



Funded by  
European Union  
Civil Protection

EUROPEAN COMMISSION

Directorate-General for European Civil Protection and Humanitarian Aid Operations  
(ECHO) Disaster Preparedness and Prevention Knowledge Network and Evidence-Based  
Policy

B.03 – Knowledge Network and Evidence-Based Policy

Ref. Ares(2021)798258 - 27/12/2021



# RESISTANT

## Crisis Training Platform

### Training and Knowledge Sharing Platform for First Responders and Educational Tools for students' and citizens' awareness and preparedness against Natural and Manmade Disasters and Risks

#### D2.2 Second Report on *RESISTANT's* observatory

**Workpackage:** WP2 – Observatory of existing initiatives and training infrastructure

<b>Authors:</b>	International Hellenic University [IHU], Konnektable Technologies Ltd.- Greek Branch [KTGR], Association of officers and sub-officers with university degrees of Hellenic Fire Corps [EPAYPS], Military academy „General Mihailo Apostolski“ [MAGMA], Croatian Crisis Management Association [CCMA], Evia Rescue Team [SAR-312], Rescue Team Delta [RTD]
<b>Status:</b>	Final
<b>Due Date:</b>	31/12/2021
<b>Version:</b>	1.0
<b>Submission Date:</b>	26/12/2021
<b>Dissemination Level*:</b>	PU

**Disclaimer:**

The content of this document was issued within the frame of the RESISTANT project and represents the views of the authors only and is his/her sole responsibility. The European Commission does not accept any responsibility for use that may be made of the information it contains. The project has received funding from the European Union's Civil Protection Knowledge Network: Network Partnership (UCPM-2020-KN-AG) under Grant Agreement No. 101017819. This document and its content are the property of the RESISTANT Consortium. All rights relevant to this document are determined by the applicable laws. Access to this document does not grant any right or license on the document or its contents. This document or its contents are not to be used or treated in any manner inconsistent with the rights or interests of the RESISTANT Consortium or the Partners detriment and are not to be disclosed externally without prior written consent from the RESISTANT Partners. Each RESISTANT Partner may use this document in conformity with the RESISTANT Consortium Grant Agreement provisions.

(\*) Dissemination level. -PU: Public, fully open, e.g., web; CO: Confidential, restricted under conditions set out in Model Grant Agreement; CI: Classified, Int = Internal Working Document, information as referred to in Commission Decision 2001/844/EC.

## RESISTANT Project Profile

**Grant Agreement No.:** 101017819

<b>Acronym:</b>	RESISTANT
<b>Title:</b>	Training and Knowledge Sharing Platform for First Responders and Educational Tools for students' and citizens' awareness and preparedness against Natural and Manmade Disasters and Risks
<b>URL:</b>	<a href="http://www.resistantproject.eu/">http://www.resistantproject.eu/</a>
<b>Start Date:</b>	01/01/2021
<b>Duration:</b>	18 months

### Partners

 INTERNATIONAL HELLENIC UNIVERSITY	DIETHNES PANEPISTIMIO ELLADOS (IHU)	Greece
	ENOSI PTYCHIOYCHON AXIOMATIKON YPAXIOMATIKON PYROSVESTIKOY SOMATEIO (EPAYPS)	Greece
 konnektable TECHNOLOGIES	KONNEKT-ABLE TECHNOLOGIES LIMITED (KT)	Ireland
	UNIVERSITY GOCE DELCEV-STIP, MILITARY ACADEMY GENERAL MIHAILO APOSTOLSKI-SKOPJE, ASSOCIATE MEMBER (MAGMA)	Republic of North Macedonia
	HRVATSKA UDRUGA KRIZNOG MENADZMENTA UDRUGA ZA PROMICANJE I RAZVOJ UPRAVLJANJA KRIZAMA I PRUZANJA POMOCI UKATASTROFAMA (CCMA)	Croatia
	OMADA DIASOSIS EVOIAS SAR 312 (S.A.R 312)	Greece
	OMADA DIASOSIS DELTA (RTD)	Greece

---

## Document History

Version	Date	Author (Partner)	Remarks/Changes
0.1	10/10/2021	Manuela Titorencu (KTGR)	Table of Contents
0.2	31/10/2021	Kalliopi Kravari, Dimitrios Emmanouloudis (IHU) Michail Chalaris (EPAYPS), Mitko Bogdanoski (MAGMA), Igor Magdalenic (CCMA), Nikolaos Apostolou (SAR-312), Aristotelis Miliaras (RTD)	1 <sup>st</sup> Draft ready for internal review
0.3	15/11/2021	Kalliopi Kravari, Dimitrios Emmanouloudis (IHU) Michail Chalaris (EPAYPS), Mitko Bogdanoski (MAGMA), Igor Magdalenic (CCMA), Nikolaos Apostolou (SAR-312), Aristotelis Miliaras (RTD)	2 <sup>nd</sup> Draft ready for quality control
1.0	20/12/2021	Kalliopi Kravari, Dimitrios Emmanouloudis (IHU)	FINAL VERSION TO BE SUBMITTED

## Abbreviations and acronyms

Augmented Reality	AR
Croatian Crisis Management Association	CCMA
Deliverable	D
Expected Outcomes	EO
Enosi Ptychioychon Axiomatikon Ypaxiomatikon Pyrosvestirkou Somatos (Association of officers and sub-officers with university degrees of Hellenic Fire Corps)	EPAYPS
International Hellenic University	IHU
Konnekt-able Technologies Ltd. – Greek Branch	KTGR
Military Academy General Mihailo Apostolski	MAGMA
Non-governmental organization	NGO
Operational Objectives	OO
Rescue Team DELTA	RTD
Evia Rescue Team	S.A.R. 312
Strategic Objective	SO
Union Civil Protection Mechanism Programme	UCPM
Virtual Control Room	VCR

## Executive Summary

RESISTANT is an 18-month duration project co-funded by the Union Civil Protection Mechanism Programme (UCPM-2020) under grant agreement no. 101017819.

The overarching objective of the RESISTANT project is to build the first European Crisis Training Platform to train first responders through threefold comprehensive training: educational training with the state-of-the-art knowledge in safety, including tools for characterisation of hazards and associated risks, operational training on mock-up real scale transport, and innovative virtual reality training reproducing the entire accident scenarios, intervention strategies and tactics, including the whole chain of command and communications between all members of the first responders team, facility managers, and public (e.g. volunteer fire fighters, school children, citizens with disabilities). RESISTANT will also put in place a virtual 'agora' for first and second responders, academia, market practitioners, volunteers and other civil protection stakeholders to share knowledge and exchange best practices, especially in cross-border crisis management. The 'agora' will facilitate discussion and contribute towards the development of a common prevention and protection culture.

The main purpose of this document is to present a comparison of national experiences and lessons learned in Croatia, Greece and North Macedonia during various incidents. National experiences in case of natural incidents are examined and compared including interconnected key indicators like evacuation plans, dealing with volunteers and improving the resilience of the citizens. Finally, the deliverable updates the information provided in D2.1 regarding the software tools that are currently available for the training of the first responders and for emergency management.

## Table of Contents

<b>1</b>	<b>Introduction</b>	<b>10</b>
1.1	About the project.....	10
1.2	Purpose of the document.....	11
1.3	Work Package Objective.....	12
1.4	Relation to other deliverables .....	12
1.5	Intended audience .....	12
1.6	Structure of the document.....	13
<b>2</b>	<b>Research aims and methodology</b>	<b>14</b>
2.1	Research aims.....	14
2.2	Methodological framework.....	14
<b>3</b>	<b>Comparative analysis of emergency response operations and of improving the resilience of citizens in Croatia, Greece and North Macedonia</b>	<b>16</b>
3.1	Emergency and crises cases .....	16
3.1.1	Croatia .....	16
3.1.1.1	European floods (2021).....	16
3.1.1.2	Zagreb flash flood (2020) .....	16
3.1.1.3	Zadar flash flood (2017) .....	17
3.1.1.4	Southeast Europe floods (2014).....	17
3.1.1.5	Petrinja Earthquake (2020).....	17
3.1.1.6	Zagreb earthquake (2020).....	18
3.1.1.7	Croatian coast fires (2007) .....	18
3.1.2	Greece .....	18
3.1.2.1	Cyclone Ianos (2020) .....	18
3.1.2.2	Evros floods (2021).....	19
3.1.2.3	Mandra, Nea Peramos and Megara floods (2017) .....	19
3.1.2.4	Aegean Sea earthquake (2020).....	19
3.1.2.5	Athens earthquake (2019) .....	19
3.1.2.6	Greece wildfires (2021) .....	19
3.1.2.7	Attica wildfires (2018) .....	20
3.1.3	North Macedonia.....	20
3.1.3.1	Macedonian floods (2016) .....	20
3.1.3.2	Vrutok Earthquake (2020) .....	20

3.1.3.3 Wildfires (2021) .....	21
<b>3.2 Disaster classification .....</b>	<b>21</b>
<b>3.2.1 Criteria .....</b>	<b>21</b>
<b>3.2.2 Emergency and crises cases classification.....</b>	<b>22</b>
<b>3.3 Comparison of approaches .....</b>	<b>26</b>
3.3.1 Similarities.....	26
3.3.1.1 Disaster Management Authorities.....	26
3.3.1.2 Vulnerability .....	29
3.3.1.3 Civil Protection Volunteering System .....	32
3.3.2 Differences .....	33
3.3.2.1 Assessment and crisis management structure .....	33
3.3.2.2 Resilience .....	34
<b>3.4 Lessons learned .....</b>	<b>36</b>
3.4.1 Floods .....	36
3.4.2 Earthquakes .....	37
3.4.3 Wildfires.....	37
3.4.4 Volunteer networking .....	37
<b>2 Inventory and analysis of results of research projects in the field of emergency and crisis management 38</b>	
<b>2.1 R&amp;I projects and their results .....</b>	<b>38</b>
<b>2.1.1 LINKS .....</b>	<b>38</b>
<b>2.1.2 STRATEGY .....</b>	<b>40</b>
<b>2.1.3 INGENIOUS.....</b>	<b>41</b>
<b>2.1.4 ASSISTANCE.....</b>	<b>43</b>
<b>2.1.5 CURSOR .....</b>	<b>45</b>
<b>2.1.6 FASTER.....</b>	<b>46</b>
<b>2.1.7 INTREPID.....</b>	<b>48</b>
<b>2.1.8 PathoCERT .....</b>	<b>50</b>
<b>2.1.9 RESPOND-A.....</b>	<b>51</b>
<b>2.1.10 RESPONDRONE .....</b>	<b>54</b>
<b>2.1.11 Search and Rescue .....</b>	<b>55</b>
<b>2.1.12 ANDROMEDA .....</b>	<b>58</b>
<b>2.1.13 EU-CIRCLE.....</b>	<b>59</b>
<b>2.1.14 STAMINA .....</b>	<b>61</b>
<b>2.1.15 TeamAware .....</b>	<b>63</b>
<b>2.1.16 FIRESPELL .....</b>	<b>64</b>

<b>3</b>	<b>Conclusions and recommendations</b>	<b>67</b>
	<b>Annex I: Template for project presentation and analysis</b>	<b>69</b>
	<b>References</b>	<b>70</b>



## List of Figures & Tables

Figure 1 LINKS Sustainable Advanced Learning .....	39
Figure 2 FASTER .....	47
Figure 2 RESPOND-A-five-tier architectural structure .....	52

# 1 Introduction

---

## 1.1 About the project

RESISTANT (Training and Knowledge Sharing Platform For First Responders and Educational Tools for students' and citizens' awareness and preparedness against Natural and Manmade Disasters and Risks) is a 18 months project that has been started on 01/01/2021 and is implemented by a consortium led by the International Hellenic University – IHU (Greece) in cooperation with the Association of officers and sub-officers with university degrees of Hellenic Fire Corps -E.P.A.Y.P.S. (Greece), Konnekt-able Technologies Limited, Greek Branch – KTGR (Ireland), Military academy „General Mihailo Apostolski“, Skopje – MAGMA (North Macedonia), Croatian Crisis Management Association – CCMA (Croatia), Evia Rescue Team – S.A.R. 312 (Greece) and Rescue Team DELTA – RTD (Greece). The project is co-funded under the **Union Civil Protection Knowledge Network : Network Partnership (UCPM-2020-KN-AG) call of the Union Civil Protection Mechanism.**

RESISTANT's aim is to build the first **European Crisis Training Platform** to train first responders through threefold comprehensive training:

- **educational training** with the state-of-the-art knowledge in safety, including tools for characterisation of hazards and associated risks,
- **operational training** on mock-up real scale transport, and
- **innovative virtual reality training** reproducing the entire accident scenarios, intervention strategies and tactics, including the whole chain of command and communications between all members of the first responders' team, facility managers, and public (e.g. volunteer fire fighters, school children, citizens with disabilities).

### RESISTANT Operational Objectives (OO)

**OO.1:** Support civil protection and disaster risk management actors that promote and facilitate the development, dissemination and exchange of knowledge, good practices and expertise.

**OO.2:** Update and expand a **training programme** through further development of emergency scenarios to reflect the latest state of the art

**OO.3:** Implement an **educational platform**, where educational and training programs for primary, secondary schools, residents of endangered areas, citizens with disabilities of the aforementioned areas and tourists, as well as, for municipalities' employees, could be demonstrated with the help of **Augmented Reality (AR)** Techniques.

**OO4: Mapping and status of current initiatives, procedures and resources for coordination, education and training for natural disasters and technological risk mitigation.**

### RESISTANT Strategic Objectives (SO)

**SO.1: Support new and consolidate existing partnerships** in civil protection and disaster risk management that **enhance cooperation and synergies** in prevention, preparedness and response.

**SO.2:** Establish a **European network of trainers for first and second responders**, supported by stakeholders from EU and beyond, to share best practices and facilitate dissemination of knowledge and experience generated within the RESISTANT project and relevant follow-up projects from EU to national level.

**SO.3: Educate and train tomorrow's responder trainers** through established and regularly updated comprehensive educational, operational and virtual reality training.

**SO.4: Establish strong links between first responders' activities from different countries and constituencies and research and educational projects;** Valuing the responders' experience and their feedback to **enrich and harmonise harm criteria, models for hazards and risk assessment**, expand communications to other stakeholders, including but not limited to legislators, technology experts, insurance companies, citizens and students to raise awareness and increase preparedness.

### **RESISTANT Expected Outcomes (EO)**

**EO.1:** The implementation of a **Trans-European Network of trainers for first and second responders**.

**EO.2:** Design and implementation of **innovative training programs for natural disaster and technological risks prevention and mitigation especially focusing on cross-border events** that will be implemented in Virtual Control Room (VCR) with an integrated state of the art emergency management system.

**EO.3:** Implementation and deployment of a **dual-purpose platform** which will incorporate **the training programs for natural disaster and technological risks prevention and mitigation** along with **a series of educational and awareness programs enhanced with AR techniques for students', citizens' and tourists' preparedness**.

**EO.4: Mapping of current activities in Croatia, Greece and North Macedonia in the areas of disaster management and of disasters' education and training.** A comprehensive report with data derived from the mapping training exercises will allow decision and policy makers to evaluate the current state, challenges and opportunities for collaborative disaster management across Europe. Results and the mapping itself will serve as a basis for collaboration, knowledge sharing/exchanging and training among the network member countries.

## **1.2 Purpose of the document**

The purpose of **Deliverable D2.2 Second Report on RESISTANT's observatory** is to present a comparison of national experiences and lessons learned in Croatia, Greece and North Macedonia during various incidents. Investigating reports on various incidents in the partnering countries gives an insight on lessons learned and lessons not learned. Comparing these national experiences with the experiences of the international partners will help to develop a vision on what the differences and overlap in experiences are. National experiences in case of natural incidents are examined and compared including interconnected key indicators like evacuation plans, dealing with volunteers and improving the resilience of the citizens. Finally, the deliverable updates the information provided in D2.1 regarding the software tools that are currently available for the training of the first responders and for emergency management (e.g., data mining and analysis tools for Natural Disaster Management).

This document is the output of two tasks:

- **Task 2.1: Inventory and investigation of national research projects of participating countries and European research projects**, coordinated by IHU and
- **Task 2.3: Comparisons of national experiences made during incidents**, coordinated by EPAYPS.

### 1.3 Work Package Objective

**D2.2 Second Report on RESISTANT's Observatory** is a deliverable of **Work Package (WP) 2: Observatory of existing initiatives and training infrastructure**. The objective of WP2 is to analyse European and national research projects regarding their technical innovations, their tactical and operational recommendations and their potential to develop new guidelines and operational procedures within the field of emergency and crisis management.

### 1.4 Relation to other deliverables

**The current deliverable - D2.2 Second Report on RESISTANT's observatory** - is one of the 3 reports (D2.1, D2.2 and D2.3) of WP2 that will be released by the RESISTANT Consortium every 6 months in order to develop recommendations related to innovative approaches and new technologies, share lessons learned and common good practices in prevention, preparedness and response.

**Deliverable D2.1** provides a thorough insight in the outcomes of national research projects of the RESISTANT participating countries (Croatia, Greece and North Macedonia) and the European research projects by making an inventory and investigation of the projects that impact operations in case of natural disasters. The focus is on nearly finished projects or on projects that are finished within the last two years. Additionally, this document presents existing technologies for emergency management (e.g. data mining and analysis tools in case of Natural Disaster Management) and for training of first responders as well as a word cloud of interconnected key indicators, which are relevant for the operations in case of natural disasters. This deliverable has been released on Month 6 of the project (June 2021)

**Deliverable D2.3 Third Report on RESISTANT's observatory** will present the current activities in Croatia, Greece and North Macedonia in the area of disaster management, and disaster education and training and to make an inventory of strategic innovation agendas in these countries. The aim is at understanding the current activities – initiatives, procedures, and resources – that are being held, or planned, in the RESISTANT network's participating countries in the area of disaster management. A special focus will be to investigate how first responder organizations could better work together with society in general and specific on how they could improve the cooperation with volunteers. Finally, this deliverable will update the information provided in D2.1 and D2.2 regarding the software tools that are currently available for the training of the first responders and for emergency management (e.g., data mining and analysis tools for Natural Disaster Management). This deliverable will be released by Month 18 of the project (June 2022).

