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Executive Summary

Recent natural and manmade disasters have shown gaps in the level of preparedness of European society for disasters, highlighting the importance of increasing risk awareness, which ensures a direct positive impact on citizen and organisational resilience among people and decision-makers in Europe.

Recognising the need to examine, explore, capture and compare the challenges of effectively responding to all manner of major disasters and crises to improve societal resilience and compliance, project CORE (sCience & human factOr for Resilient sociEty) strategic objectives include conducting a thorough and in-depth analysis of natural and manmade disasters and crisis incident case studies. This analysis seeks to extract lessons learnt from a variety of perspectives including human factors, organizational issues and quantitative and qualitative aspects of lessons learnt from societal aspects, including gender and ethnicity, education, income, physical abilities. For this to be effectively achieved, a set of challenging use case disaster scenarios are required to be identified, and research undertaken to capture data to be recorded in a consistent and coherent way, from which sound comparative analysis could thereafter be conducted to reveal common themes, best practices and lessons learned to improve resilience to future disasters.

This report serves to explain the methodological approach undertaken to conduct research to capture data in support of a suite of identified natural and manmade use case disaster scenarios including terrorist attack, earthquake, flash flooding, wildfire, industrial accident, tsunami, and pandemic. The cooperation and collaboration of 11 CORE partners from 10 member states was achieved to complete this research, and included organisations across academia, emergency response agencies, and the private sector. The close collaborative partnership developed between beneficiaries ensured that the adoption of measures to ensure consistency of quality assurance and quantity management across the suite of disaster scenarios was effectively achieved.

The primary output of this *Natural and Manmade Disaster Case Study Identification, Research and* Analysis report is contained within the seven presented use cases, providing evidence of substantial research and data capture. The completion of the set of seven use case disaster scenarios meets the intended objectives of the assigned task, providing a suite of consistent and coherent case studies that can now be compared and analysed to improve disaster resilience, response, and recovery as part of the next important phase of project CORE under Task 2.*5 – Natural and man-made disaster scenarios comparative analysis.* The completion of the *Natural and Manmade Disaster Case Study Identification, Research and Analysis* marks an important milestone in the continued progress and development of project CORE, fulfilling the requirement to examine, explore, and capture the challenges of effectively responding to all manner of major disasters and crises to improve societal resilience and compliance.

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Acronyms

AutRC	Austrian Red Cross
CORE	sCience & human factOr for Resilient sociEty
COVID-19	Severe acute respiratory syndrome coronavirus 2
CRI	Italian Red Cross – Vicenza Committee
DRR	Disaster Risk Reduction
D 2.2	Deliverable 2.2 Natural and manmade disaster case study identification, research and analysis
ETHZ	Swiss Federal Institute of Technology Zurich
EU	European Union
GA	Grant Agreement
H2020	Horizon 2020 Programme
HANKEN	Hanken School of Economics
HUD	University of Huddersfield
INFC	Italian National Fire Corp
ISSNOVA	Institute for Sustainable Society & Innovation
KOM	Kick-Off Meeting
MR	Multi-Risk
UNISA	National Authority for Fire & Rescue
NGO	Non-Governmental Organisation
REA	Research Executive Agency
SAHER	SAHER (Europe) OU
SDG	Sustainable Development Goals
SEC	Security
UN	United Nations
UNISA	University of Salerno
WP	Work package
WP2	Work Package 2: Natural and Manmade Disasters

Introduction

A common lesson learnt from previous disaster crisis situations is the need to optimise public information communication to promote risk awareness and vigilance without raising levels of fear, uncertainty and insecurity leading to public panic. Societal acceptance and public compliance with official public safety instructions represents a major challenge for managing risk during all manner of crises and disaster events. An orderly evacuation during a volcanic crisis is as essential as maintaining social distancing during a pandemic. Following advice from authorities during sustained and ongoing terrorist attacks is essential to ensure citizens do not put themselves at greater risk. Public compliance with regulations is also key to minimising adverse behaviours in triggering forest fires and industrial accidents. Optimal crisis decision-making can be negated by a lack of sufficient public compliance, therefore, a prerequisite for societal disaster resilience is achieving public compliance.

Recognising the need to examine, explore, capture and compare the challenges of effectively responding to all manner of major disasters and crises to improve societal resilience and compliance, project CORE (sCience & human factOr for Resilient sociEty) strategic objectives includes conducting a thorough and in-depth analysis of natural and manmade disasters and crisis incident case studies to extract lessons learnt from a variety of perspectives, including human factors, organizational issues and quantitative and qualitative aspects of lessons learnt from societal aspects, including gender and ethnicity, education, income, physical abilities. Moreover, project CORE seeks to identify and forensically examine the public messaging challenges faced by authorities responsible for decision-making and associated processes to inform and share public information during the identified series of case studies, extracting best practices and lessons learned, including screening for ethics core-values that need to be further applied.

To effectively achieve these key objectives, a methodological approach has been designed, developed, and delivered by the publication of the *Disaster Scenarios Analysis Framework* within *Work Package 2: Natural and Manmade Disasters*. *The* CORE *Disaster Scenarios Analysis Framework* is supported and underpinned by guidance within a framework to ensure consistency of research and captured data to be analysed. The CORE *Disaster Scenarios Analysis Framework* serves to shape the scale and scope of research activities within CORE *Work Package 2: Natural and Manmade Disasters,* providing a framework for CORE consortium partners within which to conduct their research and analysis of natural and manmade disasters. The use of the *CORE Disaster Scenarios Analysis Framework* and Use Case Template were essential tools to guide and inform the approach of *Deliverable 2.2 Natural and manmade disaster case study identification, research and analysis(D2.2)*. This report serves to explain and present the research and data captured for each of the identified use case, enabling the effective future comparative analysis of multiple disaster scenarios within *Work Package 2: Natural and Manmade Disasters (WP2)*.

1. Methodology

1.1 Programme of work

Delivery of the *D2.2 Natural and manmade disaster case study identification, research and analysis* has been informed following extensive review of the research requirements, structures and timescales set out in the CORE programme of work agreed by CORE consortium partners, ratified by the European Union (EU) Horizon 2020 Programme under Grant Agreement (GA) 101021746 following the description provided of *Task 2.2: Natural and manmade disaster case study identification, research and analysis (T2.2.)*. This task, being led by CRI and AutRC, involved UNISA, ISSNOVA, ETHZ, HUD, SAHER, HANKEN, MTO, UNISA, and HFOD as contributing partners. This task involved the identification of a set of seven natural and manmade disaster case studies for investigation and analysis as follows:

- **Use Case 1: Terrorist Attack:** Manchester Arena bombing (UK) on 22 May 2017 - led by **UNISA**
- **Use Case 2: Earthquake**: Aquila (ITALY) on 6 April 2009 - led by **UNISA** and **ETHZ**
- **Use Case 3: Flash Flooding:** Aude region (FRANCE) 14-15 October 2018 – led by **SAHER**
- **Use Case 4: Wildfire:** Judean Mountains, Jerusalem (ISRAEL) 15-19 August 2021 – led by **UNISA**
- **Use Case 5: Industrial Accident:** Venkata Puram (INDIA) 7 May 2020 – led by **SAHER**
- **Use Case 6: Earthquake & Tsunami:** Great East (JAPAN) 11 March 2011 – led by **HUD**
- **Use Case 7: Pandemic:** COVID-19 (CHINA) 19 December 2019 - led by **HANKEN&CRI**

Following the *Natural and manmade disaster scenarios analysis framework* provided by Task 2.1 and the delivery of D2.2, the purpose of Task 2.2 includes conducting in-depth analysis of identified case studies examining public information sharing challenges, ethical issues and extracting lessons learned. Particular attention was also to be given to the lessons learned by the recent COVID- 19 experience. This task also provides an analysis of cascading effects modelling for each of the identified case studies. This analysis will determine the cascade effect of the identified case studies, assessing the inevitability of unforeseen chain of events affecting the response to natural and manmade disasters   and crises.

In approaching the delivery of this task, the CORE consortium of partners contributing to T2.2 and D2.2 recognise that safety depends on beliefs, knowledge and behaviours of all human actors involved at any stage of a disaster. How individuals and groups apply knowledge, interpret data, and adopt their own criteria for decision making with respect to known and unknown risks in safety critical situations is strongly affected by their culture, values, behaviours,

and knowledge commonly shared within a community. In the Disaster Risk Reduction (DRR) context, culture and safety culture are the framework that enable individuals and organizations to reach an appropriate risk awareness, to benefit from shared knowledge and practices, to engage themselves in cooperative and more effective disaster management. Within this framework, as described in the CORE Grant Agreement Part B, the CORE project methodological approach relies upon the following five building blocks:

Building block 1: Safety culture - In any safety critical context, high levels of safety performance are only achievable with a proper safety culture, that make people able to develop awareness of the situation (clear picture of present and future state of a situation), make wise judgement, undertake proper actions at personal and collective level.

Building block 2: Social media support & threats to safety culture & community resilience - The efficiency of the spread of information through social media depends on many factors. Among these there are trust in this source of information, perceptions about easiness of its use, existing digital infrastructure, experience of usage, examples from peers and many others.

Building block 3: Disaster scenarios, human behaviour & disaster community identity as resilience factors - Collective elaboration (social and cultural) of risk is a historical and social product. It arises from a public debate (i.e. from the level and quality of information, from the credibility of the political and scientific institutions, from the predictive ability of science, from the experienced/supposed rescue capacity, from local beliefs and knowledge, from the feasibility and acceptability of emergency management plans and from the priority between different risks).

Building block 4: Cascading effects - Societal resilience is eroded by a lack of awareness and preparedness for a sequence of cascading effects which may be associated with an initial triggering event. The high multiplicity of potential cascading effects is exemplified by the COVID-19 global crisis.

Building block 5: Governance - In the context of governance, which is multi-stakeholder and multi-layered, different actors will have different perceptions and evaluations of risk; they will have different types of knowledge and evidence; and they will have different incentives and political interests

The delivery of D2.2 Natural and manmade disaster case study identification, research and analysis has been designed with due cognisance of the 5 building block methodological approach, serving to frame and provide the parameters within which the appropriate scale and scope of disaster analysis should be delivered.

1.2 Work Package 2 Framework Programme integration

At the commencement of *Work Package 2: Natural and Manmade Disasters* in M1 of the CORE project during September 2021, it became clear to WP2 leaders SAHER that a programmed approach of all WP2 tasks was required. The approach of WP2 was therefore developed and designed in the programme

presented in *D2.1 Disaster Scenario Analysis Framework Programme*, shown below in *Table 1: Disaster Scenario Analysis Framework Programme* which provides the framework and schedule for activities completed and presented in this report.

Table 1: Disaster Scenario Analysis Framework Programme

PHASE 1: Disaster Scenario Research Requirements [M1-12]

Month	Date	Event	Purpose
M1	September 2021	WP2 CORE KOM Consortium Meeting	To provide an overview of the aim of WP2 and introduce WP2 tasks, timescales, and Deliverables
M2	October 2021	WP2 Partners Meeting	To introduce WP2 Task 2.1 and identify interdependencies with WP2 tasks
M4	December 2021	WP2 & WP3 Leaders Meeting	To examine and explore WP2 & WP3 tasks, activities, Deliverables, and interdependencies
M7	March 2022	Disaster Scenario Use Case Template Version 1	To publish initial version of the template and seek feedback from partners
M9	May 2022	Workshop 1 - Disaster Scenario Analysis Framework	To examine WP2 tasks, activities, Deliverables, and interdependencies with WP3, WP4 & WP7
M9	May 2022	Disaster Scenario Use Case Template Version 2	To publish second iteration of the template and seek further feedback from WP3, WP4 and WP7
M10	June 2022	Workshop 2 - Disaster Scenario Analysis Framework	To explore WP2 tasks, activities, Deliverables, and interdependencies with ALL CORE project partners
M11	July 2022	Disaster Scenario Use Case Template Version 3	To publish final version of the Disaster Scenario Use Case Analysis template
PHASE 2: Disaster Scenario Analysis Knowledge Exchange [M12-18]			
M14	October 2022	Disaster Scenario Use Case Analysis Presentation (1)	To present findings and data captured for each use case keeping all partners sighted on research
M15	November 2022	Disaster Scenario Use Case Analysis Presentation (2)	To present findings and data captured for each use case keeping all partners sighted on research
M16	December 2022	Disaster Scenario Use Case Analysis Presentation (3)	To present findings and data captured for each use case keeping all partners sighted on research
M17	January 2023	Disaster Scenario Use Case Presentation & Conclusion (4)	To present key research findings and draw initial conclusions for each use case
PHASE 3: Disaster Scenario Comparative Analysis [M18-24]			
M19	March 2023	Workshop 4: Comparative analysis for WP2 and WP3	To compare all use cases, identifying common and critical factors for future disaster risk reduction

| M22 | June 2023 | Workshop 5 Comparative analysis for WP4 and WP7 | To compare all use cases, identifying common and critical factors for future disaster risk reduction |
| M24 | August 2023 | Comparative Analysis Finalisation | To finalise the comparative analysis of all use case disaster scenarios identifying recommendations |

1.3 Staged approach

To effectively deliver the *Natural and manmade disaster case study identification, research and analysis* task, a set of key stages were devised within the schedule created in *PHASE 2: Disaster Scenario Analysis Knowledge Exchange* [M12-18] shown in Table 1 above. The staged approach, specifically designed for *Task 2.2 Natural and manmade disaster case study identification, research and analysis* from which the results are included in this report, were identified as follows:

- **STAGE 1**: Use Case Template design input [M3-M12]
- **STAGE 2**: Use case research and data capture [M12-M16]
- **STAGE 3**: Use case harmonisation and review [M16-18]

1.3.1 Stage 1 - Use Case Template design input

It was considered essential for all partners engaged in the research and development of each use case disaster scenario to actively participate and thereby inform the framework and, more importantly, the use case scenario template designed to record their data and research findings. From M3 during November 2021 to M12 in August 2022, all use case research partners were consulted on the   development of the Use Case Template, including the three iterations of the template Version 1 in M7, Version 2 M9 and the final Version 3 in M11. This engagement served to ensure that all partners involved in the research and development of their respective use case disaster scenarios, had a direct input and influence upon the design of the final use case scenario template. The engagement of each consortium partner across Task 2.2 and Deliverable 2.2, also ensured from an early stage, that issues of a consistent and coherent approach to   each use case was embedded in the template to support future comparative analysis.

1.3.2 Stage 2 - Use case research and data capture

To progress the use case research of all seven use case disaster scenarios, including capturing and the accurate recording of data, a single point of contact (SPOC) was recommended for each use case,   selected by each partner leading the development of their respective case study. The purpose of identifying a SPOC was to ensure effective communication across the seven case studies and to have an identified lead to attend meetings and assigned responsibility to report on progress. The use case leader SPOC's for each case study were identified as follows:

- **Use Case 1: Terrorist Attack** - Use Case Leader: Gordon Woo (UNISA)
- **Use Case 2: Earthquake** - Use Case Leader: Ferdinando Napolitano (UNISA)

- **Use Case 3: Flash Flooding** - Use Case Leader: Meredyd Hughes (SAHER)
- **Use Case 4: Wildfire** - Use Case Leader: Avny Ronnen (UNISA)
- **Use Case 5: Industrial Accident** - Use Case Leader: Meredyd Hughes (SAHER)
- **Use Case 6: Earthquake & Tsunami** - Use Case Leader - Malith Senevirathne (HUD)
- **Use Case 7: Pandemic** - Use Case Leader: Mimmi Pöysti (HANKEN)/Monica Crisan (CRI)

To progress the development of the use cases and to share knowledge, expertise, challenges and capture issues and risks, a set of four meetings was established for the SPOC use case leaders. The purpose of the four use case meetings was to provide a regular forum to present and discuss the development of the use cases, affording an opportunity to check and monitor progress but also to allow for the sharing and identification of best practices. Moreover, the use case meetings provided an opportunity to begin to identify common themes as part of the future comparative analyses of the use cases of PHASE 3 shown above in *Table 1: Disaster Scenario Analysis Framework Programme*. The four Use Case Leaders meeting were conducted on the following dates:

- Use Case Leaders Meeting 1 - 13th October 2022
- Use Case Leaders Meeting 2 - 17th November 2022
- Use Case Leaders Meeting 3 - 15th December 2022
- Use Case Leaders Meeting 4 - 12th January 2023

A summary of each Use Case Leaders Meeting was recorded and key actions captured and circulated. A copy of each of the Use Case Meeting Summaries is shown in Annex 1. The series of meetings, facilitated by WP2 leader SAHER, and co-chaired by Task 2.2 and Deliverable 2.2 leaders CRI and AutRC, led to the timely completion and submission of all seven use case disaster scenario templates.

An important issue that emerged from the very commencement of Stage 2 was the requirement to provide greater granularity of detail to the guidance notes already included in the use case templates shown below in Figure 2: Use Case Template Guidance Notes. The guidance notes in red text provided useful guidance to ensure correct and consistent interpretation of each Use Case Template and field to be completed, but to ensure an increasingly thorough and robust set of guidance for all use case scenario leaders, CRI and AutRC developed a Use Case Guidance for Completion of Template shown in Annex 2. This guidance, as an example, included referencing guidelines to ensure consistency of recording, amplifying the integrity and credibility of the research.

1.3.3 Stage 3 - Use case harmonisation and review

The final stage of completing the Task 2.2 was to provide an opportunity for review of all seven use cases. To this end, each partner was requested to submit their completed use Case, in line with the guidance template. The case studies were individually reviewed by CRI and AutRC where gaps in research, recording of minor details and administrative issues were identified, in order to support the review stage, and to ensure harmonisation across all seven use cases to support

future comparative analysis, a *Use Case Harmonisation Matrix* was devised and is shown in Annex 3. This matrix provided an effective tool to identify inconsistencies in use case scenario template recording across all seven use case complete templates.

All three stages of the use case scenario research and development ensured that all seven use case disaster scenario templates were completed on time to the required standards, each presenting the appropriate quantity of captured data and expected quality to facilitate effective future comparative analysis.

2. Framework programme for Disaster scenario research

The development of *D2.2 Natural and manmade disaster case study identification, research and analysis* was made possible by the design, development, and delivery of the *Disaster Scenarios Analysis Framework. This framework was central in focusing the direction of the use case research and analysis of all use cases.* The visual representation of the framework architecture shown below in *Figure 1: Disaster Scenarios Analysis Framework Model,* communicated the importance of the use case research to all use case lead researchers, which showed what key themes within disaster preparedness, factors and cascades should be included. The development of the *Disaster Scenarios Analysis Framework* was considered incomplete without being moulded into a single model, providing a visual representation of the framework architecture for strategic oversight. The development of the *Disaster Scenarios Analysis Framework* has been designed with due cognisance of the 5-building block methodological approach, serving to frame and provide the parameters within which the appropriate scale and scope of disaster analysis should be delivered. The 5 building blocks of the CORE methodological approach are integrated and visible within the model shown in *Figure 1 Disaster Scenarios Analysis Framework Model* below, reflected by the inclusion of *safety culture*, *social media*, *disaster scenarios, cascading effects,* and *governance*. The model illustrates the central importance of comparative analysis to CORE research while signposting the key areas for analysis across disaster preparedness, cascading effects, and response and recovery factors critical to disaster risk reduction (DRR) development.
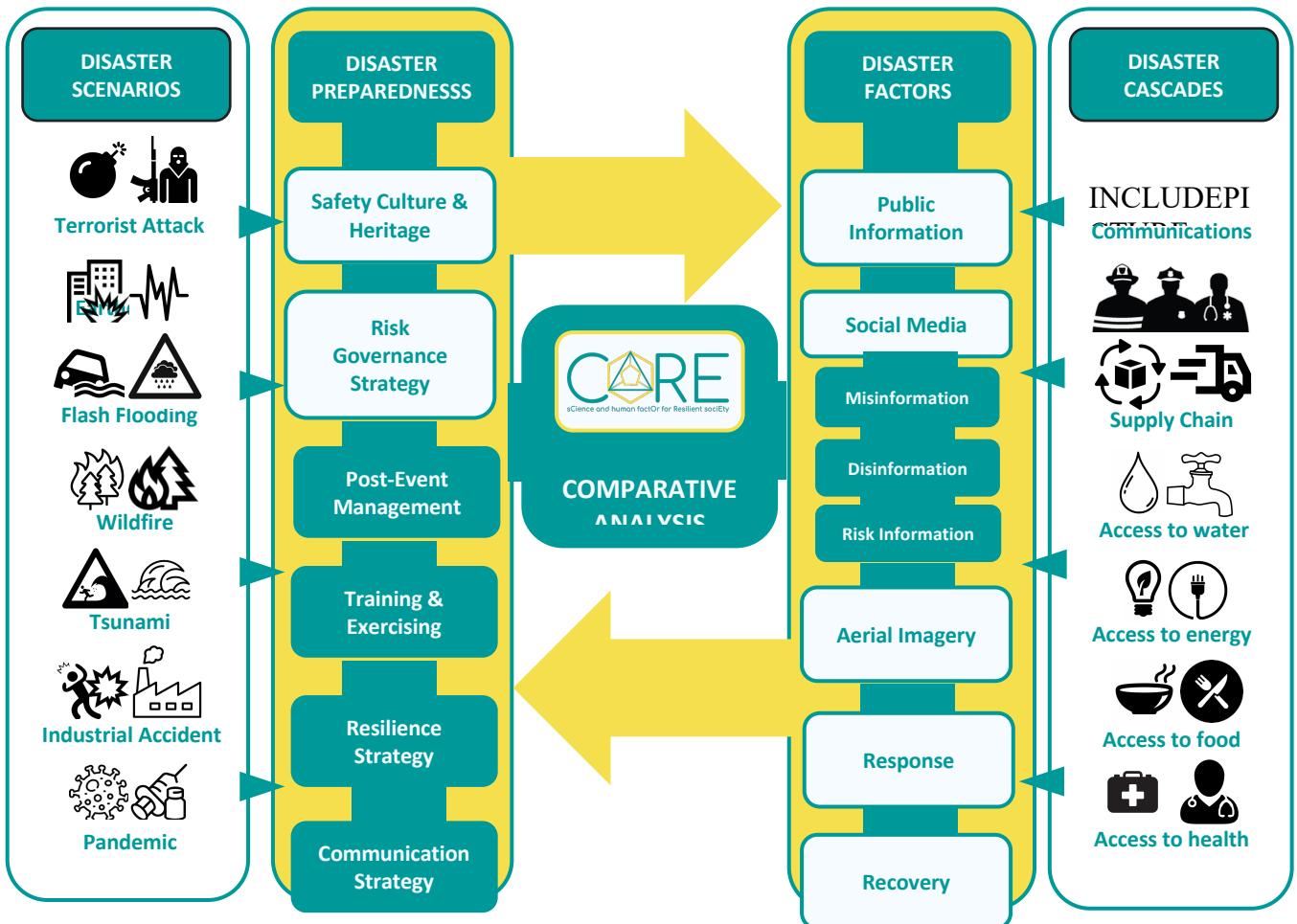
Figure 1 – Disaster Scenario Analysis Framework Model

3. DISASTER SCENARIO CASE STUDIES

The seven identified disaster scenario use cases were recorded in the Use Case Template developed in D2.1 *Disaster Scenario Analysis Framework Programme*. The Use Case Template provided each consortium partner contributing to the research and analysis of each use case within which to shape the scale and scope of the data to be captured and recorded. Other than following the Use Case Template Guidance Notes (Annex 2), each partner was afforded autonomy to progress the research and analysis of their respective use case scenario.

Before starting to read the following sections in this deliberable, it should be kept in mind that this Deliverable and the contribution asked to the leaders of the case study, in this phase of the project, **was to research and complete only the following sections**: i) *Incident*, *Location*, ii) *Time&Data*, iii) *Description and timeline of the incident* and fill iv) *Task 2.2. Natural and manmade disaster case study identification, research, and analysis*. There are partners that completed other sections of the Use Case Template as well so we decided to attach within

the Annexes the entire Use Case Template. The Reference List for each case study includes   all sections of the Use Case Template, so not only the ones mentioned above.

A brief description and overview of each use case is provided in the following sections.

3.1 Development of Case Study 1: TERRORIST ATTACK

Research and analysis of the terrorist attack scenario was progressed by the University of Salerno (UNISA). The Terrorist Attack Use Case was focused upon the event of the Manchester Arena suicide bombing in the UK on 22 May 2017. This incident was widely reported as a major terrorist event and the timing of the research and data collection was timely, given the ongoing public inquiry and investigation into   the incident by the United Kingdom (UK) government. Moreover, a major report was published during the period of research from the Manchester Arena Inquiry alongside the introduction of Martyn's Law in the UK related to a victim of the bombing and new legislation enacted to pass into law requirements for public safety minimum standards of protective measures at event venues.

A copy of the final completed research template is shown in ANNEX 4 – Case Study 1: TERRORIST ATTACK.

3.2 Development of Case Study 2: EARTHQUAKE

Research and analysis of the earthquake scenario was progressed by the University of Salerno (UNISA) and the Swiss Federal Institute of Technology Zurich (ETHZ). This use case focused upon the earthquake in Aquila, Italy, on 6 April 2009. As a major international disaster event, there exists substantial data sets and previous research available for analysis. The earthquake which occurred in Aquila, given its devastating dimensions, provided an important disaster scenario to analyse, complementing the suite of CORE use case scenarios being investigated. The volume of available data required the synthesisation of information from different sources to refine and reduce the captured and recorded data in the Use Case Template.

A copy of the final completed research template is shown in ANNEX 5 – Case Study 2: EARTHQUAKE

3.3 Development of Case Study 3: FASH FLOODING

Research and analysis of the flash flooding scenario was progressed by SAHER. This use case focused upon the flooding of the   Aude region of France which occurred on 14-15 October 2018. Identified government reports were successfully translated from French to English to assist analysis. The flash flooding in France during 2018 provided a recent use case to examine and explore and is an important use case in the suite of identified CORE disaster scenarios because the event was caused by severe weather which remains a critical challenge and consequence of changes in climate. Data was also captured regarding social

media posts which were signposted for future CORE research activities in Work Package 2. A copy of the final completed research template is shown in ANNEX 6 – Case Study 3: FLASH FLOODING.

3.4 Development of Case Study 4: WILDFIRE

Research and analysis of the industrial accident scenario was progressed by UNISA. This use case focused upon the wildfires in the Judean Mountains, Jerusalem, Israel, on 15-19 August 2021. This use case is an important part of the suite of CORE disaster scenarios to be examined being the most recent emergency event. The wildfire scenario research was enriched through the collection of aerial imagery from Unmanned Aerial Vehicles (UAVs) and satellites. This use case also focused upon the rescuing of vulnerable citizens as part of the emergency response. A copy of the final completed research template is shown in ANNEX 7 – Case Study 4: WILDFIRE

3.5 Development of Case Study 5: INDUSTRIAL ACCIDENT

Research and analysis of the industrial accident scenario was progressed by SAHER with support and contributions from MTO. This use case focused upon the industrial incident at Venkata Puram in India on 7 May 2020. The majority of the research to fulfil this task was completed through online desk-top research, coupled with interviews of police officers. There were a series of challenges given the international nature of this incident, and none more so than the incident itself being known by three different names. There were also socio-economic, cultural, and political factors that provided additional challenges to accessing and analysing data as part of the   research but efforts to find information and to cross-reference with multiple sources was achieved. A copy of the final completed research template is shown in ANNEX 8 – Case Study 5: INDUSTRIAL ACCIDENT

3.6 Development of Case Study 6: TSUNAMI

Research and analysis of the tsunami scenario was progressed by HUD. This use case focused upon the earthquake and resulting tsunami in the Great East of Japan on 11 March 2011. As a major international disaster event, there exists substantial data sets and previous research available for analysis. The tsunami which occurred in the Great East of Japan, given both its age and international dimension, provided an important disaster scenario to analyse, complementing the suite of CORE use case scenarios being investigated within Europe. The volume of available data required the synthesisation of information from different sources to refine and reduce the captured and recorded data in the Use Case Template. A copy of the final completed research template is shown in ANNEX 9 – Case Study 6: TSUNAMI

3.7 Development of Case Study 7: PANDEMIC

HANKEN and CRI decided to develop two different case studies   of the Pandemic disaster scenario in order to analyse the disaster from two different

country perspectives . Firstly, HANKEN was supposed to research the management of the disaster from a governmental point of view in Finland and CRI from NGO's point of view in Italy, but due to the lack of enough official reports from NGO's in English they agreed to work on the management of the disaster from a governmental point of view in both countries.

It is imperative to emphasise that, due to the wide range of documents available and areas that could have been explored, it was agreed to analyse only the first 6 months after the start of the Pandemic: from December 2019 to May 2022. A copy of the final completed research template is shown in ANNEX 10 – Case Study: PANDEMIC in Finland and ANNEX 11 – Case Study: PANDEMIC in Italy

4. Data capture challenges

The research of the identified set of seven CORE use case disaster scenarios brought forward a series of challenges relating to data capture and recording. The initial and primary concern that was experienced by consortium partners were related to language barriers, with many of the reports, articles, media, and social media sets of data being presented in the native language where the scenario occurred. To manage this issue a pragmatic approach was taken which carefully balanced the need to capture and assess important data to achieve the granularity of detail required to analyse the case studies, against the scale, scope and schedule of the project timescales and available resources. The decision was collectively made to capture the information in the domestic language as a priority, and then to provide a brief overview and summary of what the data set broadly contained, together with a reference and link to the full data set wherever full translation of the information was not possible due to issues of capacity, capability, or available resource. This approach ensured that important identified information would be captured, included, and recorded for future analysis and of direct benefit for the wider programme of work.

An important challenge to overcome by several partners was the sheer substantial volume of data readily accessible and made available. For those disaster scenarios chosen as part of the suite of CORE use cases occurring more than 5 or 10 years ago, more information existed from multiple sources. Moreover, many of these use cases had been the subject of research and analysis by state bodies, international organisations, and academic institutions. The key challenge was to ensure that the available data when captured was synthesised from different sources and both refined and reduced before being recorded in the Use Case Template. Conversely, some partners also experienced a limited amount of available and accessible data. The industrial accident use case presented specific problems of not only language barriers being outside of the EU, but also being a disaster occurring in the poorest population, being compounded by related cultural, political, societal, and economic issues. In this case, very little data of integrity or evidential rigour was available when compared to other such disaster scenarios occurring within EU boundaries. The information that was available and accessible was captured, assessed, and recorded but

several important caveats must be recognised when comparing this use case with other such studies of disaster scenarios in the future comparative phase of CORE activities within the Work Package 2 programme of work.

A major challenge arose for partners researching disaster use cases outside of EU boundaries, specifically related to the process of capturing the accurate recording of casualty numbers. Future consideration of how authorities across Europe record and reflect casualty data for incidents that occur within EU member states is important, but also seeking clarity and confirmation of the process for the accurate recording and publishing of casualty numbers from disaster events occurring outside of EU jurisdiction would be welcomed. Despite a series of data collection and recording challenges, they were largely overcome by the introduction and implementation of the Use Case Guidance for Completion, shown in Annex 2, and the Use Case Harmonisation Matrix, shown in Annex 3, resulting in the provision of a series of use cases for future comparative analysis.

5. Conclusions

The completion of the *Natural and Manmade Disaster Case Study Identification, Research and Analysis* report marks an important milestone in the progress and development of project CORE, fulfilling the requirement to examine, explore, and capture the challenges of effectively responding to all manner of major disasters and crises to improve societal resilience and compliance.

The delivery of this report and the completion of the seven disaster use cases has been completed with due cognisance of the 5-building block methodological approach of CORE, serving to frame and provide the parameters within which the appropriate scale and scope of disaster scenario analysis has been delivered. This approach has served to deliver a set of use cases which meets the objectives of identifying, researching, and analysing a diverse set of natural and manmade disaster scenarios, enabling the future examination and comparative analysis of data to capture best practices and lessons learned to improve disaster resilience, response, and recovery.

