objective is to include the SMR tools in current standardisation processes: "We have developed three CWAs, and we are now pushing them to be relevant in the standards that are being developed at the ISO level," Prof. Sarriegi concludes.

PROJECT
Smart Mature Resilience

COORDINATED BY
University of Navarra, Spain

FUNDED UNDER
H2020

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/194885

PROJECT WEBSITE
smr-project.eu/



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Information and medical technologies combined with AI enhance triage of the masses

Chemical, biological, radiological and nuclear (CBRN) events increasingly target civilians, with first responders likely to be police officers or paramedics. A new platform for medical care and site management during triage of CBRN crises will enhance information access and utilisation to enhance outcomes.



© Andy Weaks

When unprotected civilians are the target of CBRN attacks, coordination is required among inexperienced and often disconnected entities and agencies, including civilians themselves. The EU-funded TOXI-triage project brought together 19 partners, many of whom are competitors outside the project, to achieve better outcomes for humanity during CBRN crises.

Knowledge is power

The main goal of crisis management is to collect, analyse and distribute accurate and valuable information in real time to all stakeholders and decision-makers so that they can take the most effective actions quickly. According to project coordinator Prof. C. L. Paul Thomas, chair of Analytical Science at Loughborough University, "A police officer seeking to initiate self-decontamination in the immediate aftermath while waiting for specialist help has completely different information needs than a senior government official seeking to counter a social media disinformation campaign being mounted by bad actors some hours after an incident. Both end users require verified information that is contextually appropriate."

The devil is in the details

TOXI-triage intends its benefits to extend significantly beyond enhanced CBRN resilience to routine use in medical, environmental, urban and search-and-rescue emergencies.

TOXI-triage developed and integrated numerous technologies to address the operational, technological, ethical and societal dimensions of CBRN response and recovery, and to ensure a path to a sustainable CBRN and multiuse system. Tag and Trace technology integrated with traceable point-of-care diagnostic tests delivers casualty traceability. The tests detect exposure to many CBRN agents. In a pioneering world-first, metabolites of injury from exposure (volatile organic compounds) in breath, respired skin vapours and saliva can be assessed with a single platform.

This technology also provides continuous mapping of a casualty as the person moves from the site of contamination to the site of medical care. "A vital attribute of the technology network is connecting an individual casualty to personal data in almost real time," says Prof. Thomas.

Although not envisioned at project start, TOXI-triage incorporated a 'test atmosphere generator' to deliver relevant concentrations of target molecules. As the coordinator explains, "this was a non-trivial challenge and was accomplished successfully. In doing so, the confidence in, and validity of, the subsequent operational tests was enhanced significantly."

Few can be expected to have the detailed knowledge required to handle all types of CBRN catastrophes, particularly amidst the confusion, chaos and poisonous environment. Prof. Thomas states: "The comprehensive field toolbox provides threat identification guidance followed by operational responses – immediate access to state-of-the-art best-practice guidance for any end user anywhere in the field."

Sustainable networks for triage in many contexts

TOXI-triage will enable a first responder to quickly analyse the environment and locate individuals in need, and then screen a casualty's breath/skin/saliva to monitor the extent of the toxic injury. Prof. Thomas sums up: "We have shown that, soon, every detail of the rescue will be recorded in real time and analysed to optimise the healthcare system's response and resilience."

In the meantime, continued development of technology and up-to-date training of first responders to CBRN crises require more frequent use of the platform. As Prof. Thomas explains, "TOXI-triage intends its benefits to extend significantly beyond enhanced CBRN resilience to routine use in medical, environmental, urban and search-and-rescue emergencies."

PROJECT
Integrated and adaptive responses to toxic emergencies for rapid triage: engineering the roadmap from casualty to patient to survivor

COORDINATED BY
Loughborough University, United Kingdom

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toxi-triage.eu/

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cordis@publications.europa.eu

Editorial coordination
Zsófia TÓTH, Silvia FEKETOVÁ

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