### 1.5 Intended audience

The intended audience of this deliverable consists of the following target groups:

- Representatives from civil protection and risk disaster management community - First responders (fire fighters, law enforcement, emergency services, etc.), civil protection units and civil society organisations / NGOs and their networks with interest in the Crisis Management domain;
- International and national networks of civil protection and disaster management actors
- Members of the projects funded under the same call as RESISTANT project (Union Civil Protection Knowledge Network: Network Partnership (UCPM-2020-KN-AG))

- Information Communication Technology entities (industry organisations and SMEs)
- Universities and research centres
- Civil protection authorities of European countries
- Policymakers at local, national, EU and the wider Neighbourhood level
- RESISTANT project partners and the Project Officer at the Knowledge Network and Evidence-Based Policy (ECHO.B.3) Unit in the Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO) of the European Commission

## **1.6 Structure of the document**

In chapter 2, this report describes the data collection process, the different sources of information that were used to collect data, the methodology for presenting and analysis of outcomes of the research projects.

In chapter 3, this report presents national approaches and experiences in case of natural incidents from Croatia, Greece and North Macedonia and a comparative analysis of these approaches and experiences.

In chapter 4, this report presents an inventory of European research projects and an analysis their technical innovations, their tactical and operational recommendations and their potential to develop new guidelines and operational procedures within the field of emergency and crisis management.

The Conclusions and Recommendations outline the conclusion of the research.

---

## 2 Research aims and methodology

---

### 2.1 Research aims

The findings presented in this report are based on two main lines of research.

1. A comparative analysis of national experiences and lessons learned in Croatia, Greece and North Macedonia during various incidents.
2. An inventory of national research projects of the participating countries in RESISTANT project, namely Croatia, Greece and North Macedonia as well as the European research projects and an analysis their technical innovations, their tactical and operational recommendations and their potential to develop new guidelines and operational procedures within the field of emergency and crisis management.

The aim of the first research line is to analyse whether the first responders from the three participating countries of the project share the same or similar or different problems and solutions and to highlight key issues for policy makers, practitioners and stakeholders. Investigating reports on various incidents in the partnering countries will give an insight on lessons learned and lessons not learned. Comparing these national experiences with the experiences of the international partners will help to develop a vision on what the differences and overlap in experiences are.

The aim of the second research line is to monitor research and innovation projects with a view to recommending the uptake or the industrialisation of results.

### 2.2 Methodological framework

For the analysis of the national approaches, experiences and lessons learned in Croatia, Greece and North Macedonia during various incidents most data were gathered via desk research. Information collection and analysis was structured taking into account case studies of actual crises. Structure of crisis management and resilience approaches as well as the role of volunteers and social media studied too.

Desk research was implemented by the RESISTANT partners in order to undertake an inventory of national research projects of participating countries and European research projects that have impact on operations in case of **natural disasters**.

The focus was on ongoing, nearly finished projects or on projects that were finished within the last two years.

The sources of information regarding the research projects were:

- The Community Research and Development Information Service (CORDIS) <https://cordis.europa.eu/>
- Interreg Europe: <https://www.interregeurope.eu/projectresults/>
- Erasmus+ Project Results Platform: [https://ec.europa.eu/programmes/erasmus-plus/projects\\_en](https://ec.europa.eu/programmes/erasmus-plus/projects_en)
- the Projects Explorer, a common repository of relevant research and operational projects along with their results that is accessible through both, the DRMKC - Disaster Risk Management Knowledge Centre and the CoU - Community of Users on Secure, Safe and Resilient Societies of DG HOME web-platforms: <https://drmkc.jrc.ec.europa.eu/knowledge/PROJECT-EXPLORER>

- A Community of Users on Secure, Safe and Resilient Societies (CoU) Mapping Horizon H2020 and EU-Funded Capacity-Building Projects under 2016-2018 Programmes - October 2019 - Publications Office of the EU (europa.eu): <https://op.europa.eu/en/publication-detail/-/publication/e626e2c2-f388-11e8-9982-01aa75ed71a1/language-en/format-PDF/source-82621453>
- The Knowledge DB is part of the website stores results of the DRIVER+ project systematic literature research: <https://pos.driver-project.eu/en/gt/knowledge>

The RESISTANT Consortium partners searched these aforementioned sources for research and innovation projects from the last 5 years (started in January 2016) and selected a number of 20 projects. At the same time a research was implemented by the RESISTANT partners in order to identify current tools for emergency management (e.g Data Mining and Analysis tools for Natural Disaster Management) and training infrastructures for first responders. The sources of information were:

- <https://www.preventionweb.net>
- The Disaster Risk Management Knowledge Centre
- <https://pos.driver-project.eu/en/PoS/solutions>

A template (see **Annex 1**) to be used as a guideline by the partners to present the research projects and their outcomes in terms of technical innovations, their tactical and operational recommendations was developed by IHU. The projects identified were classified and structured according to the following criteria: goal, impact, tools, results, media etc.

After the selection of the relevant research projects, the RESISTANT Consortium has used a template to present and analyse the outcomes of selected research projects.

## **3 Comparative analysis of emergency response operations and of improving the resilience of citizens in Croatia, Greece and North Macedonia**

---

This chapter presents a comparison of national experiences and lessons learned in Croatia, Greece and North Macedonia during various incidents. National experiences in case of natural incidents are examined and compared including interconnected key indicators like evacuation plans, dealing with volunteers and improving the resilience of the citizens.

Regarding national risks, different but similar major crises have happened in the participating countries. Normally no investigation about the lessons learned is done after the incident. A comparison with the same or similar crises in other countries does not thus far exist. Therefore, nobody fully comprehends the advantages and challenges of rescue operations in Europe.

### **3.1 Emergency and crises cases**

This section presents the cases that were taken into account for this study. They are all actual crises that illustrate what national crisis management systems have actually done to address emergencies and what were the lessons learned. Among others, these cases reflect answers to questions such as which groups were affected, how vulnerable groups were managed during the crisis as well as if and volunteers were involved.

#### **3.1.1 Croatia**

##### **3.1.1.1 European floods (2021)**

Severe floods affected several European countries during July 2021. The floods started in the United Kingdom as flash floods but later floods affected several river basins across Europe including Croatia. At least 242 people have died in the floods, but none in Croatia. In addition, the flooding led to widespread power outages, forced evacuations and damage to infrastructure and agriculture in the affected areas. The floods are estimated to have cost up to €2.55 billion in insured losses, with the total damage costs at a minimum of €10 billion. In the aftermath, scientists, activists and reporters all highlighted the connection to global trends in extreme weather, especially more frequent heavy rainfall caused by climate change.

##### **3.1.1.2 Zagreb flash flood (2020)**

On the night of 24–25 July 2020, Zagreb faced one of the worst flash floods in the city's history. At first, it was an upper-level trough with cool air was approaching Croatia from the Alps in the west, meeting humid air arriving from the sea in the southwest. The situation was made even worse when these conditions were combined with orographic lift stemming from coastal Dinaric Alps. As a result, this created conditions highly conducive to forming strong thunderstorms, signalled by high convective available potential energy and deep layer wind shear [3]. The first severe thunderstorms were reported



over northern Italy but a few hours later, Croatia was struck by the storm. Hail was recorded in Istria while a flash flood struck Senj, a coastal city south of Zagreb.

### **3.1.1.3 Zadar flash flood (2017)**

On 11 September 2017, a flash flood hit the city of Zadar and the surrounding area. The flash flood was caused by a mesoscale convective system that produced extreme rainfall. During that day, almost 300 millimetres (12 in) of rain, threefold the monthly average, were reported. Nearly 190 mm (7.5 in) of which fell in the space of two hours in the morning. Sali and Sukošan were also flooded but the worst case was reported in the town of Nin as the floodwaters overwhelmed its embankment. The area was declared at a state of emergency. Although, the flood caused an estimated 322 million Croatian kuna in damage (€43 million), there were no fatalities. Houses, apartments and institutions were damaged, including Zadar cemetery, hospitals, roads and a mall while the roads Zadar–Ražanac and Poljica-Brig – Nin were washed out. Zadar's water treatment plant suffered 10 million kuna in damage, while the salt ponds in Nin lost the year's salt harvest to the flood. The rainfall and flooding were caused by the terrain surrounding Zadar. Although it is a coastal city, lying in a flat region, a mountain range extends behind the area. That range caused the storms arriving from Tyrrhenian Sea in the west to undergo orographic lift and continually produce rain while passing over Zadar. The mesoscale convective system responsible for the flood spanned over 400 kilometres (250 mi) east–west, and reached a temperature of  $-65$  °C at the cloud tops. Furthermore, over 25,000 lightning strikes were recorded near Zadar.

### **3.1.1.4 Southeast Europe floods (2014)**

In May 2014 (from 13 to 18) a low-pressure cyclone [1] designated Tamara and Yvette, causing floods and landslides. The cyclone affected a large area of South-eastern and Central Europe, but Croatia was affected by the floods to a lesser extent than other countries. Yet, the most critical area was in southern Slavonia. During the crisis, the embankment on the Sava River was breached near Rajevo Selo and Račinovci, and thus evacuation was ordered for Gunja, Rajevo Selo and Račinovci. As a result, around 15,000 people in easternmost parts of Croatia was estimated that evacuated their homes. More floods were reported in the towns of Hrvatska Kostajnica and Dvor, where the Una River reached its highest level in almost 60 years. Fortunately, the embankment of the Sava River in Slavonski Šamac, despite the severe pressure caused by the huge amount of water coming from Bosnia, was not breached. That point is the confluence of the Bosna and Sava, affecting an area where more than 300.000 people live. Video: <http://vimeo.com/96164094>.

### **3.1.1.5 Petrinja Earthquake (2020)**

On 29 December (12:19 CET), a 6.2 magnitude earthquake with the epicentre 3km from Petrinja, and some 50km from the capital Zagreb, struck Croatia. It was the strongest earthquake in more than 140 years. 8 people were killed and at least 36 people were injured, 10 severely. Three foreshocks hit the same area the day before with no reports of injuries or fatalities, but with moderate to substantial damage in some buildings and structures in Petrinja and Glina mainly closest to the epicentre. On 4 January 2021, the Government declared a state of disaster for Sisak-Moslavina County and parts of Zagreb and Karlovac counties. The seismic activity has continued over next nine months with aftershocks, 1.244 of which were reported over the first two months. The aftershocks caused more damages on already damaged buildings, roads and infrastructure. The worst-affected areas are the

towns of Petrinja, Sisak, Glina and Hrvatska Kostajnica, consisting of one medium size town, three small rural towns and a total of 272 villages, many of them in hilly remote areas with a population of nearly 105,000. An additional approx. 45,000 people living in Zagreb and Karlovac counties were also affected. As a result, major revisions were made to emergency plan of action (EPoA). The EPoA implementation period were extended by 3 months with a no-cost extension of the operation timeframe after a request from the Croatian Red Cross. The main reasons for the extension request is additional EA funding and the delayed delivery of Alaska tents needed for the rough winter conditions in the affected areas (Red Cross branches had lost their premises during the earthquake). Furthermore, psychosocial activities and assistance to children and older people were planned.

### **3.1.1.6 Zagreb earthquake (2020)**

On 22 March 2020 (6:24 CET), a 5.3 Mw magnitude earthquake hit Zagreb with an epicenter 7 kilometres north of the city centre. One person was killed and 27 others were injured. The maximum felt intensity was VII–VIII (Very strong to Damaging) on the Medvedev–Sponheuer–Karnik scale. The earthquake was the strongest since 1880 and caused substantial damage in the historical city center. It was followed by numerous aftershocks, causing damages to more than 1,900 buildings to the point of becoming uninhabitable. Unfortunately, the earthquake occurred during the coronavirus pandemic and complicated the enforcement of social distancing measures set out by the Government of Croatia. It occurred during the Croatian Presidency of the Council of the European Union.

### **3.1.1.7 Croatian coast fires (2007)**

In the summer of 2007 a series of fires struck the Croatian coast. At first it was a heat wave in the entire Southern and Eastern Europe and unavoidable drought. Then, a southern wind supported the spread of the fires all over the Croatian coast. There were 750 fires on the coast from 1 June to 8 August. The Istria, the Zadar, the Šibenik-Knin, the Split-Dalmatia and the Dubrovnik-Neretva counties were burned, an area of 159,000 hectares, while a large part of the fragile plant and animal life was destroyed.

## **3.1.2 Greece**

### **3.1.2.1 Cyclone Ianos (2020)**

Cyclone Ianos was a rare Mediterranean tropical-like cyclone (medicane) that impacted Greece on September 2020. Ianos was developed from an area of low pressure over the Gulf of Sidra that quickly began tropical cyclogenesis while moving over warm waters. After Italy, the storm went on to strike Malta and Crete with tropical storm-force winds. Despite land interaction, the small cyclone reached its peak intensity of 120 km/h on 18 September, immediately before making landfall in southwestern Greece. After landfall, Ianos turned back out to sea and moved south-southeastward, before dissipating on 21 September. Four people were killed while damage was severe in Greece, with cities in the central part of the country flooded for several days and heavy agricultural damage. A state of emergency was declared for the islands of Ithaca, Kefalonia, and Zakynthos. Ianos caused at least \$100 million in damages [5].

### **3.1.2.2 Evros floods (2021)**

The rivers Erythropotamos and Evros, during January and February 2021, overflowed twice. Heavy rainstorms resulted in severe floods of the areas around the rivers, leading to one death and serious damages to private and public property. In order to prevent more deaths, some of the residents evacuate their village (Polia) because of a broken embankment in the area. The floods were described by the media and residents as "one of the biggest disasters the area has ever faced" while residents of the area were forced to abandon their cars and homes because of the rising floodwaters.

### **3.1.2.3 Mandra, Nea Peramos and Megara floods (2017)**

A heavy overnight rain, with a total height of approximately 150-160 mm, caused flash floods mainly to the industrial towns of Mandra, Nea Peramos and Megara, west of the capital Athens. 23 people were killed, most of the dead were elderly people found inside their homes, while fast-flowing torrents of red mud flooded roads. Unfortunately, it was a flood event that has one hundred years return period due to three hours period of continuous intensive rain (39-40 mm/h) [6]. Hence, except the human losses severe damages were caused to the buildings. Examination of the streambeds after flood, at points with no human intervention, revealed that the flood was unusually large. Additionally, a negative intervention of man, such as the restraint of the streambed size, buildings across and inside it, artificial drainage failures etc., intensified the flood.

### **3.1.2.4 Aegean Sea earthquake (2020)**

On 30 October 2020, a 7.0 magnitude earthquake hit 14 km northeast of the Greek island of Samos. The earthquake is known as the Samos–İzmir earthquake since although Samos was closest to the epicenter, it was the Turkish city İzmir which took the brunt of the quake. There more than 700 residential and commercial structures were seriously damaged or completely destroyed. One hundred and seventeen (117) people died in Turkey's İzmir Province while an additional 1,034 were injured. In Greece, there were two fatalities and 19 minor injuries. This earthquake was the most powerful in the Aegean Sea since 1981, and the deadliest in İzmir Province since 1955. The earthquake is also the deadliest in the year of 2020.

### **3.1.2.5 Athens earthquake (2019)**

On 19 July 2019 (2:13 p.m.), a 5.1 magnitude earthquake hit Athens with the epicentre south of Mt Parnitha, approximately 20 km NW of the Athens metropolitan area. It affected millions of Athenians in the middle of the day. The earthquake engendered power cuts and communication problems for at least two hours around Athens and the emergency responders reported receiving calls about people being trapped in elevators.

### **3.1.2.6 Greece wildfires (2021)**

The 2021 Greece wildfires are multiple wildfires burning in Greece since early August 2021. After a historic heatwave for the country, the worst since 1987, with the highest temperatures, reaching 47.1°C, the wildfires killed 3 people, injured at least 20 others and burned dozens of homes. Authorities have evacuated several villages and towns. The largest wildfires are in Attica, Olympia, Messenia, and the most destructive in northern Euboea from which ferries have evacuated about 2000 people. The World Meteorological Organization connected the fires with the regional heatwave and wildfire season made worse by climate change. The fire in northern Euboea is estimated to have burned at least

600,000 acres of forest, which ranks it as the largest forest fire in the history of Greece. The initial assessment of the effects of the fire in Northern Euboea is that in several Local Communities the percentage of their area that has been burned exceeds 80% and reaches up to 100% where the total area of the fire amounts to 512,031.54 acres, and forest areas that have burned, amounting to 379,392.82 acres and constitute 74.1% of the total burned area [7]. Many countries worldwide helped or offered aid to Greece.

### **3.1.2.7 Attica wildfires (2018)**

During the 2018 European heat wave, a series of wildfires struck Greece. They began in the coastal areas of Attica and ended up to one hundred and three (103) human losses in Mati. The fires were the second-deadliest wildfire in the 21st century, after the 2009 Black Saturday bushfires in Australia that killed 173. Over 700 residents were evacuated or rescued, mainly from the seaside settlements located north of the port town of Rafina, where rescuers found 26 corpses trapped just metres away from the sea. Boats also recovered corpses from the water, and rescued hundreds of people from beaches and the sea. Ten people drowned when the boat rescuing them from a hotel in Mati capsized. More than 4,000 residents were affected by the wildfires. The Greek prime minister declared a state of emergency in Attica, and announced a three-day period of national mourning. Many countries worldwide helped or offered aid to Greece.

## **3.1.3 North Macedonia**

### **3.1.3.1 Macedonian floods (2016)**

In August 2016, several rainstorms hit the western and north-western parts of the Republic of North Macedonia. On 6 August 2016, a storm with strong winds and flooding hit Skopje and the western parts of the country, leaving at least 21 people dead and dozens injured or missing. It started as a heavy rain began falling in the area of the country's capital Skopje, resulting in strong winds and floods. The weather service reported that 93 litres per square metre fell in two hours on Skopje, which is equivalent to the average for an entire month of August. The water level reached a height of 1.5 metres at some of the areas. Meteorologists reported that more than 800 lightning strikes were recorded in the first two hours of the storm, which went on for about five hours in total. Three villages to the northeast of the city were cut off due to landslides.

### **3.1.3.2 Vrutok Earthquake (2020)**

On 11 November 2020 (4.54 am local time), a 5.5 magnitude earthquake hit near the town of Vrutok. Moderate to heavy damage to buildings and other infrastructure could occur. Moderate shaking occurred in Dolna Banjica (pop. 10,100) located 13 km from the epicenter, Zajas (pop. 12,200) 13 km away, Gostivar (pop. 51,000) 14 km away, and Vrapčište (pop. 8,700) 17 km away. Weak shaking might have been felt in Skopje (pop. 474,900) located 61 km from the epicenter, Tirana (pop. 374,800) 93 km away, and Pristina (pop. 550,000) 113 km away.