The staged approach to manage the delivery of the use case research, including STAGE 1 Use Case Template design input; STAGE 2: Use case research and data capture; and STAGE 3: Use case harmonisation and review, proved essential, providing the framework to effectively deliver the completed use case research within required timescales. Although this framework provided an effective management tool, it could not have been achieved without the cooperation and collaboration of all beneficiary partners engaged in this task. In total, 11 CORE partners from 10 member states were actively engaged in contributing to this research, and included organisations across academia, emergency response agencies, and the private sector. The willingness to work together, share knowledge and expertise remains a highlight of the completion of the seven use cases in which the operational insights and data sets from emergency service first-responder agencies were invaluable. The close collaborative partnership

developed between beneficiaries ensured that challenges of data capture, including language barriers and data access, were swiftly identified, shared and practical solutions and decisions made as to an effective way forward were both discussed and agreed without detrimental impact to the quality of reporting or delay to use case delivery.

The identification of the seven use case scenarios including: Terrorist Attack, Earthquake, Flash Flooding, Wildfire, Industrial Accident, Earthquake, Tsunami, and Pandemic, provides a rich and diverse set of disaster events in different jurisdictions, settings, and environments, bringing forward all manner of unique challenges to examine and explore. The identification and allocation of specific use case disaster scenarios to partners with existing knowledge, expertise and active interest in those disaster scenarios has also proven to be an important development in the delivery of the use case data capture. Moreover, the decision to identify a SPOC for each use case from beneficiary partners ensured effective communication across the seven case studies whilst under development. It is also important to note that the end-user first-responder agencies and NGOs, including CRI, AutRC and UNISA, were able to offer operational insights to other use case leaders, supporting the understanding and interpretation of captured data, enriching the process of use case research development.

The delivery of the *Natural and Manmade Disaster Case Study Identification, Research and Analysis* use cases shown in ANNEX 4-11 of this report, have been significantly improved by the adoption of measures to ensure consistency of quality and quantity across the suite of disaster scenarios. The creation of the *Use Case Template Guidance Notes* to provide greater granularity of detail to the Use Case Template guidance ensured correct and consistent interpretation of each Use Case Template and field to be completed, resulting in the provision of a robust set of guidance for all use case scenario leaders to follow. This improved guidance was reinforced by the inclusion of the *Use Case Harmonisation Matrix* providing an effective tool to identify inconsistencies in use case scenario template recording across all seven use cases complete templates. Taken together, the guidance and matrix have provided a high degree of consistency of data recording, amplifying the integrity and credibility of the research and data captured in the use case disaster scenario templates.

The primary output of this *Natural and Manmade Disaster Case Study Identification, Research and* Analysis report is contained within the seven use cases shown in ANNEX 4-11 which provides evidence of substantial research and analysis. Moreover, the completion of the data captured as part of activities under *WP2 – Natural and Manmade Disasters* has also recorded and referenced information of direct relevance to support other areas of research across the CORE programme of work to avoid duplication, and to maximise the efficiency of research efforts.

In conclusion, the completion of the set of seven use case disaster scenarios meets the intended objectives of the assigned task, providing a suite of consistent and coherent case studies that can now be compared and analysed

to improve disaster resilience, response, and recovery as part of the next important phase of project CORE under Task 2.*5 – Natural and man-made disaster scenarios comparative analysis.*

Annex 1 – Use Case Leaders meeting summaries

Use Case leaders meeting n. 1

CORE WP2 TASK 2.2 Use Case Leaders Meeting (1)				
Title	CORE WP2 Task 2.2 Use Case Leaders Meeting			
Time	10hrs-11:30hrs (CET)	**Date**	13th October 2022	**Location**	Online via Zoom
Purpose	To present & discuss WP2 T2.2 Use Case Progress		**Chair**	Andrew Staniforth (SAHER)
Attendees	Andrew Staniforth, Dave Fortune & Med Hughes (SAHER); Vitor Sjolin (MTO); Ronnen Avny (UNISA); Danka Foitik Schmidt & Rita Soliman (AutRC); Raffaella Russo, Gordon Woo & Ferdinando Napolitano (UNISA); Monica Crisan (CRI); Lorena Kuratle (ETHZ); Mimmi Poysti & Aino Ruggiero (HANKEN); Rosa Vicari & Alba-Mimi Edjossan (RESALLIENCE)			
Apologies	HUD – provided link for update of Use Case 6: Tsunami prior to the meeting			
Key Discussion Points	**Introduction**: Provided by SAHER – Andrew opened the meeting communicating the primary purpose as a focus and forum for use case leaders to share knowledge, expertise and challenges, and to support CRI monitor progress of Task 2.2 leading to D2.2 in M18 **Task 2.2 Update:** Provided by CRI – Monica requested all use case leaders to now use SharePoint and update their case study templates online. All use cases to be available via SharePoint by 30/10/22. Confirmation the Israel wildfire case study is the wildfire at the Judean Mountains, Jerusalem, 15-19 August 2021, being led by UNISA. Regarding language issues, all data on the templates to be recorded in English with a summary in English from the language of the original report provided by the use case researcher. **Use Case 1: Terrorist Attack Update:** Provided by UNISA – Gordon stated Manchester bombing report due in 3 weeks to support research and the introduction of Martins' Law in the UK related to a victim of the bombing and the need to pass into law requirements for safety at venues. **Use Case 2: Earthquake Update:** Provided by UNISA – Ferdinando provided an update. Question raised on the template for specific questions regarding WP2 and CRI signposted data sources at CRI/AutRC. SAHER encouraged all partners to maximise the use of end-user partner expertise to support case study development. **Use Case 3: Flash Flooding Update:** Provided by SAHER – Med discussed learning so far. Reports translated from French. Identified challenges of translating and analysing local social media reports. This issue to be discussed and progressed within T2.4. **Use Case 4: Wildfire Update:** Provided by UNISA – Ronnen provided update. Waiting for an official report. Aerial imagery and data gathered and a timeline being progressed. Case study to also include and focus on rescuing vulnerable citizens to support CRI. **Use Case 5: Industrial Accident Update:** Provided by SAHER - Med provided update. Challenges include the incident being known by 3			

Key Actions	different names. Poorest population affected. Identified cultural, political and societal issues. Future consideration of how authorities across Europe record and reflect casualty data. access gained to police officers engaged in the incident. UNISA (Gordon) to provide access to engineering academic paper. **Use Case 6: Tsunami Update:** Link provided with update by HUD. **Use Case 7: Pandemic Update:** Provided by HANKEN – Mimmi explained HANKEN are leading the case study with CRI supporting. To cover the 6-month period December 2019-May 2020 of COVID-19. Reference made to HERoS project and other such EU-wide projects and reviews to support use case research from AutRC. Potential to reflect on the response by Sweden but not mandatory given the scale and scope of this use case. All use case leaders to commence working on their use case templates online using SharePoint to increase access and visibility of progress and research results. All use case leaders to upload their updated Use Case Templates on SharePoint no later than 30th October 2022. CRI to develop an Excel file to support recording of all available data sets and links across the 7 case studies creating a single accessible repository for all partners.
Next meeting	**17th November 2022, 10-11:30AM (CET)** via Zoom as follows: **Topic:** CORE WP2 Task 2.2 Use Case Leaders Meeting **Time:** 17/11/22 10-11:30 AM CET **Join** **Zoom** **Meeting:** https://us06web.zoom.us/j/87210597151?pwd=L0NoVXVkY2dTT0JzTW5TRCtRR3VyUT09

Use Case leaders meeting n. 2

CORE WP2 TASK 2.2 Use Case Leaders Meeting (2)				
Title	CORE WP2 Task 2.2 Use Case Leaders Meeting			
Time	10hrs-11hrs (CET)	**Date**	17th November 2022	**Location** Online via Zoom
Purpose	To present & discuss WP2 T2.2 Use Case Progress	**Chair**		Andrew Staniforth (SAHER)
Attendees	Andrew Staniforth & Med Hughes (SAHER); Vitor Sjolin (MTO); Ronnen Avny (UNISA); Danka Foitik Schmidt & Rita Soliman (AutRC); Raffaella R, Gordon Woo & Ferdinando Napolitano (UNISA); Monica Crisan (CRI); Lorena Kuratle (ETHZ); Mimmi Poysti & Aino Ruggiero (HANKEN); Rosa Vicari & Alba-Mimi Edjossan (RESALLIENCE)			
Key Discussion Points	**Introduction:** Provided by SAHER – Andrew opened the meeting communicating the primary purpose as a focus and forum for use case leaders to share knowledge, expertise and challenges, and to support AutRC and CRI monitor progress of Task 2.2 leading to D2.2 in M18. Meeting facilitated by AutRC. **Task 2.2 Update:** Provided by CRI – Monica thanked all use case leaders for uploading their content to SharePoint and encouraged partners to continue to update their case study templates online.			

	Use Case 1: Terrorist Attack Update: Provided by UNISA – Gordon stated Manchester bombing report had been published and a lot of information had been uploaded to the SharePoint in the Use Case Template. Gordon currently writing a paper on the event and will share with partners completed.
	Use Case 2: Earthquake Update: Provided by UNISA – all progressing well and nothing to report, no risks and no concerns at this time.
	Use Case 3: Flash Flooding Update: Provided by SAHER – Med discussed the learning and analysis conducted so far. Use cases uploaded to SharePoint and references will be completed in due course. All on schedule and good collaboration with MTO.
	Use Case 4: Wildfire Update: Provided by UNISA – Ronnen provided update. Data is now included in the use case document on SharePoint. No problems or issues identified at this time. Progressing the capturing of data form satellite and UAV companies.
	Use Case 5: Industrial Accident Update: Provided by SAHER - Med provided update. Challenges include the socio-economic factors and an issue to find information and to cross-reference with multiple sources. The template has been updated and has been uploaded to SharePoint. The template will be ready and completed by the next meeting and further issues raised and discussion related to the connectivity with the social media reporting and links to other tasks in WP2 include T2.3 social media reporting for the comparative analysis.
	Use Case 6: Tsunami Update: Provided by HUD – Malith stated that a review of the use case had been completed and had now been updated and uploaded to the SharePoint. Included in the template was a separate table of contents to aid navigation for the reader.
	Use Case 7: Pandemic Update: Provided by HANKEN – Mimmi explained HANKEN are leading the case study with CRI support . COVID-19 timeline had been completed, limiting the scope. Data has been uploaded to SharePoint. Seeking information made available at the time as best evidence and useful for contrasting and comparing estimates suich as financial predictions and impacts. All on schedule.
Key Actions	All use case leaders to continue working on their Use Case Templates online using SharePoint to increase access and visibility of progress and research results. Change of next meeting on 15th December 2022 to 9am-10am (CET) to accommodate WP Leaders meeting.
Next meeting	**15th December 2022, 9-10 AM (CET)** via Zoom as follows: **Topic:** CORE WP2 Task 2.2 Use Case Leaders Meeting **Time:** 15/12/22 9-10 AM CET **Join** **Zoom** **Meeting:** https://us06web.zoom.us/j/88644802754?pwd=TjVGa05wR3phZEp1SEh DRVhtMUFIZz09

Use Case leaders meeting n. 3

CORE WP2 TASK 2.2 Use Case Leaders Meeting (3)

Title	CORE WP2 Task 2.2 Use Case Leaders Meeting		
Time	9am-10am (CET)	**Date**	15th December 2022	**Location**	Online via Zoom
Purpose	To present & discuss WP2 T2.2 Use Case Progress	**Chair**	Andrew Staniforth (SAHER)
Attendees	Andrew Staniforth, Dave Fortune & Med Hughes (SAHER); Vitor Sjolin (MTO); Ronnen Avny (UNISA); Danka Foitik Schmidt & Rita Soliman (AutRC); Raffaella R, Gordon Woo & Ferdinando Napolitano (UNISA); Monica Crisan (CRI); Mimmi Poysti & Aino Ruggiero (HANKEN)		
Apologies	HUD, RESALLIANCE & ETHZ		
Key Discussion Points	**Introduction**: Provided by SAHER – Andrew opened the meeting and passed the chair to Rita at AutRC. **Task 2.2 Update:** Provided by AutRC – Rita presented the T2.2 roadmap and all partners present were satisfied with timings and next steps. Monica from CRI stated she would go through each of the uploaded use cases next week and liaise with SAHER to address if any further data is needed. **Use Case 1: Terrorist Attack Update:** Provided by UNISA – Gordon stated Manchester bombing reports had been integrated to the use cased template and uploaded on SharePoint. **Use Case 2: Earthquake Update:** Provided by UNISA – Ferdinando provided an update. All progressing well and remaining on track. Use case uploaded to SharePoint. **Use Case 3: Flash Flooding Update:** Provided by SAHER – Med discussed the learning and emerging so far including the guidance and advice offered to the public may be of direct interest to other use cases. The completed use case has been uploaded to SharePoint. **Use Case 4: Wildfire Update:** Provided by UNISA – Ronnen provided update. Data is now uploaded in the use case document and on SharePoint. The use case is nearly complete and includes unique information from the evacuation of patients and medical staff from a hospital caught up in the wildfire. **Use Case 5: Industrial Accident Update:** Provided by SAHER - Med provided update and thanked MTO colleagues for their work providing useful insights and added value to the use case. Learning points for further analysis are emerging including the provision and access of smart mobile technology to younger generations to support response, recording and recovery issues. Use Case Template completed and on SharePoint. **Use Case 6: Tsunami Update:** Not provided as HUD not present. **Use Case 7: Pandemic Update:** Provided by HANKEN – Aino explained HANKEN are leading the case study and the COVID-19 timeline limiting the scope of the study. Data has been uploaded to SharePoint. Both case studies in Finland and Italy are progressing well. The scope does not include analysis of long-COVID issues or concerns. UNISA to send CRI and Hanken data on a study in U.S, and Monica will assess the possibility of referring and/or including this data in the use case and/or D2.2. **Any other business/next steps** Provided by SAHER - Andrew mentioned the next and final use case leaders meeting will be on 12th January and that

	a draft structure for D2.2 will be provided to Monica at CRI by the close of business on 16th December.
Key Actions	UNISA (Gordon) to provide CRI (Monica) with data/article on the U.S. study of long-COVID for potential inclusion in the COVID-19 use case and/or referenced in D2.2. SAHER (Andrew) to provide draft structure for D2.2 to CRI (Monica) at the close of business on 16th December.
Next meeting	**12th January 2023, 10AM (CET)** via Zoom as follows: **Topic:** CORE WP2 Task 2.2 Use Case Leaders Meeting **Time:** 12/1/23 10AM CET **Join** **Zoom** **Meeting:** https://us06web.zoom.us/j/89808701609?pwd=eHk3YTNyb0QwWGwyVjVTbmNpTDVUUT09

Use Case leaders meeting n. 4

	CORE WP2 TASK 2.2 Use Case Leaders Meeting (4)		
Title	CORE WP2 Task 2.2 Use Case Leaders Meeting		
Time	2pm-3pm (CET)	**Date** 9 th February 2023	**Location** Online via Zoom
Purpose	To finalise WP2 T2.2 & D2.2	**Chair**	Andrew Staniforth (SAHER)
Attendees	Andrew Staniforth (SAHER), Danka Foitik Schmidt (AutRC) & Monica Crisan (CRI)		
Key Discussion Points	**Introduction**: Provided by SAHER – Andrew opened the meeting and stated the purpose to finalise the t2.2 use cases, identify what additions need to be made, and make a plan for delivery of D2.2 by M18 deadline. **Task 2.2 Update:** Provided by AutRC & CRI – Monica and Danke presented the current status of all use cases in line with the T2.2 roadmap. All seven use cases are progressing well and have been submitted and uploaded to Sharepoint. Each use case has been assessed and examined against the harmonisation matrix and there remains small modifications for each use case to ensure consistency for future comparative analysis. Monica is writing to each use case leader following a review of each case study and requesting final additions or amendments.		

	D 2.2. Update: provided by SAHER – Andrew, Monica and Danka discussed the final plan to ensure delivery of T2.2 via D2.2 by 28 th February 2023 [M18]. The plan to finalise D2.2 is as follows: ● Monday 13th - SAHER (Andrew) to write all sections and send to CRI (Monica) ● Tuesday 14th - Thursday - CRI & AutRC (Monica & Danka) to add remaining sections and annexes ● Wednesday 15th - AutRC (Monica) to send to RESALLINECE for internal quality assurance review ● Monday 20th - RESALLIEN CE to return to AutRC with comments ● Monday 20th- Friday 24th (latest) - AutRC to update and submit final version to UNISA for uploading of Internal review – SAHER stated that Dave at SAHER could also review the main body of the Deliverable (not the use case annexes but just the main body of the report – approximately 10 pages including section 1-section 5) next week to ensure the accurate and detailed description of the approach and activities included in T2.2 has bee captured and recorded in D2.2 this data in the use case and/or D2.2
Key Actions	1. CRI (Monica) to individually write to all use case leaders to inform of any additions and amendments required to be made and to return them by 15th February for integration into D2.2 template. 2. SAHER (Andrew) to provide completion of working draft structure and content for D2.2 to CRI (Monica) by 13th February including abstract, Introduction, Methodology, Use Case Overview and Conclusions. 3. SAHER (Andrew) to provide an update of D2.2 progress to CORE coordinator and WP leaders at the monthly CORE meeting planned for 23rd February 2023. 4. SAHER (Andrew) to write to reviewers of D2.2 RESALLIENCE stated availability and timing of D2.2 for review.
Next meeting	**No further meetings to progress T.2.2 or D2.2**

Annex 2 – Use Case Guidance for Completion of Template

CASE STUDY X: **Disaster Scenario Y**	
Guidance notes *are provided in red text offering additional description and direction of the response/s required in each field.*	
Incident	*Provide a brief title to best describe the disaster*
Location	*Provide details of the specific location of the disaster, including name of the building, premises, street, village, town, city, area, region, and country*
Time & Date	*Provide the time and date the disaster occurred*

Description and timeline of the incident

Provide a detailed description of the disaster (minimum of 1k words), including a narrative which describes the context of the disaster, including times and dates of key events, issues and incidents that occurred as the disaster unfolded. Describe the nature of the disaster, the response, the damage, and disruption caused, together with information concerning loss of life, casualties, and the wider economic, environmental, and other associated impacts. The description of the incident should provide an informative account of the disaster.

WP2	**Task 2.2: Natural and manmade disaster case study identification, research, and analysis**

What were the public information sharing challenges?

Provide a detailed analysis of identified issues, concerns and challenges when sharing public information about the disaster. Include perspectives from citizens engaged in the disaster, emergency first-responder agencies and public authorities.

What were the ethical issues?

Provide a detailed analysis of any identified ethical issues, concerns or challenges that impacted upon the disaster, the emergency and public authority response or other aspect of the disaster.

What lessons have been learned?

Provide a detailed analysis of any lessons that have been learned following the disaster by public authorities, NGO's, emergency service responders, community groups or other body, group, network, or association.

What were the cascading effects across events, sectors, and supply chain disruptions? Including the inevitability or unforeseen chain of events affecting the response to the disaster? What were the societal vulnerabilities in health and retail sectors?

Provide a detailed analysis of any cascading effects following the disaster, including impacts following unfolding events on different sectors and supply chains. Include any unforeseen chain of events or unintended consequences of actions taken that impacted upon the disaster. Also describe the specific societal vulnerabilities in health and retail sectors within the jurisdiction, regional, locality, community and/or neighbourhood where the disaster occurred.

What was preparedness before and after the event with regards to prepositioning, training, framework contracts and supplier management.	
Please note disaster preparedness planning includes the fundamental identification of risks, vulnerabilities, the possibilities of influence, organizational resources and capacity, division of responsibilities, developing and agreeing practices and processes as well as implementing an action plan to have the best possible preparedness in case of a disaster. Provide a detailed analysis of preparedness for the disaster in line with the disaster preparedness description.	
Please provide a list with links of data sources used in the following categories	
Government/Official reports	*Reports, papers, and statements made by governments, their departments and officials*
NGO reports	*Reports, papers and statements made by NGOs and their officials*
Community interviews/reports	*Reports and interviews with citizens, community leaders and local representatives*
Eyewitness/first-hand accounts	*Reports, accounts and statements made by witnesses providing best evidence*
News/media reports	*Reports and articles from journalist and commentators published by news and media*
Documentaries	*Investigative film, interviews, comments and witness accounts*
Social Media	*Online social media platform posts and comments from users*
Satellite/other aerial imagery	*Images captured by satellite or other aerial unmanned drone or manned aircraft*
Academic Papers/Reports (Peer Reviewed)	*Assessed, evaluated, and qualified evidence-based research and analysis published in recognised academic journals and books*
Academic Papers/Reports (Non-Peer Reviewed)	*Research and analysis published in recognised academic journals and books*
Public Enquiry Reports/Findings	*Official reports, findings, and recommendations of government-led or independent public reviews and inquiries including formal judicial, legal and coroners review and investigations*
Journal/Magazine articles	*Articles, papers, comments and interviews in journals and magazines*
Online podcasts, blogs, forums & chat rooms	*Written or recorded content for online podcasts, blogs, forums, and chat rooms including radio shows, community groups, interest groups and professional bodies*

Official policy recommendations & findings	*Recommendations and findings arising from formal government, independent body or other official investigative commission, association or group including lessons learned*
Other (Please specify)	*Any other data source snot falling within any of the above categories*

WP2	Task 2.3: Natural and manmade case study social media analysis

What was the role, influence, and impact of social media communications during this incident?

Provide a detailed analysis of the role of social media communications during the disaster. Also include a description of how social media communications influenced and impacted on the disaster.

What patterns of interactions between opinion makers and recurring topics in the Twitter debate following the disaster have been identified?

Provide evidence and detailed analysis of the patterns of interactions between opinion makers, informers, influencers, and credible voices on Twitter following the disaster. In addition, identify, describe, and analyse recurring topics of discussion on Twitter following the incident.

Please provide a list with links of data sources used in the following categories

Government/Official reports	*Reports, papers, and statements made by governments, their departments and officials*
Community interviews/reports	*Reports, papers and statements made by NGOs and their officials*
Eyewitness/first-hand accounts	*Reports and interviews with citizens, community leaders and local representatives*
News/media reports	*Reports, accounts and statements made by witnesses providing best evidence*
Documentaries	*Reports and articles from journalist and commentators published by news and media*
Social Media	*Investigative film, interviews, comments and witness accounts*
Satellite/other imagery	*Online social media platform posts and comments from users*
Academic Papers/Reports (Peer Reviewed)	*Images captured by satellite or other aerial unmanned drone or manned aircraft*
Academic Papers/Reports (Non-Peer Reviewed)	*Assessed, evaluated, and qualified evidence-based research and analysis published in recognised academic journals and books*
Public Enquiry Reports/Findings	*Research and analysis published in recognised academic journals and books*

Journal/Magazine articles	*Official reports, findings, and recommendations of government-led or independent public reviews and inquiries including formal judicial, legal and coroners review and investigations*
Online podcasts, blogs, forums & chat rooms	*Articles, papers, comments and interviews in journals and magazines*
Official policy recommendations & findings	*Written or recorded content for online podcasts, blogs, forums, and chat rooms including radio shows, community groups, interest groups and professional bodies*
Other (Please specify)	*Recommendations and findings arising from formal government, independent body or other official investigative commission, association or group including lessons learned*

WP2	Task 2.4: Natural and manmade case study aerial imagery analysis
What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform decision-making?	
Provide a detailed analysis of the positive benefits to informing decision-making during a disaster from the use of satellite and aerial imagery captured by drones.	
What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform the sharing of public information?	
Provide a detailed analysis of the positive benefits to inform the sharing of public information during a disaster from satellite and aerial imagery captured by drones.	
Please provide a list with links of data sources used in the following categories	
Government/Official reports	*Reports, papers, and statements made by governments, their departments and officials*
NGO reports	*Reports, papers and statements made by NGOs and their officials*
Community interviews/reports	*Reports and interviews with citizens, community leaders and local representatives*
Eyewitness/first-hand accounts	*Reports, accounts and statements made by witnesses providing best evidence*
News/media reports	*Reports and articles from journalist and commentators published by news and media*
Documentaries	*Investigative film, interviews, comments and witness accounts*
Social Media	*Online social media platform posts and comments from users*

Satellite/other imagery	*Images captured by satellite or other aerial unmanned drone or manned aircraft*
Academic Papers/Reports (Peer Reviewed)	*Assessed, evaluated, and qualified evidence-based research and analysis published in recognised academic journals and books*
Academic Papers/Reports (Non-Peer Reviewed)	*Research and analysis published in recognised academic journals and books*
Public Enquiry Reports/Findings	*Official reports, findings, and recommendations of government-led or independent public reviews and inquiries including formal judicial, legal and coroners review and investigations*
Journal/Magazine articles	*Articles, papers, comments and interviews in journals and magazines*
Online podcasts, blogs, forums & chat rooms	*Written or recorded content for online podcasts, blogs, forums, and chat rooms including radio shows, community groups, interest groups and professional bodies*
Official policy recommendations & findings	*Recommendations and findings arising from formal government, independent body or other official investigative commission, association or group including lessons learned*
Other (Please specify)	*Any other data sources not falling within any of the above categories*

WP3	Task 3.1 - Critical analysis of past disasters via the identified case studies on their disaster preparedness strategies	
Type of data		**Data/ information/ sources/ reference material**
3.1.1	**Type of hazards – Understanding the disaster risk**	
a.	What type of hazards were commonly identified in the region (Slow-onset and rapid onset hazards)?	*Briefly describe the type of hazards and provide evidence via a description, link, or reference to the information source*
b.	What hazards have resulted in disasters during the past 20 years?	*Provide a list of the disasters and provide evidence via a description, link, or reference to the information source*
c.	What risk assessment mechanism(s) were used by the relevant institutions for encompassing risk awareness, multi-hazard analysis, vulnerability/capacity	*Provide a list and description of the risk assessment mechanisms and cascading effects, providing evidence via a description, link, or reference to the information source*

	analysis and cascading effects?	
d.	What risk modelling and scenarios have been carried out to consider disaster risk and/or any other future threats and cascading effects?	*Provide a list and description of risk modelling and scenarios, providing evidence via a description, link, or reference to the information source*
e.	How the knowledge of indigenous communities and information in social media had been captured for disaster risk perception?	*Provide a list and description of how social media has been captured for disaster risk perception, providing evidence via a description, link, or reference to the information source*
3.1.2	**Disaster resilience and preparedness strategies**	
a.	What were the available national and local disaster management plans and systems under following categories?	
	o Individual-level activities (e.g., first aid training and response)	*Provide a list and include evidence via a description, link, or reference to the information source*
	o Household actions (e.g., stockpiling of equipment and supplies, retrofitting)	*Provide a list and include evidence via a description, link or reference to the information source*
	o Community efforts (e.g., socially responsible mitigation, training, and awareness campaigns for first respondents and responders, and field exercises)	*Provide a list and include evidence via a description, link, or reference to the information source*
	o Governmental strategies (e.g., multi-organisational planning and public private partnerships, early warning systems, contingency plans, evacuation routes, and public information dissemination, allocation of resources)	*Provide a list and include evidence via a description, link or reference to the information source*
b.	What provisions were in place for research, education, science, and technology (ex: geospatial, remote sensing)	*Provide a list and brief description of the provisions, together with supporting evidence via a description, link, or reference to the information source*

	for informed disaster preparedness?	
c.	What special provisions were undertaken to ensure pandemic preparedness in disaster preparedness measures?	*Provide a list and brief description of the provisions, together with supporting evidence via a description, link, or reference to the information source*
3.1.3	**Mitigation**	
a.	What policies and legislation were available that mainstreamed DRR in the national planning policy?	
	o Land use planning and building codes (Ex: Avoid settlement expansion towards hazard prone areas)	*Provide a list and include evidence via a description, link, or reference to the information source*
	o Critical infrastructure protection and structural design improvements	*Provide a list and include evidence via a description, link, or reference to the information source*
	o Landscape and environmental arrangement around essential services and infrastructure	*Provide a list and include evidence via a description, link, or reference to the information source*
	o Resilience strategies including planning and partnership building between sectors	*Provide a list and include evidence via a description, link, or reference to the information source*
b.	What support were provided by media platforms including social media during disaster operations?	*Provide a list and brief description of support provided by media platforms, together with supporting evidence via a description, link or reference to the information source*
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	*Provide a list and brief description of any special measures, together with supporting evidence via a description, link or reference to the information source*
3.1.4	**Response**	
a.	What were the available surveillance, early warning, and information management systems for activating response operations under the following conditions?	
	o Support or coordinate disaster operations being	*Provide a list and include evidence via a description, link, or reference to the information source*

	conducted by a designated lead agency	
	o Logistics mechanisms and essential supplies for health and relief services	*Provide a list and include evidence via a description, link, or reference to the information source*
b.	What support was provided by media platforms including social media during disaster operations?	*Provide a list and brief description of any support provided social media platforms, together with supporting evidence via a description, link, or reference to the information source*
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	*Provide a list and brief description of any special measures, together with supporting evidence via a description, link or reference to the information source*
3.1.5	**Recovery**	
a.	What were the long-term and short-term recovery actions undertaken during each post disaster recovery period including 'build back better' practices?	
	o Response endeavours such as needs and damage assessments	*Provide a list and include evidence via a description, link, or reference to the information source*
	o Community-level involvement and capacity building for disaster recovery	*Provide a list and include evidence via a description, link, or reference to the information source*
	o Local administration and coordination for resource mobilisation	*Provide a list and include evidence via a description, link, or reference to the information source*
	o Building redundancy into a DRR plan	*Provide a list and include evidence via a description, link, or reference to the information source*
b.	How the post disaster infrastructure recovery including rebuilding, restoration, or reconstruction had taken place?	*Briefly describe the infrastructure recovery, together with supporting evidence via a description, link, or reference to the information source*
c.	What plans or provisions were available to minimise the economic impact following a disaster?	*Briefly describe plans or provisions to minimise economic impact, together with supporting evidence via a description, link or reference to the information source*

d.	What environmental recovery plans were available to manage the impact for eco-systems and related services?	*Briefly describe environmental recovery plans, together with supporting evidence via a description, link, or reference to the information source*
e.	How have the mitigation and resilience-building activities of preparedness been adopted for the next disaster, and the development and implementation of legislation, policies, and practices to avoid similar situations in the future?	*Briefly describe the mitigation measures adopted, together with supporting evidence via a description, link, or reference to the information source*
3.1.6	**Monitoring and evaluation**	
How frequent are plans being reviewed and revised for emergency preparedness, response, and recovery?		*Briefly describe the frequency of review of plans, together with supporting evidence via a description, link, or reference to the information source*
WP3	**Task 3.2 – Vulnerable categories**	
3.2.1	**Identify people vulnerable categories in the different phases of disaster management**	
a.	In the analysed context, what were the consequences (death or injury) with respect to the following age groups and gender?	
	○ New-born (ages 0-4 week)	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	○ Infant (ages 4 week - 1 year)	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	○ Toddler (ages 1-3 years) - M/F	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	○ Pre-schooler (ages 3-5 years) - M/F	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	○ School aged child (ages 6-13 years) - M/F	*Briefly describe the consequences for this category with supporting*

		evidence via a description, link, or reference to the information source
	o Adolescent (ages 14-18 years) - M/F	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o Young adult (ages 19-29) - M/F	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o Adult (ages 30-64 years) - M/F	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o youngest-old (ages 64-74 years) - M/F	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o middle-old (ages 75-84 years) - M/F	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	Oldest-old (ages more than 85 years)	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
b.	During the rescue phase what were the categories of disabilities, or specific needs, that arose?	
	o Movement disabilities *	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o Sensorial disabilities (deafness, blindness) *	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o Pregnant women	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*

	o New-born	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o Infant	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o Other that emerged during the analysis of the available documentation or specific investigations conducted	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
c.	Which of the following categories of disabilities, or specific needs, were managed in the post-emergency phases to give an initial response to people involved?	
	o Movement disabilities *	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o Sensorial disabilities (deafness, blindness) *	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o Pregnant women **	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o New-born	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o Infant	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
	o Other that emerged during the analysis of the available documentation	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*

or specific investigations conducted	
*Indicate age class (see 3.2.1.a) and gender; ** indicate class age	*Briefly describe the consequences for this category with supporting evidence via a description, link, or reference to the information source*
3.2.2	**Post event management**
a.	About point 3.2.1b, were the rescuers prepared to manage the situation?
	o The rescuers were involved in specific training activities in this field	*Briefly describe the rescuers preparedness for this category with supporting evidence via a description, link, or reference to the information source*
	o Specific documentation has been made available	*Briefly describe the rescuers preparedness for this category with supporting evidence via a description, link, or reference to the information source*
	o Simulations were conducted also considering the issue of inclusive emergency management	*Briefly describe the rescuers preparedness for this category with supporting evidence via a description, link, or reference to the information source*
b.	About point 3.2.1c, were the operators prepared to manage the situation considering people with specific needs?
	o The rescuers were involved in specific training activities in this field	*Briefly describe the operators preparedness for this category with supporting evidence via a description, link, or reference to the information source*
	o Specific documentation has been made available	*Briefly describe the operators preparedness for this category with supporting evidence via a description, link, or reference to the information source*
	o Simulations were conducted also considering the issue of inclusive emergency management	*Briefly describe the operators preparedness for this category with supporting evidence via a description, link, or reference to the information source*
c.	Were people with specific needs and their family members or caregivers prepared to manage that emergency?