### 3.1.3.3 Wildfires (2021)

Starting from 30 July 2021, the Republic of North Macedonia was hit by a heat wave that resulted in severe fires in several regions in the country. The severe fires in numerous regions resulted in devastation of forests, fertile land, crops and property of the population. One casualty and several injured persons (inhaling smoke) have been reported. Numerous houses as well as other facilities have burnt down and were damaged in many villages. On 4 August 2021, the Government of the Republic of North Macedonia declared a state of crisis on the whole territory of the country for a period of 30 days. The most affected regions are Strumica, Kochani, Kumanovo, Gevgelija, Valandovo, Bitola and Prilep, Shtip, Berovo, Pehchevo, Delchevo Skopje, Radovish, Ohrid, Kriva Palanka, Veles. The crisis management system of the country coordinated efforts to put out the fires and to assist the affected population. However, due to the limited resources of the state for dealing with fires (no air tractors and only two army helicopters available for firefighting), an expansion of wildfires was observed almost on the whole territory of the country [8].

## 3.2 Disaster classification

### 3.2.1 Criteria

Disasters could be classified according to a variety of criteria, depending on the perspective or interests of the researchers or purposes of the project. In this context, a literature review was conducted in order to choose a set of criteria able to describe the properties as well as the severity of each case study. The aim is to conclude on potential patterns or differences that could be valuable knowledge for the future. To this end, several definition on disaster were studied. Over the years, there were plenty of them focusing on the actual hazard or event and its cost in terms of loss of life or damage to property and social impact [9][10][11][12]. Other definitions focus on the perspective of emergency managers about what a disaster could be or the perspectives of people that experienced such situations [13][14] while others separate conditions, characteristics and consequences of a disaster [15]. Finally, the definition that is adopted by the United Nations Office for Disaster Risk Reduction (2004) and the World Bank (2005) states that "A disaster is a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources, so external aids are needed", revealing the multidimensional nature of disasters.

In this context, this study adopts the use of the following criteria in attempt to discuss important parameters of each disaster [16].

#### I. Effect

This criterion studies how the disaster affected the local community, indicating whether it was a simple or a complex case.

#### II. Cause

The understanding of cause is of great importance. Disasters could be natural or human-induced. Of course, it important to mention here that the most cases around the world is related to natural disasters, probably that they are less predictable and more difficult to handle.

#### III. Duration

Here, we are not taking into account the duration of the disaster and its consequences but rather the time that the cause lasted. For instance, the duration of rainfall when studying a flood. This criterion is divided in three intervals: short (less than 1 hour), medium (1-24 hours), long (more than 24 hours).

#### **IV. Extent**

In many cases a disaster affects not only the surrounding area of the epicentre but a more extended area, such cases could include, for instances, earthquakes or floods. This criterion is divided in three intervals: small (less than 1 km), medium (1-10 km), large (more than 10 km).

#### **V. Casualties**

The number of casualties is a revealing criterion for intensity of the disaster. This criterion is also divided in three intervals: minor (25-100 casualties alive/dead or 10-50 casualties hospitalized), moderate (100-500 casualties alive/dead or 100-500 casualties hospitalized), major (more than 500 casualties alive/dead or more than 250 casualties hospitalized).

#### **VI. Nature of the injuries**

The living victims could have different types of injuries, sometimes depending on the severity of the case. This criterion is also divided in three intervals based on usual distribution of injuries: serious 10%, moderate 30% and light 60%.

#### **VII. Rescue time**

The time that first responders need is of great importance. This time period may include primary treatment, evacuation etc. This criterion is also divided in three intervals: short (less than 6 hours), medium (6-24 hours) or long (more than 24 hours).

#### **VIII. Type**

Natural hazards are naturally occurring physical phenomena which can be geophysical, hydrological, climatological, meteorological or biological while man-induced or technological hazards can be complex emergencies/conflicts or industrial accidents.

Furthermore, we adopt the so-called Disaster Severity Scale (DSS) in order to depict the severity of a disaster as a factor combination, such as gravity, duration, number, or intensity of the phenomenon. Hence, the next criterion is

#### **IX. Severity**

There are three levels of disaster, where all require the involvement of state and federal officials at some extent [17].

Level I: A localized incident where local resources are available and adequate.

Level II: An emergency where there are large number of casualties or side-effects.

Level III: A mass-casualty emergency situation wherein local and regional resources are exceeded.

### **3.2.2 Emergency and crises cases classification**

Based on the above criteria a comparative classification of the chosen case studied were conducted. Table 1 depicts the findings:

Table 1: Emergency and crises cases classification

	<b>Effect</b>	<b>Cause</b>	<b>Duration</b>	<b>Extent</b>	<b>Casualties</b>	<b>Nature of the injuries</b>	<b>Rescue time</b>	<b>Type</b>	<b>Severity</b>
<b>Croatia</b>									
<b>European floods (2021)</b>	Complex	Natural	Long	Large	Major	Serious	Medium	Hydrological	Level III
<b>Zagreb flash flood (2020)</b>	Complex	Natural	Medium	Medium	Minor	Light	Short	Hydrological	Level I
<b>Zadar flash flood (2017)</b>	Complex	Natural	Medium	Large	Minor	Light	Short	Hydrological	Level I
<b>Southeast Europe floods (2014)</b>	Complex	Natural	Long	Large	Major	Serious	Medium	Hydrological	Level III
<b>Petrinja Earthquake (2020)</b>	Simple	Natural	Long	Large	Major	Moderate	Medium	Geophysical	Level III
<b>Zagreb earthquake (2020)</b>	Simple	Natural	Short	Medium	Medium	Medium	Medium	Geophysical	Level II
<b>Croatian coast fires (2007)</b>	Complex	Natural	Long	Large	Minor	Minor	Medium	Climatological	Level II
<b>Greece</b>									

<b>Cyclone Ianos (2020)</b>	Complex	Natural	Long	Large	Minor	Minor	Medium	Hydrological	Level II
<b>Evros floods (2021)</b>	Complex	Natural	Long	Medium	Minor	Minor	Medium	Hydrological	Level I
<b>Mandra, Peramos and Megara (2017)</b>	Complex	Natural	Short	Medium	Medium	Medium	Medium	Hydrological	Level III
<b>Aegean Sea earthquake (2020)</b>	Simple	Natural	Short	Large	Minor	Minor	Short	Geophysical	Level I
<b>Athens earthquake (2019)</b>	Simple	Natural	Short	Medium	Minor	Minor	Short	Geophysical	Level I
<b>Greece wildfires (2021)</b>	Complex	Natural	Long	Large	Medium	Minor	Medium	Climatological	Level III
<b>Attica wildfires (2018)</b>	Complex	Natural	Long	Medium	Major	Major	Medium	Climatological	Level III
<b>North Macedonia</b>									
<b>Macedonian floods (2016)</b>	Complex	Natural	Long	Large	Major	Medium	Medium	Hydrological	Level II
<b>Vrutok Earthquake (2020)</b>	Simple	Natural	Short	Large	Minor	Minor	Short	Geophysical	Level I
<b>Wildfires (2021)</b>	Complex	Natural	Long	Large	Minor	Minor	Medium	Climatological	Level II



From the above analysis and categorization, we found out that regarding floods one of the most common effects is traffic disruption or collapse, structures and basement flooding, neighbourhoods without electricity and water, phone lines and Internet cut off (Croatia, Greece flash floods). As about the cause, heavy or extreme rainfall and severe thunderstorms, influence the intensity of the floods, leading to significant material damage. For instance, 285 mm of rain was measured in Zadar, and around 325 mm at Zadar airport, Zemunik (Zadar flash flood 2017). Sometimes in addition to the huge amount of water accumulated from the storm over a short period of time, one of causes of the urban flooding was a poor evacuation of water within the urban drainage network (Zagreb flash flood 2020 due to intervention of man, such as the restraint of the streambed size (Mandra, Nea Peramos and Megara floods 2017). Zagreb-Gric meteorological station recorded 80.1 mm of rain within a 3-hour period, causing urban flash flooding all over the city. In most cases, the duration of the cause was from a short period of just a few hours (3-4) to a day. On the other hand, the extent of the disaster differ significantly from 1Km to more than 10 km. As far as it concerns is the number of casualties where minor casualties and light were reported in most cases while the response time was short to medium. Earthquakes on the other hand, could be a compound disaster characterized by a longer initiation time more than 24 hours, although in most studied cases was short. Usually, a few foreshocks will struck nearby areas while many aftershocks will follow for months. Usually more than 10 km are affected by an earthquake. For instance, at Croatia the earthquake struck the towns of Petrinja, Sisak, Glina and Hrvatska Kostajnica in Sisak-Moslavina county consisting of one medium-size town, three small rural towns and a total of 272 villages, many in remote rural areas. Damage was also reported in neighbouring Zagreb and Karlovic counties. After an earthquake, people were provided with temporary shelter and household items. Also, Psychosocial problems and suffering of both individuals and families, as well as whole communities were identified through the following reactions:

- fear of repeated earthquakes;
- loss of home (many in the area previously lost their house during the war);
- anxiety due to uncertain future; perceived unfair distribution of aid and shelter;
- fear of being left alone with limited resources (which are already short from their perspective);
- bitterness towards the government, both local and national, but also to the Red Cross and other humanitarian organizations;
- hopelessness due to the slow reconstruction process;
- exhaustion, helplessness due to prolonged stress;
- sleeping problems;
- constant alertness;
- anger;
- lack of energy;

Fires, on the other hand, could be proved extremely catastrophic with dozens of victims. In most cases large areas were affected whereas assistant even from other countries were needed. Some cases were handle quite fast whereas others were uncontrollable for a long time. For instance, in Attica wildfires (2018) more than 1,650 homes burned along with 1,431 hectares (5.5 square miles) of agro-forestry

vegetation and urbanized land. July 23rd was the first day of the 2018 season for which a “very high” fire danger rating (class 4 in the 1-5 range) had been assigned in the region of Attica, and to a large part of southeastern continental Greece, in the Fire Danger Prediction map issued daily by the General Secretariat for Civil Protection. This rating was due to a forecast of strong to extreme westerly winds. Yet, over one hundred people were killed and more than 150 were injured. The combination of fast fire spread in a populated area, lack of a common overview of operations and poor coordination between the involved actors, combined with incorrect assessment and initial underestimation of the situation led to delayed and inadequate response – as many resources had been moved to the Kineta fire – and allowed the eastern Attica fire to grow rapidly. Inadequate firefighting mechanism for the job, many errors in managing the event and unprepared communities and citizens lead to a tragedy. Of course, this is an extreme case but reveals the severity of wildfires.

### **3.3 Comparison of approaches**

Common to all the cases, disasters and major crises are considered inevitable. Yet, evacuation plans, dealing with volunteers and improving the resilience of the citizens are considered important in order to deal with disasters and crises. The studied approaches have many similarities but some differences too.

#### **3.3.1 Similarities**

##### **3.3.1.1 Disaster Management Authorities**

All three countries have Disaster Management Authorities with similar responsibilities. Yet, only Croatia and the Republic of North Macedonia are members of the Disaster Preparedness and Prevention Initiative for South Eastern Europe (DPPI SEE)

##### **Croatia**

###### National Emergency/ Disaster Management Authority: Ministry of Interior - Civil Protection Directorate

- Conducts risk assessment of the occurrence of disaster and major accidents according to region, cause or subjects, therefore the responsible person of the threat assessment and protection and rescue plan of the local and regional self-government unit.
- Issues obligatory instructions for risk management to all participants in protection and rescue.
- Monitors and analyses the status in the area of protection and rescue and proposes measures to the Government of the Republic of Croatia for improving the status and guiding the development of the protection and rescue system.
- In the unified information system it collects, analyses and directs data about risks and consequences of disasters and major accidents.
- Keeps a unified information database on operational forces, resources and measures undertaken in the area of protection and rescue.
- Proposes a threat assessment and a Protection and Rescue Plan of the Republic of Croatia to the Government of the Republic of Croatia.
- Directly conducts the mobilisation of directorate services and units, and protection and rescue operational forces.
- Coordinates, manages and directly commands operational forces in disasters and major accidents.

- Directs and coordinates the activities of operational forces in the area of protection and rescue.
- Conducts activities in the notification and alerting of the population and coordinates the unified alarm system in the Republic of Croatia.
- Conducts inspections of operational forces.
- Passes programmes for training and further education, and trains and further educates participants in protection and rescue.
- Organises and conducts exercises of participants in protection and rescue for the purpose of checking their competency level.
- Proposes the type and quantity of state commodity reserves necessary for protection and rescue.
- Tests equipment and resources for protection and rescue, determines needs and submits proposals for the passing of Croatian standards in this area.
- Cooperates with economic and scientific institutions in the development of technology and equipment for protection and rescue.
- Cooperates with the competent authorities of other states and international organisations in protection and rescue.
- Conducts promotion and publishing activities in the area of protection and rescue.
- Also conducts other activities determined by the law.

### **Republic of North Macedonia**

#### National emergency/ disaster management authority: Protection and Rescue Directorate

##### Main tasks:

- Develops the Plan for protection and rescue from natural disasters or other disasters;
- Develops an Assessment of endangerment by natural disasters or other disasters in cooperation with the responsible state authorities;
- Organizes and prepares the protection and rescue system;
- Suggests measures for equipping and development of the protection and rescue system;
- Enables functioning of the system for prevention and tracking of occurring, as well as mitigation of consequences caused by natural disasters or other disasters;
- Provides timely engagement and efficient utilization of the protection and rescue forces of the Republic of North Macedonia and the rapid response teams;
- Administers complete implementation of protection and rescue measures;
- Enables realization of strategic and medium term protection and rescue goals;
- Participates in the manning and realization of mobilization of the protection and rescue forces of the Republic of North Macedonia;
- Determines the needs for development and equips the protection and rescue forces of the Republic of North Macedonia;
- Ensures the supply with material reserves necessary for protection and rescue;
- Controls and assesses the preparedness of protection and rescue forces;
- Organizes and conveys exercise activities for protection and rescue needs;
- Develops education curricula and training programs for protection and rescue;
- Plans and conveys international cooperation in the field of protection and rescue;

- Plans, organizes and enables exercise activities and participation in collective protection and rescue systems outside the territory of the Republic of North Macedonia;
- Develops expert directives in the area of protection and rescue.
- Determines norms and standards for the protection and rescue system.

## **Greece**

### National Emergency/ Disaster Management Authority: Ministry for Climate Crisis and Civil Protection

#### Main tasks:

- Civil protection in Greece is organised as a coordinated resource system where national, regional and local authorities work together with local and public institutions and services.
- The mission of GSCP is to protect the citizen's life, health and property from natural, technological and other major hazards.
- The GSCP studies, plans, organises and coordinates the country's policy concerning issues of public awareness, prevention and confrontation of natural or man-made disasters.
- It coordinates the actions of the public services and the civil protection volunteers.
- Each ministry is responsible for prevention plans and taking preventive structural measures in the area of their competency. The General Secretariat for Civil Protection issues circulars with guidelines not only on prevention, but also in preparedness and disaster response.
- Risk assessment: The key risks identified in the national risk assessment include forest fires, earthquakes, floods, and industrial accidents.
- The National Civil Protection Plan "Xenokrates" (Ministerial Decision no. 1299/2003) sets the national framework for an effective risk management planning and provides for the development of hazard-specific plans at the local, regional and national level.
- In accordance with "Xenokrates", at national central level, the General Secretariat for Civil Protection issues National Plans for all kinds of natural and manmade disasters. All ministries, decentralised governmental authorities, and local government authorities should design their plans based on the national plan. The General Secretariat of Civil Protection is the general coordinator of the planning.
- Risk communication and awareness raising
- Public information covers the whole disaster management cycle. The General Secretariat for Civil Protection has a cross-sectoral and all-hazards competence, while hazard-specific communication is provided by public authorities in their sphere of competences.
- Information on all kinds of natural and man-made disasters including guidelines for self-protection is available, in Greek and foreign languages (English, Spanish, French, Albanian, and Arabic). These guidelines can be found on the site of the General Secretariat for Civil Protection. Information is disseminated via various methods such as campaigns, TV and radio spots for specific disasters, publication of leaflets and brochures, electronic material, and school visits
- Trainings and exercises are undertaken at national, regional, and local level by competent authorities.
- Greece also participates in the Union Civil Protection Mechanism training programme.
- Greek authorities have also organised international exercises, such as, EU EVITA 2014, EU PROMETHEUS 2014, EU POSEIDON 2011, and EU EVROS, 2010. Greece has participated in others, such as, EU TWIST 2013, EU Dr HOUSE, 2012, PT QUAKE 2009, and SARDINIA 2008.

- Early warning systems: The General Secretariat for Civil Protection issues the daily forest fire risk map during the summer period. It is uploaded on its website and sent to all competent and local authorities involved in forest fires management.
- Severe weather phenomena warnings are issued by the Hellenic National Meteorological Service.
- Tsunami early warnings are provided by the Institute of Geodynamics, which hosts the Hellenic National Tsunami Warning Centre.
- Emergency Response: The General Secretary for Civil Protection, the regional authorities and the local government authorities are in charge of coordinating all operational forces depending on whether the disaster is general, regional, or local.
- Cross-border, European and international cooperation: Greece is a participating state of the UCPM.
- Bilateral agreements and/or memorandums of understanding have been signed with Bulgaria, Cyprus, France, Israel, Malta, the Russian Federation, Ukraine, the USA, and Turkey.
- Regional agreements in force include the Black Sea Economic Cooperation (BSEC), EUR-OPA Major Hazards Agreement, memorandum of understanding in humanitarian emergency response (UN, Greece and Turkey), the Protocol in Preventing Pollution from ships and, in cases of Emergency, Combating Pollution of the Mediterranean Sea, UNECE Convention on the Transboundary Effects of Industrial Accidents.
- Bilateral Agreements in force: Memorandum of Understanding on Cooperation in the Field of Civil Protection between the Government of the Hellenic Republic and the Government of the Republic of North Macedonia (signed in 2021)
- Multilateral Agreements in force: Memorandum of Understanding of Cooperation among the Islamic Republic of Iran, Republic of Armenia, and the Hellenic Republic on Issues of Risk Management of Technological and Natural Disasters, Health & Environment

### 3.3.1.2 Vulnerability

All three countries, similar to other countries in the South Eastern and Central Europe, is exposed to a range of natural hazards, particularly, floods, wildfires, earthquakes, extreme temperatures, strong winds, and drought, of course at a different extent. Data shows a steadily increasing trend of natural disaster incidence over the last decades, in particular in terms of flood severity and intensity. Hence, people's lives are threatened but also important economic losses are revealed after a crisis. For instance, the Republic of North Macedonia has estimated about US\$400 million in losses in the last three decades from floods and earthquakes alone. In this context, below are presented the most common vulnerability parameters of each country. Despite the differences, they all face similar issues and need similar assistance and plans.

**Croatia** shows warming, drying climate conditions, a trend which together with human activities enhances the risk of forest fires. Wildfires have been particularly dangerous along the Adriatic coast in recent years. Croatia's weather hazards are consequential economically. Croatia's coastal zone is affected by the events that strike all the countries on the eastern rim of the Adriatic: Adriatic storms, cyclones making landfall from west to east, and intense bora winds. Croatia faces also strong convective events and locally arising storms that bring hail, wind and heavy precipitation which end up frequently to economic damage. Flash floods, water channel overflow in river valleys, and flooding endanger more than 15 percent of the country's inland territory. Zagreb still remains vulnerable to flash floods. Along

its mountain zone, Croatia is subject to flash flooding and to severe snowstorms during the winter. Drought has caused economic damage several times in recent decades. The country is also prone to seismic risk, particularly in the coastal zone. The Pannonian Basin has typical intraplate seismicity, characterized by rare occurrence of large events.

The climate in **Greece** is mainly cold. However, due to the unique geography of the country, Greece has a remarkable range of microclimates and local variants. To the west of the Pindos mountain range, the climate is generally colder and has some marine characteristics. The eastern part of the Pindos mountain range is generally colder and colder in summer. The northern regions of Greece have a transitional climate between the mainland and the northern climate of Europe. There are also mountainous areas with an alpine climate. Hence, there are plenty of climate and hydrological hazards that occur in the country. From a seismological point of view, Greece is located in the complex boundary zone of the eastern Mediterranean between the African and the Eurasian tectonic plate which makes Greece an extreme seismic country. Specifically, the northern part of Greece is located in the Eurasian plate while the southern part is located in the Aegean plate, which moves southwest in relation to the Eurasian, at a rate of 30 mm / year while the African falls to the north below the Aegean plate with rate of about 40 mm / year. The northern plate boundary is a relatively diffuse divergent boundary while the southern convergent boundary forms the Greek arc [21]. Hence, the effects of fires, earthquakes, heavy rains and snowfall are more serious and costly than ever for Greek households and the state over the last decades.

The **Republic of North Macedonia** is a small, landlocked country that is located in the middle of the Balkan Peninsula in Southern Europe. It has a diverse topography with high mountains and deep valleys surrounded by mountains, rivers, large and small natural lakes. Land use for agriculture covers almost 50% of the surface area of the country, and forests cover approximately one-third of the country. The country's population is approximately 2.1 million (2020) people. Hence, the Republic of North Macedonia is vulnerable to the impacts of climate change from changes in climatic conditions, such as increase in temperature and decrease in precipitation and increases in extreme weather events, such as heat waves. These pose increasing risks to the country's agricultural sector which contributes to its overall economy. The Republic of N. Macedonia is also vulnerable to floods and earthquakes. In regards to flooding, the country's geography tends to concentrate and discharge surface water rapidly, resulting in flash flooding. The capital, Skopje, is exposed to flood waves from three rivers: Vardar, Treska, and Lepenec, mostly due to heavy rainfall and snow melting.

Taking into account the vulnerability of the three countries, disaster risk reduction becomes a critical factor for the sustainable economic and social development of the countries. The expected growing level of risk, due to the climate change, hazards and vulnerability is under planning using deferent policies at each country both local and national. For instance, Croatia is a member of the UN International Strategy for Disaster Reduction (ISDR) Hyogo Framework of Action 2005-2015, and the Regional Cooperation Council, and is widely considered as regional leader in the South Eastern Europe, particularly, in the area of wild fires risk management and monitoring and forecasting of meteorological hazards. The Government develops multi-year plans for hazard risk management, including the Protection and Rescue Plan developed by the National Protection and Rescue Directorate (NPRD) which describes the planned activities aimed at strengthening disaster risk management functions. Greece, on the other hand, through the Ministry for Climate Crisis and Civil Protection participates International Cooperation organizations and actions such as the European Union, the European Civil Protection

Legislation, the United Nations, NATO, the Council of Europe - EUR-OPA, the Organization of the Black Sea, the Economic Cooperation, the Adriatic & Ionian Initiative, the Hellenic-French Joint Working Group, FIRE 5, The Process of offering and Receiving International Assistance in Civil Protection Emergencies and the Bilateral Agreements and Cooperation Protocols in Force. The Republic of North Macedonia participates also in International organizations related to civil protection such as the EU Civil Protection Mechanism and DPPI SEE.

Finally, Table 3 presents the study outcomes in relation to the vulnerability elements that the three countries faces and the main actions that they did, such organizing and implementing evacuation plans when needed. At this point, we should mention that although generally speaking all countries proceeded with evacuation plans, there were cases that the authorities acted slowly leading to tragedies such as the wildfires case in Attica Greece. However, we cannot state that this is a rule, hence Table 2 depicts the general state of some characteristic elements rather than a specific case.

Table 2: Vulnerability elements - actions

Vulnerability elements	Vulnerable groups	Context and actions related to hazard crises
Limited mental and physical capacities, limited mobility	Elderly; children; disabled; etc	Context: Climate-related and natural hazards (e.g. heatwaves, floods, fires) Actions: <b>evacuation</b> and relocation of people; providing vital services (e.g. medical care)
Individual lack of skills and capacities to deal with a crisis	Socio-economic status, demography, low awareness/training	Context: natural hazards (e.g. heatwaves, floods, fires), accidents etc Actions: Provided support from <b>local authorities / volunteers</b> , evacuation
Systems' inability to act	Authorities root causes such as bureaucracy, low resources	Context: natural hazards (e.g. earthquakes, floods, fires), accidents etc Actions: Required support from national and <b>international groups, volunteers</b>
Rural and urban areas	Socioeconomic factors, different capacities, different resources availability	Context: natural hazards (strain on forests, agricultural zones and crop yields) Actions: water resource management plans, evacuation plans, volunteers actions/training, local authorities responsibilities, <b>recovery plans</b>

Hence, from a situation-dependent perspective there is an undoubtable similarity in all countries. Yet, from a conceptual and empirical perspective there are differences, mainly due to different vulnerability understanding. From a rather traditional understanding of vulnerability, geographical location would be an elements of vulnerability whereas from a dynamic and situation-oriented understanding of vulnerability each situation would be different. From our study, the studied countries are mainly

adopting a quite hybrid approach related to the severity of the crisis, tending to face traditionally local or low severity cases and situation-based extended or severe crises.

### 3.3.1.3 Civil Protection Volunteering System

The Civil Protection Voluntary Organizations are non-profit associations or groups of individuals which constitute part of the Civil Protection human resources. Their purpose is to provide assistance to Civil Protection state bodies in the fields of life protection, health, citizens' property rights, as well as the protection of the environment and the cultural heritage from natural, technological, or man-made disasters and threats which cause emergencies during peacetime.

The role of volunteers in civil protection is a key factor to a successful handling of a crisis. Undoubtedly, a well-informed and aware population has a greater chance to survive in the face of a disaster. Volunteers in Civil Protection and disaster risk management are more than needed to build solidarity and resilience among society and are a valuable resource. Hence, all studied countries acknowledge the need and examine the ways that they can involve citizens in disaster risk management, turning them to first responders when a crisis occurs. In this context, action-based methodologies are identified and developed in order to involve as much as population groups as possible, such as children and young people.

A key role of the volunteers is to inform their communities on the issues of awareness raising and risk preparedness. In this context, Civil Protection authorities try to find ways to grow and maintain an efficient volunteer network. Some of the tactics include the use of existing volunteer organisations, investment in youth and public awareness as well as the mobilization of volunteers (such as the Hellenic rescue team). Other aspects involve the training and equipment of volunteers as well as the integration of volunteer organization within the legal framework of the country.

In **Croatia**, the new Law of Protection and Rescue (came into force in 2005) states that citizens are required to implement measures of personal and mutual protection against threats and the consequences of disasters, based on the principle of solidarity and mutual help. There is a great tradition in Croatia of volunteering for forest fire-fighting duties. An estimated 60,000 people volunteer for these duties, representing over 2 per cent of the active population, mostly concentrated in inland areas of the country. According to the Croatian constitution (Croatian Official Gazette no.: 56, 22.12.1990), and on the basis of the principle of subsidiarity, municipalities and towns have responsibilities for fire-fighting and Civil Protection through a system of locally-based public fire brigades and volunteer fire brigades.

In **Greece**, the General Secretariat for Civil Protection is the competent national body responsible for keeping the so-called "Civil Protection Volunteering Register" which consists of the Civil Protection Voluntary Organizations, their members, vehicles and equipment as well as their action plans. Law 4662/2020, Part B (articles 55 to 73), regulates issues such as: Purposes and actions of the Civil Protection Voluntary Organizations, Terms of registration in the "Civil Protection Volunteering Register" and terms of acquisition of the "Civil Protection Volunteer" status, Training of Civil Protection Volunteers. Mobilization and Involvement of Volunteers, Support of Voluntary Organizations in infrastructure (materials and means), Evaluation of Voluntary Organizations.

In North Macedonia, a volunteering legal framework was adopted in 2007 (Official Gazette 85/07). The law on volunteering sets out the basic framework of organised long-term volunteering, conditions for carrying out volunteer activities, rights and obligations of volunteers and organisers of volunteering,



volunteering contract and keeping record of volunteer activities. Although, there is no special state agency responsible for volunteering, in the Strategy for promotion and development of volunteering a number of institutions are involved, including Ministry of Labour and Social Policy, Ministry of Finance, Ministry of Justice, Ministry of Education and Science, Agency of Youth and Sport, Department for Cooperation with the NGO sector in the General Secretariat of Government of North Macedonia, National Council for Development of Volunteering and Civil society organisations.

Some characteristic cases of volunteers' importance and determination:

- A devastating earthquake struck with the epicentre approximately 3 km from Petrinja, located some 50 km from Zagreb. That day, the Croatian Red Cross teams consisting of 261 staff and volunteers joined immediately the search and rescue operation on the ground providing first aid. (Croatia Petrinja Earthquake Response 2020)
- In Mati, the Hellenic Rescue Team of Attica also opened a pedestrian section. They remained there until the final announcement of the end of the investigations, 10 days after the tragedy. (Attica wildfires 2018)
- In the region bordering Bulgaria, firefighters, police officers and soldiers working to stop the spread of the wildfires have been joined by many volunteers, often armed with just shovels and rakes. (North Macedonia wildfires 2021)

### **3.3.2 Differences**

#### **3.3.2.1 Assessment and crisis management structure**

The studied cases revealed that in most cases, similar principles and standardized procedures are followed when assessing various kinds of risks that can lead to an emergency. Risk assessment can be either centralized or distributed. In most countries the processes are centralized in the sense that they stem Prime Ministers' offices or other centralized agencies which are responsible to monitor and collect data as well as to provide unified threat assessments and rescue plans. Yet, although all three countries have such a centralized authority, namely Ministry of Interior - Civil Protection Directorate in Croatia, Protection and Rescue Directorate in the Republic of North Macedonia, Ministry for Climate Crisis and Civil Protection in Greece, local and regional self-government units have their role. For instance, Croatia allows local authorities to play their role in crises following the central guidelines while Greece organizes national, regional and local authorities to work together with local and public institutions and services under the guidelines of the civil protection central authority. Yet, the authority in charge differ from country to country in terms of the actors. For instance, Croatia and Greece prefer political actors such as civil defense and (interior, civil protection) ministries. This approach leads to assessments with a broader range of threats. On the other hand, in the Republic of North Macedonia, the Ministry of Defence has the overall competence in this field, tending to see threat environments more in military terms. Of course, risk assessment protocols appear a lot of similarities, since they involve (when needed) experts and relevant institutions in an attempt to collect and handle qualitative data. Quantitative assessment methods, are used more in civil protection agencies (even regional or local) in order to calculate the probabilities and potential impacts of natural hazards. All-in-all, depending on the

threat or risk, as well as if it is internal or external threat, responsible agencies may use different assessment methods and engage different expertise.

In this context, resilience/crisis management systems are defined broadly as the national institutions, structures and policies assigned to handle issues related to threats and civil protection as well as to protect critical infrastructures. At this point is worth-mentioning that in the 1980s most (western) governments were under pressure to form a more centralized approach, called "New Public Management" [18]. Hence, resilience/crisis management institutions were reformed and shaped, forming what we already discusses above. As a result, there are to main models of crisis management. The first one is to have a central leaning agency (usually the Prime Minister's office) that will be responsible to handle large-scale disasters. This model allows fast reaction since it limits the number of involved stakeholders and decision makers. The second one is to form a network where capacities and decision-making will be distributed across a network. This approach allows regional or local expertise to be used fast when needed at a specific location while resources will be able to shift quickly. Yet, there is an extreme drawback in this approach, bureaucracy, which could lead a responsibility division and finally break down. As a result, in the studied countries a more hybrid model is adopted since their size and structure of political administration differ at some extent. They all form a centralised structure, responsible to give guidelines and policies whereas a regional/local network of civil protection (Croatia, Greece) exists in order to deal fast will local cases. Hence, disaster management is carried out at national, regional and local levels through local protection committees while National Directorates coordinate all involved parties and tasks through governmental professional bodies. In most countries, decision-making processes vary depending on the magnitude of the crisis. For instance, in Greece crisis Response could be coordinated by a mayor if the situation is related to a municipality and it does not affect larger areas or population. On the hand, if the crisis is national or just extents the municipality, such as an earthquake or extended floods, the severity of the case could require regional or national handling. In the Republic of North Macedonia the Ministry of Defence is responsible for such cases but in Croatia and Greece only when the extent or severity of crisis is beyond the capacities of the political means will require the assist of the army.

### **3.3.2.2 Resilience**

First of all, we should attempt to understand what resilience is; it can be a promise for improved crisis management or a false promise that could compromise the effectiveness of crisis management [19][20]. In this context, although resilience is considered a goal in all studied countries, its understanding and related policies differ among different countries and actors in crisis management. Some refer to resilience as adaptability, preparedness or resistance of critical infrastructure and disaster relief structures without specifically addressing the issue in policy documents while others consider it as national priority goal. Metrics that could help us understand resilience and at what extent it is considered in a country could be the respective tasks of prevention, preparedness, response and recovery.

As for the division of responsibilities between parties and resources involved in resilience-building, there is a different approach in each country. Some countries like there is a focus on informing citizens, whereas individuals and households have the responsibility to prepare themselves in order to withstand and recover from crises. In other countries, such as in Greece and Croatia, there is also support by volunteers while private sector supports some recovery actions.

Table 3: Resilience

	<b>Resilience in policies</b>	<b>Policy areas related to resilience</b>	<b>Resilience enactment</b>	<b>Resilience and resources</b>
<b>Croatia</b>	Concept is part of various government policies; esp. in managing green transition	Preparedness to natural phenomena; security of critical infrastructures, digital transformation	Information for preparedness, response and recovery	Spending at municipal, regional and national level. Increasing contribution from private sector
<b>Greece</b>	Concept is part of various government policies; esp. in managing climate change	Preparedness to natural phenomena; security of critical infrastructures	Information for preparedness, response and recovery	Spending at municipal, regional and national level. Increasing contribution from private sector
<b>Republic of North Macedonia</b>	Limited mention in policies, mainly locally references	Resilience against organized crime, Scaling-up for Sustainability, Innovation and Climate Change (Skopje)	Thematic information	Spending at municipal, regional and national level

In **Greece**, the first Greek Innovation Cluster on Disaster Resilience, DRIC Defkalion, is recently set. DRIC Defkalion, titled "Innovative Partnership for the Protection and Safety of Environmental Risks" aims to tackle climate change impacts by taking adaptation measures to mitigate its effects. It is the first coordinated, interdisciplinary and innovative collaborative action in Greece in the critical field of protection against environmental risks. DRIC Defkalion aims to bring together under the same umbrella businesses, research organisations and technology companies active in the field of Environmental Protection and Sustainable Development to market innovative products and services, as well as research results with the ultimate goal to effectively manage and deal with natural disasters, environmental crises and civil protection emergencies for a healthy and safe environment and to achieve long-term sustainability. In this light, the Disaster Resilience Innovation Cluster DRIC Defkalion seeks to create a favorable environment for the presentation and promotion of private and public sector initiatives that promote such technological innovations in the market and solutions related with early warning of climatic hazards and disaster risk management. The primary purpose DRIC Defkalion is to bring together businesses, scientific research organisations and technology companies focused on developing products, systems and services for the management and response to natural disasters, environmental crises and emergencies in the field of civil protection in the Environment & Sustainable Development – Climate Change sector. Through this cluster of forces, know-how and experience it will be possible to successfully produce and introduce new products / services to the market, as well as intermediate research results, such as product prototypes, patents and intellectual property in general (IPR). (Source: <https://www.dric-defkalion.org/>).

In **Croatia**, a recovery and resilience plan responds to the urgent need of fostering a strong recovery and making Croatia future ready. The reforms and investments in the plan will help Croatia become more sustainable, resilient and better prepared for the challenges and opportunities of the green and digital transitions. The reforms (to be completed by August 2026) address bottlenecks to lasting and sustainable growth, while investments are targeted to accelerate the transition towards a more sustainable, low-carbon and climate-resilient economy, to support post-earthquake recovery, to maximize the benefits of the digital transformation and to ensure social cohesion. In the area of climate and environmental policies, Croatia faces a challenge of post-earthquake reconstruction and energy renovation of buildings, increasing the share of renewable energy and energy efficiency, improving the waste and water management and making mobility more sustainable and innovative. Digital challenges for Croatia include the digitalisation of public administration and the provision of online public services. (Source: [https://ec.europa.eu/info/files/recovery-and-resilience-plan-croatia\\_en](https://ec.europa.eu/info/files/recovery-and-resilience-plan-croatia_en)).

In **Republic of North Macedonia**, there is a national Resilience Dialogue about enhancing cooperation between civil society and the government to strengthen resilience such as in scaling-up for sustainability, innovation and climate change at Skopje or against organized crime in a national range. For instance, the long-term objective of the first case is to assist the City of Skopje to become more resilient to climate change and other environmental challenges, and to build a public administration that will design and deliver innovative and more efficient services for its citizens. (Source: <https://www.mk.undp.org/content/north-macedonia/en/home/sustainable-development-goals.html>). To this end, the European Union (EU) has recently announced a call for proposals for Civil Society for a more Resilient and Cohesive Society to enhance the involvement and impact of the civil society in contributing to the rule of law and to a more resilient and cohesive society.