	o Specific information activities were carried out on these topics with the involvement of family members, caregivers, and the surrounding community	*Briefly describe the family members and caregivers preparedness for this category with supporting evidence via a description, link, or reference to the information source*
	o Specific documentation has been made available	*Briefly describe the family members and caregivers preparedness for this category with supporting evidence via a description, link, or reference to the information source*
	o Simulations were conducted also considering the issue of inclusive emergency management	*Briefly describe the family members and caregivers preparedness for this category with supporting evidence via a description, link, or reference to the information source*

WP3	**Task 3.3 Culture & heritage**
3.3.1	**What was the extent of the damage with respect to the type of disaster?**
Provide a detailed analysis of the extent of the damage with supporting evidence via a description, link, or reference to the information source	
3.3.2	**What was the extent of the damage with respect to the size of the disaster?**
Provide a detailed analysis of the extent of the damage with supporting evidence via a description, link, or reference to the information source	
3.3.3	**How was the human and environmental adaptive response/reaction to the damage?**
Provide a detailed analysis of the extent of the damage with supporting evidence via a description, link, or reference to the information source	
3.3.4	**How long did it take to recover/retrieve after the disaster in the following categories?**

o Land use	*Briefly describe the family members and caregivers preparedness for this category with supporting evidence via a description, link, or reference to the information source*
o Repopulation	*Briefly describe the family members and caregivers preparedness for this category with supporting evidence via a description, link, or reference to the information source*
o Everyday life condition	*Briefly describe the family members and caregivers preparedness for*

		this category with supporting evidence via a description, link, or reference to the information source
o Social life		*Briefly describe the family members and caregivers preparedness for this category with supporting evidence via a description, link, or reference to the information source*
o Lesson for the mitigation of other disasters		*Briefly describe the family members and caregivers preparedness for this category with supporting evidence via a description, link, or reference to the information source*
3.3.5	**Was there any quantitative correspondence between reaction/effort and damage?**	
Provide a detailed analysis of the quantitative correspondence with supporting evidence via a description, link, or reference to the information source		
3.3.6	**What was the timescale of such correspondence (short-term vs. long-term)?**	
Provide a detailed analysis of the quantitative correspondence with supporting evidence via a description, link, or reference to the information source		
WP3	**Task 3.4 – Risk governance strategy**	
Type of data		**Data/ information/ sources/ reference material**
3.4.1	**Disaster risk governance mechanisms**	
What were the disaster risk governance mechanisms identified in the relevant authorities to manage disaster risk under following categories?		
	o Knowledge sharing and inclusion of science and technology	*Provide a list and include evidence via a description, link or reference to the information source*
	o Harmonizing capacities and resources to the needs in risk assessment	*Provide a list and include evidence via a description, link or reference to the information source*
	o Institutionalizing partnerships, coordination, and responsibilities	*Provide a list and include evidence via a description, link or reference to the information source*
	o Participatory decision-making mechanisms, inclusive of vulnerable communities, indigenous	*Provide a list and include evidence via a description, link or reference to the information source*

	communities, and volunteers	
	o Leveraging investments in DRR	*Provide a list and include evidence via a description, link or reference to the information source*
3.4.2	**International DDR frameworks**	
What international DDR frameworks (SENDAI, SDG, Paris Agreement) were adopted in DRR projects?		*Briefly describe the adopted DRR frameworks, together with supporting evidence via a description, link, or reference to the information source*
3.4.3	**Accountability in disaster governance**	
What were the provisions to ensure accountability in disaster governance?		
o Consider accountability aspects in the Sendai Framework for Disaster Risk Reduction 2015-2030		*Provide a list and include evidence via a description, link or reference to the information source*
o Innovative elements of accountability		*Provide a list and include evidence via a description, link or reference to the information source*
o Enabling legislations		*Provide a list and include evidence via a description, link or reference to the information source*
o Regular monitoring, evaluation, and review		*Provide a list and include evidence via a description, link or reference to the information source*
WP4	**Cascades**	
1.	What is the EU country, covered by CORE partners, preparing for (crisis, war and crisis, disruption)?	*Briefly describe the preparations, together with supporting evidence via a description, link, or reference to the information source*
2.	What types of disasters is each EU country, covered by CORE partners, preparing for?	*Briefly describe the types of disasters, together with supporting evidence via a description, link, or reference to the information source*
3.	Who is involved in the preparation process?	*Provide a list and include evidence via a description, link, or reference to the information source*
a.	What kind of approach is adopted in disaster preparedness: e.g., is disaster preparedness centralized (national level) or decentralized (local level); who (which agency) has the	*Provide a list and include evidence via a description, link, or reference to the information source*

	leading role in preparedness; guiding policy frameworks and/or strategies and principles; coordination/cooperation mechanisms (and sectors involved)?	
b.	Other stakeholders for preparedness?	*Provide a list and include evidence via a description, link, or reference to the information source*
c.	EU/UN/INGO?	*Provide a list and include evidence via a description, link, or reference to the information source*
4	Training and communication preparedness	
a.	What kinds of trainings (including drills and crisis exercises) are done to prepare for a disaster?	*Provide a list and include evidence via a description, link, or reference to the information source*
b.	Who provides training, for whom and what competencies are covered?	*Provide a list and include evidence via a description, link, or reference to the information source*
c.	What kind of approach is adopted in crisis communication preparedness: e.g., what is communicated to the general public about preparedness, how (means and channels: e.g., preparedness brochure, crisis portals/websites, campaigns, formal/civic/professional education, social media mobilisation) and by whom (leading agency + other partners and stakeholders involved + partnerships with news media)? How are the needs of vulnerable groups taken into account?	*Provide a list and include evidence via a description, link, or reference to the information source*
5.	Prepositioning, framework contract and supplier management	

a.	What types of goods are pre-positioned and how are locations selected?	*Provide a list and include evidence via a description, link, or reference to the information source*
b.	Which organization is responsible for management of pre-positioned stock?	*Provide a list and include evidence via a description, link, or reference to the information source*
c.	What are the framework contracts for disaster preparedness, who manages them?	*Provide a list and include evidence via a description, link, or reference to the information source*
d.	How are suppliers who secure the supply for preparedness selected and managed	*Provide a list and include evidence via a description, link or reference to the information source*
6.	How was the preparedness and response mechanism activated for different types of risks?	*Provide a list and include evidence via a description, link, or reference to the information source*
7.	How the event influenced flow, access to and availability (length of shortage, scale, shortage by social group) of:	
	o Drinking water;	*Provide a list and include evidence via a description, link, or reference to the information source*
	o Energy supply (electricity, coal, fuel etc.);	*Provide a list and include evidence via a description, link, or reference to the information source*
	o Food (retail sales, catering, etc.);	*Provide a list and include evidence via a description, link, or reference to the information source*
	o Health (emergency and long-term provision, psychological health);	*Provide a list and include evidence via a description, link, or reference to the information source*
	o Access to information.	*Provide a list and include evidence via a description, link, or reference to the information source*
8.	How the event influenced preparedness mechanisms (in terms of training, information flow, communication, prepositioning, supplier management). What were the lessons learned from the case?	*Provide a list and include evidence via a description, link, or reference to the information source*

9.	Have there been any studies conducted on the long-term impact (five or ten years) of this disaster/crisis?	*Provide a list and include evidence via a description, link, or reference to the information source*
a.	Was there any long-term health or societal impact?	*Provide a list and include evidence via a description, link or reference to the information source*
b.	Any local supply chain impact?	*Provide a list and include evidence via a description, link, or reference to the information source*
c.	How long did it take for the communities to get back to the original state?	*Provide a list and include evidence via a description, link, or reference to the information source*
d.	Any studies on the long-term resilience of the affected region?	*Provide a list and include evidence via a description, link, or reference to the information source*
WP 7	**Social media information/misinformation and risk communication**	
Please provide a quality assessment for the accuracy and veracity of information and data used to inform this case study in the following three categories:		
a). Media information	*Provide a quality assessment for the accuracy and veracity of **media information** used to inform this case study, together with, wherever possible, supporting evidence via a description, link, or reference to the information source*	
b). Misinformation	*Provide a quality assessment for the accuracy and veracity of **misinformation** used to inform this case study, together with, wherever possible, supporting evidence via a description, link, or reference to the information source*	
c). Risk communication	*Provide a quality assessment for the accuracy and veracity of **risk communication** used to inform this case study, together with, wherever possible, supporting evidence via a description, link, or reference to the information source*	

Annex 3 – Use Case Harmonisation Matrix

CASE Study	n. 1 TERORIST ATTACK	n. 2 EARTHQUAKE	n. 3 FLASHFLOODING	n. 4 WILDFIRE	n. 5 INDUSTRIAL ACCIDENT	n. 6 TSUNAMI	n. 7 PANDEMIC	n. 7 PANDEMIC
Annex n.	Annex 4 - Terrorist Attack	Annex 5 - Earthquake	Annex 6 - FlasFlooding	Annex 7 - WildFire	Annex 8 - Industrial Accident	Annex 9 - Tsunami	Annex 10 -Pandemic Covid-19 in Finland	Annex 11 -Pandemic Covid-19 in Italy.
Leader	UNISA	UNISA + ETHZ	SAHER	NAFR	SAHER-AUTO	HUD	Hanken	CRI
Ready to be uploaded in the Deliverable?	not yet	not yet	not yet	not yet	not yet	not yet	not yet	not yet
General/Note Red Cross Team	List of References References is missing : at the end of the document? + They added extra information on other sections	problems with reference list : not all the sources are included in the Reference list at the end of the paper (please make sure you check them all)	Use Case is finished almost Completed but List of References References at the end of the document is missing + They added some extra information in other tasks	List of References references is missing and the paper is not named as final version.	No references at all in the first sections that's why they don't have the List of References reference. They added extra information in other tasks	The Use Case is not named as final. We are not sure If we am reviewing the last version, please check . Some important parts are missing, could not be found?, we don't know' if something else will be added there so please check + Extra data has been added in other Tasks	Parts missing are not marked as "data missing→ the use of the tenses must be reviewed + they added extra information in other tasks	Some references are
TIPE and other	Not all the sections have the correct style: plase make sure you use TIMES NEW ROMAN 12	ok	Not all the sections have the correct style: plase make sure you use TIMES NEW ROMAN 12	Not all the sections have the correct style: plase make sure you use TIMES NEW ROMAN 12	ok	ok	Sections PROVIDE LINKS: bullet points have different colors + not all the links have hyperlinks (that's why they also have different colors)	still on progress
					preparedness effects before and after the event + they are the only ones that added a lot of information in the first 2 paragraphs + They added a lot of EXTRA informations			
Description and timeline of the incident	Completed: 1,091 words: ok + they added pictures but we said we should not add them...so please make sure we all use the same method.- ISIS, TAIP add full name	Completed: 1,300 words: ok	Completed: 1,092 words but no references quoted at all	1,448 words: ok; + You and another case used maps; + Reference list has to be added in the last page of the paper not in this section	1,138 words ok + please make sure you first give the full name of what you are talking about and after use the acronym : ex. LG; CBRN; PPE + in some cases you use the format to indicate the hour 0255 and in some cases 03.26 please use consistance + NO REFERENCES at all	1,677 work so please make sure you reduce it to 1,500 words max.	1,999 words : Rule: min 1,000 max 1,500; so please reduce it	Completed - references are missing in some paragraphs- please check
What were the public information sharing challenges?	Completed: you quote this source (Kerslake, 2018) but you don't use reference style; you quote Kerslake Report is but don't give a reference link and don't use reference style	Completed: some references are not quoted in the List of References at the end of the paper	Completed: no references quoted at all	(No. 1 – Tel-Aviv – Jerusalem highway) and (Israeli Fire and Rescue National Authority, former Commissioner, D. Simhi, personal communication, December 1, 2022; Israeli Fire and Rescue National Authority, Head of Development, L. Melamed, personal communication, December 15, 2022; Israeli Fire and Rescue National Authority, Head of Research and Development, N. Baraki, personal communication, October 16, 2022) are sources? if so please make sure you use reference style and add it to the final List of References references	section Completed but no references at all -please add them	Completed	OK, almost done but the paragraph format is not written in a descriptive narrative manner , but in points and each one summarizes the content of the study/research to which they have identified and included in the bibliography + Hero project and the studies connected to it are not present in the final REFERENCE list	still on progress

Annex 3.1 First Matrix sent to all partners individualy

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sCience and human factOr for Resilient sociEty

CASE Study	n. 1 TERRORIST ATTACK	n. 2 EARTHQUAKE	n. 3 FLASHFLOODING	n. 4 WILDFIRE	n. 5 INDUSTRIAL ACCIDENT	n. 6 TSUNAMI	n. 7 PANDEMIC	n. 7 PANDEMIC
What were the ethical issues?	The Kerslake investigation panel: you quoted some sources but didn't use reference style	Completed: some references are not quoted in the List of References not quoted in the reference at the end of the paper	Completed - very short and references quoted but not quoted in the reference list in the last page (this is missing as well)	(D. Simhi, personal communication, December 1, 2022) is a source? if so please make sure you use reference style and add it to the final List of References references	Completed	Completed	OK: almost done but the paragraph format is not written in a descriptive narrative manner ; but in points and each one summarizes the content of the study/research to which they have identified and included in the bibliography + Hero project and the studies connected to it are not present in the final REFERENCE list	Completed
What lessons have been learned?	you quoted some sources but didn't use reference style: ex. Volume 2 of the Manchester Arena Inquiry Report. Please make sure you do it +	Completed: some references are not quoted and references quoted but not quoted in the reference list in the last page (this is missing as well)	Completed - very short and references quoted but not quoted in the reference list in the last page (this is missing as well)	(Knesset News, 2021; D. Simhi, personal communication, December 1, 2022; Knesset News, 2021; Tzoba, 2021) + (Asam et al., 2022) + Eitanim hospital General manager, G. Lubin, personal communication, November 9, 2021 are sources? if so please make sure you use reference style and add it to the final List of References references	They quote primary official report (The High-Power Committee) but don't insert it in the REFERENCE list + they quoted evidence drawn from media reporting of concerns raised by local NGOs BUT they don't name them	Completed	OK: almost done but the paragraph format is not written in a descriptive narrative manner ; but in points and each one summarizes the content of the study/research to which they have identified and included in the bibliography + Hero project and the studies connected to it are not present in the final REFERENCE list	Completed
What were the cascading effects across events, sectors, and supply chain disruptions?	you added graphics + references that must be included in the list references (es. Reference: Dark P., Smith M., Ziman H., et al. Emerg. Med. J 2021;38:746–755.)	Completed: some references are not quoted in the List of References reference at the end of the paper	Completed: no references quoted at all	(D. Simhi, personal communication, December 1, 2022) is a source? if so please make sure you use reference style and add it to the final List of References references	Completed	empty without explanations: please make sure you feel this part as well	OK: almost done but the paragraph format is not written in a descriptive narrative manner ; but in points and each one summarizes the content of the study/research to which they have identified and included in the bibliography + Hero project and the studies connected to it are not present in the final REFERENCE list	Completed
Including the inevitability or unforeseen chain of events affecting the response to the disaster? What were the societal vulnerabilities in health and retail sectors?	Completed	Completed - in some cases they use the word SOURCE and the link is paste, while in some they don't- please bee consistent.	Completed - very short and references quoted but not quoted in the reference list in the last page (this is missing as well)	(D. Simhi, personal communication, December 1, 2022) is a source? if so please make sure you use reference style and add it to the final List of References references	Completed	empty without explanations: please make sure you feel this part as well	very well described but we would like you to tables explain better the ta!dentifying the challenges ?	Completed
What was preparedness before and after the event with regards to prepositioning, training, framework, contracts and supplier management	Completed	Completed	Completed - very short and references quoted but not quoted in the reference list in the last page (this is missing as well)	(D. Simhi, personal communication, December 1, 2022) is a source? if so please make sure you use reference style and add it to the final List of References references	Completed	Completed	The HeroS team publication is a bit different in the way you added in in there…maybe you shoul just add in in the Link section	Completed
Please provide a list with links of data sources used in the following categories- Government/Official reports	Completed ; text is not TIMES NEW ROMAN 12	Completed	Completed but make sure all the text is TIMES NEW ROMAN 12	General comment: in some sections you just PASTE the LINK without giving information but in other you do: please give a information to all the link	Completed	Completed but none of the links are listed	ok: please make sure the bullet points have the same color + not all the links have the hyperlinks	Completed

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CASE Study	n. 1 TERRORIST ATTACK	n. 2 EARTHQUAKE	n. 3 FLASHFLOODING	n. 4 WILDFIRE	n. 5 INDUSTRIAL ACCIDENT	n. 6 TSUNAMI	n. 7 PANDEMIC in Finland	n. 7 PANDEMIC in Italy
Annex n.	Annex 4 - Terrorist Attack	Annex 5 - Earthquake	Annex 6 - FlasFlooding	Annex 7 - WildFire	Annex 8 - Industrial Accident	Annex 9 -Tsunami	Annex 10 -Pandemic Covid-19 in Finland	Annex 11 -Pandemic Covid-19 in Italy
Leader	UNISA	UNISA + ETHZ	SAHER	NAFR	SAHER-MTO	HUD	Hanken	CRI
Ready to be uploaded in the Deliverable?	not yet	not yet	not yet	not yet	not yet	not yet	not yet	not yet
NGO reports	Completed but no links: Greater Manchester Preventing Hateful Extremism and Promoting Social Cohesion Commission (2018) A Shared Future. Reed A., Ingram H.J. (2020) Towards a framework for post-terrorist incident communications strategies. RUSI Global Research Network on Terrorism and Technology, Paper No.12. Vidino L., Marone F., Entenmann E. (2017) Fear thy neighbour: radicalization and Jihadist attacks in the	Completed - in some cases they use the word SOURCE and the link is paste, while in some they don't- please bee consistent.	Completed	Completed: ok links but no description of what they are about	Completed	Completed but none of the links are listed	data missing without explanation please check	Completed
Community/Interview reports	Completed but no links added	Completed - in some cases they use the word SOURCE and the link is paste, while in some they don't- please bee consistent.	None identified in research phase.	data missing without explanation please check	None identified in research phase.	Completed but none of the links are listed	data missing without explanation please check	Completed
Eyewitness/first-hand accounts	Completed but no links added	All the documentaries contain eyewitnesses of people that were in L'Aquila the night of the earthquakes. See "Documentaries" Please add the link here as well	None identified in research phase.	Completed: ok links but no description of what they are about	None identified in research phase.	Completed but none of the links are listed	data missing without explanation please check	Completed
News/media reports	Completed but no links added	Completed: they paste only the link without descriptio- please check	Completed	Completed: ok links but no description of what they are about	Completed	Completed but none of the links are listed	data missing without explanation please check	Completed
Documentaries	Completed but no links added	Completed: they paste only the link without descriptio- please check	None identified in research phase.	data missing without explanation please check	None identified in research phase.	Completed but none of the links are listed	data missing without explanation please check	Completed
Social Media	You Write: Listed in section 2.3 but we need tou to insert them here as well	Completed: they paste only the link without descriptio- please check here you use the Word LINK while refering to the SOURCE . In the above sections you use the Word SOUCE: please choose one in order to be consistent here you use the Word LINK while refering to the SOURCE . In the above sections you use the Word SOUCE: please choose one in order to be consistent	Completed	Completed	None identified in research phase.	Completed but none of the links are listed	data missing without explanation please check	Completed
Satellite/other aerial imagery	Completed but no links added	Completed but none of the links are listed	Completed: ok links but no description of what they are about	Completed	Completed but none of the links are listed	Completed but none of the links are listed	data missing without explanation please check	still on progress

CASE Study	n. 1 TERRORIST ATTACK	n. 2 EARTHQUAKE	n. 3 FLASHFLOODING	n. 4 WILDFIRE	n. 5 INDUSTRIAL ACCIDENT	n. 6 TSUNAMI	n. 7 PANDEMIC in Finland	n. 7 PANDEMIC in Italy
Annex n.	Annex 4 - Terrorist Attack	Annex 5 - Earthquake	Annex 6 - FlasFlooding	Annex 7 - WildFire	Annex 8 - Industrial Accident	Annex 9 - Tsunami	Annex 10 -Pandemic Covid-19 in Finland	Annex 11 -Pandemic Covid-19 in Italy
Leader	UNISA	UNISA + ETHZ	SAHER	NAFR	SAHER-MTO	HUD	Hanken	CRI
Ready to be uploaded in the Deliverable?	not yet	not yet	not yet	not yet	not yet	not yet	not yet	not yet
Academic Papers/Reports (Peer Reviewed)	Completed but no links added	You added ANNEX 1 as an extra paper but, as we agreed, all the references has to be insert in this section so please put here all the data that is in the ANNEX 1	Completed	Completed: ok links but no description of what they are about	Completed but please make sure is a hyperlinks format	Completed but none of the links are listed	ok: please make sure the bullet points have the same color + not all the links have the hyperlinks	still on progress
Academic Papers/Reports (Non-Peer Reviewed)	Completed but no links added	here you use the Word SOURCE please choose one in order to be consistent	Completed: none found	Completed: none found	Completed but none of the links are listed	Completed but none of the links are listed	Incomplet: Parts missing are not marked as "data could not be found", we don't know if something else will be added there	still on progress
Public Enquiry Reports/Findings	Completed : text is not TIMES NEW ROMAN 12	Completed	None identified in research phase.	Completed: ok links but no description of what they are about	None identified in research phase.	Completed but none of the links are listed	bullet points are in red	still on progress
Journal/Magazine articles	Completed but no links added	here you use the Word SOURCE please choose one in order to be consistent	None identified in research phase	data missing without explanation please check	None identified in research phase.	Completed but none of the links are listed	bullet points are in red	still on progress
Online podcasts, blogs, forums & chat rooms	Completed but no links added	They paste only the link without descriptio- please check	None identified in research phase	Completed: none found	None identified in research phase.	Completed but none of the links are listed	data missing without explanation please check	still on progress
Official policy recommendations & findings	Completed : text is not TIMES NEW ROMAN 12	Completed	Completed	Completed	None identified in research phase.	Completed but none of the links are listed	ok	Completed
Other (Please specify)	data missing without explanation please check	data missing without explanation please check	None identified in research phase.	Completed: ok decription but no links	None identified in research phase	empty without explanations	ok: please make sure the bullet points have the same color + not all the links have the hyperlinks	Completed
References	NO REFERENCE list: data missing without explanation please check	Completed but not all the references are included in the final list so I put some comments directly on in the Share Point	NO REFERENCE list data missing without explanation please check	data missing without explanation please check	no references list at the end of the paper	Completed	ok but some references are missing please check	Completed
Feedback to Case Study leader?	yes via e-mail	yes via e-mail	yes via e-mail	yes via e-mail	yes via e-mail	yes via e-mail	yes via e-mail	yes

Annex 3.2 Second Matrix sent to all partners individuali

	n. 1 TERRORIST ATTACK	n. 2 EARTHQUAKE	n. 3 FLASHFLOODING	n.4 WILDFIRE	n. 5 INDUSTRIAL ACCIDENT	n. 6 TSUNAMI	n. 7 PANDEMIC in Finland	n. 7 PANDEMIC in Italy
CASE Study								
Annex n.	Annex 4 - Terrorist Attack	Annex 5 - Earthquake	Annex 6 - FlasFlooding	Annex 7 - WildFire	Annex 8 - Industrial Accident	Annex 9 -Tsunami	Annex 10 -Pandemic Covid.19 in Finland	Annex 11- Pandemic Covid-19 in Italy
Leader	UNISA	UNISA + ETHZ	SAHER	NAFR	SAHER-MTO	HUD	Hanken	CRI
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TIPE and other	ok	ok	ok	ok	ok	ok	ok	ok
Description and timeline of the incident	Completed: 1,091 words	Completed: 1,300 words	Completed: 1,092 words	Completed 1,461 words	Completed 1,138 words ok	Completed 1,507 works	Completed 1,499 words	Completed: 1,434 words
What were the public information sharing challenges?	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
What were the ethical issues?	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
What lessons have been learned?	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
What were the cascading effects across events, sectors, and supply chain disruptions? Including the inevitability or unforeseen chain of events affecting the response to the disaster? What were the societal vulnerabilities in health and retail sectors?	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
What was preparedness before and after the event with regards to prepositioning, training, framework contracts and supplier management	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed

#	A	B — n.1 TERRORIST ATTACK	C — n.2 EARTHQUAKE	D — n.3 FLASHFLOODING	E — n.4 WILDFIRE	F — n.5 INDUSTRIAL ACCIDENT	G — n.6 TSUNAMI	H — n.7 PANDEMIC in Finland	I — n.7 PANDEMIC in Italy
1	CASE Study	n.1 TERROSIST ATTACK	n.2 EARTHQUAKE	n.3 FLASHFLOODING	n.4 WILDFIRE	n.5 INDUSTRIAL ACCIDENT	n.6 TSUNAMI	n.7 PANDEMIC in Finland	n.7 PANDEMIC in Italy
2	Annex n.	Annex 4 - Terrorist Attack	Annex 5 - Earthquake	Annex 6 - FlasFlooding	Annex 7 - WildFire	Annex 8 - Industrial Accident	Annex 9 - Tsunami	Annex 10 -Pandemic Covid-19 in Finland	Annex 11 -Pandemic Covid-19 in Italy
3	Leader	UNISA	UNISA + ETHZ	SAHER	NAFR	SAHER-MTO	HUD	Hanken	CRI
13	Please provide a list of data sources used in the following categories- **Government/Official reports**	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
14	**NGO reports**	Completed but no links: Greater Manchester Preventing Hateful Extremism and Promoting Social Cohesion Commission (2018) A Shared Future. Reed A., Ingram H.J. (2020) Towards a framework for post-terrorist incident communications strategies. RUSI Global Research Network on Terrorism and Technology, Paper No.12. Vidino L., Marone F., Entenmann E. (2017) Fear thy neighbour radicalization and Jihdist attacks in the West. ISPI	Completed - in some cases they use the word SOURCE and the link is paste, while in some they don't please bee consistent.	Completed	Completed: ok links but no description of what they are about	Completed	Completed	Completed	Completed
15	**Community/Interview reports**	Completed	Completed	None identified in research phase.	Completed	None identified in research phase.	Completed	Completed	Completed
16	**Eyewitness/first-hand accounts**	Completed	Completed	Completed	Completed	None identified in research phase.	Completed	Completed	Completed
17	**News/media reports**	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
18	**Documentaries**	Completed	Completed	None identified in research phase.	Completed	None identified in research phase.	Completed	Completed	Completed
19	**Social Media**	Completed	Completed	None identified in research phase.	Completed	None identified in research phase.	Completed	Completed	Completed
20	**Satellite/other aerial imagery**	Completed	Completed	Completed	Completed	None identified in research phase.	Completed	Completed	Completed
21	**Papers/Reports (Peer Reviewed) Academic**	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
22	**Papers/Reports (Non-Peer Reviewed) Academic**	Completed	Completed	Completed	None identified in research phase.	None identified in research phase.	Completed	Completed	Completed
23	**Reports/Findings Public Enquiry**	Completed	Completed	Completed	Completed	None identified in research phase.	Completed	Completed	Completed
24	**Journal/Magazine articles**	Completed	Completed	Completed	Completed	None identified in research phase.	Completed	Completed	Completed

D2.2 Natural & manmade disaster case study identification, research, & analysis

	n.1 TERRORIST ATTACK	n.2 EARTHQUAKE	n.3 FLASHFLOODING	n.4 WILDFIRE	n.5 INDUSTRIAL ACCIDENT	n.6 TSUNAMI	n.7 PANDEMIC in Finland	n.7 PANDEMIC in Italy
CASE Study								
Annex n.	Annex 4 - Terrorist Attack	Annex 5 - Earthquake	Annex 6 - FlasFlooding	Annex 7 - Wildfire	Annex 8 - Industrial Accident	Annex 9 -Tsunami	Annex 10 -Pandemic Covid-19 in Finland	Annex 11 -Pandemic Covid-19 in Italy
Leader	UNISA	UNISA + ETHZ	SAHER	NAFR	SAHER-MTO	HUD	Hanken	CRI
Online podcasts, blogs, forums & chat rooms	Completed	Completed	Completed	Completed	None identified in research phase.	Completed	Completed	Completed
Official policy recommendations & findings	Completed	Completed	Completed	Completed	None identified in research phase.	Completed	Completed	Completed
Other /Please	Completed	Completed	Completed	Completed	Completed	Completed	Completed	Completed
References	Completed: reference list ok	Completed: reference list ok	Completed: reference list ok	Completed: reference list ok	Completed: reference list ok	Completed: reference list ok	Completed: reference list ok	Completed: reference list ok
Feedback to Case Study Leader?	yes via e-mail	yes via e-mail	yes via e-mail	yes via e-mail	yes via e-mail	yes via e-mail	yes via e-mail	yes via e-mail

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CASE STUDY 1: Terrorist Attack	
Incident	Terrorist attack
Location	Manchester Arena, England
Time & Date	10.31pm, 22 May 2017
Description and timeline of the incident	

Terrorism is a major societal peril causing casualties and economic losses, primarily focused on urban areas. A terrorist attack is a political act of violence aimed at coercing a change in government policy. With its broad political interests around the world, the UK is exposed to a persistent terrorist risk.

The largest city of northern England, Manchester, features significantly in the annals of UK terrorism. On 15 June 1996, the Irish Republican Army (IRA) detonated a 1,500 kg lorry bomb in the principal shopping centre. From this same Arndale shopping centre, Salman Abedi, a 22 year-old Mancunian of Libyan parentage, bought a rucksack on Friday, 19 May 2017. Shreds of this rucksack were found in the foyer of the Manchester Arena concert venue on the following Monday night, 22 May 2017. The Manchester Arena has a maximum audience capacity of 21,000, and is one of the busiest and biggest concert venues in the world. Visitor access is facilitated by proximity to Manchester Victoria station, a major transport hub. On that evening, Salman Abedi had managed to evade the attention of security staff and police at the Arena, despite carrying a large rucksack on his back.

The rucksack had contained an improvised explosive device, assembled by Abedi in a Manchester apartment, and packed tightly with nails and bolts. The bomb detonation and shrapnel blast at 10.31pm obliterated the terrorist, killed 22 others, and injured more than a hundred others in the foyer. Most of the casualties were young fans of the American singer Ariana Grande, who was performing on that night. Paramedics treated many walking wounded in the city centre. Hospitals in Greater Manchester treated people with serious injuries, transported by the Ambulance Service, whilst others made their way to hospitals across the wider region.

Salman Abedi's career in political violence started at the young age of 16, when he fought against the Gaddafi regime with his father Ramadan in the Libyan uprising of 2011. The group that Salman Abedi joined, fighting alongside his father, was the Libyan Islamic Fighting Group (LIFG). Ramadan Abedi was a prominent member of the LIFG. Salman Abedi was also connected to an ISIS recruiter, Abdalraouf Abdallah, a Libyan refugee who was jailed for terror offences in Britain for trying to recruit other Manchester-based extremists to join ISIS. Abedi's father Ramadan cared for Abdalraouf in Libya after he was shot and paralysed in 2012. Coming from a family of radical Libyan Islamists that sought to overthrow Gaddafi, Salman Abedi was known to the British security service MI5. Active though he was in Libya, he was not perceived to be an active threat in UK.

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and was therefore not kept under watch, notwithstanding the presence in Manchester of a clique of Libyan dissidents, including Abd Al Baset Azzouz, an expert Al Qaeda bombmaker.