### 3.4 Lessons learned

Some of the most important lessons learned are summarized in:

- Effective coordination is what stops a disaster from becoming a crisis.
- Implementation of disaster resilient structure, both technological and social.
- Enabling volunteer networks

#### 3.4.1 Floods

- The magnitude of disaster is not determined by floodwater alone but also by the pattern of vulnerability in which people live.
- The lives and livelihoods of many poor people are hardest hit by disasters. These people, often already vulnerable to other disasters and stresses.
- Many impacts of disasters are similar between themselves although their magnitude, nature and scale may vary and these impacts may be caused in different ways.
- The impacts of disasters on lives and livelihoods and the way agencies have addressed them are similar in most parts of the world. The effectiveness of agency interventions has, however, always been conditioned by factors specific to the context and circumstances, size and scale of the disaster and the affected population.

### **3.4.2 Earthquakes**

- Earthquake usually exceed assumptions of authorities in terms of magnitude and ground motion intensity.
- Total economic losses from earthquakes quake could be higher from any natural catastrophe in the world.
- The experience should lead to strengthening of existing standards of disaster mitigation.
- It is prompted to embed secondary perils in catastrophe modelling for better risk assessment.
- Help households and businesses be more resilient against earthquake risk in the future.

### **3.4.3 Wildfires**

- Overwhelming importance of an extreme wind.
- A multitude of factors affect the chance of a house to survive. The general rules hold, but there were many surprises (actions of owners and firefighters, coincidences, fire behaviour fluctuation, etc.).
- Settlement layout contributed greatly to the disaster.
- Unprepared public – Lack of knowledge resulted in fatal mistakes when seconds matter.
- The authorities (Fire Service, Police, Port Police, and Municipalities) made many serious mistakes during and immediately after the event, including slow response, lack of communication with each other, inadequate and inaccurate information to the public, and denial of the size of the disaster.

### **3.4.4 Volunteer networking**

- Volunteers help build social solidarity and integration, bringing people together.
- Volunteers extend the reach of governments during disasters, providing services they would not be able to afford otherwise.
- The successful management of volunteers is of paramount importance to support development of a faster and more efficient response hazards.

## 4 Inventory and analysis of results of research projects in the field of emergency and crisis management

---

### 4.1 R&I projects and their results

This chapter presents nearly finished projects and projects that were finished within the last years.

#### 4.1.1 LINKS

Start date 1 June 2020 - End date 30 November 2023

##### PROJECT NAME

**LINKS "Strengthening links between technologies and society for European disaster resilience"** is a comprehensive study on disaster governance in Europe. The overall aim of the LINKS project is to **strengthen links between technologies and society for improved European disaster resilience**, by producing sustainable advanced learning on the use of social media and crowdsourcing (SMCS) in disasters.

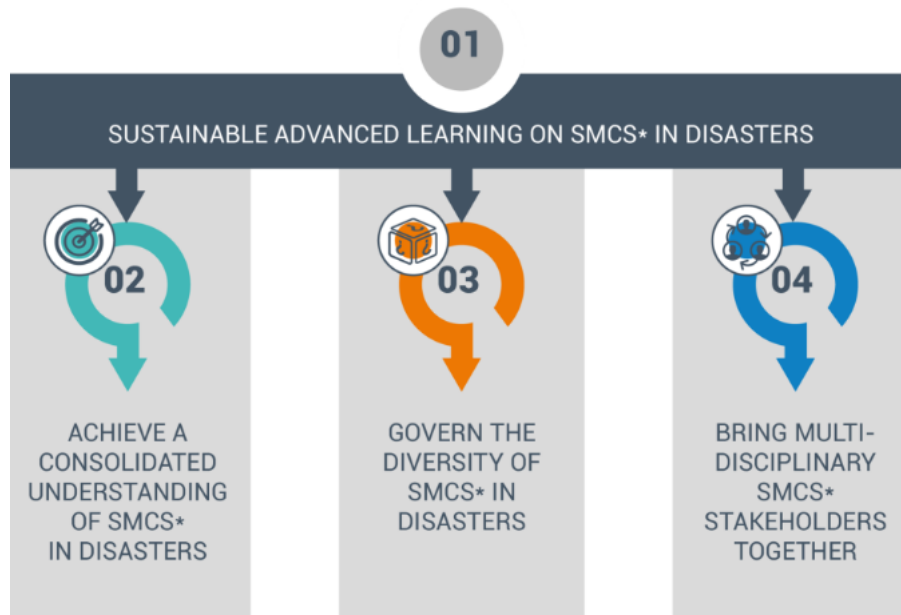
##### DESCRIPTION

In order to reach the core objectives of LINKS, the partners follow an integrative research approach, starting from an assessment of the three complementary knowledge domains: Disaster Risk Perception and Vulnerability, Disaster Management Processes, Disaster Community Technologies (DCT).

The project will develop the LINKS Framework which consists of scientific methods, practical tools, and guidelines addressing researchers, practitioners, and policy makers to understand, measure and govern SMCS for disasters. It will be developed and evaluated through five practitioner-driven European cases in Denmark, Germany, Italy, and the Netherlands, representing different disaster scenarios. Furthermore, LINKS sets out to create the LINKS Community, which brings together a wide variety of stakeholders, both online (LINKS Community Center) and in person (LINKS Community Workshops).

##### RESULTS

In LINKS, **resilience** is a normative and positive quality of a system, institution or individual that increases the capacity to manage disaster risk. LINKS contributes to strengthening resilience by enabling **sustainable advanced learning** on uses of **social media and crowdsourcing (SMCS)** in disasters.



**Figure 1** LINKS Sustainable Advanced Learning

**LINKS** defines Sustainable Advanced Learning as maintainable and evolving collection of knowledge produced for and by relevant stakeholders. This entails a cognitive dimension (the capability to gain in-depth knowledge of e.g. crises and crisis management) and a social dimension (the ability to implement that knowledge into new practices).

## PARTNERS

- Vrije Universiteit Amsterdam (VU) – Netherlands
- Københavns Universitet (UCPH) – Denmark
- Università degli Studi di Firenze (UNIFI) – Italy
- safety innovation center e.V. (SIC) – Germany
- Københavns Professionshøjskole (UCC) – Denmark
- Frederiksberg Kommune (FRB) – Denmark
- Hovedstadens Beredskab (HBR) – Denmark
- Save the Children Italia ONLUS (SCIT) – Italy
- Disaster Preparedness and Prevention Initiative for South Eastern Europe (DPPI SEE) – Bosnia and Herzegovina
- Federation of the European Union Fire Officer Associations a.s.b.l. (FEU)– Luxembourg
- Deutsche Hochschule Der Polizei (DHPol) – Germany
- Sitech Services of Chemelot (ST) – Netherlands
- European Organisation for Security (EOS) – Belgium
- Link Campus University (LCU) – Italy
- Provincia di Terni – Servizio Protezione Civile (PDT)
- Veiligheidsregio Zuid-Limburg (VRZL) – The Netherlands
- Kobe University Center for Resilient Design (CResD) – Japan

## LINKS

<https://cordis.europa.eu/project/id/883490>

<http://links-project.eu/>

### 4.1.2 STRATEGY

Start date 1 September 2020- End date 31 August 2023

#### PROJECT NAME

Facilitating EU pre-Standardisation process Through streamlining and vAlidating inTeroperability in systems and procEdures involved in the crisis management cYcle (STRATEGY)

#### DESCRIPTION

The STRATEGY project will build and implement a Pan-European pre-standardisation framework to improve the interoperability of crisis management solutions. This will be achieved by:

- Mapping existing crisis management standards to highlight areas for improvement
- Validating the efficacy of selected standards in Table-Top Exercises and a Full-Scale Exercise with first responders
- Developing a Pan-European pre-standardisation framework, and drafting policy recommendations based on the outcomes of the Table-Top and Full-Scale Exercises

#### RESULTS

- Landscape of proposed standardisation items in crisis management, gaps and opportunities
- Scenarios, use cases, Table-Top Exercises definition and standardisation items mapping
- Implementation of selected standards & integration testing in the frame of each scenario
- Full-Scale Exercise validation and open dialog
- Pre-standardisation activities implementation
- Exploitation and innovation potential
- Impact creation, communication and dissemination

#### PARTNERS

- SATWAYS - PROIONTA KAI YPIRESIES TILEMATIKIS DIKTYAKON KAI TILEPIKINONIAKON EFARMOGON ETAIRIA PERIORISMENIS EFTHINIS EPE
- FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.
- WOITSCH CONSULTING OY
- INOV INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTADORES, INOVACAO
- SINTEF AS
- TRILATERAL RESEARCH LTD
- INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS
- DEEP BLUE SRL
- KENTRO MELETON ASFALEIAS



- ATOS IT SOLUTIONS AND SERVICES IBERIA SL
- AUSTRIAN STANDARDS INTERNATIONAL
- SUOMEN STANDARDISOIMISLIITTO SFS RY
- ASOCIACION ESPANOLA DE NORMALIZACION
- ASOCIATIA DE STANDARDIZARE DIN ROMANIA
- IDEELLA FORENINGEN SVENSKA INSTITUTET FOR STANDARDER MED FIRMA SVENSKAINSTITUTET FOR STANDARDER
- MINISTERIO DA DEFESA NACIONAL
- ASSISTANCE PUBLIQUE HOPITAUX DE PARIS
- MINISTERO DELL'INTERNO
- VEILIGHEIDSREGIO IJSSELLAND
- HELLENIC POLICE
- MINISTRY OF NATIONAL DEFENCE, GREECE
- EUROPEAN ORGANISATION FOR SECURITY

## LINKS

<https://cordis.europa.eu/project/id/883520>

<https://strategy-project.eu/>

### 4.1.3 INGENIOUS

Start date 1 September 2019 - End date 28 February 2023

#### PROJECT NAME

Introducing the Next Generation Integrated Toolkit (NGIT) for Collaborative Response, increasing protection and augmenting operational capacity.

#### DESCRIPTION

Today's First Responders (FR) are using technology of the past. During their primary mission of saving lives and preserving society's safety and security, FRs face a multitude of challenges. In both small scale emergencies and large scale disasters, they often deal with life-threatening situations, hazardous environments, uncharted surroundings and limited awareness. Threats and hazards evolve rapidly, crossing municipalities, regions and nations with speed and ease. Armouring public safety services with all the tools that modern technology has to offer is critical. Such tools holistically enhance their protection and augment their operational capacities, assisting them in saving lives as well as ensuring their safe return from the disaster scene. **INGENIOUS will develop, integrate, test, deploy and validate a Next Generation Integrated Toolkit (NGIT)** for Collaborative Response, which ensures high level of Protection & Augmented Operational Capacity to respond to the disaster scene. This will comprise a multitude of the tools and services required:

- 1) for enabling protection of the FRs with respect to their health, safety and security;
- 2) for enhancing their operational capacities by offering them with means to conduct various response tasks and missions boosted with autonomy, automation, precise positioning, optimal utilisation of available resources and upgraded awareness and sense-making;

3) for allowing shared response across FR teams and disciplines by augmenting their field of view, information sharing and communications between teams and with victims.

The NGIT armours the FRs at all fronts. The NGIT will be provided at the service of the FRs for extensive testing and validation in the framework of a rich Training, Testing and Validation Programme – of Lab Tests (LSTs), Small-Scale Field Tests (SSTs) and Full-Scale Field Validations (FSXs) – towards powering the FR of the future being fully aware, fully connected and fully integrated.

## **RESULTS**

### Objective 1

To increase EU resilience against natural and man-made attacks by augmenting response capabilities in all types of disasters (multi-hazard approach)

### Objective 2

To ensure the well-being of response teams, at the EU-level (and beyond), and increase their operational capacity

### Objective 3

To deliver a Next Generation Integrated Toolkit (NGIT) for Collaborative Response extensively validated by EU and International practitioners and technology providers in the field facilitating systematic training and certification

### Objective 4

To develop a set of wearable technologies & miniaturised sensors which protect and empower first responders, and their K9 companions, during response operations

### Objective 5

To develop a set of ancillary devices and platforms, rapidly and autonomously deployed in the field, which gather information, enhance awareness, localise FRs and their assets, and optimise communication between teams and victims

### Objective 6

To fuse all available information under an integrated framework, and develop an advanced C3 (Command, Control & Coordination) providing the Common Operating Picture (COP) to all types of response units, advancing coordination and cross-team collaboration

### Objective 7

To convey the COP to the FR, by exploiting recent advances in Augmented Reality, and developing a set of mobile Apps and that allow the FR units to better coordinate tactical and operational response

### Objective 8

To increase public safety by greatly improving the capabilities of EU response units

### Objective 9

To allow cross-domain and cross-country response team collaboration (incl. Korea and US), overcoming language and policy barriers through technology

### Objective 10

Ensure legal, societal, ethical, security considerations advancing *INGENIOUS* sustainability are considered

#### Objective 11

Engage all relevant technology stakeholders and practitioners (all disciplines of first response) in the Action maximising market penetration and exploitation of the Toolkit hence facilitating adoption by the FR community

### **PARTNERS**

- INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS
- UNIVERSITEIT TWENTE
- DEUTSCHES ZENTRUM FÜR LUFT - UND RAUMFAHRT EV
- CS GROUP-FRANCE
- FUNDACION TEKNIKER
- EXUS SOFTWARE MONOPROSOPI ETAIRIA PERIORISMENIS EVTHINIS
- SINTEF AS
- ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS
- TOTALFORSVARETS FORSKNINGSSINSTITUT
- SATWAYS - PROIONTA KAI YPIRESIES TILEMATIKIS DIKTYAKON KAI TILEPIKINONIAKON EFARMOGON ETAIRIA PERIORISMENIS EFTHINIS EPE
- ALPES LASERS SA
- TECHNISCHE UNIVERSITÄT WIEN
- CY.R.I.C CYPRUS RESEARCH AND INNOVATION CENTER LTD
- UNIVERSIDAD POMPEU FABRA
- SINGULARLOGIC ANONYMI ETAIREIA PLIROFORIAKON SYSTIMATON KAI EFARMOGONPLIROFORIKIS
- KOREA INSTITUTE OF ROBOT AND CONVERGENCE
- GOBIERNO VASCO - DEPARTAMENTO SEGURIDAD
- ASSISTANCE PUBLIQUE HOPITAUX DE PARIS
- SODERTORNS BRANFORSVARSFORBUND
- I.S.A.R. GERMANY STIFTUNG GGMBH
- Police Service of Northern Ireland
- ELLINIKI OMADA DIASOSIS ATTIKIS
- TRILATERAL RESEARCH LIMITED

### **LINKS**

<https://ingenious-first-responders.eu/>

<https://cordis.europa.eu/project/id/833435>

#### **4.1.4 ASSISTANCE**

Start date 1 May 2019- End date 31 July 2022

## PROJECT NAME

Adapted Situation Awareness tools and tailored training scenarios for increasing capabilities and enhancing the protection of First Responders – **ASSISTANCE** is an international research project funded by the European Commission under the **Horizon 2020** programme in Secure Societies Challenge addressing the **SU-DRS02-2018-2019-2020 (Technologies for first responders)** topic.

## DESCRIPTION

The main purpose of ASSISTANCE project is twofold: **to help and protect different kind of first responders' (FR) organizations that work together during the mitigation of large disasters (natural or man-made)** and **to enhance their capabilities and skills for facing complex situations** related to different types of incidents.

## RESULTS

This will be achieved by accomplishing the following operational objectives:

**01. To address the FRs expressed needs and preferences** in terms of **useful information** for increasing their capabilities and new sensors mounted on **unmanned platforms** or integrated in their **wearable equipment**.

**02. To develop a novel SA platform, including the integration of UAV, Robots and drones' swarms and innovative modules**, able to be adapted to the specific information needs of the different types of FRs organizations that cooperate during the response to a large disaster (natural or man-made)

**03. To establish the core of an advanced training network based on Virtual Reality (VR), Mixed Reality (MR) and Augmented Reality (AR) along with a set of training curricula** tailored to the needs of the different types of first responders (e.g. firefighters, sanitary staff, police, etc.) and characteristics of the type of incident.

**04. To provide a robust network infrastructure for ensuring FRs and unmanned platforms connectivity during the mitigation operations** and alternative ad-hoc network capabilities based on drones' swarm for ensuring the basic sensors and modules connection.

**05. To validate the project results in a cost effective way under real conditions** in a controlled environment through 3 pilot demonstrations which will involve FRs from different organizations.

**06. To measure the societal impact of the project and assure compliance with legal, gender and ethical EU principles and requirements**, identify lacunae and hurdles and develop concrete recommendations to policy makers and FRs with the aim to improve the current level of protection for the FRs and increase their capabilities in a legal and ethical manner.

## PARTNERS

- UNIVERSITAT POLITECNICA DE VALENCIA
- ETRA INVESTIGACION Y DESARROLLO SA
- THALES
- AGENCIA VALENCIANA DE SEGURIDAD Y RESPUESTA A LAS EMERGENCIAS
- SIEC BADAWCZA LUKASIEWICZ - PRZEMYSLOWY INSTYTUT AUTOMATYKI I POMIAROW PIAP

- FUNDACION ANDALUZA PARA EL DESARROLLO AEROESPACIAL
- NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO
- RISE RESEARCH INSTITUTES OF SWEDEN AB
- INSTITUUT FYSIEKE VEILIGHEID
- UNIVERSIDAD DE CANTABRIA
- OPENBAAR LICHAAM GEZAMENLIJKE BRANDWEER
- ACIL AFET AMBULANS HEKIMLERI DERNEGI
- MINISTERIO DEL INTERIOR
- VIASAT ANTENNA SYSTEMS SA
- E-LEX - STUDIO LEGALE
- SODERTORNS BRANFORSVARSFORBUND
- OCHOTNICZA STRAZ POZARNA W OZAROWIE MAZOWIECKIM
- CENTRUM NAUKOWO-BADAWCZE OCHRONY PRZECIWPOZAROWEJ IM. JOZEFA TULISZKOWSKIEGO - PANSTWOWY INSTYTUT BADAWCZY
- CYBERETHICS LAB SRLS

## LINKS

<https://assistance-project.eu/>

<https://cordis.europa.eu/project/id/832576>

## 4.1.5 CURSOR

Start date 1 September 2019 - End date 31 August 2022

### PROJECT NAME

Coordinated **U**se of miniaturized **R**obotic equipment and advanced **S**ensors for search and rescue **O**peRations

### DESCRIPTION

After an earthquake, landslide or flood, search and rescue teams scramble to help trapped survivors. Finding victims can be a tough job, even with the use of sniffer dogs, highly sensitive audio listening devices, and thermal imaging cameras. The EU-funded CURSOR project is developing mini robotic equipment and advanced sensors to assist in these operations. Specifically, their system comprises unmanned aerial vehicles (UAVs), 3D modelling, and transportation of disposable miniaturised robots that are equipped with advanced sensors for the detection of volatile chemical signatures emanating from human beings. Information and data collected are transferred in real time to a handheld device operated by first responders at the disaster site.

### RESULTS

In the face of **natural** or **man-made disaster**, urban search and rescue teams and other first responders like police, medical units or civil protection race against the clock to locate survivors within the critical 72-hour timeframe (Golden Hours), facing challenges such as instable structures or

hazardous environments but also insufficient situational awareness – all resulting in lengthy SaR processes. In order to speed up the detection of survivors trapped in collapsed buildings and to improve working conditions for the first responders, the CURSOR project will design an innovative **CURSOR** Search and Rescue Kit (**CURSOR SaR Kit**) based using drones, miniaturised robotic equipment, and advanced sensors.

The overarching aim of CURSOR is to develop a CURSOR SaR kit that will be easy and fast to deploy leading to a reduced time in detecting and locating trapped victims in disaster areas. This will be facilitated by the development of a common, aggregated, comprehensive operational picture from all types of inputs that can support prioritisation of actions during SaR missions.

## **PARTNERS**

- BUNDESMINISTERIUM DES INNERN
- ENTENTE POUR LA FORÊT MÉDITERRANÉENNE
- MERSEYSIDE FIRE & RESCUE AUTHORITY
- SERVICE DEPARTEMENTAL INCENDIE ET SECOURS DE LA SAVOIE
- ELLINIKI OMADA DIASOSIS ATTIKIS
- INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS
- EXUS SOFTWARE MONOPROSOPI ETAIRIA PERIORISMENIS EVTHINIS
- C4CONTROLS LTD
- ISCC GMBH
- NATIONAL UNIVERSITY CORPORATION TOHOKU UNIVERSITY
- SINTEF AS
- COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
- THE UNIVERSITY OF MANCHESTER
- DIN DEUTSCHES INSTITUT FUER NORMUNG E.V.
- TRILATERAL RESEARCH LIMITED
- ARTTIC
- ARTTIC INNOVATION GMBH

## **LINKS**

<https://cordis.europa.eu/project/id/832790>

<https://www.cursor-project.eu/>

### **4.1.6 FASTER**

Start date 1 May 2019 - End date 30 April 2022

#### **PROJECT NAME**

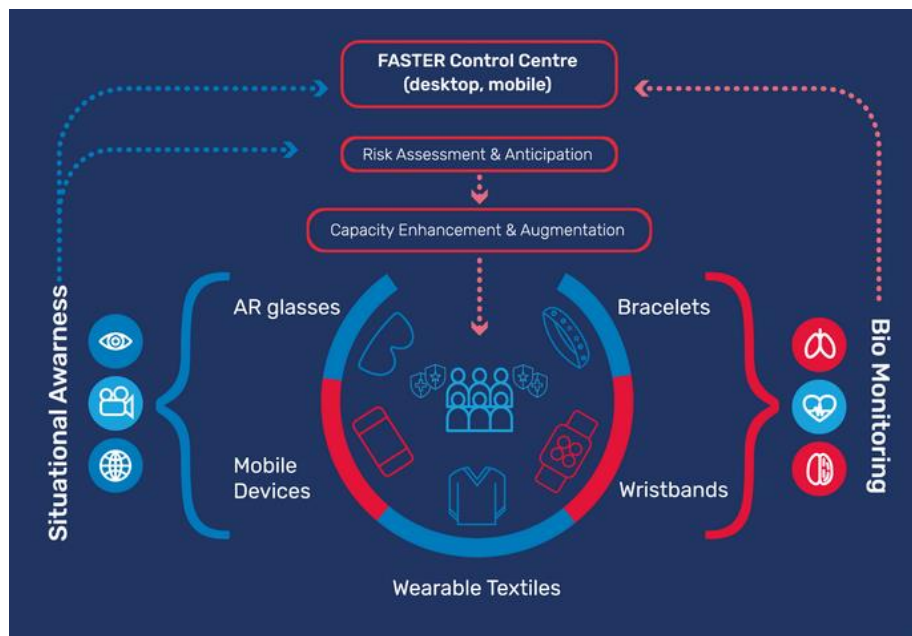
First responder Advanced technologies for Safe and efficient Emergency Response

#### **DESCRIPTION**

During natural catastrophes, technological (man-made) disasters or terrorist attacks, first responders – police, bomb squads, firefighters, anti-terrorism units and emergency medical workers – play a crucial role. Their effectiveness is dependent on a range of factors. The EU-funded FASTER project will examine the impact and the role first responders can have in cases of disasters. It will take into consideration the entire lifecycle of emergency preparedness and response, including the planning, logistical support, maintenance and diagnostics, training and management. The ultimate aim of the project is to further the European Union's ability to respond to emergencies.

## RESULTS

FASTER will develop a set of tools towards enhancing the operational capacity of first responders while increasing their safety in the field. It will introduce Augmented Reality technologies for improved situational awareness and early risk identification, and Mobile and Wearable technologies for better mission management and information delivery to first responders. Body and Gesture based User Interfaces will be employed to enable new capabilities while reducing equipment clutter, offering unprecedented ergonomics. Moreover, FASTER will provide a platform of Autonomous Vehicles, namely drones and robots, aiming to collect valuable information from the disaster scene prior to operations, extend situational awareness and offer physical response capabilities to first responders. FASTER will gather multi-modal data from the field, utilizing an IoT network, and Social Media content to extract, either locally or in the cloud, meaningful information and to provide an enhanced Common Operational Picture to the responder teams in a decentralised way using Portable Control Centres. It will additionally use blockchain technology to keep track of needs and capabilities using smart contracts for maximum efficiency. The whole system will be facilitated by tools for Resilient Communications Support featuring opportunistic relay services, emergency communication devices and 5G-enabled communication capabilities.



**Figure 2** FASTER

- Mobile Augmented Reality (AR) for Operational Support

- Extended vision technologies using commercial lightweight UAVs: Mission management and progress monitoring
- Wearable sensors and smart textiles
- Hand gesture recognition
- K9 Behaviour Recognition
- Gesture-based UxV navigation
- Robotic Platform:

## **PARTNERS**

- ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS
- ENGINEERING - INGEGNERIA INFORMATICA SPA
- ORGANISMOS TILEPIKOINONION TIS ELLADOS OTE AE
- CS GROUP-FRANCE C
- RISISPLAN BV
- DRONE HOPPER SL
- ROBOTNIK AUTOMATION SLL
- SYNELIXIS LYSEIS PLIROFORIKIS AUTOMATISMOU & TILEPIKOINONION ANONIMI ETAIRIA
- INOV INSTITUTO DE ENGENHARIA DE SISTEMAS E COMPUTADORES, INOVACAO
- FONDAZIONE LINKS - LEADING INNOVATION & KNOWLEDGE FOR SOCIETY
- KPEOPLE RESEARCH FOUNDATION
- KAJAANIN AMMATTIKORKEAKOULU OY
- VRIJE UNIVERSITEIT BRUSSEL
- PANEPISTIMIO DYTIKIS ATTIKIS
- AYUNTAMIENTO DE MADRID
- SERVICIO MADRILENO DE SALUD
- ECOLE NATIONALE SUPERIEURE DES OFFICIERS DE SAPEURS-POMPIERS (ENSOSP)
- WYZSZA SZKOLA POLICJI W SZCZYTNI
- KAJAANIN KAUPUNKI
- ELLINIKI OMADA DIASOSIS ATTIKIS
- MUNICIPIO DE GRANDOLA
- CONSORZIO PER IL SISTEMA INFORMATIVO (CSI PIEMONTE)
- KWANSEI GAKUIN EDUCATIONAL FOUNDATION

## **LINKS**

<https://cordis.europa.eu/project/id/833507>

<https://www.faster-project.eu/>

### **4.1.7 INTREPID**

Start date 1 October 2020 - End date 30 September 2023



**PROJECT NAME**

INtelligent Toolkit for Reconnaissance and assessmEnt in Perilous InciDents

**DESCRIPTION**

INTREPID aims to create a unique platform, seamlessly integrating Intelligence Amplification and eXtended Reality concepts, with unprecedented Smart Cybernetic Assistants and innovative deep indoor Networking and Positioning capabilities, to improve and accelerate the exploration and assessment of disaster zones. The project will validate its effectiveness, in iterative and complementarity pilots, to support the rescue operation in areas that are complex or dangerous to explore.

**RESULTS**

INTREPID aims to create a unique platform, seamlessly integrating Intelligence Amplification and eXtended Reality concepts, with unprecedented Smart Cybernetic Assistants and innovative deep indoor Networking and Positioning capabilities, to improve and accelerate the exploration and assessment of disaster zones. The project will validate its effectiveness, in iterative and complementary pilots, to support the rescue operations in areas that are complex or dangerous to explore.

Always first on scene, first responders will be able to immediately start operations without having to wait for specialized teams or for the zone to be fully secured. When these teams arrive, first responders have already used INTREPID to provide them with reliable information and effective assistance. The result is an immediate and targeted response that will allow faster, more effective and safer operations.

The consortium consists of world-class research centres and SMEs, coordinated by an industrial with a leading position in the security market. It will follow a user-centric methodology involving many first responders, and an international Advisory Board and Open User Group ensuring diversity. Social, ethical and legal constraints will be carefully considered during the project's lifetime.

The project will design and implement a training curriculum and an innovative evaluation framework along with an ambitious communication and dissemination plan, preparing the ground for successful exploitation.

**PARTNERS**

- CS GROUP-FRANCE
- TOTALFORSVARETS FORSKNINGSINSTITUT
- TECHNISCHE UNIVERSITAET MUENCHEN
- ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS
- VRIJE UNIVERSITEIT BRUSSEL
- CRISISPLAN BV
- ELECTRONIQUE TELEMATIQUE ETELM
- ALX SYSTEMS
- ROBOTNIK AUTOMATION SLL
- SAS INCONITO
- POLICE FEDERALE BELGE V
- ILLE DE MARSEILLE
- STORSTOCKHOLMS BRANDFORSVAR

- AYUNTAMIENTO DE MADRID
- SERVICIO MADRILENO DE SALUD
- ESCUELA ESPANOLA DE SALVAMENTO Y DETECCION CON PERROS
- ELLINIKI OMADA DIASOSIS ATTIKIS

## LINKS

<https://intrepid-project.eu/>

<https://cordis.europa.eu/project/id/883345>

### 4.1.8 PathoCERT

Start date 1 September 2020- End date

#### PROJECT NAME

**Pathogen Contamination Emergency Response Technologies**

#### DESCRIPTION

Pathogens can easily spread via water, leading to serious health complications or even death. Due to the nature of their work, first responders are more likely to become contaminated when they need to operate in areas where water is present. The EU-funded **PathoCERT** project aims to strengthen the coordination capability of first responders in the event that they have to work in places where the risk of contamination via water is high. Within this scope, the project will produce pathogen contamination emergency response technologies, tools and guidelines to be validated by first responders, helping them to detect pathogens quickly and to better control emergency situations.

#### RESULTS

Pathogens are a determining factor in emergency response due to their life-threatening nature, both for the public as well as for the safety of first responders. In many cases, pathogen contaminations are difficult to detect, and require specialized technologies, tools and procedures to handle them. Pathogens can easily spread via water, and may cause contaminations of large areas far from their origin. Waterborne pathogen contamination events can occur anywhere, and may be caused by various natural events or they can be the result of human activity, either accidental or malicious. During these emergencies, first responders may need to operate within a certain pre-defined incident area, and are likely to be exposed to contaminated water originating from various sources, such as surface water, wastewater or drinking water. This can pose a significant risk of illness, disease or even death, through skin contact, ingestion or inhalation.

The overall objective of the PathoCERT project is to strengthen the coordination capability of the first responders in handling waterborne pathogen contamination events. This will increase the first responders' capabilities, allowing the rapid and accurate detection of pathogens, improving their situational awareness, and improving their ability to control and mitigate emergency situations involving waterborne pathogens. To achieve this objective, the project will research and demonstrate Pathogen

Contamination Emergency Response Technologies (PathoCERT), a collection of novel, cost-effective and easy-to-use technologies, tools and guidelines, which will be field-validated by the first responders.

## **PARTNERS**

- UNIVERSITY OF CYPRUS
- NATIONAL TECHNICAL UNIVERSITY OF ATHENS - NTUA
- UNIVERSITATEA DE MEDICINA SI FARMACIE IULIU HATIEGANU CLUJ-NAPOCA
- CETAQUA, CENTRO TECNOLOGICO DEL AGUA, FUNDACION PRIVADA
- FUNDACIO EURECAT
- ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS
- KWR WATER B.V.
- FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.
- SATWAYS - PROIONTA KAI YPIRESIES TILEMATIKIS DIKTYAKON KAI TILEPIKINONIAKON EFARMOGON ETAIRIA PERIORISMENIS EFTHINIS EPE
- MicroLAN
- AQUA-Q AB
- PHOEBE RESEARCH AND INNOVATION LTD
- ENGINEERING - INGEGNERIA INFORMATICA SPA
- COLLABORATING CENTRE ON SUSTAINABLE CONSUMPTION AND PRODUCTION GGBH
- WATER EUROPE
- MINISTRY OF INTERIOR
- AYUNTAMIENTO DE GRANADA
- COMMUNICATION AND INFORMATION SYSTEMS DIRECTORATE
- STICHTING WATERNET
- ETAIRIA HYDREFSIS KAI APOCHETEFSIS THESSALONIKIS AE
- ELLINIKI OMADA DIASOSIS SOMATEIO
- SUNDOSOFT LTD
- Korea Institute of Science and Technology

## **LINKS**

<https://pathocert.eu/>

<https://cordis.europa.eu/project/id/883484>

### **4.1.9 RESPOND-A**

Start date 1 June 2020- End date 31 May 2023

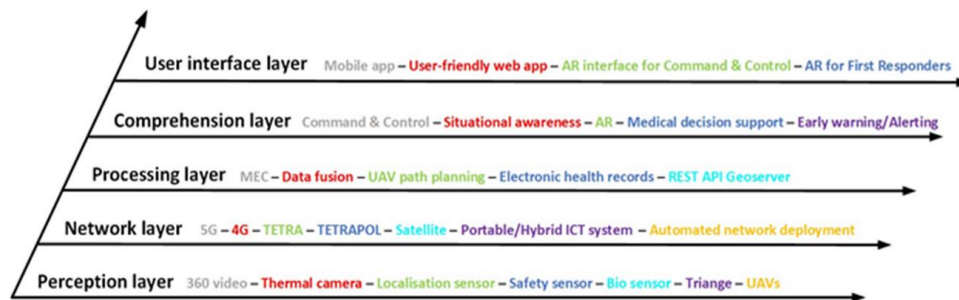
#### **PROJECT NAME**

Next-generation equipment tools and mission-critical strategies for First Responders

#### **DESCRIPTION**

Climate change and industrial accidents can create challenging environments for first responders when they are called in to deal with an incident or crisis. The EU-funded RESPOND-A project aims to develop technologies based on 5G wireless communications, augmented and virtual reality or autonomous robots to optimise first responders' work. Thanks to RESPOND-A, first responders will have the opportunity to test these technologies and see how efficiently they can be applied within the framework of diverse disaster scenarios. With these technological advances, first responders will be able to better predict and assess the incidents and to safeguard themselves before, during and after disasters.

## RESULTS



**Figure 3** RESPOND-A-five-tier architectural structure

### Perception layer

Identify the monitoring data sources and collect the multi-disciplinary information that arrive in real-time from the safety and biometric sensors in the vests of First Responders, the environmental sensors, the localisation sensors for the personnel, as well, data inputs from sensors placed on UAVs and tactical robots. Video streaming from 360o cameras, thermal cameras and AR devices takes place also in this layer.

### Processing layer

Collect and process the data transmitted from the Network layer towards (i) removing redundant data to avoid network overload, (ii) aggregating large amounts of information to foster the Situational Awareness and COP quickly with the aid of Multi-access Edge Computing (MEC), (iii) fusing and comparing the runtime information with patterns of previous incidents to discerned statistical trends for Early Warning, (iv) formulating path planning schemes for optimal UAVs/robots positioning with respect to Responders' locations, (v) articulating information for recording knowledge of emergency events and response activities, including Electronic Health Records (EHRs) and Geographic Information System (GIS) databases.

### Network layer

Transfer and process the data gathered from Perception layer towards enabling (i) the Responders and Command Centres connectivity via 5G portable telecommunications system with dynamically adjustable UAVs/drones network coverage umbrella, and (ii) ultra-reliable mission-critical services via real-time sharing of uninterrupted video flows and data-rich multimedia content formed to be projected by any kind of devices, e.g., from Responders' personal smartphones, tablets, laptops, to specialised AR glasses and 3D projectors.

### Comprehension Layer

Integrate all collected/transferred/ aggregated/processed information into a common ICT wireless system infrastructure to create the precise Situational Awareness and COP. All the intended applications and services of RESPOND-A are included in this layer, such as (i) the Command and Control Centre, (ii) AR module for overlaying real-time video streams with augmented data, (iii) medical support system, and (iv) Early Warning.