On 21 March 2017, two months before the Arena bombing, at least 33 people had been killed in a US air strike on a school sheltering displaced people near the ISIS (Islamic State) stronghold of Raqqa, Syria. According to his sister, Salman Abedi saw the explosives US planes dropped on children in Syria, and sought revenge. Being placed on an FBI terrorist watch list in 2016, an attack within the USA would have been logistically impossible; but a revenge attack on a prominent US target, such as Ariana Grande, within England was not. Indeed, in England, Salman Abedi had the assistance of his brother Hashem. In March 2020, Hashem Abedi was convicted of murder. He had played a major role in the terrorist bomb plot, helping his brother in his efforts to stockpile chemicals and materials to make the bomb. Enough TATP (acetone peroxide) explosive was found in Salman Abedi's rented apartment for more bombs to have been made. The casualty toll, horrendous as it was, might well have increased proportionally with the number of suicide bombers. However, a larger scale attack would also have had an even greater chance of MI5 joining the dots and interdicting the plot. Protocols for anticipating multiple terrorist operatives explains the caution adopted by some first responders in approaching the Arena.

Unlike an attack on the transportation infrastructure or against commercial targets, there was an absolute fixed deadline of the Ariana Grande concert date on the evening of 22 May 2017. Salman Abedi had a highly organized and busy schedule of international travel and bomb preparation in the period leading up to this date. His two years of business and management studies at Salford University ultimately trained him only to succeed in this singular ultimate project with a tight deadline. The student loans he took out to pay for his university course, including the period after he had dropped out, will never be paid back. So the actual cost of the suicide bombing to ISIS, (including foreign travel and procurement of materials for the bombing operation), was essentially minimal. The terrorist attack leverage, defined as the ratio of impact to cost, was therefore massive, as demanded for ISIS operations.

The foyer of the Manchester Arena adjoins the Manchester Victoria station, a key transport hub in the city, with both rail and tram links. Salman Abedi might have detonated his bomb within the station, or on a train, or in a store; instead, he chose the Manchester Arena concert venue. Terrorism is the language of being noticed. With the superstar, Ariana Grande, at this venue, it was the optimal terrorist target: a suicide bomber can only die once. The bomb explosion created carnage, but caused limited damage in the foyer. There was some structural damage to the Manchester Victoria station, which was closed for eight days for repairs, and the police investigation. The adjoining concert venue was closed until September, with scheduled concerts being cancelled or relocated to venues elsewhere.

Whilst the physical damage caused by the Arena bombing was repaired quite soon, the psychological impact of the terrorist attack on the survivors remains, even five years afterwards. Post-Traumatic Stress Disorder (PTSD) has been a common outcome, with longstanding mental health

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consequences for those who attended the concert as children in their teens. One of these, Eve Aston, took her own life in 2021 having experienced depression and PTSD since the Arena bombing.

What were the public information sharing challenges?

The phone company, Vodafone, operates an emergency phone system that should be activated following a terror attack, allowing other police forces to help call handlers in Greater Manchester. It should also allow the local force to set up a casualty bureau to coordinate information about the missing and injured. The National Mutual Aid Telephony system operated by Vodafone had been successfully operated on numerous occasions. However, on the night of 22 May, 2017, it experienced a catastrophic failure (Kerslake, 2018). This caused significant stress and upset on the night to the families involved, who were reduced to a frantic search around the hospitals of Greater Manchester to find out more. Vodafone apologised to families for the significant stress and upset, and admitted that any failure is unacceptable.

The Kerslake Report recommended urgent guarantees should be sought from Vodafone and called for tested backup systems to be put in place. Vodafone's contract, held since 2009, is to provide free emergency public hotlines, usually 0800 numbers, in disaster situations. The Kerslake Report found an error with a server meant Greater Manchester Police was unable to set up the service for people urgently seeking information about loved ones.

However, the Manchester Police constantly updated its Twitter account with crisis communication information. Social media platforms were used to enquire about missing friends or relatives, and offer condolences. The interplay between social media and the traditional media was a key factor in the challenge faced by public authorities in putting out a consistent message to the general public.

What were the ethical issues?

The Kerslake investigation panel was shocked and dismayed by the accounts of the families of their experiences with some of the media. They spoke of being hounded, of a lack of respect, and of sneaky attempts to take photos when families were receiving bad news. To have experienced such intrusive and overbearing unethical behaviour at a time of such enormous vulnerability was completely and utterly unacceptable.

Unethical behaviour outside the media was displayed by members of the public indulging in the spread of hoaxes and other fake news. In the immediate aftermath of the Manchester terrorist attack, there was a significant circulation of fake news carried out by various groups and individuals. These ranged from the malicious (trolls) to the ignorant and misinformed. There were hoaxes of missing children (images of children pulled from the web), including claims of a man with a gun outside the Royal Oldham Hospital, situated near the scene of the attack. One hoaxer

called the Greater Manchester Fire and Rescue Service (GMFRS) with a dirty bomb alert, which may have been a factor slowing their response. A woman, 'the angel of Manchester', claimed she was bringing children to the safety of a local hotel; the hotel denied having any such children. Ariana Grande was herself the victim of unethical behaviour, including a fake picture of her bleeding and dirty. The Manchester Arena attack was an opportunity for some hoaxers to see how many likes and retweets they could get by capitalizing on people's desire to help spread information about missing victims.

Authors of reports around mass casualty events, such as the Manchester Arena bombing, have a unique challenge when presenting events in a way that is scientific yet considers ethical issues such as patient consent, potentially identifiable data, considerations of impact of publishing on communities and inevitable media reporting.

What lessons have been learned?

The principal lessons learned are enumerated at length in Volume 2 of the Manchester Arena Inquiry Report, which was published in November 2022, five years after the bombing (Saunders, 2022). This Volume focused on the emergency response. This Volume of this Public Inquiry, chaired by John Saunders, includes a series of major recommendations:

- The Greater Manchester Resilience Forum should oversee, at least every six months, a regular tri-service review of the Major Incident plans used by Greater Manchester Police, Greater Manchester Fire and Rescue Service and North West Ambulance Service. The purpose of that review should be to ensure that there is a common understanding by each emergency service of the plans of the other emergency services. It should also ensure that the importance of joint working is embedded within each emergency service.

- British Transport Police should work with the Home Office police services with which it shares policing responsibilities at or for a particular location: (a) to agree which police service has primacy in the event of a Major Incident; (b) to put in place appropriate plans to make clear the responsibilities of each police service in the event of a Major Incident; (c) to conduct regular exercises, including joint exercises, to test those plans; and (d) to ensure that all police officers and police staff are adequately trained in what will be required.

- Greater Manchester Police's Major Incident Plan should be reviewed to ensure that it includes clear guidance on the capabilities of Greater Manchester Fire and Rescue Service, including its Specialist Response Team, as well as on the importance of joint working. Greater Manchester Police's Major Incident Plan should be reviewed to ensure that it includes clear guidance on the capabilities of North West Ambulance Service, including its Hazardous Area Response Team, Ambulance Intervention Team and Special Operations Response Team, as well as on the importance of joint working.

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- North West Ambulance Service should review its Major Incident Response Plan to consider whether, in order to speed up mobilisation, it should provide pre-determined attendances for the Hazardous Area Response Team, Ambulance Intervention Team and Special Operations Response Team crews for Major Incidents.

- North West Fire Control should review how it allocates the best-trained and most suitable Control Room Operators to roles during a Major Incident. It should consider whether it is beneficial to allocate a Control Room Operator to monitor communications on a multi-agency control room talk group and another Control Room Operator as the specific point of contact for the fire and rescue service. Both roles could be supervised by a Team Leader.

- Greater Manchester Fire and Rescue Service should review its guidance and policies on how it receives and passes on information during a Major Incident. It is important that, for any update given, it is established when the last time the person receiving the update was provided with information, to ensure that they are completely up to date.

- Counter Terrorism Policing Headquarters should review the procedures by which it is notified of a terrorist attack to ensure that all police services know that this is an early priority.

The terrorist attack was a single location, single operative event, so did not stretch the counter-terrorism services as much as a multiple swarm attack with a number of locations struck simultaneously, as with the London transport bombings of 7 July 2005. The Arena concert venue was closed until the Autumn. However, concerts were rescheduled or relocated to other venues in UK. For example, a concert by Celine Dion was moved to Leeds, about 40 miles away. [Some residents of Leeds had attended the Ariana Grande concert in Manchester]. The availability of an alternative regional venue, contributed to the resilience against supply chain disruption.

The healthcare system treated 153 injured patients (109 adults and 44 paediatric patients) who attended emergency departments, including three hospital fatalities. The systematic collation of injured patient and healthcare system data provided an objective evaluation of a regional major incident plan and provided insight into healthcare system resilience. Hospital patient care data indicated that a pre-rehearsed patient dispersal plan at incident scene was implemented effectively.

Figure 1 below (Dark et al., 2021) shows the incident patients per hour arriving at emergency departments (A), present in operating rooms (B) and critical care units (C) in first 24 hours. Patient numbers are shown per hour with the time axis indicting the start of each hour period.
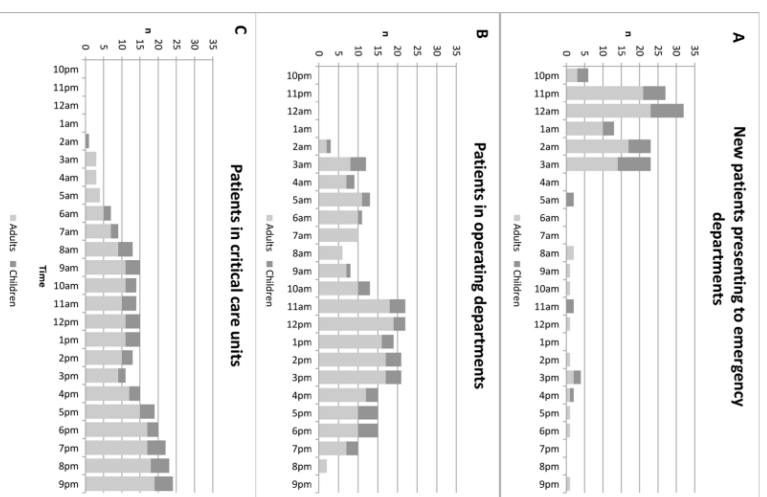
Figure 1: Arrival of patients in emergency and operating departments and critical care units

The gradual increase over the following day in the number of patients in operating departments and critical care units shows that the pressure on these crucial units was manageable. But the crisis might have been much worse, leading to a cascade of healthcare issues, if there had been many more casualties. For example, if there had been multiple suicide bombers, (as in Paris in November 2015), then there would have been much more pressure on the healthcare system, with potential cascade effects, impacting general members of the public, who may have needed emergency care on the night of the bombing. There might then have been collateral deaths from non-violent causes, such as heart attacks,

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strokes etc. Counterfactually, the Ariana Grande concert might have been scheduled for a popular Saturday night, when accident and emergency services would have been overwhelmed by the consequences of excessive drinking, and much busier than on the Monday, 22 May 2017.

What was preparedness[1] before and after the event with regards to prepositioning, training, framework contracts and supplier management.

As a result of the loss of 22 lives, a UK Public Inquiry was established. This examined in great detail all aspects of the preparedness before the terrorist attack, and response to it. Much of what follows here is taken from this extremely thorough Inquiry report. The first volume on security for the Arena was published in June 2021, the second volume on response was published in November 2022.

The marauding terrorist gun attacks in Paris in November 2015 concentrated the attention of the UK emergency services on attaining a high level of preparedness for a terrorist attack. The obligations included the following:

- British Transport Police, Greater Manchester Police, North West Ambulance Service and Greater Manchester Fire and Rescue Service (GMFRS) had a duty to maintain plans for a response to an emergency within Greater Manchester.

- They were obliged to consider collaborating with emergency responders when planning for an emergency and to make provision for training and exercising when planning for an emergency.

- They were obliged to co-operate in their local resilience forum and attend resilience forum meetings every six months.

Notwithstanding these obligations, there were serious failings in the response to the terrorist attack. The response to the explosion started well. Greater Manchester Police (GMP) directed firearms officers in numbers to the site of the explosion. They were quickly able to establish that there were no armed terrorists in the City Room (see Figure 2) and, by placing armed guards on the entrances to that location, were able to ensure that none could enter.

[1] Disaster preparedness planning includes the fundamental identification of risks, vulnerabilities, the possibilities of influence, organisational resources and capacity, division of responsibilities, developing and agreeing practices and processes as well as implementing an action plan to have the best possible preparedness in case of a disaster
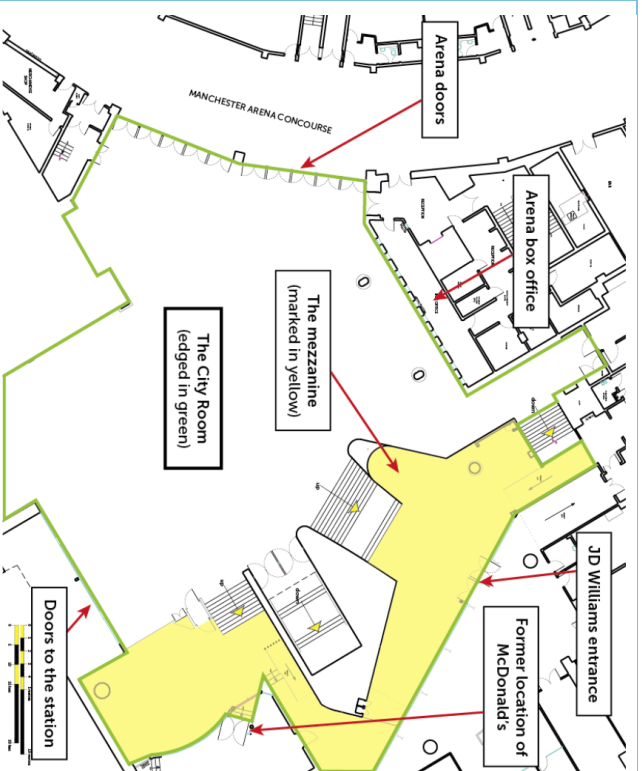
Figure 2: Map of the City Room where concert-goers gathered at the end of the concert

Unarmed and unprotected British Transport Police (BTP) and GMP officers were quickly on the scene doing what they could. From that start, it ought to have been possible to get medical assistance to the injured in the City Room speedily. This would have allowed victims to be removed safely on stretchers to the station entrance; from there they could have been put into ambulances and taken to hospital, where they would have received the best treatment.

However, long-established policy within the ambulance service is that the first paramedic on the scene of a Major Incident will become the acting Operational Commander. In that role, they are instructed not to treat casualties. Instead, the acting Operational Commander is expected to assess the scene and pass a message to the control room, then seek to establish command and control, before co-ordinating with incident commanders from the police and fire and rescue services. All of that takes time. The failure of paramedics to arrive in numbers was a terrible disappointment to the injured and the rescuers in the City Room, who did not have the skills to triage the injured and give them the life-saving medical help they might need prior to being moved.

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There was a major failure in the coordination of the police with the fire service, who stood off and did not deploy at the Manchester Arena for two hours. On the night of the Attack, North West Fire Control did not manage communications in the way that would have been expected of them by the public and by the Fire Service. The control room was responsible for significant failures in the management of information throughout that night. There were gross lapses in inter-agency communications, even after training for a crisis. Significant aspects of the emergency response went wrong, and should not have happened. Some of what wrong had serious, and in one case, fatal consequences.

The Manchester Arena Inquiry report states that the overarching aim of any response to an emergency is saving lives and reducing harm. This should be the most important consideration throughout every decision-making process. The five main principles for achieving this, known as the "Principles for joint working",- were: communication, co-location, co-ordination, shared situational awareness and joint understanding of risk. There were significant failures in relation to each of these principles for joint working on the night of the attack.

The Joint Emergency Services Interoperability Principles (JESIP) emphasise the need for co-ordination, either by locating commanders at the same place and, if that is not possible or is still to happen, by having effective communication between all the emergency services. Manuals have been written on what is needed to make JESIP work; everyone is meant to be trained on the principles. JESIP still failed on 22nd May 2017.

The Manchester Arena Inquiry report makes multiple recommendations for all the emergency services. North West Fire Control should take steps to ensure that it is involved in multi-agency exercises, particularly those that test mobilisation and the response to a Major Incident. North West Fire Control should also ensure that it regularly tests how it operates, by ensuring that its staff participate in regular exercises and practical tests. These should include multi-agency exercises. Greater Manchester Police should ensure that its plans for responding to a Major Incident, including a terrorist incident, are reviewed regularly by those with the appropriate skills and experience. Greater Manchester Police's Major Incident Plan should be reviewed to ensure that it includes clear guidance on the capabilities of North West Ambulance Service, including its Hazardous Area Response Team, Ambulance Intervention Team and Special Operations Response Team, as well as on the importance of joint working. North West Ambulance Service should ensure that it has up-to-date site-specific plans for all large, complex or high-risk locations within its area. North West Ambulance Service should ensure that all its site-specific plans are multi-agency.

Please provide a list with links of data sources used in the following categories	
Government/Official reports	Kerslake R. (2019) Emergency response to the Manchester Arena attack report: [Microsoft Word - Kerslake Arena Review PROOFED.docx (jesip.org.uk)](jesip.org.uk) Manchester Arena Inquiry Volume 1: [Manchester Arena Inquiry - Volume 1: Security for the Arena (publishing.service.gov.uk)](publishing.service.gov.uk)

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	Saunders J. (2022) Manchester Arena Inquiry Volume 2: Manchester Arena Inquiry Volume 2: Emergency Response (publishing.service.gov.uk)
NGO reports	Greater Manchester Preventing Hateful Extremism and Promoting Social Cohesion Commission (2018) Preventing Hateful Extremism and Promoting Social Cohesion Commission - Greater Manchester Combined Authority (greatermanchester-ca.gov.uk)A Shared Future.

Reed A., Ingram H.J. (2020) Towards a framework for post-terrorist incident communications strategies. RUSI Global Research Network on Terrorism and Technology, Towards a Framework for Post-Terrorist Incident Communications Strategies | Royal United Services Institute (rusi.org) Paper No.12.

Vidino L., Marone F., Entenmann E. (2017) Fear thy neighbour: radicalization and jihadists in the West. ISPI Report. |
| Community interviews/reports | These are included in Volume 2 of the Manchester Arena Inquiry Report. Of particular note is the attention given to the bereaved. Saunders J. (2022) Manchester Arena Inquiry Volume 2: Manchester Arena Inquiry Volume 2: Emergency Response (publishing.service.gov.uk) |
| Eyewitness/first-hand accounts | These are included in the Kerslake report by Bob Kerslake. Kerslake R. (2019) Emergency response to the Manchester Arena attack report: Microsoft Word - Kerslake Arena Review PROOFED.docx (jesip.org.uk) Families were interviewed. Some gave negative accounts such as: *"I spoke to someone on the phone posing as a bereavement nurse." "The most distressing part was the press making statements up." "They ... lifted photos and stories from his Facebook page." "One tried to push his way into the house, put his foot inside the house to try to get in".* |
| News/media reports | Britton P. (2021) Arena bomb public inquiry: fire service and control room response after attack was inadequate, says expert. Greater Manchester News, 8 September. Manchester Arena Inquiry LIVE updates as policing experts give evidence - Manchester Evening News

Dettmer J. (2017) British-Libyans express anger, fear following Manchester bombing. British-Libyans Express Anger, Fear Following Manchester Bombing (voanews.com) VoA, May 26. |

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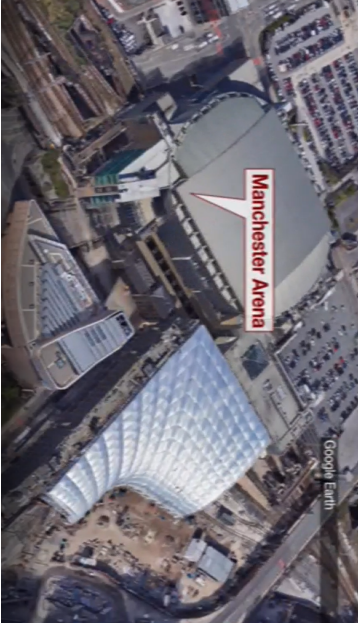
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Other (Please specify)	None has been identified
WP2	**Task 2.3: Natural and manmade case study social media analysis**

What was the role, influence, and impact of social media communications during this incident?

More than 14 million tweets were posted about the Manchester bombing, including the hashtag #MissinginManchester about people who had not been found. Facebook also launched its safety check feature so users who attended the concert could mark they were safe.

One of Manchester's symbols, the worker bee, contributed to a politics of post-terror togetherness. This symbol was followed on social media platforms via an analysis of 53,000 Instagram images.

From a database of millions of messages posted on Twitter within 24 hours of the attack, tweets were largely dominated by resilience messages, requests for help, and reporting of details about the attack. There was also a substantial amount of Islamophobia, some misinformation and hoaxes, and some offensive comments and trolling. Constant negative portrayal of Muslims by British media left them looking for their own media communication platforms that project their unique voice.

Intrusion into the privacy of victims' families was a problem. Regarding the overall themes displayed in social media responses, the tweets showed a mix of empathetic and not empathetic responses but also showed presence in the crisis, being rooted on what was happening, rather than looking at the past. Some of the main Manchester Arena Twitter accounts were: @ManCityCouncil, @ArianaGrande, @GMPolice. There were numerous Tweets from the hashtags #ManchesterBombing, #Manchester, #OneLoveManchester and the Manchester Bombing Twitter Moment.

Not only did the Manchester Police send out press releases and media alerts to news outlets who broadcasted the information or published it in their newspapers or online formats, but the Manchester Police also constantly updated its Twitter account with the same information. This practice ensured that the information was disseminated to the appropriate outlets in order for the message to be spread and consumed by the

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target audience. In this case, it was important for audiences worldwide to be kept updated with the latest information on the Manchester Arena bombing investigation, so using a traditional media and social media strategy was the best crisis communication response.

What patterns of interactions between opinion makers and recurring topics in the Twitter debate following the disaster have been identified?

Because of the failure of the Vodafone emergency communication system, national counter-terrorism police had to rely on updates from Twitter for nearly two hours after the Manchester Arena attack. Assistant Commissioner Neil Basu, then the country's senior national co-ordinator for counter-terrorism, said he first heard about the attack through the husband of one of his senior officers who was a firearms officer on a training course, around 24 minutes after the attack. The SO15 Reserve, a 24-hour operations centre for national counter-terrorism operations, was still having to rely on Twitter for information at 12.13am, nearly two hours after the attack.

The dissemination of information via social media was crucial when the Vodafone telecommunications system was down. The offer of help from the public, e.g. a bed for the night, was a positive influence on the disaster response, and promoted resilience. There was a strong sense of Mancunian solidarity and strength in the face of a terrorist atrocity. In Twitter, supportive posts joined the thematic collection of attack victims' memorial messages.

However, there was a dark side to the Twitter debate. Russian trolls live-tweeted the Manchester attack.

Spoof Russian accounts included the sending of inflammatory messages within 15 minutes of the Manchester attack. The goal of these actions appears to be the amplification of social tension, and thus the public harms from the attacks, in support of Russia's wider geopolitical strategy, which targets NATO countries to this day.

ISIS supporters used Twitter to celebrate the terrorist attack by an ISIS supporter. Twitter had shut down 125,000 ISIS-linked accounts the previous year in 2016, and said it was hiring more staff to police terrorist propaganda and improve algorithms to find hateful material. Spontaneous hate towards Islam and Muslims was witnessed in tweets related to the Manchester attack. Whenever an Islamophobic tweet is made, then the re-tweeter was found most of the time to be another anti-Islam Twitter user, or one who also blames Islam for the attack.

Please provide a list with links of data sources used in the following categories

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Community interviews/reports	A substantial amount of community information is contained in the major 2018 Kerslake report, (referenced above), commissioned by the Mayor of Manchester, Andy Burnham, to have an early review of the bombing, and implications for future public safety.
Eyewitness/first-hand accounts	Documentaries include eye-witness accounts. Examples are Manchester Bomb: Our Story [BBC Three - Manchester Bomb: Our StoryBBC 2019]; A Manchester Story Anton Arenko on 'A Manchester Story' by Ben on WFM	Mixcloud[Anton Arenko 2022]; Worlds Collide:The Manchester BombingWorlds Collide: The Manchester Bombing - Series 1 - Episode 1 - ITVX; Worlds Collide: The Manchester Bombing - Series 1 - Episode 2 - ITVX [ITV 2 episodes 2022]; Manchester Bomb: Saffie's Story [BBC Panorama 2022]. Also Thistleton K. (2021) Introducing Manchester Arena bomb: stories of hope. BBC Sounds - Manchester Arena Bomb: Stories of Hope - Downloads BBC podcast 14 May.
News/media reports	ISIS supporters celebrate terror attack on social media as Twitter confirms tweet predicting Manchester attack was posted after the bombing. ISIS fans celebrate Manchester attack on Twitter	Daily Mail Online MailOnline 23 May 2017 After Manchester, Social Media helps and hurts. Venues stay alert and shows go on. After Manchester, Social Media Helps And Hurts, Venues Stay Alert And Shows Go On : The Record : NPR NPR, 24 May 2017. Brother of Manchester bombing victim reveals 'astonishing' abuse from far-right Trolls. Independent. 5 November Brother of Manchester bombing victim reveals 'astonishing' abuse from far-right trolls	The Independent	The Independent MI5 had evidence of extremist material on Facebook account of Manchester Arena bomber Salman Abedi's brother two years before terror attack which killed 22 people. MI5 'had evidence of extremist Facebook account of Manchester Arena bomber Salman Abedi's brother'	Daily Mail OnlineMailOnline, 25 April 2017.

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Documentaries	Manchester Bomb: Our Story [BBC Three - Manchester Bomb: Our StoryBBC 2019]; A Manchester Story Anton Arenko on 'A Manchester Story' by Ben on WFM | Mixcloud[Anton Arenko 2022]; Worlds Collide:The Manchester BombingWorlds Collide: The Manchester Bombing - Series 1 - Episode 1 - ITVX; Worlds Collide: The Manchester Bombing - Series 1 - Episode 2 - ITVX [ITV 2 episodes 2022]; Manchester Bomb: Saffie's Story BBC One - Panorama, Manchester Arena Bombing: Saffie's Story [BBC Panorama 2022].
Social Media	Social media used as key tool in wake of terrorist attack. Public Technology.net, 23 May. Social media used as key tool in wake of terrorist attack | PublicTechnology.net
Satellite/other imagery	Google Earth views of the Manchester Arena Manchester Arena blast - Google My Maps
Academic Papers/Reports (Peer Reviewed)	Berube M., Tang T-U. et al. (2020) Social media forensics applied to assessment of post-critical incident social reaction: the case of the 2017 Manchester Arena terrorist attack. [PDF] Social media forensics applied to assessment of post-critical incident social reaction: The case of the 2017 Manchester Arena terrorist attack. | Semantic Scholar Forensic Science International, 313.
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	Open doors and fake news: how people used social media after the Manchester attack. Open doors and fake news: how people used social media after the Manchester attack - Prospect Magazine Prospect magazine, 2 June 2017.
	We talked to a troll who made up a fake Manchester victim for retweets. The Future, 23 May 2017.
	Brother of Manchester bombing victim reveals 'astonishing' abuse from far-right Trolls. Brother of Manchester bombing victim reveals 'astonishing' abuse from far-right trolls	The Independent	The Independent Independent. 5 Nov. 2017.
	Sick trolls spread fake news saying Darlington teens are missing following Manchester bombing. Sick trolls spread fake news saying Darlington teens are missing following Manchester bombing	The Northern Echo Northern Echo, 26 May 2017.
	Terror victims warned: beware of social media trolls. NHS England » Terror victims warned: beware of social media trolls NHS, 9 September 2017.
	Vile Facebook banter groups have been mocking the Manchester bombing victims since last week's atrocity. Vile Facebook 'banter' groups have been mocking the Manchester bombing victims since last week's atrocity	The Sun The Sun 31 May 2017.
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	Turton W. (2017) We talked to a troll who made up a fake Manchester victim for retweets. The Future, 23 May. We talked to a troll who made up a fake Manchester victim for retweets | The Outline
Online podcasts, blogs, forums & chat rooms	Thistleton K. (2021) Introducing Manchester Arena bomb: stories of hope. BBC Sounds - Manchester Arena Bomb: Stories of Hope - Downloads BBC podcast 14 May.
	Gardham D., Smith S. (2020) The Case Files: Manchester bombing. The Case Files: Manchester Arena Bombing on Apple Podcasts Apple podcast, 1 September.
	Fawcett D. (2018) After the Manchester Bombing: one year on. After the Manchester Arena attack: one year on - Victim Support Victim support blog, 22 May.

| Official policy recommendations & findings | Recommendations are detailed in Volume 2 of the Manchester Arena Inquiry, published on 3rd November 2022. Saunders J. (2022) Manchester Arena Inquiry Volume 2: [Manchester Arena Inquiry Volume 2: Emergency Response (publishing.service.gov.uk)](publishing.service.gov.uk)

Kerslake R. (2019) Emergency response to the Manchester Arena attack report: [Microsoft Word - Kerslake Arena Review PROOFED.docx (jesip.org.uk)](jesip.org.uk)

Manchester Arena Inquiry Volume 1: [Manchester Arena Inquiry - Volume 1: Security for the Arena (publishing.service.gov.uk)](publishing.service.gov.uk)

An additional recommendation is that there ought to be a risk assessment for every public venue, which should include the risk of a terrorist attack. This is named Martyn's Law, after one of the victims, Martyn Hett. ["Martyn's Law" - What you need to know	ProtectUK](ProtectUK)
	HomeOfficeMediaBlog: [manchester bombing - Home Office in the media (blog.gov.uk)](blog.gov.uk)

RedCross support for young people:

Fig.4: British Red Cross Manchester bombing appeal |

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| Other (Please specify) | As and when Martyn's Law passes through parliament, there will be further publicity about the Manchester bombing.
 "Martyn's Law" - What you need to know | ProtectUK |

| WP2 | Task 2.4: Natural and manmade case study aerial imagery analysis |

What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform decision-making?

The terrorist attack was localised just at the Manchester Arena. Because the attack was perpetrated by a lone suicide bomber, there was no fleeing terrorist to track via aerial imagery. If the terrorist had escaped by vehicle from the Arena, aerial imagery, particularly via police drones, would have been useful in tracking their route. Indeed, drones have become an important asset for law enforcement services in many countries.

What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform the sharing of public information?

The Google maps image of the Manchester Arena location is a useful source of public information on the extent of the area around the bombing location, in particular its adjacency to the Manchester Victoria station.

Please provide a list with links of data sources used in the following categories

Government/Official reports	This data was not requested in this phase.
NGO reports	This data was not requested in this phase.
Community interviews/reports	This data was not requested in this phase.
Eyewitness/first-hand accounts	This data was not requested in this phase.
News/media reports	This data was not requested in this phase.
Documentaries	This data was not requested in this phase.
Social Media	This data was not requested in this phase.
Satellite/other imagery	This data was not requested in this phase.

Type of data	Data/ information/ sources/ reference material
WP3 — **Task 3.1 - Critical analysis of past disasters via the identified case studies on their disaster preparedness strategies**	
3.1.1 — **Type of hazards – Understanding the disaster risk**	
a. What type of hazards were commonly identified in the region (Slow-onset and rapid onset hazards)?	This data was not requested in this phase.
b. What hazards have resulted in disasters during the past 20 years?	This data was not requested in this phase.
c. What risk assessment mechanism(s) were used by the relevant institutions for encompassing risk awareness, multi-hazard analysis, vulnerability/capacity analysis and cascading effects?	This data was not requested in this phase.
d. What risk modelling and scenarios have been carried out to consider disaster risk and/or any other future threats and cascading effects?	This data was not requested in this phase.
e. How the knowledge of indigenous communities and information in social media had been captured for disaster risk perception?	This data was not requested in this phase.
Academic Papers/Reports (Peer Reviewed)	This data was not requested in this phase.
Academic Papers/Reports (Non-Peer Reviewed)	This data was not requested in this phase.
Public Enquiry Reports/Findings	This data was not requested in this phase.
Journal/Magazine articles	This data was not requested in this phase.
Online podcasts, blogs, forums & chat rooms	This data was not requested in this phase.
Official policy recommendations & findings	This data was not requested in this phase.
Other (Please specify)	This data was not requested in this phase.