### **User interface Layer**

Deliver the Situational Awareness COP in most coherent and easiest manner through dedicated mobile applications, user-friendly web applications and easy-to-use AR/haptic devices assisted by interactive processes, like gesture and context recognition. The intended interfaces will be dedicated (i) either to Command and Control

### **PARTNERS**

- EUROPEAN UNIVERSITY CYPRUS
- AIRBUS DS SLC
- SAFRAN PASSENGER INNOVATIONS GERMANY GMBH
- "NATIONAL CENTER FOR SCIENTIFIC RESEARCH ""DEMOKRITOS"""
- FUNDACION CENTRO DE TECNOLOGIAS DE INTERACCION VISUAL Y COMUNICACIONES VICOMTECH
- FUNDACIO PRIVADA I2CAT, INTERNET I INNOVACIO DIGITAL A CATALUNYA
- ATMOSPHERE GMBH
- PROBOTEK LTD
- ROBOTNIK AUTOMATION SLL
- ATHONET SRL
- NIFAKOS SOKRATIS
- 0 INFINITY LIMITED
- HELLENIC INSTRUMENTS IKE
- PROMETECH BV
- EIGHT BELLS LTD
- SIDROCO HOLDINGS LIMITED
- CYBERLENS BV
- VALLFIREST TECNOLOGIAS FORESTALES SL
- CSI CENTER FOR SOCIAL INNOVATION LTD
- FUNDACIO D'ECOLOGIA DEL FOC I GESTIO D'INCENDIS PAU COSTA ALCUBIERRE
- FUNDACION DE LA COMUNIDAD VALENCIANA PARA LA INVESTIGACION, PROMOCION Y ESTUDIOS COMERCIALES DE VALENCIAPORT
- PUBLIC SAFETY COMMUNICATION EUROPE FORUM AISBL
- AYUNTAMIENTO DE VALENCIA
- Cyprus police
- DIMOS EGALEO
- INSTITUT PO OTBRANA
- SMARTEX SRL
- UPRAVA POMORSKE SIGURNOSTI I UPRAVLJANJA LUKAMA
- MINISTRY OF NATIONAL DEFENCE, GREECE

- Ministério da Justiça
- "UNIVERSITETSKA MNOGOPROFILNA BOLNITSA ZA AKTIVNO LECHENIE ""SVETI GEORGI"" - UNIVERSITY MULTIPROFILE HOSPITAL FOR ACTIVE TREATMENT ""SAINT GEORGE"""
- SOFTWARE COMPANY EOOD
- INNOVATIVE ENERGY AND INFORMATION TECHNOLOGIES LTD
- IANUS CONSULTING LTD

## LINKS

<https://cordis.europa.eu/project/id/883371>

<https://respond-a-project.eu/>

### 4.1.10 RESPONDRONE

Start date 1 May 2019- End date 30 April 2022

#### PROJECT NAME

NOVEL INTEGRATED SOLUTION OF OPERATING A FLEET OF DRONES WITH MULTIPLE SYNCHRONIZED MISSIONS FOR DISASTER RESPONSES

#### DESCRIPTION

In case of a disaster, the rapid, effective and efficient response of first responders is crucial for saving lives. Unmanned aircraft systems (UAS) technology can aid emergency management in complementing existing systems used in first response missions. The EU-funded RESPONDRONE project aims at developing a multi-UAS platform for first responders to enhance their situation awareness. The fleet of UAS will provide enhanced capabilities to support assessment missions, search and rescue operations, as well as forest fire fighting by simplifying operations for first responders and thus making first response operations more efficient. The platform will be designed to provide relevant information in real-time to all involved stakeholders using a cloud-based system, supporting on-time decision making and operations management.

#### RESULTS

The ResponDrone system will simplify and accelerate situation assessment, information sharing, decision making and operations management. It will also deliver high quality information to any involved control center through an intelligent web-based system, which is accessible and can be operated from a remote site. In addition, it will serve as an on-demand airborne communications network to allow people on the ground to communicate with the command center in case of cellular coverage collapse.

By using the innovative ResponDrone system, emergency response teams will be able to respond more rapidly, effectively and efficiently to an emergency or disaster and therefore save more lives. The fleet of drones will provide enhanced capabilities to support mission assessment, search and rescue operations, as well as forest fire fighting.

The deployment of the ResponDrone system will be very simple. Each fleet of a few drones will be operated by a single pilot, unlike the current situation in which each drone is operated by a single pilot.

To ensure seamless uptake and adaption by first responder organizations, ResponDrone will be fully integrated and embedded within the current processes and procedures of real emergency response agencies and teams.

## **PARTNERS**

- DEUTSCHES ZENTRUM FUR LUFT – UND RAUMFAHRT EV
- ISRAEL AEROSPACE INDUSTRIES LTD.
- ALPHA UNMANNED SYSTEMS SL
- THALES SIX GTS FRANCE SAS
- KOREA AVIATION TECHNOLOGIES CO LTD
- HAUT COMITE FRANCAIS DEFENSE CIVILE
- MINISTRY OF DEFENSE
- SERVICE DEPARTEMENTAL D'INCENDIE ET DE SECOURS DE LA HAUTE-CORSE
- VEILIGHEIDSREGIO HAAGLANDEN
- STATE FIRE AND RESCUE SERVICE
- MINISTRY OF EMERGENCY SITUATIONS
- PERIFEREIA DYTIKHS MAKEDONIAS
- REGION OF CENTRAL MACEDONIA
- REGIONAL ADMINISTRATION VARNA
- INESC TEC - INSTITUTO DE ENGENHARIADE SISTEMAS E COMPUTADORES, TECNOLOGIA E CIENCIA
- A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
- AMERICAN UNIVERSITY OF ARMENIA FOUNDATION
- TIME.LEX
- AGORA P.S.V.D.
- INHA UNIVERSITY RESEARCH AND BUSINES FOUNDATION

## **LINKS**

<https://cordis.europa.eu/project/id/833717>

<https://respondroneproject.com/>

### **4.1.11 Search and Rescue**

Start date 1 July 2020- End date 30 June 2023

#### **PROJECT NAME**

Search and Rescue: Emerging technologies for the Early location of Entrapped victims under Collapsed Structures and Advanced Wearables for risk assessment and First Responders Safety in SAR operations

#### **DESCRIPTION**

After an earthquake, an industrial chemical release or a building's collapse, a timely and effective response is crucial and can prevent or significantly reduce the risk of casualties. This is why first responders and rescue teams need to be equipped with cutting edge tools and specialised instruments

in order to enhance their capabilities in terms of accuracy, quick localisation, and reduction of false alarms. Through a series of large-scale pilot scenarios, the EU-funded Search and Rescue project will design, implement and test a highly interoperable open architecture platform for first responders, including advanced frontend equipment systems and backend applications, improving the decision-making of first responders and providing a dynamic common operational picture of the crisis.

## RESULTS

The **S&R** project will design, implement and test through a series of large scale pilot scenarios a highly interoperable, modular open architecture platform for first responders' capitalising on expertise and technological infrastructure from both COncORDE and IMPRESS FP7 projects. The governance model of S&R will be designed to operate more effectively and its architectural structure will allow to easily incorporate next generation R&D and COTS solutions which will be possibly adopted in the future disaster management systems. The Model will also support a unified vision of the EU role and will provide a common framework to assess needs and integrate responses.

The framework will enable supportive approach using a wider range of decisional support features and monitoring systems and will also give to first responders an effective and unified vision of

- (a) the dynamic changes going on during event's lifetime and
- (b) the capabilities and resources currently deployed in the field

The impact of S&R towards the international crisis management community will be related to disseminating a new governance concept, which combined with the technological solutions that will be presented by the consortium is related to:

- Production of smaller, lighter rescue tools with increased effectiveness in confined spaces; early detection of toxic environments for the first responders and K-9s
- Response time; it is the most critical parameter in the recovery of live victims in collapsed building environments.
- Planning time; it will be reduced by engaging reliable, adaptable technologies for disaster scene fast overview, wide-area situation awareness and imaging (e.g. UAVs, thermal cameras etc.);
- Lowering the incidence rate of injuries for victims; fast extrication providing with medical support based on on-site noninvasive methods.
- Next generation garments; totally textile sensors embedded on first responders' SMART uniform and first aid for kids device for situational awareness, as well as health and safety of the first responders.
- The enduring impact of S&R on citizen safety and security, which will be maximised because the science and technology is informed and driven by end users, who will run the pilots in order to assess the added value of S&R solutions
- Re-introduce the citizen as a very important active element in the crisis environment
- Enhancement of the culture of preparedness and readiness capability upon disaster risks for the population; inclusion of all people in the disaster management cycle
- Ensure that the crisis management community has full access to the S&R project, in terms of contributing to the considered governance model and eventually participating to the



innovative implementation of the toolbox concept, in order for the project results to have a lasting impact on European society

- Share the information collected and the knowledge developed within the project with civil protection and security actors in the EU
- Provide a comprehensive test-bed organisation, in terms of full scale exercises and demonstrations of simulated complex crisis management situations, that EU bodies and national organisations may use for testing diverse response frameworks allowing for better operational and societal adaptation to rapidly evolving threats,
- Education of end users in the developed S&R toolbox and holistic approach to European crisis management (impact to policies).

## **PARTNERS**

- NATIONAL TECHNICAL UNIVERSITY OF ATHENS – NTUA
- AIDEAS OU
- SOFTWARE IMAGINATION & VISION SRL
- MAGGIOLI SPA
- KONNEKT ABLE TECHNOLOGIES LIMITED
- THALES ITALIA SPA
- ATOS IT SOLUTIONS AND SERVICES IBERIA SL
- ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS
- UNIVERSITA DEGLI STUDI DI CAGLIARI
- UKEMED (GLOBAL) LTD
- PUBLIC SAFETY COMMUNICATION EUROPE FORUM AISBL
- UNIVERSITA DEGLI STUDI DI FIRENZE
- DEUTSCHES FORSCHUNGSZENTRUM FUR KUNSTLICHE INTELLIGENZ GMBH
- UNIVERSITA CATTOLICA DEL SACRO CUORE
- VRIJE UNIVERSITEIT BRUSSEL
- SYNYO GmbH
- UNIVERSITEIT HASSELT
- SPOLECZNA AKADEMIA NAUK
- GIOUMPI TEK MELETI SCHEDIASMOY YLOPOIISI KAI POLISI ERGON PLIROFORIKIS ETAIREIA PERIORISMENIS EFTHYNIS
- ELLINIKI OMADA DIASOSIS SOMATEIO
- ENOSI PTYCHIOYCHON AXIOMATIKON YPAXIOMATIKON PYROSVESTIR OY SOMATEIO
- JOHANNITER-UNFALL-HILFE EV
- JOHANNITER OSTERREICH AUSBILDUNG UND FORSCHUNG GEMEINNUTZIGE GMBH
- CONSIGLIO NAZIONALE DELLE RICERCHE
- POMPIERS DE L'URGENCE INTERNATIONALE
- ASOCIATA CLUSTERUL ROMAN PENTRU PROTECTIE SI ECOLOGIE IN DOMENIUL MATERIALELOR CHIMICE, BIOLOGICE, RADIOLOGICE/NUCLEARE SI EXPLOZIVE
- SERVICIO MADRILENO DE SALUD
- ESCUELA ESPANOLA DE SALVAMENTO Y DETECCION CON PERROS

**LINKS**

<https://cordis.europa.eu/project/id/882897>

<https://search-and-rescue.eu/>

**4.1.12 ANDROMEDA**

Start date 1 September 2019- End date 31 August 2021

**PROJECT NAME**

An Enhanced Common Information Sharing Environment for Border Command, Control and Coordination Systems

**DESCRIPTION**

Sharing data can make surveillance cheaper and more effective. Under the European Union's Common Information Sharing Environment (CISE), information may be shared seamlessly with a range of third actors, including police agencies and defence forces. It is making different systems interoperable so that data and other information can be exchanged easily via modern technologies. Already an important building block of the EU's overall maritime surveillance framework, CISE can also be extended to help secure land borders. The EU-funded ANDROMEDA project aims to extend the scope of CISE for land borders. The project will leverage on the developments, results and experience of the consortium from current and previous research projects (PERSEUS, CloseEye, MARISA, RANGER).

**RESULTS**

A scrutiny of the current maritime surveillance systems and cooperation arrangements in the EU maritime domain, revealed that there are few technical limitations to achieve a higher degree of information sharing. The legal conditions for information sharing at the EU level are fragmented and based on a primarily sectoral (vertical) approach.

ANDROMEDA aims to unlock the full capabilities of the CISE Model by enhancing the Maritime CISE Model and by extending its scope to the Land Surveillance Information Exchange.

The project will address the "fragmentation" and close "gaps" in information sharing by providing a secure, effective common situational awareness and information exchange system integrated with CISE.

The proposed solution is a distributed set of systems and services interconnected according to the CISE principles, that aim to foster:

- Faster detection of new events.
- Better informed decision making.
- Achievement of a joint undestarting & undertaking of a situation across borders.

**PARTNERS**

- MINISTRY OF MARITIME AFFAIRS AND INSULAR POLICY

- GMV AEROSPACE AND DEFENCE SA
- SATWAYS - PROIONTA KAI YPIRESIES TILEMATIKIS DIKTYAKON KAI TILEPIKINONIAKON EFARMOGON ETAIRIA PERIORISMENIS EFTHINIS EPE
- INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS
- EXUS SOFTWARE LTD
- INOVAWORKS II, COMMAND AND CONTROL,SA
- FONDAZIONE CENTRO EURO-MEDITERRANEOSUI CAMBIAMENTI CLIMATICI
- LAUREA-AMMATTIKORKEAKOULU OY
- CODIN - SOCIETA PER AZIONI
- STEMO OOD
- KENTRO MELETON ASFALIAS
- ENGINEERING - INGEGNERIA INFORMATICA SPA
- HELLENIC POLICE
- MINISTERO DELLA DIFESA
- MINISTERIO DA DEFESA NACIONAL
- MINISTRY OF PUBLIC SECURITY
- EXECUTIVE AGENCY MARITIME ADMINISTRATION
- MINISTRY OF NATIONAL DEFENCE, GREECE
- MINISTARSTVO SAOBRAČAJA I POMORSTVA
- UPRAVA POMORSKE SIGURNOSTI I UPRAVLJANJA LUKAMA

## LINKS

<https://cordis.europa.eu/project/id/833881>

<https://andromeda-project.eu/>

### 4.1.13 EU-CIRCLE

Start date 1 June 2015- End date 30 September 2018

#### PROJECT NAME

A panEuropean framework for strengthening Critical Infrastructure resilience to climate change

#### DESCRIPTION

It is presently acknowledged and scientifically proven that climate related hazards have the potential to substantially affect the lifespan and effectiveness or even destroy of European Critical Infrastructures (CI), particularly the energy, transportation sectors, buildings, marine and water management infrastructure with devastating impacts in EU appraising the social and economic losses. The main strategic objective of EU-CIRCLE is to move towards infrastructure network(s) that is resilient to today's natural hazards and prepared for the future changing climate. Furthermore, modern infrastructures are inherently interconnected and interdependent systems ; thus extreme events are liable to lead to 'cascade failures'.

#### RESULTS

EU-CIRCLE's scope is to derive an innovative framework for supporting the interconnected European Infrastructure's resilience to climate pressures, supported by an end-to-end modelling environment where new analyses can be added anywhere along the analysis workflow and multiple scientific disciplines can work together to understand interdependencies, validate results, and present findings in a unified manner providing an efficient "Best of Breeds" solution of integrating into a holistic resilience model existing modelling tools and data in a standardised fashion.

It, will be open & accessible to all interested parties in the infrastructure resilience business and having a confirmed interest in creating customized and innovative solutions. It will be complemented with a webbased portal. The design principles, offering transparency and greater flexibility, will allow potential users to introduce fully tailored solutions and infrastructure data, by defining and implementing customised impact assessment models, and use climate / weather data on demand.

Objectives:

- From response & prevention to resilience
- Balancing Priorities
- CIRP, Advanced Modelling and Simulation Environment for Assessing Climate Impacts to Infrastructures
- SimICI a unique reference test-bed
- Innovative local impact assessments
- Reduce uncertainties
- Contribute to Climate impact assessment standards
- Scientific Support to policies and CI stakeholders
- EU-CIRCLE as a vehicle to Industry Growth

## **PARTNERS**

- "NATIONAL CENTER FOR SCIENTIFIC RESEARCH ""DEMOKRITOS"""
- FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.
- METEOROLOGISK INSTITUTT
- THE UNIVERSITY OF EXETER
- MORSKI W GDYNI
- ARTELIA EAU ET ENVIRONNEMENT SAS
- SATWAYS - PROIONTA KAI YPIRESIES TILEMATIKIS DIKTYAKON KAI TILEPIKINONIAKON EFARMOGON ETAIRIA PERIORISMENIS EFTHINIS EPE
- ENTENTE POUR LA FORÊT MÉDITERRANÉENNE
- RINA CONSULTING SPA
- DRZAVNI HIDROMETEOROLOSKI ZAVOD
- XUVASI LTD
- MRK MANAGEMENT CONSULTANTS GMBH
- EUROPEAN UNIVERSITY CYPRUS
- KENTRO MELETON ASFALEIAS
- THE UNIVERSITY OF SALFORD
- Drzavna uprava za zastitu i spasavanje
- ADDITISS ADVANCED INTEGRATED TECHNOLOGY SOLUTIONS & SERVICES LTD
- THE COUNCIL OF THE BOROUGH OF TORBAY

- MINISTRY OF NATIONAL DEFENCE, GREECE
- VELEUCILISTE VELIKA GORICA
- UNIVERSITY OF HUDDERSFIELD

## LINKS

<https://cordis.europa.eu/project/id/653824>

<https://www.eu-circle.eu/>

### 4.1.14 STAMINA

Start date - End date

#### PROJECT NAME

Smart support platform for pandemic prediction and management

#### DESCRIPTION

Infectious diseases have the potential to result in serious cross-border public health threats. Management of this type of crisis remains a serious challenge due to number of people involved, the different legal, administrative, professional and political cultures, and the lack of transboundary crisis management infrastructures.

STAMINA helps to overcome these challenges by providing improved decision-making technology to pandemic crisis management practitioners at a regional, national and European level.

The project will target two stages of the emergency management cycle: Preparedness and Response.

The STAMINA solution provides national planners, regional crisis management agencies, first responders and citizens with new tools as well as a clear guide to how they can be used in line with international standards and legislation.

The STAMINA vision has been designed through a user perspective, with five main objectives:

- Create a set of guidelines and best practices to improve preparedness and response.
- Provide stakeholders with novel, easy-to-use software tools that complement EU-level systems.
- Increase diagnostic capability.
- Improve cooperation between and within the EU Member States and neighbouring countries.
- Ensure the sustainability of the STAMINA solution.

#### RESULTS

STAMINA will be developed using a combination of pre-existing technology not currently used by health emergency planners or first responders in Europe in their daily practice of pandemics management. It will function through its partnership with a set of guidelines and best practices, and a key focus on ethics and public trust.

The method involves gathering data in order to predict potential threats, assess impact on financial and societal levels, and recommend mitigation actions. An intelligent decision support toolset with a map-based interface will be the main technical outcome of the project.