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3.1.2	**Disaster resilience and preparedness strategies**	
a.	What were the available national and local disaster management plans and systems under following categories?	This data was not requested in this phase.
	o Individual-level activities (e.g., first aid training and response)	This data was not requested in this phase.
	o Household actions (e.g., stockpiling of equipment and supplies, retrofitting)	This data was not requested in this phase.
	o Community efforts (e.g., socially responsible mitigation, training, and awareness campaigns for first responders and responders, and field exercises)	This data was not requested in this phase.
	o Governmental strategies (e.g., multi-organisational planning and public private partnerships, early warning systems, contingency plans, evacuation routes, and public information dissemination, allocation of resources)	This data was not requested in this phase.
b.	What provisions were in place for research, education, science, and technology (ex: geospatial, remote sensing) for informed disaster preparedness?	This data was not requested in this phase.
c.	What special provisions were undertaken to ensure pandemic preparedness in disaster preparedness measures?	This data was not requested in this phase.
3.1.3	**Mitigation**	
a.	What policies and legislation were available that mainstreamed DRR in the national planning policy?	This data was not requested in this phase.
	o Land use planning and building codes (Ex: Avoid settlement expansion towards hazard prone areas)	This data was not requested in this phase.
	o Critical infrastructure protection and structural design improvements	This data was not requested in this phase.
	o Landscape and environmental arrangement around essential services and infrastructure	This data was not requested in this phase.
	o Resilience strategies including planning and partnership building between sectors	This data was not requested in this phase.

b.	What support were provided by media platforms including social media during disaster operations?	This data was not requested in this phase.
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	This data was not requested in this phase.
3.1.4	**Response**	
a.	What were the available surveillance, early warning, and information management systems for activating response operations under the following conditions?	This data was not requested in this phase.
	○ Support or coordinate disaster operations being conducted by a designated lead agency	This data was not requested in this phase.
	○ Logistics mechanisms and essential supplies for health and relief services	This data was not requested in this phase.
b.	What support were provided by media platforms including social media during disaster operations?	This data was not requested in this phase.
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	This data was not requested in this phase.
3.1.5	**Recovery**	
a.	What were the long-term and short-term recovery actions undertaken during each post disaster recovery period including 'build back better' practices?	This data was not requested in this phase.
	○ Response endeavours such as needs and damage assessments	This data was not requested in this phase.
	○ Community-level involvement and capacity building for disaster recovery	This data was not requested in this phase.
	○ Local administration and coordination for resource mobilisation	This data was not requested in this phase.
	○ Building redundancy into a DRR plan	This data was not requested in this phase.

b.	How the post disaster infrastructure recovery including rebuilding, restoration, or reconstruction had taken place?	This data was not requested in this phase.
c.	What plans or provisions were available to minimise the economic impact following a disaster?	This data was not requested in this phase.
d.	What environmental recovery plans were available to manage the impact for eco-systems and related services?	This data was not requested in this phase.
e.	How have the mitigation and resilience-building activities of preparedness been adopted for the next disaster, and the development and implementation of legislation, policies, and practices to avoid similar situations in the future?	This data was not requested in this phase.
3.1.6	**Monitoring and evaluation**	
	How frequent are plans being reviewed and revised for emergency preparedness, response, and recovery?	This data was not requested in this phase.
WP3	**Task 3.2 – Vulnerable categories**	
Type of data		**Data/ information/ sources/ reference material**
WP3	**Task 3.3 – Culture and heritage**	To be included in V3 (June 2022)
Type of data		**Data/ information/ sources/ reference material**
WP3	**Task 3.4 – Risk governance strategy**	To be included in V3 (June 2022)
	To be included in V3 (June 2022)	

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Type of data	Data/ information/ sources/ reference material
3.4.1 **Disaster risk governance mechanisms**	
What were the disaster risk governance mechanisms identified in the relevant authorities to manage disaster risk under following categories?	This data was not requested in this phase.
o This data was not requested in this phase.	None identified in research phase.
o This data was not requested in this phase.	None identified in research phase.
o This data was not requested in this phase.	None identified in research phase.
o This data was not requested in this phase.	None identified in research phase.
o This data was not requested in this phase.	None identified in research phase.
3.4.2 **International DDR frameworks**	
What international DDR frameworks (SENDAI, SDG, Paris Agreement) were adopted in DRR projects?	This data was not requested in this phase.
3.4.3 **Accountability in disaster governance**	
What were the provisions to ensure accountability in disaster governance?	This data was not requested in this phase.
o Consider accountability aspects in the Sendai Framework for Disaster Risk Reduction 2015-2030	This data was not requested in this phase.
o Innovative elements of accountability	This data was not requested in this phase.
o Enabling legislations	This data was not requested in this phase.
o Regular monitoring, evaluation, and review	This data was not requested in this phase.
WP4 **Cascades**	

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1.	What is the EU country, covered by CORE partners, preparing for (crisis, war and crisis, disruption)?	This data was not requested in this phase.
2.	What types of disasters is each EU country, covered by CORE partners, preparing for?	This data was not requested in this phase.
3.	Who is involved in the preparation process?	This data was not requested in this phase.
	○ What kind of approach is adopted in disaster preparedness: e.g., is disaster preparedness centralized (national level) or decentralized (local level); who (which agency) has the leading role in preparedness; guiding policy frameworks and/or strategies and principles; coordination/cooperation mechanisms (and sectors involved)?	This data was not requested in this phase.
	○ Other stakeholders for preparedness?	This data was not requested in this phase.
	○ EU/UN/INGO?	This data was not requested in this phase.
4	Training and communication preparedness	
a.	What kinds of trainings (including drills and crisis exercises) are done to prepare for a disaster?	This data was not requested in this phase.
b.	Who provides training, for whom and what competencies are covered?	This data was not requested in this phase.
c.	What kind of approach is adopted in crisis communication preparedness: e.g., what is communicated to the general public about preparedness, how (means and channels: e.g., preparedness brochure, crisis portals/websites, campaigns, formal/civic/professional education, social media mobilisation) and by whom (leading agency + other partners and stakeholders involved + partnerships with news media)? How are the needs of vulnerable groups taken into account?	This data was not requested in this phase.
5.	Prepositioning, framework contract and supplier management	

a.	What types of goods are pre-positioned and how are locations selected?	This data was not requested in this phase.
b.	Which organization is responsible for management of pre-positioned stock?	This data was not requested in this phase.
c.	What are the framework contracts for disaster preparedness, who manages them?	This data was not requested in this phase.
d.	How are suppliers who secure the supply for preparedness selected and managed	This data was not requested in this phase.
6.	How was the preparedness and response mechanism activated for different types of risks?	This data was not requested in this phase.
7.	How the event influenced flow, access to and availability (length of shortage, scale, shortage by social group) of:	
	○ Drinking water;	This data was not requested in this phase.
	○ Energy supply (electricity, coal, fuel etc.);	This data was not requested in this phase.
	○ Food (retail sales, catering, etc.);	This data was not requested in this phase.
	○ Health (emergency and long-term provision, psychological health);	This data was not requested in this phase.
	○ Access to information.	This data was not requested in this phase.
8.	How the event influenced preparedness mechanisms (in terms of training, information flow, communication, prepositioning, supplier management). What were the lessons learned from the case?	This data was not requested in this phase.
WP7	**Social media information/misinformation and risk communication**	
	Please provide a quality assessment for the accuracy and veracity of information and data used to inform this case study.	
	This data was not requested in this phase.	

Reference List Terrosist Attack case study

Berube M., Tang T-U. et al. (2020) Social media forensics applied to assessment of post-critical incident social reaction: the case of the 2017 Manchester Arena terrorist attack. Forensic Science International, 313.

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Annex 5 - Case Study 2 – EARTHQUAKE (partner: University of Salerno)

CASE STUDY 2: Earthquake	
Guidance notes are provided in red text offering additional description and direction of the response/s required in each field.	
Incident	The L'Aquila earthquake of 2009 (Mw6.3).
Location	The name 2009 L'Aquila earthquake refers to a series of earthquake events, which began in December 2008, with epicenters in the entire area of the city of L'Aquila, the L'Aquila basin, and part of the province of L'Aquila (Alto Aterno, Monti della Laga, and lower Aterno Valley). The name refers mainly to the main earthquake, which occurred on 6th April 2009 at 3:32 am (Mw 6.3), with epicenter between the hamlets around L'Aquila, affecting to varying degrees much of the territory located between central and southern Italy.
Time & Date	The main event occurred at 3:32 am (CEST), 6th April 2009
Description and timeline of the incident	

Description and timeline. The Mw 6.3 mainshock of 6th April 2009, represented the most damaging event in Italy since the 1980 Irpinia earthquake (Mw 6.9) (Chiaraluce, 2012). Thousands of foreshocks, started in December 2008, preceded this mainshock event. The largest foreshock event was the Mw4.0, recorded on 30th March 2009.

During the sequence Giampaolo Giuliani, an INAF technician (Istituto Nazionale di Astrofisica), noticed significant spikes in radon emissions in the L'Aquila region in late March 2009. He warned the authorities that a significant earthquake might occur in the final week of March 2009, possibly close to Sulmona, which is 50 kilometers southeast of L'Aquila. The National Commission on the Forecasting and Prevention of Major Risk, which responsibility was to offer counsel and direction on scientific issues to the Dept. of Civil Protection, met in L'Aquila on 31st March 2009 as a result of the unrest and the magnitude 4.0 the day before (30th March 2009). At this conference, it was explicitly stated that there was no need to worry about how the dominant earthquake swarm was developing because seismic energy was only being produced in brief bursts. No significant tremor was conceivable. The terrible earthquake struck six days later, on 6th April.

Around 18,000 aftershocks followed the main event in one year, and five events with moment magnitude larger than 5.0 have been recorded, among which the strongest were a Mw 5.6 and a Mw 5.4, occurred on 7th and 9th April, respectively. The earthquake was felt across central Italy. The location (right below the city of L'Aquila) and the shallow hypocentral depth (around 10 km), resulted in 309 casualties, more than 1,600 people injured, 65,000 temporarily displaced, and over €10 billion was the damage estimate. A total of 81 municipalities were affected by the earthquake.

Source: https://www.reluis.it/doc/pdf/Aquila/EERI_L_Aquila_report.pdf

Geology and past earthquakes. The area involved is located in one of the zones with the highest seismic hazard in Italy (Akinci et al., 2009). The faults of the Apennines are characterized by extensional tectonics. The area has been hit by several destructive earthquakes in the past (1315, 1349, 1452, 1501, 1646, 1703, 1706, and 1958). The Mw6.8 earthquake of February 17th, 1703, which destroyed the city and killed 5,000 people. In

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addition, the Mw7.0 1915 earthquake in L'Aquila killed over 30,000 people and destroyed nearly every building in Avezzano and numerous other communities. Seismic microzonation studies had also highlighted the capacity for amplification of seismic waves by the underlying geological terrain (incoherent alluvial soils), causing more damage than expected. The areas near the Aterno River Valley suffered damage greater than VIII degree of the Mercalli-Cancani-Sieberg intensity scale (MCS), reaching the maximum values of IX-X MCS in the small villages of Onna and Castelnuovo.

Response. At 3:32 a.m. on April 6, 2009, the main earthquake occurred. The quake was felt throughout much of central Italy, and early fragmentary information reported destroyed houses, damaged buildings and thousands of people in the streets.

At 4:15 a.m., the Civil Protection Department's Crisis Unit meets and the situation immediately appears very serious. A group of technicians from the Department leaves to conduct the first seismic surveys of the area, and two teams move in the direction of L'Aquila to support local authorities and prepare the necessary conditions to ensure national coordination on the ground.

The Civil Protection Operational Committee, convened for 4:40 a.m. and chaired by the Head of the Civil Protection Department, brings together the heads of all administrations and structures involved in managing the emergency. The entire National Civil Protection System is mobilized. With the declaration of a state of emergency by the Prime Minister, at 9 a.m. the following morning the Direzione di Comando e Controllo (Di.Coma.C.), the coordinating body for the emergency is formed at the headquarters of the Guardia di Finanza School in L'Aquila. In the morning, men and vehicles from all over Italy begin to converge on earthquake-stricken areas. Damaged roads and buildings are manned and cordoned off to allow help to arrive as quickly as possible.

Within 48 hours of the earthquake, 2,400 firefighters, more than 1,800 members of the Armed Forces, more than 1,500 members of the Police Forces, more than 800 doctors and nurses from the Italian Red Cross, more than 4,000 Civil Defense volunteers and more than 100 canine units are on the ground. Array of seismic stations were installed by institutions coming from Italy, France and Germany. This response allowed the scientific community to collect a very high-quality dataset (Margheriti et al. 2011), the largest ever acquired in Italy until the 2017 Amatrice-Visso-Norcia seismic sequence

In the same hours, 30 reception areas are set up to provide assistance to nearly 18 thousand people and more than 10 thousand beds are made available in private homes and hotels on the coast. More than 20 field kitchens are also activated to distribute thousands of meals. Eight sleeping cars offered by the State Railways are stationed at L'Aquila station in response to requests made by the Civil Defense.

By the end of April 2009, the number of assisted population will rise to 67,459, the highest value reached in emergency management.

Source: Dept. Civil Protection

Damages. The historical center of L'Aquila suffered the collapse of several buildings, including some recent reinforced concrete ones, and severe damage for a big portion of public and residential buildings which were declared unusable. In 2009, L'Aquila was home to approximately 73,150 inhabitants and a population of commuters of up to 100,000 people. The earthquake destroyed 3,893 buildings (ancient and modern) and damaged 69,591 others, including many buildings of medieval, renaissance and baroque architecture. Among the masonry buildings historic in the city center to have collapsed include the city hall, the Abruzzo National Museum and the Cathedral of St. Maximus, which was already destroyed by the 1703

earthquake and rebuilt in the 19th century and, among the modern ones, a university dormitory, a modern concrete building. Eight students were killed. The earthquake destroyed or seriously damaged around 80% of the artistic heritage of L'Aquila. Almost 1,677 historic buildings were surveyed, of which 973 were churches, 649 were palaces and the remaining 55 correspond to other typologies of historical buildings, such as towers, fountains, etc. Only 240 churches were declared fit for habitation. After more than 10 years L'Aquila is still one of the largest building sites in Europe.

Loss of life. during the earthquakes there were 309 casualties, more than 1,600 people injured, 65,000 temporarily displaced (Dell'Osso et al., 2011). L'Aquila is a University town. Indeed, 66 of the 309 deaths were students in the age group 20–29 years, nine of whom died in the collapse of one wing of a university dormitory called "Casa dello Studente" (Alexander, 2010).

Economic impacts. Until 2020, the government has allocated a total of 17.5 billion euros for L'Aquila's reconstruction and emergency management, including funds spent on all temporary housing and planned spending until 2047. Source: Swiss Re Institute.

Environmental impacts. From the very first days afterwards, Berlusconi and Civil Defense chief Guido Bertolaso talked about building New Town in the L'Aquila suburbs, an earthquake-proof "new town" with earthquake-proof houses in addition to real semi-permanent villages, to be placed outside the affected centers, which would prevent the exodus of the population. This was accomplished with the subsequent C.A.S.E. project and M.A.P. project, but the people of L'Aquila and the municipality of L'Aquila, fearing that the core of the city might become a "museum city," opposed the idea with pressing demands for the reconstruction and rehabilitation of the historic center soon organizing themselves into reconstruction committees. However, such "New Towns" were built in a few months at 19 new settlements distributed in various locations on the outskirts of the city: Sant'Antonio, Sant'Elia, Coppito 2, Sant'Elia2, Gignano, Coppito 3, Bazzano, Sassa, Pagliare di Sassa, Paganica Sud, Cese di Preturo, Paganica 2, Tempera, Roio Poggio, Roio 2, Collebrincioni, Camarda, Assergi 2, and Arischia. In the C.A.S.E project 11,776 displaced residents from L'Aquila were resettled, while in the MAP project 2468 were resettled. 4276 were receiving a special economic contribution for housing, while 478 were paying rent at special rates. the allocation of facilities was oriented to supply basic needs, but neglected other ones, which reduced community resilience. (Contreras et al., 2017).

WP2	Task 2.2: Natural & manmade disaster case study identification, research & analysis

What were the public information sharing challenges?

One of the main challenges emerging from the case study of the L'Aquila earthquake is fighting misinformation and proper engagement of the population. Mr Gioacchino Giampaolo Giuliani was a technician who worked in the National Gran Sasso Physics Laboratory 40 km east of L'Aquila. For some years his hobby has been to monitor atmospheric radon emissions in an attempt to correlate them with heightened seismic activity and thus gain a means of making short-term predictions of violent earthquakes. He maintained a radon meter in the basement of a school in L'Aquila and took frequent readings from it. He noted increases in radon emissions shortly before the October 2002 San Giuliano di Puglia earthquake, which occurred 240 km southeast of L'Aquila but was unable to pinpoint the epicentre. Radon is an inert gas that is transferred in increasing quantities to air or

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groundwater when micro-fracturing around an active geological fault is induced by seismic strain. However, it should be emphasized that with current knowledge and technology, earthquakes cannot be predicted in the short-term with such measurements.

After a few days in which he vacillated when questioned by journalists, on 29 March 2009 Mr Giuliani informed the mayor of the town of Sulmona (population 25 200) that a 'catastrophic' earthquake was about to happen. His prediction was followed within 24 hours by a seismic event of magnitude 3.8 that, of course, was too small to produce damage. Moreover, it was one of 900 tremors registered over the six months that preceded the L'Aquila main shock. However, word had got around and the population of Sulmona busied itself taking precautions, albeit not in a systematic way and without activating the town's emergency plan. The Italian National Department of Civil Protection (DPC) began legal proceeding and asked for punitive damages because Giuliani was alleged to have created unnecessary alarmism. Moreover, the National Astrophysics Institute was careful to point out that Mr Giuliani's predictions were not made in the context of his job and were not sanctioned by his employer. As a result of the ensuing chaos, at 18:30 hrs on Tuesday 31 March 2009 the DPC convened the national Commission on Major Risks (Commissione sui Grandi Rischi) in L'Aquila. Present at the meeting were more than a dozen officials from the national Department of Civil Protection, universities, and regional and local government. The minutes were later published by a weekly magazine (L'Espresso, 2009). The two-page summary of the one-hour meeting shows considerable complacency, some oversimplification, and a degree of evasiveness. Its main conclusions were articulated by Professor FrancoBarberi, a volcanologist at the University of Rome III and former Undersecretary of State for Civil Protection:

Professor Barberi concluded that there was no reason to say that a sequence of low-magnitude shocks could be considered as the precursor of a major event. Referring to what was happening at L'Aquila,

Professor Barberi explained that the measurement of radon gas in order to predict earthquakes is an old problem that has long been studied without obtaining useful solutions. (L'Espresso, 2009)

The main shock occurred one week after Mr Giuliani had predicted it, and with an epicentre located just outside the city of L'Aquila, 55 km away from Sulmona. In a television interview after the disaster, Mr Giuliani stated that radon measurements had reached such a peak on the night of 5 April 2009 that three hours before the main shock he made his family leave their home and spend the night outside. However, during another television appearance after the disaster he contradicted this affirmation and said that they had remained at home. The televised debates, which went on for more than a week, were vitriolic and involved a welter of accusations and counter-accusations. Giuliani demanded that the authorities beg his pardon, but they were disinclined to do so. (Alexander, 2010).

What have we learned from L'Aquila? With technology advancing, what could happen if, under the same conditions as in 2009 in L'Aquila, someone spreads disinformation, or worse, hacks the Civil Defense Department website during the earthquake swarm alarming the population with fake messages. Would we be prepared to discriminate real from fake? Would we have a situation like 2009? Which action would be taken from the government in this case? What is certain is that a population that is scientifically prepared for the earthquake phenomenon (not to be confused with the word "disaster"), constantly updated even in scientific terms, and not "reassured" or, worse, confused, could become more resilient in future similar scenarios.

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What were the ethical issues?

There are different ethical issues related to the L'Aquila earthquake case study, according to different studies.

Scientific misinformation.

- Ethical dilemmas related to predictions and warnings of impending natural disasters. Giampaolo Giuliani's numerous false alarms and the "failure" of scientists on the Major Risks Commission to warn after a long-lasting seismic swarm preceding the L'Aquila earthquake were material to one of the main ethical problems coming out of this case study. Source: Phua & Hue, 2013.

- Mr Gioacchino Giampaolo Giuliani was a technician who worked in the National Gran Sasso Physics Laboratory 40 km east of L'Aquila. For some years his hobby has been to monitor atmospheric radon emissions in an attempt to correlate them with heightened seismic activity and thus gain a means of making short-term predictions of violent earthquakes. He maintained a radon meter in the basement of a school in L'Aquila and took frequent readings from it. He noted increases in radon emissions shortly before the October 2002 San Giuliano di Puglia earthquake, which occurred 240 km southeast of L'Aquila but was unable to pinpoint the epicentre. Radon is an inert gas that is transferred in increasing quantities to air or groundwater when micro-fracturing around an active geological fault is induced by seismic strain. However, it should be emphasized that with current knowledge and technology, earthquakes cannot be predicted in the short-term with such measurements.

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Immediately after the disaster, was that whether or not a prediction was possible was a red herring: unless the organizational means to deal with it existed, including adequate deployment of resources, little could be done to manage the emergency. Civil protection in Abruzzo was undeniably poorly developed and distinctly under-resourced. In short, it was unable to cope in any way with a major disaster.

The post-disaster recovery.

- The reconstruction efforts have been criticized for being ad hoc, delayed, ineffective, and untargeted. Source: Özerdem & Rufini, 2012.

- Post-earthquake reconstructions imply the risk of triggering a set of social disasters that may affect the public health sphere. In the case of the L'Aquila earthquake this risk seems to emerge within the urban planning on two levels of dwelling: at a landscape level, where there has been a change in the shape of the city towards a sprawling-sprinkling process; at an architectural level, on the problematic relationship between the politics and the poetics of cultural heritage protection and the goal to get restoration works capable to ensure the citizens seismic safety. Source: Cicozzi, 2016

- Project C.A.S.E.: a new type of reconstruction completely different from those of the past, with a direct shift from tents to new houses in the "New Towns" proposed by Berlusconi and Bertolaso. These new towns are sites devoid not only of any affective and symbolic reference point, but also-in most cases-material and organizational, with services absent or otherwise lacking. The configuration that the territory of L'Aquila has assumed since the earthquake has led to an acceleration and accentuation of the characters of fragmentation and dispersion of the built-up area and population, which, although already present before the earthquake, did not assume such widespread and generalized connotations throughout the territory and its inhabitants. Source: Castellani et al. 2016

- Resilience should be the main principle in guiding urban reconstruction to reduce emerging vulnerability in urban environments. The lack of spatial resilience in L'Aquila is demonstrated in the lack of ability to return to at least the original situation before the earthquake. The top-down approach adopted by the Italian Government closed the door to grassroots involvement, justified in the urgency of provide housing solutions. Lack of resilience is a problem in countries with low capacity to anticipate, to cope and to recover. The post-disaster phase offers an opportunity to reduce the existing vulnerability and improve the conditions of the community in the physical, social, economic, cultural,

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institutional and environmental dimension. It means to build a resilient community, through application of lessons learned. Nevertheless, it seems that this opportunity has not been harnessed yet in L'Aquila. Source: Conttreras et al., 2017

What lessons have been learned?

The principal lessons learned are:

The importance of risk awareness and of science communication. The L'Aquila region is an area characterized by high seismic risk, but with a low risk perception (Marincioni et al., 2012) by the population. Mr Gioacchino Giampaolo Giuliani was a technician who worked in the National Gran Sasso Physics Laboratory 40 km east of L'Aquila. For some years his hobby has been to monitor atmospheric radon emissions in an attempt to correlate them with heightened seismic activity and thus gain a means of making short-term predictions of violent earthquakes. He maintained a radon meter in the basement of a school in L'Aquila and took frequent readings from it. He noted increases in radon emissions shortly before the October 2002 San Giuliano di Puglia earthquake, which occurred 240 km southeast of L'Aquila but was unable to pinpoint the epicentre. Radon is an inert gas that is transferred in increasing quantities to air or groundwater when micro-fracturing around an active geological fault is induced by seismic strain. However, it should be emphasized that with current knowledge and technology, earthquakes cannot be predicted in the short-term with such measurements.

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Damages caused by moderate earthquakes. Moderate earthquakes are more common than the larger events, and, as the L'Aquila example shows, can cause disproportionate large human impact. They therefore need to be studied not only from the scientific point of view (geology, known faults, building resistance), but also more strongly from a policy point of view (central government failures, local authorities actions, safeguards against corruption and abuse, clear knowledge of the role of authorities) (Alexander, 2010). Given the moderate size of the earthquake, the high level of structural damage and the sizeable casualty figures should concern governmental agencies, public bodies, and insurance and construction companies, particularly in the context of the fact that significant larger earthquakes are possible. In mitigating the impacts of future, more powerful, earthquakes, particular emphasis needs to be placed on ensuring that the historical centers of villages and towns of central and southern Italy, which sustained significant damage during this event, are better prepared next time (Papanikolaou et al. 2010).

The consequences of disaggregation: the CASE project. Central government policy on rehousing the survivors concentrated heavily, indeed almost exclusively, on the CASE project. Judged in its own terms, it was a distinct success. Residents were provided by the state with all necessities, right down to cutlery and bed linen. However, the complexes lack virtually all external services. Most of them are detached, even distant, from shops and other amenities. Nothing has been done to stimulate employment. For lack of accommodation, service industries and commercial concerns have moved out of the area, increasing the unemployment rate at 12.2% (youth unemployment 40%) (Alexander, 2010). In this framework, territorial and local governments are required to provide for measures avoid the discomfort, shaped in the L'Aquila case by a deterioration in the state of coexistence due to the disaggregation of the community because of the CASE project. This implies to bring attention on topics that target individuals such as fear, loneliness, alcohol abuse, as well as communities, such as vandalism of public goods and spaces (Calandra, 2016).

Attention to post-traumatic spectrum symptoms. The Psychopathological chronic sequelae of the 2009 earthquake in L'Aquila, Italy. High rates of post-traumatic spectrum symptoms in adolescents who survived the L'Aquila earthquake. Having experienced the loss of a close friend or a relative in the framework of the earthquake seems to be related to higher PTSD rates and more severe symptomatology. These results highlight the need to carefully explore adolescents exposed to a significant loss as consequence of an earthquake. source (Dell'Osso et al. 2011)

What were the cascading effects across events, sectors and supply chain disruptions? Including the inevitability or unforeseen chain of events affecting the response to the disaster? What were the societal vulnerabilities in health and retail sectors?

L'Aquila is 117 km, or about 90 minutes' drive, from the center of Rome via a good autostrada expressway, which suffered little damage in the earthquake. Response to the disaster was rapid. The Italian Government's policy on the issue of immediate disaster response was to ensure it went

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well by encouraging an indiscriminate convergence reaction involving massive amounts of resources. This was perhaps as well, given that the main trauma hospital in the area had suffered major structural damage (concentrated, unfortunately, on the Accident & Emergency reception area). Within 24 hours it was completely replaced by the first of two field hospitals that arrived in the area. Meanwhile, early management of casualties was largely in the hands of the Italian armed forces, which employed 'Medivac' aerial evacuation techniques to remove seriously injured patients to hospitals outside the disaster area. As luck would have it, at Coppito just outside the city of L'Aquila lies the national training center for the country's financial police force (Guardia di Finanza), which has a spacious, secure compound, and plenty of accommodation, including residential units. It was an ideal site from which to manage the emergency. The national on-site emergency operations center (the DICOMAC) was rapidly established in the sports hall of this facility and the managers of 16 support functions began to coordinate their activities. Volunteer organizations, the Italian Red Cross, and the armed forces also set up bases in this hall, which functioned as the nerve center of emergency management for some months.

The earliest actions included the total evacuation of town centers, including the entire historical core of L'Aquila, the first time in modern Italian history that a major city had been completely emptied of its population by government decree. (Alexander, 2010)

From April 17-24, a team made up of representatives of the Earthquake Engineering Research Institute, the Applied Technology Council, and the Pacific Earthquake Engineering Research Center investigated the effects of the Abruzzo earthquake (Source: https://www.reluis.it/doc/pdf/Aquila/EERI_L_Aquila_report.pdf and http://www.reluis.it/doc/pdf/Aquila/Lifelines_TCLEE.pdf).

Public Buildings

Hospitals: The EERI team inspected the San Salvatore Hospital, the main hospital in the L'Aquila province located in Coppito. This hospital, which has 13 wings constructed from 1972-2000 to a 1967-era "intermediate" seismic design, attracted a great deal of attention in the media because it was shut down some hours after the earthquake, likely because of damage to a few concrete columns in three of its many buildings (Figure 16). Patients were transferred elsewhere. Nonstructural damage was relatively moderate and limited.

Schools: The damage level in schools was varied. The EERI team inspected 6 schools. The Pettino Elementary school, completed in 1994, was seriously damaged and partially collapsed. The Pettino middle school, completed in the 1980s, had a small amount of nonstructural damages, such as the elementary school in Pianola, built at the end of the 1990s. Two old masonry schools were inspected. The elementary school in Coppito, strengthen in 2003-04 by adding micro-piles in the foundations, showed moderate damages, while the elementary school in L'Aquila, an old (1400-1700) poor-quality masonry building formerly used as the hospital, was seriously damaged and its roof partially collapsed.

Industrial structures: The industrial building construction in L'Aquila is similar to that found in the United States: precast concrete buildings with precast panels, reinforced frames with concrete block walls, and steel or light metal frames with precast panel walls. The damage observed was generally concentrated in nonstructural elements (e.g., partitions and ceiling tiles) and contents, although some structural damage to beams and columns was observed. This was the case at the two-story reinforced concrete frame Vibac chemical facility close to Paganica, engineered in 2003 and constructed in 2006. The EERI inspectors observed multiple column shear failures, rupture of the column tie reinforcement spaced at 20 cm, cracking and falling of the hollow clay tile infill, and collapse of the window wall glass. At a manufacturing plant in the same facility we observed

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three tall steel silos storing polypropylene beads that suffered damage. The three silos that were full during the earthquake either collapsed or suffered extensive damage (Figure 19). The silos pounded on the adjacent precast warehouse, partially crushing the concrete wall and leaving an imprint of impact. The silos also crumpled at their bases. The undamaged sections are being salvaged and reused.

Lifelines: Highways A24 and A25, connecting the Tyrrhenian and Adriatic coasts of Italy, run through the area affected by the earthquake. The A24 and A25 were closed for inspection following the earthquake, but reopened to passenger vehicles a few days later. The only collapsed bridge structure was over the Aterno River along a secondary road to Fossa. . The collapse of the bridge was likely induced by failure of the columns. A number of regional and provincial roads were partially closed, mainly as a result of earthquake-induced land and rock slides and settlements.

The **railways** crossing the area affected by the earthquake were inspected immediately after the event, and most were reopened in time to have a minimal impact on service (given the early hour of the earthquake). All local lines were reopened by the end of the day, except for the one track from Rome to Sulmona, which required repairs due to a minor landslide. Full service was active by April 9, three days after the earthquake.

The **airport** at Pescara maintained regular service during and after the event. The national air traffic authority ENAV closed the air space in a radius of 25 miles around the epicenter to an altitude of 10,000 ft. to provide uninterrupted access to helicopters supporting emergency rescue operations. Utility networks for **water, electricity and phone services** were all briefly interrupted by the earthquake, but damage was localized. All services were fully functional within a day after minor repairs and reconfigurations. Natural gas services to areas with significant damage were interrupted upon request of the fire department as a safety precaution. Gas provider ENEL successively checked over 250 miles of pipes for damage. Natural gas and electricity remained off in areas of severe damage, like downtown L'Aquila and Onna, and several individual users remain disconnected because of severe damage to their buildings. Gas and electricity provider ENEL contributed to emergency response and temporary housing operations by providing mobile gas canisters to the field hospital and the central command center of the Department of Civil Protection, and electrical service to shelters and tent camps. The most important damage to the water system was the pipe break in the aqueduct from the Gran Sasso, the main water supply of the area. A high pressure water main broke at the crossing of the Paganica fault, which experienced a co-seismic movement in the main event. There were also a number of pipe breaks in the distribution system, and many had to be repaired in order to provide water to emergency shelters and temporary accommodations. Phone services were only briefly interrupted because of power failure. Problems were typically solved by putting emergency generators into service.