The STAMINA toolset will include:

- Real-time web and social media analytics
- Wearable and portable diagnostic devices
- Predictive modelling
- An early warning system
- A crisis management tool
- A preparedness pandemic training tool
- A common operation picture

## **PARTNERS**

- EXUS SOFTWARE MONOPROSOPI ETAIRIA PERIORISMENIS EVTHINIS
- INSTITUTE OF COMMUNICATION AND COMPUTER SYSTEMS
- AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH
- CRISISPLAN BV
- INTRASOFT INTERNATIONAL SA
- SQUAREDEV
- SATWAYS - PROIONTA KAI YPIRESIES TILEMATIKIS DIKTYAKON KAI TILEPIKINONIAKON EFARMOGON ETAIRIA PERIORISMENIS EFTHINIS EPE
- TRILATERAL RESEARCH LTD
- BIOCOS IKE
- EIGEN VERMOGEN VAN HET INSTITUUT VOOR LANDBOUW- EN VISSERIJONDERZOEK
- MCS DATALABS
- INNOSYSTEMS SYMVOULEUTIKES YPIRESIES KAI EFARMOGES PLIROFORIKIS YPSILIS TECHNOLOGIAS MONOPROSOPI IDIOTIKI KEFALAIOUCHIKI ETAIREIA
- BRUNEL UNIVERSITY LONDON
- ISTITUTO PER L'INTERSCAMBIO SCIENTIFICO
- VERISK ANALYTICS GMBH
- WESTFAELISCHE WILHELMS-UNIVERSITAET MUENSTER
- UNIVERZA V MARIBORU
- BYS GRUP BILISIM SISTEMLERI DANISMANLIK TICARET VE SANAYI ANONIM SIRKETI
- TECHNOLOGICKA PLATFORMA ENERGETICKABEZPECNOST CR ZS
- INSTITUT PASTEUR DE TUNIS
- BEIA CONSULT INTERNATIONAL SRL
- ERASMUS UNIVERSITAIR MEDISCH CENTRUM ROTTERDAM
- ASSISTANCE PUBLIQUE HOPITAUX DE PARIS
- ZDRAVSTVENI DOM DR ADOLFA DROLCA MARIBOR
- JOHANNITER OSTERREICH AUSBILDUNG UND FORSCHUNG GEMEINNUTZIGE GMBH
- CRUZ ROJA ESPANOLA
- FILIALA DE CRUCE ROSIE SECTOR 5
- ETHNIKO KAI KAPODISTRIAKO PANEPISTIMIO ATHINON
- FUNDACION DE LA COMUNIDAD VALENCIANA PARA LA INVESTIGACION, PROMOCION Y ESTUDIOS COMERCIALES DE VALENCIAPORT
- AYUNTAMIENTO DE VALENCIA

- ETHNIKOS ORGANISMOS DIMOSIAS YGEIAS
- NACIONALINIS VISUOMENES SVEIKATOS CENTRAS PRIE SVEIKATOS APSAUGOS MINISTERIJOS
- MINISTRY OF HEALTH
- Turkiye Cumhuriyeti Saglik Bakanligi
- OBSERVATOIRE NATIONAL DES MALADIES NOUVELLES ET EMERGENTES
- Department of Health
- MINISTRY OF THE INTERIOR OF THE CZECH REPUBLIC
- INSTITUTUL DE VIRUSOLOGIE STEFAN S. NICOLAU

## LINKS

<https://cordis.europa.eu/project/id/883441>

<https://stamina-project.eu/>

### 4.1.15 TeamAware

Start date 1 May 2021- End date 30 April 2024

#### PROJECT NAME

Team Awareness Enhanced with Artificial Intelligence and Augmented Reality

#### DESCRIPTION

First responders are the first to arrive and provide assistance at the scene of an emergency that requires rescue operations and crisis management. However, despite their heroic services, first responders often struggle with inefficient and old technologies. Advanced technology like smart sensor systems, wearables, data processing, data fusion, data analytics, communication infrastructure and AI can dramatically improve performance. The EU-funded TeamAware project will develop an integrated and cost-efficient situational awareness system with heterogeneous and interoperable sensor units. It will include drone-mounted, wearable and external sensor systems, existing first responder services and operational centres. Highly standardised augmented reality and mobile human-machine interfaces will increase the flexibility and reaction ability of first responders.

#### RESULTS

**First responders** are the groups of people, services and organisations with specialised skills and qualifications whose duty is to arrive first to the emergency zone, search, save and rescue operations, and perform **crisis management** in natural or **human-made disasters**. Although first responders provide secure and safe societies by protecting the communities,

responding to the disasters and rescuing lives, they often use inefficient, weak and obsolete technologies in the operations. With respect to the current situation, the operational capabilities of the first responders can be dramatically boosted by the advances in technology and engineering fields such as smart sensor systems, wearables, data processing, data fusion, data

analytics, communication infrastructure, and artificial intelligence tools. The main objective of **TeamAware** Project is to develop an integrated and cost-efficient situational awareness system for first responders from different sectors with heterogeneous and hardly interoperable sensor units including drone mounted, wearable, and external sensor systems, existing first responder services, and operation centres. The purpose is to enhance crisis management, flexibility and reaction capability of first responders of different sectors through real-time, fused, refined, filtered, and manageable information by using highly-standardized augmented reality and mobile human machine interfaces.

## **PARTNERS**

- SOFTWARE IMAGINATION & VISION SRL
- TREE TECHNOLOGY SA
- THALES SIX GTS FRANCE SAS
- CENTRO EUROPEO DI FORMAZIONE E RICERCA IN INGEGNERIA SISMICA
- ASOCIACION DE INVESTIGACION DE LA INDUSTRIA TEXTIL
- MICROFLOWN AVISA BV
- DUNE S.R.L.
- INNOVA INTEGRA LIMITED
- SRDC YAZILIM ARASTIRMA VE GELISTIRME VE DANISMANLIK TICARET ANONIM SIRKETI
- AIT AUSTRIAN INSTITUTE OF TECHNOLOGY GMBH
- FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.
- LUCIAD NV
- ENIDE SOLUTIONS .S.L
- SABANCI UNIVERSITESI
- ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS
- ETICAS RESEARCH AND INNOVATION
- HAVELSAN HAVA ELEKTRONIK SANAYI VE TICARET
- RESILIENCE ADVISORS (EUROPE) LIMITED
- BURSA BUYUKSEHIR BELEDIYESI
- ACIL AFET AMBULANS HEKIMLERI DERNEGI
- ASSOCIACAO HUMANITARIA DOS BOMBEIROS VOLUNTARIOS DE PENICHE
- JOHANNITER OSTERREICH AUSBILDUNG UND FORSCHUNG GEMEINNUTZIGE GMBH
- SERVICIUL DE PROTECTIE SI PAZA
- ELLINIKI ETAIREIA EPEIGOUSAS PRONOSOKOMEIAKIS FRONTIDAS

## **LINKS**

<https://cordis.europa.eu/project/id/101019808>

### **4.1.16 FIRESPELL**

Start date 04.01.2020- End date 31.12.2022

## **PROJECT NAME**



## **Fostering Improved Reaction of crossborder Emergency Services and Prevention Increasing safety Level**

### **DESCRIPTION**

FIRESPELL overall objective is to enhance the capacity of Emergency Service Organizations to increase cross-border effectiveness in tackling natural and man-made disasters, decreasing the exposure of the populations to the impact of hazards and increasing the safety of the Croatian and Italian Adriatic basin by improving emergency prevention and management measures and instruments. Project joint activities will be implemented per each risk taken into consideration, aiming at:

- (a) the improvements of existing Emergency Services Regulatory System;
- (b) the improvement of Emergency Management Systems (EMS) in terms of new and innovative solutions;
- (c) the activation of citizens' participatory process. Specific actions will be dedicated to each main risk in chosen pilot areas (fire, oil spill and other marine hazards, earthquake, pandemic).

### **RESULTS**

The enhancement of Emergency Service Organizations' operational capabilities will be ensured by provision of safety equipment, emergency land and sea vehicles, mobile command and control units, communications systems, and Advanced Training Center establishment. Improvements in the governance area will be achieved by comparing the current civil protection legislation in the two countries to identify their homogenization level and the arguments on which to intervene to improve the overall system efficiency.

Joint approaches will be adopted for the development of common monitoring strategies and a disaster management system, through strengthening administrative and technical capacities, raising awareness, educating, equipping, and preparing population and rescue teams.

The participatory process of citizenship will be activated addressing and altering the population role from "vulnerable element" to "active sensor" during hazardous occurrences, in order to: (a) obtain its contribution to Civil Protection activities of natural and manmade risk forecasting, prevention, monitoring and management within its own living territory;

- (b) to educate to a proper behavior and a thorough knowledge of risk issues and
- (c) to reduce the natural and man-made phenomena that lead to emergencies.

### **PARTNERS**

- PUBLIC INSTITUTION RERA S.D. FOR COORDINATION AND DEVELOPMENT OF SPLIT DALMATIA COUNTY
- ABRUZZO REGION
- EMILIA-ROMAGNA REGION
- ENVIRONMENTAL PROTECTION AGENCY OF FRIULI VENEZIA GIULIA
- VENETO REGION
- SPLIT DALMATIA COUNTY
- EUROPE POINT CONSORTIUM

- DUBROVNIK NERETVA REGION
- ADRIATIC TRAINING AND RESEARCH CENTRE FOR ACCIDENTAL MARINE POLLUTION PREPAREDNESS AND RESPONSE – ATRAC
- ZADAR COUNTY
- MARCHE REGION
- REGION OF ISTRIA
- DEVELOPMENT AGENCY OF ŠIBENIK-KNIN COUNTY
- PUGLIA REGION - CIVIL PROTECTION DEPARTMENT
- PORT CAPTAINCIES – COAST GUARD CORP, MARITIME DIRECTION OF PESCARA

**LINK**

<https://www.italy-croatia.eu/web/firespill>

## 5 Conclusions and recommendations

---

This study following the previous observatory report, confirmed the finding as far as it concerns the main actions of projects that deal with issues related to hazards and crisis management. More specifically, more projects were studied which are among the most up-to-date in the field as they have either been implemented in the last two - three years or they are still running. All efforts made or proposed in these projects are targeted at four (4) main actions. Furthermore, all highlighted key indicators characterize or result from these 4 main actions.

The first action refers to the **cooperation-training**. It became clear that the effort to deal with natural hazards is no longer a matter of just one service or one country. Cooperation among local, regional, national and even international services is needed. To this end, the development of a communication network is a high priority in order to make cooperation possible and effective.

The second action refers to the **collection of information**, which is not as simple as it seems. The utilization of every possible means for gathering information about natural hazards is a need. Furthermore, the channel could be also used by authorities and volunteers before and during a crisis occurs in order to deal more effectively with the situation. In this context, social applications gain more and more attention.

The third action is to **awareness** and the development of appropriate **alert systems**. This will be achieved by utilizing the two previous actions. For example, social platforms used by citizens to collect and send information, in real time, will inform with notifications or live maps for places / areas at risk. The warning system can also be used during the action / mobilization of the first responders in order to have a clear picture of the evolution of the phenomenon around them.

The fourth action is related to a **crisis management model** that will utilize all the above. Handling a crisis requires the coordination of multiple types of stakeholders and volunteers, sometimes even from different countries (wildfires (2021) in Greece was such a case). Hence, one of the key requirements to manage crisis is to have access to Situational Awareness. Both public and private stakeholders require adequate solutions in organization, procedures and technological capabilities to be able to respond timely and effectively. Thus, there is a need to develop specific standards that enable various public and private organizations within Europe or internationally to be effectively coordinated ensuring as much as possible a smoothly cooperation before, during and after an event.

Additionally, to the above finding the study proceeded with a comparative analysis of emergency response operations and of improving the resilience of citizens in Croatia, Greece and North Macedonia. At first, actual crises that illustrate what national crisis management systems have actually done to address emergencies were taken into account. These cases revealed which groups were affected, how vulnerable groups were managed during the crisis as well as how volunteers were involved. For purposes of better understanding, cases of floods, wildfires and earthquakes were taken into account from all three countries. Next, the study proceeded with **disaster classification** in order to provide a comparative finding. For this purpose, based on a literature review, nine classification criteria were adopted in attempt to discuss important parameters of each disaster. These criteria are the effect, the cause, the duration, the extent, the casualties, the nature of injuries, the rescue time, the type as well as the severity of the emergency case. Among the finding that reported, it is worth mentioning that there are many cases that the response time is medium, in other words 6-24 hours, in some cases this was one of the parameters that lead to major losses.

Next, a comparison of the approaches in terms of managing authorities, vulnerability etc was conducted in order to reveal similarities as well as differences. First of all, the National Emergency / **Disaster Management Authority** although they have different organizational structures present mostly the same principles, services and goals. In this context, the key tasks and perspectives of each authority/country were presented. Other quite similar context is that of **vulnerability**. Although, from a conceptual and empirical perspective there are differences, mainly due to different vulnerability understanding, from a situation-dependent perspective there is an undoubtable similarity in all countries. All three countries, similar to other countries in the South Eastern and Central Europe, is exposed to a range of natural hazards, particularly, floods, wildfires and earthquakes but of course at a different extent. The study presented each country in terms of vulnerability, revealing that all countries face similar hazards in an accelerating scale over the last years. As far it concerns the vulnerability elements, e.g. individual lack of skills, quite similar approaches were detected such as evacuation and relocation of people with the involvement of local authorities and volunteers. Another similarity was the acknowledgement of the importance of a **civil protection volunteering system**. The study presented the structure of volunteering organization and protection in each country and despite the legal differences, in all cases volunteers are considered important and public is enhance to participate and get appropriate training. Volunteers play a key role in Disaster Risk Management, since they are an invaluable resource. Volunteers organisations are involved in civil protection (e.g. volunteers firefighters and Red Cross local groups) are very effective and all counties try to enhance volunteering. Civil protection authorities intervene to protect, promote and recognize volunteers' organisations, although they use different organizational structures. This study proposes, in this directions, the development of strong local first response networks since volunteers must have a clear, meaningful and acknowledged role within the national and local system and a clear legal framework is indispensable to secure their activities. Furthermore, joint exercises (which is one of the scope of this project) with national authorities as well as border cooperation/ development of international, regional and national programs would improve the way to use volunteers in emergency situations.

Yet, some differences were detected too. The **assessment and crisis management structure** defers from country to country. Croatia and Greece prefer political actors such as civil defense and (interior, civil protection) ministries while the Republic of North Macedonia have set responsible the Ministry of Defence. Of course, risk assessment protocols appear a lot of similarities. Another key factor that reveal some differences is the how countries understand and deal with **resilience**. In this context, there is a bit of diversity amongst crisis/resilience management structures, since each country define it differently, implement it differently, and fund related action in different ways. Most cases include information actions while there are some first resilience plans involving even private sector. Yet, each country focus on different fields. There is still a lot of work to be done on building the necessary resilient abilities that will help population to be self-sufficient to deal and recover from a crisis. Furthermore, generally acceptable metrics that would reveal the accomplished level of resilience at local, regional and national level is still missing. As far as it concerns critical infrastructures, in most studied countries, the focus is on material whereas as far as it concerns societal resilience the focus in on campaigns aiming to support civilian responsibility to local level (e.g. volunteers). Finally, all countries try to take advantage from EU and national funding as well as private corporate social responsibility to support an equitable and effective resilience policy. Finally, some of the most important lessons learned are summarized in relation to floods, earthquakes, wildfires as well as volunteer networking.

## **Annex I: Template for project presentation and analysis**

---

To keep the time-consuming data collection work to a minimum level, we only added information of projects relevant to the RESISTANT project as listed and explained below.

<b>Field Name</b>	<b>Description</b>
Acronym	Abbreviation of the project, if any
Duration	Start and end date of project
Project Name	Complete name of the project. Brief explanation, if applicable
Description	Main objectives and key topics of the project
Results	Results of the project
Partners	Lead partner (first in of the list)
Links	Link to website of project, if available

## References

---

- [1] Nemanja Pancic (17 May 2014). "Cyclone Tamara". Kamerades. Retrieved 13 October 2021.
- [2] Floods have united the people of the Balkans | Andrej Nikolaidis | Opinion | The Guardian. Available at <https://www.theguardian.com/commentisfree/2014/may/20/floods-people-balkans-yugoslavia>. Retrieved 13 October 2021.
- [3] Flood defence plan for Area C14, 2014, p. 8. Retrieved 10 October 2021.
- [4] Strongest earthquake in 140 years rattles Croatia's capital; at least 1 dead". *upi.com*. Retrieved 23 July 2021.
- [5] "Global Catastrophe Recap - September 2020". Aon Benfield. 8 October 2020. p. 6. Retrieved 9 October 2021.
- [6] Soulios, G., Stournaras, G., Nikas, K., & Mattas, C. (2018). The floods in Greece: the case of Mandra in Attica. *Bulletin of the Geological Society of Greece*, 52(1), 131-144. doi:<https://doi.org/10.12681/bgsg.16419>.
- [7] "Initial evaluation of the results of the fire in Northern Euboea". *archive. ph*. September 2, 2021. Retrieved 2 September 2021.
- [8] North Macedonia: Wildfires - Emergency Plan of Action (EPoA) DREF Operation n° MDRMK009, Retrieved 10 November 2021.
- [9] Carr, L.J. (1932). Disaster and the sequence-pattern concept of social change. *American Journal of Sociology*, 38, 207–218.
- [10] Fritz, C.E. (1961). Disasters. In R.K. Merton & R.A. Nisbet (Eds.), *Contemporary social problems. An introduction to the sociology of deviant behavior and social disorganization* (pp. 651–694). Riverside, CA: University of California Press
- [11] Picou, J. S., & Martin, C. G. (2006). *Community Impacts of Hurricane Ivan: A Case Study of Orange Beach Alabama - Quick Response Research Report 190*. Colorado
- [12] Pyles, L. (2007). Community organizing for post-disaster social development. *International Social Work*, 50(3), 321-333.
- [13] Kroll-Smith and Gunter, (1998), "Legislators, Interpreters and Disasters: The Importance of How as well as What is Disaster?", *What is a Disaster: A Dozen Perspectives on the Issue*, pp. 160-176. New York: Routledge.
- [14] Britton, N.R. (1986). Developing an understanding of disaster. *Australian and New Zealand Journal of Sociology*, 22, 254–272.
- [15] Quarantelli, E.L. 2005. *Catastrophes are different from disasters: Understanding Katrina*. Available at <http://understandingkatrina.ssrc.org/quarantelli>. Retrieved 2 September 2021.
- [16] Rutherford, W. Definition and classification of disaster. In: MacMahan J, Jooste P. *Disaster Medicine*. Balhame: Cape Town. 1980.
- [17] Fagel, M. (2011). *Principles of Emergency Management and Emergency Operations Centers*, CRC Press, Taylor & Francis Group New York
- [18] Hood, C., Rothstein, H., & Baldwin, R. (2001). *The government of risk: Understanding risk regulation regimes*. Oxford: Oxford University Press.
- [19] Boin, A., Comfort, L., & Demchak, C. (2010). *Designing Resilience for Extreme Events*. (A. Boin, L. Comfort, & C. Demchak, Eds.). Pittsburgh: Pittsburgh University Press.
- [20] Rhinard, M. (2017). Resilience: a false promise for the EU's Global Strategy? In F. Gaub & N. Popescu (Eds.), *After the EU Global Strategy: building resilience* (pp. 25–29). Paris: EU-ISS.

- [21] «Tectonic Summary of Greece». U.S. Geological Survey. U.S. Department of the Interior. Retrieved 20 Απριλίου 2021.