Retail sector. The retail sector suffered after the earthquake. Here an article written 6 months after the earthquake make a picture of the retail sector.

Source: https://www.dw.com/en/laquila-farmers-launch-sos-to-consumers/a-4771699

"The week of the earthquake - just before Easter - was precisely the time when lots of people would come here for their holidays and to buy our products," says Giulio Petronio, a sheep farmer from the mountain village of Castel del Monte in the Gran Sasso National Park. "So from one day to the next, we found ourselves missing a sizeable chunk of our market."

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Along with the houses, hotels and roads, the quake also destroyed the fresh produce outlets that served L'Aquila and its inhabitants. Some 1,500 businesses – including supermarkets, grocery stores and restaurants – were forced to close on April 6, 2009, and have not re-opened since. Farmers in the province have been left with a glut of produce and no consumers.

Health care assistance. Whitin the DI.COMA.C operated a function dedicated to "Health, social, and veterinary assistance" that worked during the emergency in direct contact with: Operation Centre 118, the Italian Red Cross, Asl, Order of Malta, Experimental Zoophrophylactic Institute of Abruzzo and Molise.

The main activities performed until January 31, 2010 are reported by the Civil protection Department at the link: https://emergenze.protezionecivile.gov.it/en/seismic/abruzzo-2009-earthquake/healthcare-activities

What was preparedness before and after the event with regards to prepositioning, training, framework contracts and supplier management.

Preparedness before. Through the enactment of Law No. 225 of Feb. 24, 1992, the National Civil Protection Service was established in Italy to protect the integrity of life, property, settlements and the environment from damage or the danger of damage resulting from natural disasters, catastrophes and other disasters. Since 2001, the Civil Defense Department has issued guidance with the aim of improving the organization of relief and medical assistance in emergencies. The first directive "Broad Criteria for the Organization of Relief in Disasters" came out in 2001, which was followed in 2003 by the document on "Broad Criteria on the Provision of Medicines and Medical Devices for an Advanced Medical Post." In 2006, the Department chooses to devote an internal document to a very delicate aspect of emergency management that is psychological and psychiatric care during a disaster: with the "Outline Criteria on Psychosocial Interventions in Disasters" common objectives and organizational schemes are identified. In 2007, the directive "Procedures and Forms for Health Triage" is published, outlining procedures for dividing patients by severity and treatment priority in the event of a disaster (Alexander, 2010)

Before L'Aquila earthquake, due to this seismic "swarm", many buildings began to crack. Public schools were often closed as a precaution. According to some interviewees, L'Aquila city and surrounding area were unprepared for any disaster and no civil protection plans existed. The L'Aquila hospital and other key public buildings were known to be vulnerable to seismic hazards, and many residential buildings were badly constructed. The poor state of buildings and the risks associated with this were known for at least 20 years. As a key informant reported, local awareness of the increasing vulnerability was evident in comments made at body corporate meetings by some residents about cracks appearing in buildings (many of which collapsed during the earthquake) and by their demands for building inspections and to see civil protection plans.. In this framework, the Giuliani – Civil Protection debate led to a meeting of the Major Risks Committee with the goal of silencing Giuliani's rumors while informing the public. Following the discussion, the Civil Protection Agency's deputy director reassured the public with false information. Rather than expecting a deadly earthquake, he said the situation was favorable because the tremors were dissipating the energy. Inevitably, people were disorientated from the chaos created. Then the mainshock occurred, killing 309 people. (Imperiale & Vanclay, 2018)

During the L'Aquila earthquake. By April 8, a total of 2,250 firefighters, 1,500 army personnel, 2,000 policemen, and more than 1,000 technical employees of the Abruzzo Regional office were working in the region, as were 3,000 volunteers. By then, 31 tent cities had been put up to house

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17,772 homeless people, and 171 hotels on the Adriatic coast were allocated to host an additional 10,000. Field hospitals were also installed to provide first emergency aid. The facilities for the care and housing of homeless residents increased over time, with about 1,700 private residences in the region opened for displaced people (Imperiale & Vanclay, 2018; Bazzurro et al., 2009)

After. The legal process against the Major Risks Committee revealed that disaster governance was inadequate and not informed by the Disaster Risk Reduction (DRR) paradigm or international guidelines. Risk assessment was carried out only in a techno-scientific manner, with little acknowledgement of the social issues influencing risks at the local community level. There was no inclusion of local knowledge or engagement of local people in transformative DRR strategies (Imperiale and Vanclay, 2018).

Something, in terms of preparedness improvements, fortunately, changed after the earthquake. For example, in 2011, considering the evolution of the National Health Service toward a regional organization, Operational Guidelines are published to define the general lines for the activation of Regional Health Modules. In order to meet the health care needs of the population from the disaster event until the restoration of ordinary health services, a directive is issued in 2013 establishing field health facilities Pass - Posto di Assistenza Socio Sanitaria. In 2016, the Cross - Remote Health Rescue Operations Center and Regional Health Referents in case of national emergency are identified by directive.

The Department, in cooperation with the Europe Consulting cooperative, also carries out the "Abili a proteggere" project to keep a high focus on rescue and assistance to people with disabilities in emergencies and encourage prevention interventions in this area.

Source: https://www.abiliaproteggere.net/

The "Io non rischio" information campaign (whose aim is to reduce the gap between scientists and population to improve the resilience of locals about natural phenomena) is created from an idea conceived and proposed in 2011 by Anpas-National Association of Public Assistance and immediately espoused by the Department of Civil Protection, Ingv-National Institute of Geophysics and Volcanology, ReLUIS-Interuniversity Consortium of Earthquake Engineering Laboratories and CIMA Foundation, with contributions from the Conference of Regions and Autonomous Provinces and Anci-National Association of Italian Municipalities.

Source: https://iononrischio.protezionecivile.it/en/

Please provide a list with links of data sources used in the following categories	
Government/Offic ial reports	Source : https://emergenze.protezionecivile.gov.it/it/sismiche/terremoto-abruzzo-2009 The official report by the International Commission on Earthquake Forecasting for Civil Protection "OPERATIONAL EARTHQUAKE FORECASTING - State of Knowledge and Guidelines for Utilization". Source : https://rischi.protezionecivile.gov.it/static/b263aeefdd6803efac719b5a4131b912/ICEF_FinalReport_enpdf.pdf Seismic microzonation of the city of L'Aquila. The official report about the 2009 L'Aquila earthquake emergency has been provided by the Dept. of Civil Protection.

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	Source: https://www.protezionecivile.gov.it/en/notizia/the-book-on-seismic-mcrozonation-for-l-aquila-area-reconstruction-now-available
	THE 2009 L'AQUILA EARTHQUAKE: FINDINGS AND IMPLICATIONS.
	Source: https://www.elekkas.gr/images/attachments/967_222-ESR2.pdf
	Report about the effects of the L'Aquila earthquake.
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	EERI report. .
	Source : https://www.reluis.it/doc/pdf/Aquila/EERI_L_Aquila_report.pdf
NGO reports	Red Cross report (9 Dec. 2009).
	Source :
	https://www.ifrc.org/docs/appeals/09/MDRIT001dfr.pdf
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	Source: https://www.torrossa.com/it/resources/an/4598639
Eyewitness/first-hand accounts	All the documentaries contain eyewitnesses of people that were in L'Aquila the night of the earthquakes.
	Witness - Return to L'Aquila: Broken promises [Al Jazeera English - 2011].
	Source: https://www.youtube.com/watch?v=-I8Tokacr28
	Per L'Aquila [Giuliano Di Gaetano - Legambiente].
	Source: https://www.youtube.com/watch?v=cSSkh6SH41M
	Manifesto per l'Aquila - Speciale Tg1 sui 10 anni del terremoto dell'Aquila del 2009 [Rai 2019].
	Source: https://www.youtube.com/watch?v=gAN7dE73XvE&t=1051s
	L'AQUILA 10 anni dopo il terremoto "La generazione dimenticata" [Ercolani-Cappa StandByMe and RaiCInema2019].
	Source: https://www.youtube.com/watch?v=xpOqoHsTGbE&t=3369s

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News/media reports	Yes We Camp – Docuseries [Alberto Puliafito – iK productions]. Source: https://www.youtube.com/watch?v=kxakL6CyKEs Draquila: Italy Shakes - satirical documentary film about the political matters regarding the earthquake that hit the Italian city of L'Aquila in 2009 – by Sabina Guzzanti (2010). Source: https://www.youtube.com/watch?v=FOXgY09RYo8 Ju Tarramutu di Paolo Pisanelli (2010). Source: https://docucity.unimi.it/film/901/ A collection of newspaper articles of 7 April 2009 can be accessed for free at this link: http://www2.consiglio.regione.abruzzo.it/terremoto/LAquila_06.04.09/Prime_pagine.html About the National Commission for the Forecast and Prevention of Major Risks trial: https://www.ilfattoquotidiano.it/2015/02/06/sisma-laquila-de-bernardinis-condannato-per-unintervista-prima-riunione/1403307/
Documentaries	Witness - Return to L'Aquila: Broken promises [Al Jazeera English - 2011]. Source: https://www.youtube.com/watch?v=-I8Tokacr28 Per L'Aquila [Giuliano Di Gaetano - Legambiente]. Source: https://www.youtube.com/watch?v=cSSkh6SH41M Manifesto per l'Aquila - Speciale Tg1 sui 10 anni del terremoto dell'Aquila del 2009 [Rai 2019]. Source: https://www.youtube.com/watch?v=gAN7dE73XvE&t=1051s L'AQUILA 10 anni dopo il terremoto "La generazione dimenticata" [Ercolani-Cappa StandByMe and RaiCInema2019]. Source: https://www.youtube.com/watch?v=xpOqoHsTGbE&t=3369s Yes We Camp – Docuseries [Alberto Puliafito – iK productions]. Source: https://www.youtube.com/watch?v=kxakL6CyKEs Draquila: Italy Shakes - satirical documentary film about the political matters regarding the earthquake that hit the Italian city of L'Aquila in 2009 – by Sabina Guzzanti (2010). Source: https://www.youtube.com/watch?v=FOXgY09RYo8 Ju Tarramutu di Paolo Pisanelli (2010). Source: https://docucity.unimi.it/film/901/
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Regarding the potential for using digital technologies in material reconstruction, finally, Casagrande and Pesaresi (2012) highlight the potential applications of oblique aerial photographs in assisting the planning of recovery works (particularly of historical and cultural heritage) and in providing a progressive and up-to-date record of reconstruction (pp. 204-206), while Pesaresi and Gallinelli (2018 and 2019) consider remarkable the potential of GIS applications in verifying of reconstruction timelines and compliance with safety standards.

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Buildings, resilience, reconstruction

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Del Gaudio, C. et al. (2021) Evolution of the seismic vulnerability of masonry buildings based on the damage data from L'Aquila 2009 event. Bulletin of Earthquake Engineering: 1-36.

Scolobig, Anna, et al. (2014) The co-production of scientific advice and decision making under uncertainty: lessons from the 2009 L'Aquila earthquake, Italy. Planet@ risk 2.2 (2014): 71-76.

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Marincioni, Fausto, et al. (2012) "Perception and communication of seismic risk: The 6 April 2009 L'Aquila earthquake case study." Earthquake Spectra 28.1 (2012): 159-183.

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Imperiale, A. J., & Vanclay, F. (2018). Reflections on the L'Aquila trial and the social dimensions of disaster risk. Disaster Prevention and Management: An International Journal, 28(4), 434-445.

All the reports by RELUIS consortium (Consortium of the Net of University Laboratory of Seismic and Structural Engineering). Source: https://www.reluis.it/it/divulgazione/report-l-aquila.html

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Enquiry	
Public Reports/Findings (Non-Peer Reviewed)	The November 2015 Supreme Court ruling. Source: https://www.giurisprudenzapenale.com/wp-content/uploads/2016/04/terremoto-sentenza.pdf The official report by the International Commission on Earthquake Forecasting for Civil Protection "OPERATIONAL EARTHQUAKE FORECASTING - State of Knowledge and Guidelines for Utilization". Source: https://rischi.protezionecivile.gov.it/static/b263aeefdd6803efac719b5a4131b912/ICEF_FinalReport_enpdf.pdf
Journal/Magazine articles	Earthquake parameters on the official INGV website. Source: http://terremoti.ingv.it/event/1895389 A complete description in several respects have been stored in the Treccani encyclopedia. Source: https://www.treccani.it/enciclopedia/l-aquila-le-macerie-il-raconto-pubblico-le-narrazioni-private_%28L%27Italia-e-le-sue-Regioni%29/ Earthquakes and historic memory in Italy. Source: https://www.treccani.it/enciclopedia/memoria-e-mappa-sismica_%28L%27Italia-e-le-sue-Regioni%29/
Online podcasts, blogs, forums & chat rooms	Podcast on Spotify: "L'Aquila fenice" by Spotify Studios, in collaboration with Chora Media and Maxxi Wikipedia page about L'Aquila earthquake. Source: https://open.spotify.com/show/2fxzSw5a1T4tlAzWH8wuFO Source: https://en.wikipedia.org/wiki/2009_L%27Aquila_earthquake Blog to remember the victims of the earthquake. Source: http://www.6aprile.it/ Newspaper article on the ruling against the National Commission for the Forecasting and Prevention of Major Hazard and De Bernardinis. Source: https://www.ilfattoquotidiano.it/2015/02/06/sisma-laquila-de-bernardinis-condannato-per-unintervista-prima-riunione/1403307/
Official policy recommendations & findings	The official report by the International Commission on Earthquake Forecasting for Civil Protection "OPERATIONAL EARTHQUAKE FORECASTING - State of Knowledge and Guidelines for Utilization". Source: https://rischi.protezionecivile.gov.it/static/b263aeefdd6803efac719b5a4131b912/ICEF_FinalReport_enpdf.pdf Guidelines and report by the Deputy Commissioner for Reconstruction in Abruzzo region. Source: https://www.comune.laquila.it/pagina600_i-documenti-del-commissario-delegato-per-la-ricostruzione.html

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Other (Please specify)	None identified in research phase.
WP2	Task 2.3: Natural and manmade case study social media analysis

What was the role, influence, and impact of social media communications during this incident?

Even though social media was just spreading across Italy, many citizens of L'Aquila during the earthquake swarm prior to the April 6 quake posted alarmist and fearful phrases. In the night, before the news was even broadcast on television, the first information came minutes after the quake from the Internet, Facebook and Twitter. From social media, there were those who managed to find reliable information even before it was passed on TV by cross-referencing data from different social networks. For the first time, we have two narratives of the earthquake, with TV on one side and new social media on the other.

What patterns of interactions between opinion makers and recurring topics in the Twitter debate following the disaster have been identified?

When the L'Aquila earthquake occurred, Twitter was at the early beginning in Italy, but used all around the world. Right after the earthquake, many tweets have been posted online, from private accounts and also from online newspapers and magazines. Following the mainshock, many of these accounts simply posted the news about the earthquake, or updates on the damages, affected cities and number of victims. Others asked people to pray for the inhabitants or to donate to the Italian Red Cross. It was also not uncommon to find tweets from people, ordinary but also with a considerable number of followers, indignant at not having listened to Giuliani's predictions, such as @digg_biz who wrote "Italy muzzled scientist who foresaw quake: An Italian scientist predicted a major earthquake around L'Aquila" or the magazine article by @jaidenbenz. This is an important pattern to take into account in fighting misinformation and increasing the resilience of the society.

Please provide a list with links of data sources used in the following categories

Government/Offic ial reports	The official report about the 2009 L'Aquila earthquake emergency has been provided by the Dept. of Civil Protection. Source: https://emergenze.protezionecivile.gov.it/it/sismiche/terremoto-abruzzo-2009 The official report by the International Commission on Earthquake Forecasting for Civil Protection "OPERATIONAL EARTHQUAKE FORECASTING - State of Knowledge and Guidelines for Utilization". Source: https://rischi.protezionecivile.gov.it/static/b263aeefdd6803efac719b5a4131b912/ICEF_FinalReport_enpdf.pdf Seismic microzonation of the city of L'Aquila. Source: https://www.protezionecivile.gov.it/en/notizia/the-book-on-seismic-mcrozonation-for-l-aquila-area-reconstruction-now-available THE 2009 L'AQUILA EARTHQUAKE: FINDINGS AND IMPLICATIONS source Report about the effects of the L'aquila earthquake. Source: https://www.elekkas.gr/images/attachments/967_222-ESR2.pdf https://www.protezionecivile.gov.it/static/4f16aae5dcb100c5c7d8fc2f8ad899ea/Elenco_centri_abitati_danneggiati.pdf

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Community interviews/reports	Zaccaria, A. M., & Zizzari, S. (2016). Spaces of resilience: Irpinia 1980, Abruzzo 2009. Spaces of resilience: Irpinia 1980, Abruzzo 2009, 64-82: https://www.torrossa.com/it/resources/an/3577663
Eyewitness/first-hand accounts	Zizzari, S. L'Aquila oltre i sigilli. Il Terremoto tra Ricostruzione e Memoria: https://www.torrossa.com/it/resources/an/4598639 All the documentaries contain eyewitnesses of people that were in L'Aquila the night of the earthquakes. See "Documentaries"
News/media reports	A collection of newspaper articles of 7 April 2009 can be accessed for free at this link: http://www2.consiglio.regione.abruzzo.it/terremoto/L'Aquila 06.04.09/Prime_pagine.html About the National Commission for the Forecast and Prevention of Major Risks trial: https://www.ilfattoquotidiano.it/2015/02/06/sisma-laquila-de-bernardinis-condannato-per-unintervista-prima-riunione/1403307/
Documentaries	Witness - Return to L'Aquila: Broken promises [Al Jazeera English - 2011]: https://www.youtube.com/watch?v=-I8Tokacr28 Per L'Aquila [Giuliano Di Gaetano - Legambiente]: https://www.youtube.com/watch?v=cSSkh6SH41M Manifesto per l'Aquila - Speciale Tg1 sui 10 anni del terremoto dell'Aquila del 2009 [Rai 2019]: https://www.youtube.com/watch?v=gAN7dE73XvE&t=1051s L'AQUILA 10 anni dopo il terremoto "La generazione dimenticata" [Ercolani-Cappa StandByMe and RaiCinema2019]: https://www.youtube.com/watch?v=xpOqoHsTGbE&t=3369s Yes We Camp – Docuseries [Alberto Puliafito – iK productions]: https://www.youtube.com/watch?v=kxakL6CyKEs Draquila: Italy Shakes - satirical documentary film about the political matters regarding the earthquake that hit the Italian city of L'Aquila in 2009 – by Sabina Guzzanti (2010): https://www.youtube.com/watch?v=FOXgY09RYo8 Ju Tarramutu di Paolo Pisanelli (2010): https://docucity.unimi.it/film/901/
Social Media	Sarrica, M., Farinosi, M., Comunello, F., Brondi, S., Parisi, L. & Fortunati, L. (2018). Shaken and stirred: Social representations, social media, and community empowerment in emergency contexts. Semiotica, 2018(222), 321-346. Link: https://www.degruyter.com/document/doi/10.1515/sem-2016-0208/html Social media analysis for the 10th year anniversary using twitter data: Contreras, D., Wilkinson, S., Balan, N., & James, P. (2022). Assessing post-disaster recovery using sentiment analysis: The case of L'Aquila, Italy. Earthquake Spectra, 38(1), 81-108. Link: https://journals.sagepub.com/doi/10.1177/87552930211036486
Satellite/other imagery	Papers collected in which the authors make use of Satellite Imagery Lanari et al., 2010. Link: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2010GL044780

Academic Papers/Reports (Peer Reviewed)	Castaldo, R., De Nardis, R., DeNovellis, V., Ferrarini, F., Lanari, R., Lavecchia, G., ... & Tizzani, P. (2018). Coseismic Stress and Strain Field Changes Investigation Through 3-D Finite Element Modeling of DInSAR and GPS Measurements and Geological/Seismological Data: The L'Aquila (Italy) 2009 Earthquake Case Study. Journal of Geophysical Research: Solid Earth, 123(5), 4193-4222. Link: *https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017JB014453* D'Agostino et al., 2012. Link: *https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2011JB008523* Atzori et al., 2009. Link: *https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2009GL039293* Regarding the potential for using digital technologies in material reconstruction, finally, Casagrande and Pesaresi (2012) highlight the potential applications of oblique aerial photographs in assisting the planning of recovery works (particularly of historical and cultural heritage) and in providing a progressive and up-to-date record of reconstruction (pp. 204-206), while Pesaresi and Gallinelli (2018 and 2019) consider remarkable the potential of GIS applications in verifying of reconstruction timelines and compliance with safety standards
Academic Papers/Reports (Peer Reviewed)	We provided an attached file with a summary of the most interesting papers about several analyses performed from the occurrence of the seismic sequence (see Annex 1).
Academic Papers/Reports (Non-Peer Reviewed)	All the reports by RELUIS consortium (Consortium of the Net of University Laboratory of Seismic and Structural Engineering). Source: https://www.reluis.it/it/divulgazione/report-l-aquila.html A complete description in several respects have been stored in the Treccani encyclopedia. Source: https://www.treccani.it/enciclopedia/l-aquila-le-macerie-il-racconto-pubblico-le-narrazioni-private_%28L%27Italia-e-le-sue-Regioni%29/
Public Enquiry Reports/Findings	Earthquakes and historic memory in Italy. Source: https://www.treccani.it/enciclopedia/memoria-e-mappa-sismica_%28L%27Italia-e-le-sue-Regioni%29/ The November 2015 Supreme Court ruling. Source: https://www.giurisprudenzapenale.com/wp-content/uploads/2016/04/terremoto-sentenza.pdf The official report by the International Commission on Earthquake Forecasting for Civil Protection "OPERATIONAL EARTHQUAKE FORECASTING - State of Knowledge and Guidelines for Utilization". Source: https://rischi.protezionecivile.gov.it/static/b263aeefdd6803efac719b5a4131b912/ICEF_FinalReport_enpdf.pdf
Journal/Magazine articles	Earthquake parameters on the official INGV website. Source: http://terremoti.ingv.it/event/1895389

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Online podcasts, blogs, forums & chat rooms	Podcast on Spotify: "L'Aquila fenice" by Spotify Studios, in collaboration with Chora Media and Maxxi Wikipedia page about L'Aquila earthquake: https://en.wikipedia.org/wiki/2009_L%27Aquila_earthquake Blog to remember the victims of the earthquake: http://www.6aprile.it/ Newspaper article on the ruling against the National Commission for the Forecasting and Prevention of Major Hazard and De Bernardinis: https://www.ilfattoquotidiano.it/2015/02/06/sisma-laquila-de-bernardinis-condannato-per-unintervista-prima-riunione/1403307/
Official policy recommendations & findings	The official report by the International Commission on Earthquake Forecasting for Civil Protection "OPERATIONAL EARTHQUAKE FORECASTING - State of Knowledge and Guidelines for Utilization". Source: https://rischi.protezionecivile.gov.it/static/b263aeefdd6803efac719b5a4131b912/ICEF_FinalReport_enpdf.pdf Guidelines and report by the Deputy Commissioner for Reconstruction in Abruzzo region: https://www.comune.laquila.it/pagina600_i-documenti-del-commissario-delegato-per-la-ricostruzione.html
Other (Please specify)	None
WP2	Task 2.4: Natural and manmade case study aerial imagery analysis
What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform decision-making?	It was possible to get satellite images extremely fast, notably through the Copernicus project, which was sponsored by the European Union, but it is impossible to determine if it was useful for crisis decision-making. The first obvious application of this technology is in images used for broadcast or imaging by media employees and to map surface deformations (see Academic papers below); there is no evidence that UAVs are being employed strategically or tactically by first responders, but have been used in recent years to map the buildings, the slop of a terrain, literally everything in the city of L'Aquila and surroundings: available at https://www.opendatalaquila.it/
What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform the sharing of public information?	The use of satellite images and UAV data can definitely help with both first aid, assessing the most damaged areas and escape routes for the arrival of emergency vehicles, but also informing the population about the safest areas to take shelter in. In fact, the main quake will always be followed by aftershocks, and the risk of subsequent collapse is always very high. Securing the population by warning them even with the help of UAV images can be crucial to improve community resilience.
Please provide a list with links of data sources used in the following categories	

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Government/Official reports	The official report about the 2009 L'Aquila earthquake emergency has been provided by the Dept. of Civil Protection. Source: https://emergenze.protezionecivile.gov.it/it/sismiche/terremoto-abruzzo-2009
	The official report by the International Commission on Earthquake Forecasting for Civil Protection "OPERATIONAL EARTHQUAKE FORECASTING - State of Knowledge and Guidelines for Utilization". Source: https://rischi.protezionecivile.gov.it/static/b263aeefdd6803efac719b5a4131b912/ICEF_FinalReport_enpdf.pdf
	Seismic microzonation of the city of L'Aquila. Source: https://www.protezionecivile.gov.it/en/notizia/the-book-on-seismic-microzonation-for-l-aquila-area-reconstruction-now-available
NGO reports	THE 2009 L'AQUILA EARTHQUAKE: FINDINGS AND IMPLICATIONS source Report about the effects of the L'aquila earthquake. Source: https://www.elekkas.gr/images/attachments/967_222-ESR2.pdf
	Red Cross report (9 Dec. 2009). Source: https://www.ifrc.org/docs/appeals/09/MDRIT001dfr.pdf
	Save the children about the emergency and post-emergency little attention paid to children. Source: https://www.savethechildren.it/press/abruzzo-terremoto-2-anni-dopo-save-children-poca-attenzione-ai-bambini-nell%E2%80%99-emergenza-e-post
Community interviews/reports	Zaccaria, A. M., & Zizzari, S. (2016). Spaces of resilience: Irpinia 1980, Abruzzo 2009. Spaces of resilience: Irpinia 1980, Abruzzo 2009, 64-82.: https://www.torrossa.com/it/resources/an/3577663
	Zizzari, S. L'Aquila oltre i sigilli. Il Terremoto tra Ricostruzione e Memoria: https://www.torrossa.com/it/resources/an/4598639
Eyewitness/first-hand accounts	All the documentaries contain eyewitnesses of people that were in L'Aquila the night of the earthquakes. See "Documentaries"
News/media reports	A collection of newspaper articles of 7 April 2009 can be accessed for free at this link: http://www2.consiglio.regione.abruzzo.it/terremoto/LAquila_06.04.09/Prime_pagine.html
	About the National Commission for the Forecast and Prevention of Major Risks trial: https://www.ilfattoquotidiano.it/2015/02/06/sisma-laquila-de-bernardinis-condannato-per-unintervista-prima-riunione/1403307/
Documentaries	Witness - Return to L'Aquila: Broken promises [Al Jazeera English - 2011]: https://www.youtube.com/watch?v=-I8Tokacr28
	Per L'Aquila [Giuliano Di Gaetano - Legambiente]: https://www.youtube.com/watch?v=cSSkh6SH41M
	Manifesto per l'Aquila - Speciale Tg1 sui 10 anni del terremoto dell'Aquila del 2009 [Rai 2019]: https://www.youtube.com/watch?v=gAN7dE73XvE&t=1051s

Social Media	L'AQUILA 10 anni dopo il terremoto "La generazione dimenticata" [Ercolani-Cappa StandByMe and RaiCinema2019]: https://www.youtube.com/watch?v=xpOqoHsTGbE&t=3369s

Yes We Camp – Docuseries [Alberto Puliafito – iK productions]: https://www.youtube.com/watch?v=kxakL6CyKEs

Draquila: Italy Shakes - satirical documentary film about the political matters regarding the earthquake that hit the Italian city of L'Aquila in 2009 – by Sabina Guzzanti (2010): https://www.youtube.com/watch?v=FOXgY09RYo8

Ju Tarramutu di Paolo Pisanelli (2010): https://docucity.unimi.it/film/901/

Sarrica, M., Farinosi, M., Comunello, F., Brondi, S., Parisi, L. & Fortunati, L. (2018). Shaken and stirred: Social representations, social media, and community empowerment in emergency contexts. Semiotica, 2018(222), 321-346. Link: https://www.degruyter.com/document/doi/10.1515/sem-2016-0208/html

Social media analysis for the 10th year anniversary using twitter data:
Contreras, D., Wilkinson, S., Balan, N., & James, P. (2022). Assessing post-disaster recovery using sentiment analysis: The case of L'Aquila, Italy. Earthquake Spectra, 38(1), 81-108. Link: https://journals.sagepub.com/doi/10.1177/87552930211036486 |
| Satellite/other imagery | Papers collected in which the authors make use of Satellite Imagery

Lanari et al., 2010. Link: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2010GL044780
Castaldo et al., 2018. Link: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017JB014453
D'Agostino et al., 2012. Link: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2011JB008523
Atzori et al., 2009. Link: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2009GL039293

Regarding the potential for using digital technologies in material reconstruction, finally, Casagrande and Pesaresi (2012) highlight the potential applications of oblique aerial photographs in assisting the planning of recovery works (particularly of historical and cultural heritage) and in providing a progressive and up-to-date record of reconstruction (pp. 204-206), while Pesaresi and Gallinelli (2018 and 2019) consider remarkable the potential of GIS applications in verifying of reconstruction timelines and compliance with safety standards |
| Academic Papers/Reports (Peer Reviewed) | We provided an attached file with a summary of the most interesting papers about several analyses performed from the occurrence of the seismic sequence (see Annex 1). |
| Academic Papers/Reports (Non-Peer Reviewed) | All the reports by RELUIS consortium (Consortium of the Net of University Laboratory of Seismic and Structural Engineering). Source: https://www.reluis.it/it/divulgazione/report-l-aquila.html |

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Type of data		
Public Enquiry Reports/Findings	A complete description in several respects have been stored in the Treccani encyclopedia. Source: https://www.treccani.it/enciclopedia/l-aquila-le-macerie-il-raconto-pubblico-le-narrazioni-private_%28L%27Italia-e-le-sue-Regioni%29/ Earthquakes and historic memory in Italy. Source: https://www.treccani.it/enciclopedia/memoria-e-mappa-sismica_%28L%27Italia-e-le-sue-Regioni%29/	
Journal/Magazine articles	The November 2015 Supreme Court ruling. Source: https://www.giurisprudenzapenale.com/wp-content/uploads/2016/04/terremoto-sentenza.pdf The official report by the International Commission on Earthquake Forecasting for Civil Protection "OPERATIONAL EARTHQUAKE FORECASTING - State of Knowledge and Guidelines for Utilization". Source: https://rischi.protezionecivile.gov.it/static/b263aeefdd6803efac719b5a4131b912/ICEF_FinalReport_enpdf.pdf Earthquake parameters on the official INGV website. Source: http://terremoti.ingv.it/event/1895389	
Online podcasts, blogs, forums & chat rooms	Podcast on Spotify: "L'Aquila fenice" by Spotify Studios, in collaboration with Chora Media and Maxxi Wikipedia page about L'Aquila earthquake: https://en.wikipedia.org/wiki/2009_L%27Aquila_earthquake Blog to remember the victims of the earthquake: http://www.6aprile.it/ Newspaper article on the ruling against the National Commission for the Forecasting and Prevention of Major Hazard and De Bernardinis: https://www.ilfattoquotidiano.it/2015/02/06/sisma-laquila-de-bernardinis-condannato-per-unintervista-prima-riunione/1403307/	
Official policy recommendations & findings	The official report by the International Commission on Earthquake Forecasting for Civil Protection "OPERATIONAL EARTHQUAKE FORECASTING - State of Knowledge and Guidelines for Utilization". Source: https://rischi.protezionecivile.gov.it/static/b263aeefdd6803efac719b5a4131b912/ICEF_FinalReport_enpdf.pdf Guidelines and report by the Deputy Commissioner for Reconstruction in Abruzzo region: https://www.comune.laquila.it/pagina600_i-documenti-del-commissario-delegato-per-la-ricostruzione.html	
Other (Please specify)	None	
WP3	Task 3.1 - Critical analysis of past disasters via the identified case studies on their disaster preparedness strategies	
Type of data	Data/ information/ sources/ reference material	
3.1.1	Type of hazards – Understanding the disaster risk	

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	Question	Description
a.	What type of hazards were commonly identified in the region (Slow-onset and rapid onset hazards)?	The region presents several risks. Certainly, the first and highest risk to be considered is the **seismic risk**. In terms of seismic hazard, the city of L'Aquila is in zone 2 (where 1 is the highest seismic hazard value), i.e. 'an area with medium seismic hazard where strong earthquakes can occur' (Source: the Department of Civil Protection). The city has been hit by devastating seismic events in the past (e.g. in 1315, 1349, 1452, 1501, 1646, 1703, 1706, and 1958), but it has also been affected by surrounding events, such as Mw7.0 in Avezzano in 1915 or Mw6.8 in 1703, which killed about 5,000 people in L'Aquila alone (Stucchi et al. 2009), or even, in a lesser form, the Amatrice-Visso-Norcia sequence. The risk of induced seismicity should not be underestimated. For example, in Abruzzo there is the Campotosto dam, which was already affected by a seismic sequence in 2017, or several gas storage plants (Edison's Cellino in the Teramo area and the Fiume Treste plant). These, together with other activities in the area, obviously make the risk of an industrial accident non-negligible. The region surrounding L'Aquila is also subject to a high hydro-geological and fire risk. In recent years, there has been some movement in terms of funds allocated for the drainage of areas at risk of flooding (e.g. the Fosso di San Giuliano in L'Aquila) or affected by fires in 2020 and which may contribute to possible landslides. Given the mountainous terrain, avalanche risks (such as the one in Rigopiano in 2017) are also frequent.
b.	What hazards have resulted in disasters during the past 20 years?	L'Aquila earthquake, 2009 Wildfire, in 2020 Rigopiano avalanche, 2017
c.	What risk assessment mechanism(s) were used by the relevant institutions for encompassing risk awareness, multi-hazard analysis, vulnerability/capacity analysis and cascading effects?	The INGV provided the seismic hazard map, whose most recent version dates back to 2004 (Stucchi et al. 2004), before the L'Aquila earthquake. Most of the region, comprising the city of L'Aquila, was in the two most dangerous categories in terms of seismic risk. Even due part of the city was subject to ground amplification (De Luca et al. 2005, only study about site effects before the earthquakes), the buildings, mainly in the old town were not reinforced before the earthquake and the damage was very large in terms of collapsing buildings and loss of life. Cascading effects, such as possible landslides, have been taken into account through the IFFI catalog.

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d.	What risk modelling and scenarios have been carried out to consider disaster risk and/or any other future threats and cascading effects?	After the earthquake, several studies from several points of view have been carried out. Now the knowledge of the fault responsible for the earthquake, the seismic microzonation, fluid migration, new geological studies, and maps of the faults, have been carried out (See Annex 1).
e.	How the knowledge of indigenous communities and information in social media had been captured for disaster risk perception?	Not applicable to this case study
3.1.2	**Disaster resilience and preparedness strategies**	
a.	What were the available national and local disaster management plans and systems under following categories?	
	○ Individual-level activities (e.g., first aid training and response)	The preparation of the local community about first aid and response to an earthquake was underestimated. Children and young people were trained in the school with basic concepts of what to do during the earthquake. Indeed, as stated in the survey made by [Marincioni et al. 2012](#), "Remarkably, four respondents reported that children who had been instructed about earthquake safety at school directed their parents to adopt successful protective behaviors. [...] This finding is in line with the results of Shaw et. al. (2004) and underlines the importance of earthquake (and, more widely, natural disaster) education to increase risk awareness, encourage emergency planning, and enhance the chances of survival." Moreover "A higher percentage of men alleged rational and focused behavior during the earthquake, whereas many women admitted a less calm reaction (Table 3). There was a very significant subdivision of responsibilities between men and women in terms of earthquake preparation (Figure 3). Most of the women said they had previously thought about or planned a protective response for the critical moments of the earthquake, which was mostly seen as a male responsibility. Despite their concerns about the critical moments of the earthquake, most women focused on preparing for the aftermath. Twenty-five percent of the responding women had prepared bags containing necessary personal items for their family in case of a quick evacuation from their home. Nonetheless, almost half (46%) of all interviewees admitted to have never thought about protective behavior in case of an earthquake."

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	"Before the 2009 earthquake the residents of L'Aquila considered it unlikely that a destructive, high-magnitude earthquake would hit their city. Besides this assumption, residents were most likely overly optimistic about the capacity of their houses to withstand an earthquake. [...] This overestimation most likely inhibited emergency planning at the individual, family, and community level, and reduced dialogue among friends and within families about protective behavior against earthquakes. " (Marincioni et al. 2012).
o Household actions (e.g., stockpiling of equipment and supplies, retrofitting)	Buildings in L'Aquila and the hinterland, as in most of Italy, were of 4 different type. "The most vulnerable one, that suffered most of the damages were the "a sacco" buildings, because they are made by disjointed bond stones. This type of buildings were prohibited since 1927. But, pre-existing "a sacco" masonry buildings could be (and still are) restored without real structural retrofitting by simply covering them with new render finish." "The brick masonry buildings and historical cut stone buildings in L'Aquila, although vulnerable to earthquakes, responded slightly better than the "a sacco" masonry buildings. Most of the buildings in L'Aquila's historic downtown were erected after the devastating 1703 earthquake, which destroyed a substantial part of the city (EEFIT 2009). The buildings that survived were strengthened by inserting large timber beams into the masonry walls and connecting them with steel anchors and plates (EERI 2009)." "The multistory reinforced concrete buildings suffered less damage from the 2009 earthquake, except for a few that collapsed under the seismic forces (EERI 2009). These buildings, which became widespread in Italy after the end of World War II, are made of a reinforced concrete frame with hollow clay brick infill." Credits: Marincioni et al. 2012
o Community efforts (e.g., socially responsible mitigation, training, and awareness campaigns for first respondents and responders, and field exercises)	Young people are trained in the schools in escaping and how to behave during an earthquake. But, mainly before the 2009 L'Aquila earthquake, most of the community was not prepared, despite the fact that they knew that they were in an high vulnerability and high hazardous area.
o Governmental strategies (e.g., multi-organisational	Following the passing of a national law (No. 225 of 1992) which set up the Italian civil protection system, Abruzzo Regional Law No. 72 of 1993 obliged the region to produce an emergency plan and organise civil

	planning and public private partnerships, early warning systems, contingency plans, evacuation routes, and public information dissemination, allocation of resources)	protection services. In this legal instrument there is no direct reference to the need for municipalities to have plans, and, indeed, a fully fledged emergency plan did not emerge in L'Aquila city until February 2015 (Comune dell'Aquila, 2015). Although the Italian civil protection system is well developed (OECD, 2010) it is very top-down and in the 2009 earthquake it had to compensate for the weakness of the local, provincial and regional systems.
b.	○ What provisions were in place for research, education, science, and technology (ex: geospatial, remote sensing) for informed disaster preparedness?	Young people were trained in the schools in escaping and how to behave during an earthquake (Marincioni et al. 2012) The INGV provided the seismic hazard map, whose most recent version dates back to 2004 (Stucchi et al. 2004), before the L'Aquila earthquake. But the average community was not informed and prepared against earthquakes, even due the high seismic hazard and the high vulnerability of the area.
c.	○ What special provisions were undertaken to ensure pandemic preparedness in disaster preparedness measures?	None identified in research phase.
3.1.3	Mitigation	What policies and legislation were available that mainstreamed DRR in the national planning policy?
a.	○ Land use planning and building codes (Ex: Avoid settlement expansion towards hazard prone areas)	The transposition in Italy of Eurocode 8 (CEN 1998), the European Union's seismic building standard, was initiated in 2003 (Government of Italy 2003), after an earthquake in San Giuliano di Puglia on 31 October 2002 in which 27 children were killed by the collapse of their elementary school. The complicated approval process of this new building code delayed its application (Government of Italy 2009) until after the earthquake of 6 April 2009. (Marincioni et al. 2012)

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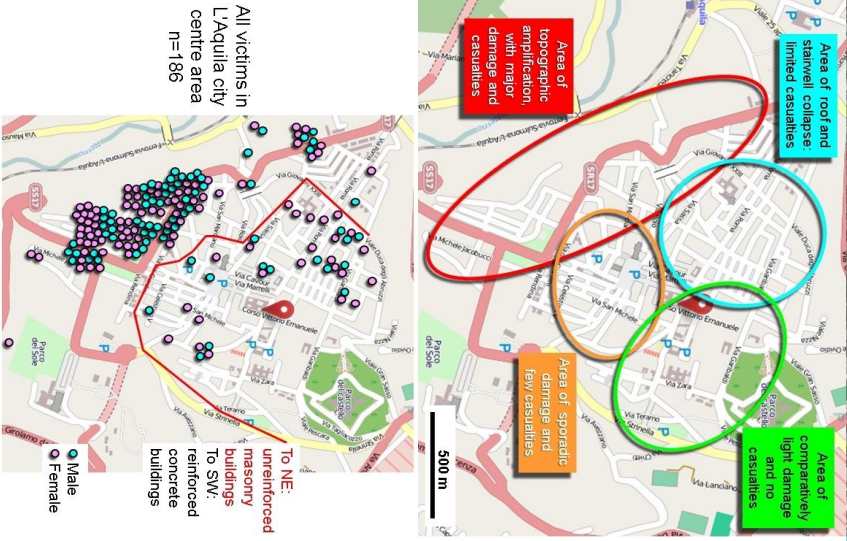|		
	o Critical infrastructure protection and structural design improvements	*There was no action in protection of the critical infrastructure. Marincioni et al. 2012 gives an interesting overview of the main type of buildings in L'Aquila at the time of the earthquakes and the damage incurred*
	o Landscape and environmental arrangement around essential services and infrastructure	Not found in literature, to be discussed
	o Resilience strategies including planning and partnership building between sectors	
b.	What support were provided by media platforms including social media during disaster operations?	At an early stage, the web had also been used with service functions, e.g., to propagate information and coordinate aid: the Ansa as early as 1:54 p.m. on April 6 beat out a report that many groups dedicated to the earthquake were active on Facebook, including one called Aiutiamo l'Abruzzo "for the exchange of useful information [...] or reports to organize 'concrete aid' for the displaced population." Moreover, according to early empirical research, around 3 p.m. of the same day on the most popular social network, there were already 158 active groups, the largest of which had over 28,000 members. This is all without considering the contribution of individual Facebook users who, not infrequently, had taken action to share information or direct aid. At the same time, however, from the beginning the web had also fulfilled other functions: e.g., it had been the 'watchdog' of mainstream information, pointing out errors and inaccuracies and supplementing information.
		Not found in literature, to be discussed
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	Not applicable to this case study
3.1.4	**Response**	
a.	What were the available surveillance, early warning, and information management systems for activating response operations under the following conditions?	

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o Support or coordinate disaster operations being conducted by a designated lead agency	At 3:32 a.m. on April 6, 2009, a violent earthquake struck L'Aquila and several other towns in Abruzzo. The quake was felt throughout much of central Italy, and early fragmentary information reported destroyed houses, damaged buildings and thousands of people in the streets. At 4:15 a.m., the Civil Protection Department's Crisis Unit meets and the situation immediately appears very serious. A group of technicians from the Department leaves to conduct the first seismic surveys of the area, and two teams move in the direction of L'Aquila to support local authorities and prepare the necessary conditions to ensure national coordination on the ground. The Civil Protection Operational Committee, convened for 4:40 a.m. and chaired by the Head of the Civil Protection Department, brings together the heads of all administrations and structures involved in managing the emergency. The entire National Civil Protection System is mobilized. With the declaration of a state of emergency by the Prime Minister, at 9 a.m. the following morning the Direzione di Comando e Controllo (Di.Coma.C.), the coordinating body for the emergency is formed at the headquarters of the Guardia di Finanza School in L'Aquila. Source: Dept. Civil Protection
o Logistics mechanisms and essential supplies for health and relief services	In the morning, men and vehicles from all over Italy begin to converge on earthquake-stricken areas. Damaged roads and buildings are manned and cordoned off to allow help to arrive as quickly as possible. Within 48 hours of the earthquake, 2,400 firefighters, more than 1,800 members of the Armed Forces, more than 1,500 members of the Police Forces, more than 800 doctors and nurses from the Italian Red Cross, more than 4,000 Civil Defense volunteers and more than 100 canine units are on the ground. In the same hours, 30 reception areas are set up to provide assistance to nearly 18 thousand people and more than 10 thousand beds are made available in private homes and hotels on the coast. More than 20 field kitchens are also activated to distribute thousands of meals. Eight sleeping cars offered by the State Railways are stationed at L'Aquila station in response to requests made by the Civil Defense. By the end of April 2009, the number of assisted population will rise to 67,459, the highest value reached in emergency management. Source: Dept. Civil Protection
b. What support was provided by media platforms including social media during disaster operations?	At an early stage, the web had also been used with service functions, e.g., to propagate information and coordinate aid: the Ansa as early as 1:54 p.m. on April 6 beat out a report that many groups dedicated to the earthquake were active on Facebook, including one called Aiutiamo l'Abruzzo "for the exchange of useful information [...] or reports to organize 'concrete aid' for the displaced population." Moreover,

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		according to early empirical research, around 3 p.m. of the same day on the most popular social network, there were already 158 active groups, the largest of which had over 28,000 members. This is all without considering the contribution of individual Facebook users who, not infrequently, had taken action to share information or direct aid. At the same time, however, from the beginning the web had also fulfilled other functions: e.g., it had been the 'watchdog' of mainstream information, pointing out errors and inaccuracies and supplementing information.
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	Not applicable to this case study
3.1.5	**Recovery**	
a.	What were the long-term and short-term recovery actions undertaken during each post disaster recovery period including 'build back better' practices?	○ Response endeavours such as needs and damage assessments
		Safety measures taken immediately following the earthquake were multiple. Complete closure of the A24 freeway section between Valle del Salto and Assergi in both directions, the Rome-Torimparte section to heavy vehicle traffic over 7.5 tons, and a section of the Tiburtina Valeria from Corfinio toward Rome to check the stability of some structures. The government quickly approved a decree establishing a state of national emergency, assigning the title of Commissioner for the Emergency to Guido Bertolaso, head of the Civil Protection; activations of Fire Fighters and Civil Protectionunits were arranged, logistical lines were defined, and funds were later allocated for the reconstruction of the city.
		Immediately after the event, the INGV had activated the QUEST Operational Group for macroseismic survey - made up, on this occasion, of teams of expert surveyors from the INGV sections in Bologna, Rome, Naples and Catania, in coordination with teams from the Civil Protection Department (supported by ENEA technicians) and colleagues from the University of Basilicata and the CNR (IMAA) - starting the survey of macroseismic effects immediately.
	○ Community-level involvement and capacity building for disaster recovery	Local community was involved in the recovery phase after the earthquake. Many volunteers from different associations have been involved in the reconstruction both from a practical standpoint (such as ANPAS, Misericordia from other regions of Italy) and financial support, with several fundraisers nationwide.

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	o Local administration and coordination for resource mobilisation	With Regional Law No. 28/2011, last amended by Regional Law 10/2012, the Abruzzo Region defined the new rules for seismic risk reduction and for the supervision and control of works and constructions built in seismic zones.
	o Building redundancy into a DRR plan	None identified in research phase.
b.	How the post disaster recovery infrastructure rebuilding, including restoration, or reconstruction had taken place?	Following the earthquake of 6 April, one of the priority objectives was to guarantee the affected population adequate accommodation as soon as possible while waiting to repair or rebuild their homes. This objective provided various solutions for the inhabitants of the earthquake 'crater' whose homes were destroyed, uninhabitable or in the red zone: the buildings of the CASE Project – Anti-seismic sustainable and environmentally friendly complexes, the MAP – Provisional Housing Modules, subsidized rents, accommodation in hotels and facilities made available by the State, and the CAS – Contribution for self-sufficiency. In particular, for the citizens of L'Aquila affected by the earthquake, the Civil Protection Department has launched a survey to know and monitor housing needs. As part of the C.A.S.E. Project, 185 earthquake-proof buildings have been constructed in 19 areas in the municipality of L'Aquila, for a total of about 4,500 flats capable of housing over 15,000 people. The first deliveries of the Case project districts started on 29 September 2009, the last buildings were handed over in February 2010. On 31 March 2010, the management of all the project buildings passed to the L'Aquila municipality. For the citizens of the other municipalities in Abruzzo affected by the earthquake and for some inhabitants of the fractions of the L'Aquila municipality, with a destroyed or uninhabitable house or in the 'red zone', the Map were instead provided as a temporary housing solution. In total, approximately 1,900 wooden houses have been provided for the municipalities outside L'Aquila, while approximately 1,400 modules have been built in the municipality of L'Aquila, of which more than 1,100 have been built by the Civil Protection Department. To these must also be added the more than 360 Map donated by companies, organizations, associations and foundations both as homes for private use and as facilities for citizen services, such as clinics or schools. Source: Dept. Civil Protection "The Law Decree n. 39 allocated EUR 200 million to ANAS S.p.A., a state-owned road construction company under the control of the national Ministry of Infrastructure and Transport, and EUR 100 million to the Italian Railway Network (Rete Ferroviaria Italiana; RFI) to implement actions considered to be

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necessary for the regional reconstruction process that were within the framework previously established by programme agreements signed before the earthquake. Surprisingly, ANAS S.p.A. also obtained emergency powers 'to restore with maximum urgency the ANAS offices in L'Aquila' (OPCM, n. 3755, art. 14, 15 April 2009).

The State of Emergency lasted (as noted) for three years, an extraordinarily long period (Venice Commission, 1995; Khakee, 2009; Imperiale and Vanclay, 2019b). However, many decisions taken under this regime, such as about demolitions, safety measures, and construction of infrastructure, continued to be implemented for years afterwards, usually under emergency procedures. The actions of the regional and provincial leaders, and the daily operations of the municipal governments, were not publicly disclosed or monitored, and were covered by state secrecy provisions"
Credits: Imperiale and Vanclay, 2020.

c.	What plans or provisions were available to minimise the economic impact following a disaster?	Just after the earthquake, there were several fundraisers, which totalled some 68,000,000 Euros, earmarked for reconstruction, the CASE project, the construction of schools and churches, and health care. The interventions initiated after the April 6, 2009 Abruzzo earthquake were defined in Decree-Law 39/2009. Subsequently, Decree-Law 195/2009 introduced a series of provisions to launch the post-emergency phase. Most recently, Decree-Law 83/2012 provides articulated regulations for the closure of emergency management. It is also recalled that the European Parliament gave the final green light to the European Union's allocation of 493.8 million euros for the Abruzzo earthquake. All the details about the actions to minimise the economic impact following the earthquake at this link.
d.	What environmental recovery plans were available to manage the impact for eco-systems and related services?	From the environmental point of view, debris can have environmental and social impacts, and so it needs to be managed carefully to protect public health and the surroundings (USEPA, 1995, 2008). During the recovery from the L'Aquila earthquake the top-down planning did not take into account the environmental and social impacts of the interventions. (Imperiale and Vanclay, 2020)

Also Brown et al., 2010 evaluated the impact of waste management in the environmental recovery plan |
| e. | How have the mitigation and resilience-building activities of preparedness been adopted for the next disaster, and the development and implementation of legislation, | About the prevention of seismic risk: Decree Law No. 39/2009 brought forward to June 30, 2009 the entry into force of earthquake-proofing regulations (Art. 1-bis), in accordance with the provisions of Resolution 8-00039 passed on April 8, 2009, and a Seismic Risk Prevention Fund was established. With Regional Law No. 28/2011, last amended by Regional Law 10/2012, the Abruzzo Region defined the new rules for seismic risk reduction and for the supervision and control of works and constructions built in seismic |

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policies, and practices to avoid similar situations in the future?	zones. Finally, it should be noted that the Commissione ambiente della Camera held a series of hearings as part of a fact-finding investigation into the state of seismic safety in Italy.
3.1.6	**Monitoring and evaluation**
How frequent are plans being reviewed and revised for emergency preparedness, response, and recovery?	The emergency plan should be updated on the occasion of any changes that may alter the prevention and protection measures; the update should include information to workers and involvement of emergency management personnel. The current plans of the L'Aquila municipality is available at this link, updated at Dicember 2021. It includes different risks. Seismic risk emergency plan is at page 74 of the PDF file.
WP3	**Task 3.2 – Vulnerable categories**
3.2.1	**Identify people vulnerable categories in the different phases of disaster management**
a.	In the analysed context, what were the consequences (death or injury) with respect to the following age groups and gender?
o New-born (ages 0–4 week)	No victims in this age group NOTES: At this link you can scroll through the list of 309 victims of the L'Aquila earthquake, with an attached sheet with the victim's information. They enable a detailed picture to be built up of the conditions at the time of death, the demographic characteristics of the victims and behavioural factors that may have influenced survival probabilities. Unfortunately, the same analysis cannot be applied to injured people, as, owing to loss of functionality of local medical centres, many of the wounded were dispersed to hospitals at diverse locations around central Italy and records of that process are not available. However, although the mortality data set is (thankfully) rather small, it gives an excellent opportunity to conduct research into the profiles and behaviour of victims in relation to the circumstances under which they died (Alexander and Magni, 2013). The paper by Alexander and Magni 2013 provides a profile of the deaths in terms of age, gender, location, behaviour during the tremors, and other aspects. This could help predict the pattern of casualties and priorities for protection in future earthquakes. These factors are investigated for the data set covering the 308 fatalities in the L'Aquila earth- quake, with help from interview data on behavioural factors obtained from 250 survivors.

o Infant (ages 4 week - 1 year)	3 victims
o Toddler (ages 1-3 years) - M/F	4 victims

All victims in L'Aquila city centre area n=186

Area of roof and stairwell collapse limited casualties

Area of topographic amplification, with major damage and casualties

Area of sporadic damage and few casualties

Area of comparatively light damage and no casualties

To NE: unreinforced masonry buildings
To SW: reinforced concrete buildings

● Male
● Female

500 m

Interesting link between victims and local site effects by Alexander and Magni 2013

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	o Pre-schooler (ages 3-5 years) - M/F	1 victim
	o School aged child (ages 6-13 years) - M/F	14 victims
	o Adolescent (ages 14-18 years) - M/F	10 victims
	o Young adult (ages 19-29) - M/F	69 victims - L'Aquila is a university town, this is why this number is so large, but it could have been larger. Many students were off-site, so they were in their hometown for Palm Sunday.
	o Adult (ages 30-64 years) - M/F	85 victims
	o youngest-old (ages 64-74 years) - M/F	35 victims
	o middle-old (ages 75-84 years) - M/F	57 victims
	o Oldest-old (ages more than 85 years)	30 victims
b.	During the rescue phase what were the categories of disabilities, or specific needs, that arose?	
	o Movement disabilities *	It is not possible to retrieve information about the specific needs of disables during the rescue. Here we list all the disabilities emerged from the victims.
		3 victims suffered from movement disabilities: 2 were unspecified, one was in bedridden.
	o Sensorial disabilities (deafness, blindness) *	2 victims suffered of sensorial disabilities: 1 victim, 75 years old, deafness 1 victim ,77 years old, blindness
	o Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	No victims in this category

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	o Pregnant women	1 victim, 30 year old
	o New-born	No victims in this category
	o Infant	No victims in this category
	o Other that emerged during the analysis of the available documentation or specific investigations conducted	4 victims, 58 y.o. with unspecified health problems, 81 y.o. and 88 y.o iss, hospitalized, and a 50 y.o. rescuer, died of heart attack
c.	Which of the following categories of disabilities, or specific needs, were managed in the post-emergency phases to give an initial response to people involved?	
	o Movement disabilities *	It has not been possible to identify data to accurately complete this section due to the large number of injured people displaced in different hospitals of the Abruzzo region.
	o Sensorial disabilities (deafness, blindness) *	None identified in research phase.
	o Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	None identified in research phase.
	o Pregnant women **	None identified in research phase.
	o New-born	None identified in research phase.
	o Infant	None identified in research phase.
	o Other that emerged during the analysis of the available documentation or	None identified in research phase.

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	specific investigations conducted	None identified in research phase.
	*Indicate age class (see 3.2.1.a) and gender; ** indicate class age	
3.2.2	**Post event management**	
a.	About point 3.2.1b, were the rescuers prepared to manage the situation?	
	○ The rescuers were involved in specific training activities in this field	The Italian National Fire brigade was prepared to handle rescue following a seismic event, as were the Civil Protection, the Police and the Italian Red Cross.
	○ Specific documentation has been made available	_https://www.lastampa.it/cronaca/2009/04/06/news/la-macchina-dei-soccorsi-in-moto-1.37066700/_ National Fire Brigade website with information about the L'Aquila rescue and videos about some rescues: https://www.vigilfuoco.it/aspx/Page.aspx?IdPage=8769 National Fire brigade and seismic events: https://www.vigilfuoco.it/aspx/download_file.aspx?id=13143
	○ Simulations were conducted also considering the issue of inclusive emergency management	Simulation are always conducted during the preparation of the rescuers for all the armed forces.
b.	About point 3.2.1c, were the operators prepared to manage the situation considering people with specific needs?	
	○ The rescuers were involved in specific training activities in this field	All the rescuers from National Fire brigate, Police, Italian Red Cross and Civil Protection are trained to manage the post-emergency following an earthquake, also including people with specific needs and disabilities.
	○ Specific documentation has been made available	https://www.vigilfuoco.it/allegati/biblioteca/legge_disabili.pdf https://www.openstarts.units.it/bitstream/10077/12415/1/Pecorella.pdf
	○ Simulations were conducted also considering the issue of inclusive emergency management	Simulation are always conducted during the preparation of the rescuers

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c.	Were people with specific needs and their family members or caregivers prepared to manage that emergency?	
	o Specific information activities were carried out on these topics with the involvement of family members, caregivers, and the surrounding community	No information about this topic
	o Specific documentation has been made available	No information about this topic
	o Simulations were conducted also considering the issue of inclusive emergency management	No information about this topic

WP3	Task 3.3 Culture & heritage
3.3.1	What was the extent of the damage with respect to the type of disaster?

The earthquake, which resulted in a ground subsidence over an area of 600 km2, with maximum vertical displacement of 30 cm (between L'Aquila and Fossa), caused devastation in the capital of Abruzzo (with extensive damage to the monumental heritage of the historic center), inflicted damage in 56 municipalities in the area (distances in some cases larger thn 10 km), with the most disastrous outcomes in the territories of the Aterno Valley (historic centers of Castelnuovo, Paganica, Onna, Villa Sant'Angelo, Sant'Eusanio Forconese and Fossa), causing a total of 308 casualties, 1,500 injured, more than 68, 000 homeless and the unusability of 933 monumental sites (churches, palaces, walls, towers, fountains, etc.). Unlike other recent national earthquakes involving larger territories and smaller centers (Friuli, Irpinia, Umbria-Marche), the damage was concentrated in areas with a high rate of housing, eventually compromising a large part of civil buildings and complexes housing public and administrative facilities, many of them located in centuries-old monumental buildings (in L'Aquila, e.g. the Prefecture, City Hall, the Superintendency of the Ministry of Cultural Heritage and Activities, the National Museum, the Provincial Library, and important sectors of the region, province, university and school, churches and houses of worship).

3.3.2	What was the extent of the damage with respect to the size of the disaster?

"According to Alexander (2010) the earthquake in L'Aquila "was a moderate seismic event", with a rather insignificant magnitude compared to other worldwide events, but with a very high magnitude for a European country. However, the physical vulnerability level of its masonry buildings (poorly maintained and not strengthened) – mainly concentrated in the historical city center – led to the enormous damage described earlier. The earthquake also affected reinforced concrete structures; and overall all the affected buildings were a typical example of the construction type in several European countries. Nevertheless, it is noticeable there were more casualties due to the collapse of reinforced concrete buildings than in the masonry ones, which demonstrate the high vulnerability of the first ones, as compared to the latter."

Credits: Contreras et al., 2014.

3.3.3	How was the human and environmental adaptive response/reaction to the damage?

None identified in research phase.

3.3.4	How long did it take to recover/retrieve after the disaster in the following categories?	
o	Land use	None identified in research phase.
o	Repopulation	None identified in research phase.
o	Everyday life condition	None identified in research phase.
o	Social life	None identified in research phase.
o	Lesson for the mitigation of other disasters	None identified in research phase.
3.3.5	Was there any quantitative correspondence between reaction/effort and damage?	
	None identified in research phase.	
3.3.6	What was the timescale of such correspondence (short-term vs. long-term)?	
	None identified in research phase.	
WP3	Task 3.4 – Risk governance strategy	
Type of data	Data/ information/ sources/ reference material	
3.4.1	Disaster risk governance mechanisms	
What were the disaster risk governance mechanisms identified in the relevant authorities to manage disaster risk under following categories?		
o	Knowledge sharing and inclusion of science and technology	None identified in research phase.
o	Harmonizing capacities and resources to the needs in risk assessment	None identified in research phase.
o	Institutionalizing partnerships, coordination, and responsibilities	None identified in research phase.
o	Participatory decision-making mechanisms, inclusive of vulnerable communities, indigenous communities, and volunteers	None identified in research phase.
o	Leveraging investments in DRR	None identified in research phase.
3.4.2	International DDR frameworks	
What international DDR frameworks (SENDAI, SDG, Paris Agreement) were adopted in DRR projects?		None identified in research phase.
3.4.3	Accountability in disaster governance	
What were the provisions to ensure accountability in disaster governance?		
o	Consider accountability aspects in the Sendai Framework for Disaster Risk Reduction 2015-2030	None identified in research phase.
o	Innovative elements of accountability	None identified in research phase.
o	Enabling legislations	None identified in research phase.
o	Regular monitoring, evaluation, and review	None identified in research phase.

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WP4	Cascades	
1.	What is the EU country, covered by CORE partners, preparing for (crisis, war and crisis, disruption)?	None identified in research phase.
2.	What types of disasters is each EU country, covered by CORE partners, preparing for?	None identified in research phase.
3.	Who is involved in the preparation process?	None identified in research phase.
a.	What kind of approach is adopted in disaster preparedness: e.g., is disaster preparedness centralized (national level) or decentralized (local level); who (which agency) has the leading role in preparedness; guiding policy frameworks and/or strategies and principles; coordination/cooperation mechanisms (and sectors involved)?	None identified in research phase.
b.	Other stakeholders for preparedness?	None identified in research phase.
c.	EU/UN/INGO?	None identified in research phase.
4	Training and communication preparedness	
a.	What kinds of trainings (including drills and crisis exercises) are done to prepare for a disaster?	None identified in research phase.
b.	Who provides training, for whom and what competencies are covered?	None identified in research phase.
c.	What kind of approach is adopted in crisis communication preparedness: e.g., what is communicated to the general public about preparedness, how (means and channels: e.g., preparedness brochure, crisis portals/websites, campaigns, formal/civic/professional education, social media mobilisation) and by whom (leading agency + other partners and stakeholders involved + partnerships with news media)? How are the needs of vulnerable groups taken into account?	None identified in research phase.
5.	Prepositioning, framework contract and supplier management	
a.	What types of goods are pre-positioned and how are locations selected?	None identified in research phase.
b.	Which organization is responsible for management of pre-positioned stock?	None identified in research phase.
c.	What are the framework contracts for disaster preparedness, who manages them?	None identified in research phase.
d.	How are suppliers who secure the supply for preparedness selected and managed	None identified in research phase.
6.	How was the preparedness and response mechanism activated for different types of risks?	None identified in research phase.
7.	How the event influenced flow, access to and availability (length of shortage, scale, shortage by social group) of:	None identified in research phase.
o	Drinking water;	None identified in research phase.
o	Energy supply (electricity, coal, fuel etc.);	None identified in research phase.

○ Food (retail sales, catering, etc.);	None identified in research phase.
○ Health (emergency and long-term provision, psychological health);	None identified in research phase.
○ Access to information.	None identified in research phase.
8. How the event influenced preparedness mechanisms (in terms of training, information flow, communication, prepositioning, supplier management). What were the lessons learned from the case?	None identified in research phase.
9. Have there been any studies conducted on the long-term impact (five or ten years) of this disaster/crisis?	None identified in research phase.
a. Was there any long-term health or societal impact?	None identified in research phase.
b. Any local supply chain impact?	None identified in research phase.
c. How long did it take for the communities to get back to the original state?	None identified in research phase.
d. Any studies on the long-term resilience of the affected region?	None identified in research phase.
WP7 Social media information/misinformation and risk communication	
Please provide a quality assessment for the accuracy and veracity of information and data used to inform this case study in the following three categories:	
a). Media information	None identified in research phase.
b). Misinformation	None identified in research phase.
c). Risk communication	None identified in research phase.

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Annex 6 – Case Study 3 – FLASH FLOODING

CASE STUDY 3: Flash Flooding

Guidance notes *are provided in red text offering additional description and direction of the response/s required in each field.*	
Incident	Aude Region (France) Flash Flooding
Location	Aude Region, Occitan, France
Time & Date	14th/15th October 2018

Description and timeline of the incident

Aude is a department in the Occitan region of southern France. The population in 2018 was approximately 370k, and the region is semi-rural in nature, with the largest town being the historic fortified mediaeval city of Carcassonne. The department topography is of forested hills and valleys in the South, Central and West of the region, with a coastal plain in the East. The key geographic feature is the river Aude itself, flowing northwards from the Pyrenees, until at Carcassonne it swings east towards the Mediterranean. The area has below average rainfall for France.

Aude is one of 15 departments considered to be part of the "Mediterranean Basin", a region at particular risk from flooding as it is exposed to very specific weather conditions which bring heavy rainfall every year, mainly in early autumn. These episodes are caused by hot, humid and unstable air rising up and moving inland from the Mediterranean, leading to violent and occasionally locally sustained storms. Given the topography of the land with steep sided narrow valleys, this often results in potentially dangerous flash floods.

(Guidance re Rainfall and Flooding. Government of France. (2022). *Guidance on rain and flooding*. Ecologie.gouvre.fr.)

It is therefore relatively common for the equivalent of several months of rain to fall in just a few hours or days, and the French Weather Service has identified that these extreme rainfall events in the regions mentioned have increased in frequency, and overall, there has been increased rainfall since the 1960s.

The River Aude has a large catchment area of 6,074 square kilometres that extends into the Pyrenees. Upstream of Carcassonne, the Aude receives no less than 16 significant tributaries which often have "the characteristics of mountain torrents", namely significant meltwaters in Spring, and the potential to be in spate from heavy rainfall anywhere in the catchment. They are thus often fast flowing and deep, even without rainfall in a flood affected area.

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Over the night of 14th /15th October 2018, a major storm struck the region. With the severest rain falling from 2100hrs onwards on the 14th, in just 12 hours overnight, 295 mm of rainfall was recorded in Trèbes, which is the equivalent of 4 months of rain. 244 mm of that total fell in just a 6-hour period. Elsewhere, 211 mm of rain was recorded in Arquettes-en-Val, 178 mm in Mouthoumet, 172 mm in Les Martys and 138 mm in Carcassonne itself.

Levels of the Aude River at Trèbes jumped 7 metres overnight, reaching levels not seen since the floods of October 1891. The overnight flash flooding – commencing from approximately 0300hrs – was distinguished from regular floods by having a timescale of fewer than six hours between rainfall and the onset of flooding, was accompanied by strong winds gusting over 100 kph. The flash flooding led to rivers and waterways bursting their banks at multiple locations; the destruction of roads and bridges; the inundation of residential and business areas; and the widespread breakdown of power, water and transport infrastructure.

Most contemporary reporting, and the official report, "Retour d'expérience des inondations du 14 au 17 Octobre 2018 dans l'Aude" (Referred to here in English throughout this document as the "Aude Feedback Report 2019"), state that 14 people died. The database "Developing a large-scale dataset of flood fatalities for territories in the Euro-Mediterranean region, FFEM-DB", published 12th April 2022 in the journal Scientific Data identifies 15 known victims. This will be fully cited and discussed further below.

Worst hit was the town of Trèbes, where 6 residents were killed. Across the Department, 75 people were seriously injured, 1800 were evacuated, whilst 10,000 homes were without drinking water for over 24 hours, and 1500 homes had no electricity supply for several days. 126 municipalities in the Department were declared disaster zones, and Finance Minister Bruno Le Mair estimated that the material damage amounted to €200 million, with the government making €80 million immediately available. Later estimates suggested the damage totalled €269 million. (Guion de Meritens et al, I. French Government Ministry of Interior. (2019). *Retour d'expérience des inondations du 14 au 17 octobre 2018 dans l'Aude*. Conseil général de l'Environnement et du Développement durable - Inspection générale de l'Administration.)

This indicated the scale of the challenges facing the Department. Although the flooding did not match the death toll and damage of the floods of November 1999 – where 35 people died, the sudden rise in water levels severely tested the preparedness and planning of the Department, and the individual municipalities.

Neither these floods in 2018 nor those of 1999 matched the scale of the floods of 1891. Records indicated that the inundation levels were far higher, but the population and associated urban development was significantly less.

Nonetheless, the floods of 1999 demonstrate why the Department should have been in a high state of readiness. As stated, there were 35 fatalities, over 2000 evacuated by helicopter or boats/manual intervention and records show 5,000 hectares of vineyards were significantly damaged.

(Lefrou, C. French Government - Ministry of the Environment. (2000). *Les Crues des 12, 13 et 14 novembre 1999 dans les départements de l'Aude, de l'Hérault, des Pyrénées-Orientales et du Tarn [rapport consolidé après la phase contradictoire]* . Conseil général des Ponts et Chaussées - Inspection générale de l'Environnement - Ministère de l'Environnement.)

Rebuilding after the 1999 flooding may have impacted on the scale of the 2018 events. Official data shows one in four French people (17 million) lives in an area prone to flooding, with half of all cities, towns and villages in France having some built-up areas in flood-risk zones. This may be less relevant where flooding is a rare phenomenon, but in the Aude region, 39% of residents live in flood-risk areas. One of the properties flooded in October 2018 was a brand new multi-million-euro hospital - built in a flood zone.

(Kougkoulos, I., Merad, M., Cook, S.J. *et al.* Floods in Provence-Alpes-Côte d'Azur and lessons for French flood risk governance. *Nat Hazards* **109**, 1959–1980 (2021).)

As demonstrated, the floods of October 2018 were not a rare event in the Aude region. Nonetheless, the scale and ferocity of the October floods appear to have taken the authorities and responders by surprise.

The mayor of Trèbes, Eric Ménassi was quoted as saying, "The tragedy that we have been through was impossible to predict and overwhelming... The heavy rain came at around 2am in a way that was sudden and extreme." French Prime Minister at the time, Edouard Philippe was quoted as stating, "The extreme weather was unpredictable," and said all the local services were mobilised to deal with the tragedy.

(EFE News Agency: FRANCE FLOODS

Macron steps up emergency aid in flood-affected areas with $91.7 million)

By contrast, an Interior Ministry spokesman suggested an initial first red alert about the Aude floods had come "too late", and that orange alerts are used so frequently that people "no longer take notice" of them. There is evidence also that the Aude Department was only placed on red alert (Vigilance Rouge) at 6am on Monday morning (the 15th October 2018), when the heaviest rains had already passed, and rivers had already burst their banks.

There seems ample evidence that first responders in the emergency services, together with volunteers and NGO staff reacted to the events with courage, speed, and resourcefulness. Given the history of flooding in the region however – with innumerable smaller scale floods as well as frequent major incidents – there is obviously much that can be learned about preparedness, planning, and communication.

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WP2	Task 2.2: Natural and manmade disaster case study identification, research, and analysis

What were the public information sharing challenges?

The Aude floods were triggered by heavy rain starting late on a Sunday evening in rural France, and peaking at around 06:00 am. Whilst the storm's arrival had been predicted, the intensity was underestimated, and public communication issues which potentially could have been managed on Sunday afternoon were being dealt with even as the most serious aspects of flooding were occurring - several of the deaths were indicated as persons who were asleep and unaware of the crisis.

(Petrucci, Olga (2018), MEFF-Mediterranean Flood Fatalities, *Mendeley Data*, V1, DOI: 10.17632/rh9mx7fh7b.1and European Flood Fatalities Database (EuFF))

What were the ethical issues?

None identified. For example, unlike the Hurricane Katrina response in New Orleans (2005) in which both the disaster management phase and recovery phase were allegedly managed to the advantage of white wealthier communities, the speed and location of the Aude floods were such that response prioritisation could not be skewed.

What lessons have been learned?

In May 2019, the Ministry of Ecology and the Ministry of the Interior jointly published a significant review titled, "Retour d'expérience des inondations du 14 au 17 Octobre 2018 dans l'Aude"

(Retour d'expérience des inondations du 14 au 17 Octobre 2018 dans l'Aude.

[Feedback from the floods of October 14 to 17, 2018 in Aude]

Guion de Meritens et al, I. French Government Ministry of Interior. (2019). Retour d'expérience des inondations du 14 au 17 octobre 2018 dans l'Aude. Conseil général de l'Environnement et du Développement durable - Inspection générale de l'Administration.)

This impressive report contains 15 specific targeted recommendations for action by local, regional, and national government bodies. The report identifies a number of recommendations created following previous floods, which at the time of this major incident had not been implemented. In common with many areas worldwide, it appears that once the initial responses have been delivered, other priorities may dominate the bodies involved.

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What were the cascading effects across events, sectors, and supply chain disruptions? Including the inevitability or unforeseen chain of events affecting the response to the disaster? What were the societal vulnerabilities in health and retail sectors?

The region affected is economically underpinned by tourism and agriculture. There is some light industry, but overwhelmingly the local economy is a service-based economy which is also in receipt of substantial support funding from central government. There was therefore minimal disruption to areas outside the department directly affected. This region has few through routes regarded as essential to the economy of France or Spain. Significant damage to transport infrastructure adjacent to the affected waterways disrupted not only the immediate rescue and recovery operations, but the ability to move goods and services throughout the region. Whilst air support was effectively used in rescue operations, topography limited the impact of air support on the strategy to return the local area to pre-event normality.

(Retour d'expérience des inondations du 14 au 17 Octobre 2018 dans l'Aude.

[Feedback from the floods of October 14 to 17, 2018 in Aude]

Guion de Meritens et al, I. French Government Ministry of Interior. (2019). Retour d'expérience des inondations du 14 au 17 octobre 2018 dans l'Aude. Conseil général de l'Environnement et du Développement durable - Inspection générale de l'Administration.)

What was preparedness before and after the event with regards to prepositioning, training, framework contracts and supplier management.

There is substantial evidence of well-resourced meteorology and a coherent programme of inspection review and development of flood defences following the 1999 floods in the region.

The Aude Feedback Report 2019 however states that, "Whilst the operation of the meteorological vigilance and flood vigilance devices appeared faultless, the warning system remains too complex and difficult to understand for elected officials and the population", which struggles to distinguish the concepts of alert levels. "Public information and awareness raising activities still need to be strengthened on these subjects". This same report identifies a failure to correctly anticipate the scale and breadth of the critical incident and "an absence of structured anticipation, communication, or decision-making units".

Retour d'expérience des inondations du 14 au 17 Octobre 2018 dans l'Aude

Guion de Meritens et al, I. French Government Ministry of Interior. (2019). Retour d'expérience des inondations du 14 au 17 octobre 2018 dans l'Aude. Conseil général de l'Environnement et du Développement durable - Inspection générale de l'Administration.

Extensive review of media footage shows some deployment of specialist equipment, but equally a significant amount of ad hoc rescue techniques.

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This would match experiences in other flooding scenarios worldwide such as in South Yorkshire in 2007, where all available resources were quickly overwhelmed by competing demands.

Please provide a list with links of data sources used in the following categories

Government/Official reports	Retour d'expérience des inondations du 14 au 17 Octobre 2018 dans l'Aude
	(Feedback from the floods of October 14 to 17, 2018 in Aude)
	Guion de Meritens et al, I. French Government Ministry of Interior. (2019). *Retour d'expérience des inondations du 14 au 17 octobre 2018 dans l'Aude*. Conseil général de l'Environnement et du Développement durable - Inspection générale de l'Administration. https://www.vie-publique.fr/rapport/271240-retour-dexperience-des-inondations-du-14-au-17-octobre-2018-dans-laude
	Les Crues des 12, 13 et 14 novembre 1999 dans les départements de l'Aude, de l'Hérault, des Pyrénées-Orientales et du Tarn
	(The Floods of 12,13, and 14 November 1999 in the departments of Aude, Herault, Pyrénées-Orientales, and Tarn. [Consolidated Report]).
	Lefrou, C. French Government - Ministry of the Environment. (2000). *Les Crues des 12, 13 et 14 novembre 1999 dans les départements de l'Aude, de l'Hérault, des Pyrénées-Orientales et du Tarn [rapport consolidé après la phase contradictoire]* . Conseil général des Ponts et Chaussées - Inspection générale de l'Environnement - Ministère de l'Environnement. https://www.vie-publique.fr/rapport/24706-les-crues-des-12-13-et-14-novembre-1999-dans-les-departements-de-laude
	Limoux Town Council. (2010). *EMERGENCY PLANNING Information & Advice* [Pamphlet]. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiy0q7hw6_4AhWRDuwKHan8Da4QFnoECAIQAQ&url=https%3A%2F%2Fwww.limoux.fr%2Fad_attachment%2FPlaquette%2520en%2520Anglais.pdf&usg=AOvVaw3RYie10JQOdEUoeGo9tduf

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	Sallèles-d'Aude Council. (2022). *Viappel: flooding alert service.* sallelesdaude.fr. http://sallelesdaude.fr/en/cadre-de-vie/les-innondations Guidance re Rainfall and Flooding Government of France. (2022). *Guidance on rain and flooding.* ecologie.gouvre.fr. https://www.ecologie.gouv.fr/en/rainfall-and-flooding and Petrucci, Olga (2018), MEFF-Mediterranean Flood Fatalities, *Mendeley Data*, V1, DOI: 10.17632/rh9mx7fh7b.1 European Flood Fatalities Database (EuFF) https://data.4tu.nl/articles/dataset/EUFF_2_0_European_Flood_Fatalities_database_/1475499 9/1 Developing a large-scale dataset of flood fatalities for territories in the Euro-Mediterranean region, FFEM-DB" https://www.nature.com/articles/s41597-022-01273-x#Sec18
NGO reports	Deadly Floods in South West After 244mm of Rain in 6 Hours. Davies, R. Floodlist.com. (2022). *France -Deadly Floods in South West After 244mm of Rain in 6 Hours.* https://floodlist.com/. https://floodlist.com/europe/france-floods-aude-department-october2018
Community interviews/reports	None identified in research phase.
Eyewitness/first-hand accounts	Mas Cabardes Residents. (2018). *Storm and Flooding the night of 14th – 15th October 2018. Mas Cabardes - Aude.* *https://www.mascabardes.com/Innondation/Innondation.aspx*

Category	Content
News/media reports	Whitfield, K. (2018, October 15). France flash floods MAPPED: Where is DEADLY flash flooding in Aude? *The Express*. https://www.express.co.uk/news/world/1031759/france-flash-flood-map-where-is-flash-flooding-aude-Carcassonne-weather
	Connexion Journalist, (2018, October 25). Flood-zone building row after Aude deaths. *The Connexion*. https://www.connexionfrance.com/article/French-news/Flood-zone-building-row-after-deaths-in-Aude-region-southern-France
	Staff, (2018, October 16). Floods LATEST: Clean-up begins in south western France as anger rises. *The Local.fr.* https://www.thelocal.fr/20181016/south-western-france-remains-on-alert-as-flood-waters-recede/
	EFE News Agency: FRANCE FLOODS Macron steps up emergency aid in flood-affected areas with $91.7 million https://www.efe.com/efe/english/world/macron-steps-up-emergency-aid-in-flood-affected-areas-with-91-7-million/50000262-3788602
Documentaries	None identified in research phase.
Social Media	None identified in research phase.
Satellite/other aerial imagery	**Copernicus Satellite Imagery:** Copernicus Emergency Management Service. (© 2018 European Union), EMSR324 *Floods in Aude, France*. https://emergency.copernicus.eu/mapping/list-of-components/EMSR324
Academic Papers/Reports (Peer Reviewed)	Kougkoulos, I., Merad, M., Cook, S.J. *et al.* Floods in Provence-Alpes-Côte d'Azur and lessons for French flood risk governance. *Nat Hazards* **109,** 1959–1980 (2021). https://doi.org/10.1007/s11069-021-04905-4
Academic Papers/Reports (Non-Peer Reviewed)	None identified in research phase.
Public Enquiry Reports/Findings	None identified in research phase.

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Journal/Magazine articles	None identified in research phase.
Online podcasts, blogs, forums & chat rooms	None identified in research phase.
Official policy recommendations & findings	Retour d'expérience des inondations du 14 au 17 Octobre 2018 dans l'Aude (Feedback from the floods of October 14 to 17, 2018 in Aude) Guion de Meritens et al, I. French Government Ministry of Interior. (2019). *Retour d'expérience des inondations du 14 au 17 octobre 2018 dans l'Aude*. Conseil général de l'Environnement et du Développement durable – Inspection générale de l'Administration. https://www.vie-publique.fr/rapport/271240-retour-dexperience-des-inondations-du-14-au-17-octobre-2018-dans-laude
Other (Please specify)	None identified in research phase.

WP2	Task 2.3: Natural and manmade case study social media analysis

What was the role, influence, and impact of social media communications during this incident?

There is no evidence of any effective social media communication immediately prior to, or at the commencement of the incident. Individuals, when affected by the flooding, immediately started to circulate images and commentary, and there is some evidence of local citizens actively placing themselves at risk in order to secure material for this purpose. There is no evidence of any strategic use of social media by the authorities to issue instructions or reinforce guidance. Research is needed to identify whether the region has more or fewer regular Twitter users than the average for France as a whole.

The Aude Feedback Report states that, "it is up to the mayor and his services to alert the population of the municipality". The report goes on to point out that in certain upstream sectors, the critical incident arose so fast that the text-based alert system was inoperative, and for many areas, the mobile phone service was not functioning. For the municipalities closer to the sea there was sufficient time to alert the population by automated telephony. This is mentioned approvingly by the report, but it would appear that in 2018/2019 little consideration was given to the opportunities available through social media.

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Given the advances in communication technology it would now be appropriate to consider regional and national models of warning citizens, and utilising a range of technologies.

What patterns of interactions between opinion makers and recurring topics in the Twitter debate following the disaster have been identified?

As previously stated, the debate centres on the effectiveness of local government and relevant authorities prior to the event and what if any advance warning could have been given. The authorities have not engaged strategically as far as can be determined, preferring to make statements through traditional media, and given the nature of the communities in the region, this may well be the most appropriate response.

Please provide a list with links of data sources used in the following categories

Government/Official reports	Not identified in current research
Community interviews/reports	Not identified in current research
Eyewitness/first-hand accounts	Not identified in current research
News/media reports	Not identified in current research
Documentaries	Not identified in current research
Social Media	Not identified in current research
Satellite/other imagery	Not identified in current research
Academic Papers/Reports (Peer Reviewed)	Not identified in current research
Academic Papers/Reports (Non-Peer Reviewed)	Not identified in current research
Public Enquiry Reports/Findings	Not identified in current research
Journal/Magazine articles	Not identified in current research
Online podcasts, blogs, forums & chat rooms	Not identified in current research
Official policy recommendations & findings	Not identified in current research

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| Other (Please specify) | This data was not requested in this phase. |

| WP2 | Task 2.4: Natural and manmade case study aerial imagery analysis |

What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform decision-making?

Satellite imagery, particularly through the European Union funded Copernicus project, was available very quickly, but it is not possible to assess whether it had any value in decision-making during the crisis. There is no evidence of strategic or tactical use being made of UAVs by the first responders, and the first apparent use of this technology is in imagery used for broadcast or imagery by media staff. The Aude Feedback Report 2019 does not reference any use of satellite data or UAV imagery in its review of either the preparation and planning or response to the flooding.

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What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform the sharing of public information?

This is an area for further research, using analysis of other use case studies.

Please provide a list with links of data sources used in the following categories	
Government/Official reports	Not identified in current research
NGO reports	Not identified in current research
Community interviews/reports	Not identified in current research
Eyewitness/first-hand accounts	Not identified in current research
News/media reports	Not identified in current research
Documentaries	Not identified in current research
Social Media	Not identified in current research
Satellite/other imagery	Not identified in current research
Academic Papers/Reports (Peer Reviewed)	Not identified in current research
Academic Papers/Reports (Non-Peer Reviewed)	Not identified in current research
Public Enquiry Reports/Findings	Not identified in current research
Journal/Magazine articles	Not identified in current research
Online podcasts, blogs, forums & chat rooms	Not identified in current research
Official policy recommendations & findings	Not identified in current research
Other (Please specify)	Not identified in current research

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WP3	Task 3.1 - Critical analysis of past disasters via the identified case studies on their disaster preparedness strategies
Type of data	**Data/ information/ sources/ reference material**
3.1.1	**Type of hazards – Understanding the disaster risk**
a. What type of hazards were commonly identified in the region (Slow-onset and rapid onset hazards)?	The region is heavily forested, and tourist focused. There are examples of emergency planning public relations material in both English and French. The main focus of this material is to respond to forest fires and flash floods. These should both be considered rapid onset hazards, as should the other subsidiary focus for emergency planning namely hazardous chemical transportation. There are plans in place to deal with breaches of the two major dams in the region, but these largely echo the advice given in the event of any other flooding activities.
b. What hazards have resulted in disasters during the past 20 years?	Whilst there have been a number of relatively small forest fires, the most significant hazard has been flash flooding caused by rapid run off following heavy precipitation.
c. What risk assessment mechanism(s) were used by the relevant institutions for encompassing risk awareness, multi-hazard analysis, vulnerability/capacity analysis and cascading effects?	The published material refers to a multi-agency risk assessment partnership, but a more detailed analysis of their planning and capabilities would require further research.
d. What risk modelling and scenarios have been carried out to consider disaster risk and/or any other future threats and cascading effects?	The Aude Feedback Report 2019 states in a discreet footnote: "The review suggests replacing the conventional method of planning by reference to past floods with a simulation method, while accompanying these plans with conditions and methods of construction in flood zones so as not to excessively reduce the building spaces in regions where the needs are great".

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		This features beneath the clear statement that at the time of the floods a substantial number of plans had not been updated, and that lessons learned were not being actioned.
e.	How the knowledge of indigenous communities and information in social media had been captured for disaster risk perception?	The review and associated research strongly suggest an "Expert led" model of emergency planning, with little input from local residents.
3.1.2	**Disaster resilience and preparedness strategies**	
a.	What were the available national and local disaster management plans and systems under following categories?	
	○ Individual-level activities (e.g., first aid training and response)	Some guidance is offered by local authorities on appropriate action in the event of a major incident, focusing on staying in a safe location, and receiving communication - via a battery powered radio. This information is varied marginally dependant on the nature of the threat - i.e., fire, flood, or chemical escape.
	○ Household actions (e.g., stockpiling of equipment and supplies, retrofitting)	Every household in the region has received written advice which is also available online. This focuses on identifying appropriate supplies and equipment in the event of a flood or fire, and maintaining a state of vigilance, and awareness of how to respond. There are noticeable advertisements both in physical media and online in the region offering potential mitigation or solutions to flooding risks for individual householders.
	○ Community efforts (e.g., socially responsible mitigation, training, and awareness campaigns for first respondents and responders, and field exercises)	This would require further research to offer an authoritative response.
	○ Governmental strategies (e.g., multi-organisational planning	Evidence exists of national and local government disaster preparedness and a multi-agency approach to emergency and contingency planning. There is some evidence of

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	and public private partnerships, early warning systems, contingency plans, evacuation routes, and public information dissemination, allocation of resources)	communication with the public through online media as well as more traditional local authority campaigns. The core evacuation and response plans are identified as a Prefecture responsibility – i.e., local government.
b.	What provisions were in place for research, education, science, and technology (ex: geospatial, remote sensing) for informed disaster preparedness?	Across France there have been several academic papers relating to the need to bring together geographical, geological, geomorphological, and historical studies to better assess the location and likely impact of flooding. Further research is necessary to assess the impact of these research documents if any.
c.	What special provisions were undertaken to ensure pandemic preparedness in disaster preparedness measures?	Outside the scope of this initial review.
3.1.3	Mitigation	
a.	What policies and legislation were available that mainstreamed DRR in the national planning policy?	
	o Land use planning and building codes (Ex: Avoid settlement expansion towards hazard prone areas)	Evidence suggests that settlement expansion and new building has taken place regardless of assessed risk. This is confirmed in the Aude Feedback Report 2019.
	o Critical infrastructure protection and structural design improvements	There were significant critical infrastructure failures, even in structures rebuilt or repaired after previous flood damage, and one valuable hospital facility was made unavailable due to a poor choice of location, and inadequate protection from hazards.

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	o Landscape and environmental arrangement around essential services and infrastructure	Commented upon in the Aude 2019 Feedback Report, but research cannot identify any evidence of comprehensive policy delivery in the region
	o Resilience strategies including planning and partnership building between sectors	There is some evidence of an interagency approach to issues, but further research would be necessary to identify the effectiveness of the planning, and how successful were any joint command and control arrangements. The Aude Feedback Report 2019 contains a specific recommendation designed to improve inter agency planning and collaboration (Rec. 10)
b.	What support were provided by media platforms including social media during disaster operations?	There is evidence of individual use of social media to identify hazards and to make public the issues. No evidence has yet been found suggesting that this was effectively used by responding authorities.
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	The critical incident under review predates the COVID-19 pandemic.
3.1.4	Response	
a.	What were the available surveillance, early warning, and information management systems for activating response operations under the following conditions?	
	o **Support or coordinate disaster operations being conducted by a designated lead agency**	The elected mayors of prefectures have a significant responsibility for disaster operations within their municipality. They operate a system of communal safeguarding plans, although it was noted that these have not always been updated as they should be. The activities of the municipalities are coordinated by a Departmental Operational Centre. Whilst this operated to a satisfactory level throughout the 2018 flooding, comment at the time as well as the official review suggested that this facility would struggle in the event of a longer lasting or more widespread emergency. There is an

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		absence of geographical information systems, and no multi agency accessible command and control system. Municipal responses were therefore based on historic data and in effect responded to the last emergency rather than the current one.
	○ Logistics mechanisms and essential supplies for health and relief services	Regional planning structures include the stockpiling of emergency equipment, both for responding organisations and the population. Evidence was found that the distribution of equipment and supplies was handicapped by the road infrastructure's proximity to the main sources of flooding, and this would need to be addressed for the future.
b.	What support was provided by media platforms including social media during disaster operations?	There is little evidence of social media or other media platforms providing support during the disaster management phase. Mass media attention during the recovery phase served to highlight areas where services were not succeeding in supporting communities.
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	The critical incident under review predates the COVID-19 pandemic.
3.1.5	**Recovery**	
a.	What were the long-term and short-term recovery actions undertaken during each post disaster recovery period including 'build back better' practices?	
	○ Response endeavours such as needs and damage assessments	Notably successful was the distribution of emergency funds of €500 per adult and €200 per child in a single simple grant system which made funds available to citizen bank accounts or in cash from community centres within 48 hours of the emergency. Families whose homes were affected by the flooding were swiftly relocated temporarily but the emergency aid nominally ended within six months and homeowners attempting to access permanent relocation found it difficult to achieve this within this time scale.

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Municipality teams assessed infrastructure damage quickly but there was a shortage of civil and mechanical engineers to quickly assess longer term issues.

Evidence drawn from local residents suggest that services were quickly restored.

"In the meantime, though electricity was restored in a day, internet in a week although intermittent but still no phones. From the very first morning the local commune staff did an amazing job, clearing the landslips and trees so that we could at least get out of the village by the end of the day... Short term repairs to roads were done with incredible speed and efficiency... Finally, yesterday the road to Carcassonne was reopened. About 300 metres of road and a 10-15 metre bridge have been completely rebuilt (a month later)". Mas Cabardes (Aude) Resident

o Community-level involvement and capacity building for disaster recovery

Again, the municipalities and prefecture between them had the capacity to deal with the Aude flooding which was a comparatively short-term event. The Aude Feedback Report 2019 identifies that in the event of a larger scale disaster or longer-term problems, anywhere in France, government shrinkage and reduced public spending have diminished capacity to the extent that in this region at least, expected retirements are likely to remove the expertise and capabilities which were already stretched.

While cash donations to support victims were effectively dealt with by an existing voluntary sector body, donations of in-kind materials and support were found to be a problem. In some municipalities, capacity was found within local authority resources, but elsewhere storage pending use was an issue.

o Local administration and coordination for resource mobilisation

Much of the responsibility for coordinating resources for recovery is vested in the municipality. This was found to cause problems in the deployment of military assets, when a deployment might need to extend across a municipality border, and later in the recovery process when there were competing demands for resources. Whilst there is an association of mayors which can assist, there is clearly a requirement for command-and-control functions to be augmented at the prefecture and indeed regional level.

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	○ Building redundancy into a DRR plan	This is identified as a risk within local plans since over this period, the French government is engaged in a budgetary reduction programme, in common with many other European governments.
b.	How the post disaster infrastructure recovery including rebuilding, restoration, or reconstruction had taken place?	Since the Aude floods, most major infrastructure has been successfully re-established, and there has been a distinct effort to include risk mitigation in redevelopment plans, as well as ensuring that regional urbanisation and proposed new developments are more closely linked to the flood risk prevention plans (PPRIs).
c.	What plans or provisions were available to minimise the economic impact following a disaster?	A combination of national and regional funding was quickly made available under a national scheme that supports businesses, particularly SMEs with a turnover under €1 million. Funding was made available to support employment and to pay expenses outwith insurable damage to ensure business continuity. This was not seen as overly bureaucratic by the recipients.
d.	What environmental recovery plans were available to manage the impact for eco-systems and related services?	Environmental considerations are built into the standard flood risk prevention plans of the region. The area is heavily reliant upon forestry and waterways for economic reasons, and there is evidence that environmental protection is highly prioritised in all local planning processes.
e.	How have the mitigation and resilience-building activities of preparedness been adopted for the next disaster, and the development and implementation of legislation, policies, and practices to avoid similar situations in the future?	A number of organisational and policy changes are recommended within the Aude Feedback Report 2019.
3.1.6	**Monitoring and evaluation**	

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How frequent are plans being reviewed and revised for emergency preparedness, response, and recovery?	Local emergency plans are required by statute to be updated within a five-year time frame. At the time of the critical incident, 16 of the 28 relevant Departmental level plans had not been updated correctly, and the specific flood related detailed annexes had not been approved and implemented – overdue by 2 years.
WP3	Task 3.2 – Vulnerable categories
3.2.1	Identify people vulnerable categories in the different phases of disaster management
a.	In the analysed context, what were the consequences (death or injury) with respect to the following age groups and gender?

- New-born (ages 0-4 week)

No children or young persons were identified as having died in the flooding itself. Within the constraints of this research, it has not been possible to identify specific other issues in respect of these groups, namely access to education, welfare, or additional trauma.

Victim age and gender has been identified from the European Flood Fatalities Database, established following the creation of a Mediterranean Flood Fatality database (MEFF) by a consortium of academic staff drawn from multiple universities.

The original work in 2018 has been developed, and the current most appropriate references are:

Petrucci, Olga (2018), MEFF-Mediterranean Flood Fatalities, *Mendeley Data*, V1, DOI: 10.17632/rh9mx7fh7b.1 https://data.mendeley.com/datasets/rh9mx7fh7b/1

And

European Flood Fatalities Database (EuFF) https://data.4tu.nl/articles/dataset/EUFF_2_0_European_Flood_Fatalities_database_/14754999/1

The latest information is available at: Developing a large-scale dataset of flood fatalities for territories in the Euro-Mediterranean region, FFEM-DB" https://www.nature.com/articles/s41597-022-01273-x#Sec18

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o Infant (ages 4 week - 1 year)	Please see above commentary
o Toddler (ages 1-3 years) - M/F	Please see above commentary
o Pre-schooler (ages 3-5 years) - M/F	Please see above commentary
o School aged child (ages 6-13 years) - M/F	Please see above commentary
o Adolescent (ages 14-18 years) - M/F	Please see above commentary
o Young adult (ages 19-29) - M/F	One young adult male was identified as having died during the flooding. He had left the family home to check outbuildings and was swept away
o Adult (ages 30-64 years) - M/F	3 adult males were identified as having died in the flooding. The database identifies 2 of them being outdoors in vehicles and being drowned as they attempted to escape. At least one was categorised as working at the time. The third adult male had refused evacuation.
o youngest-old (ages 64-74 years) - M/F	11 fatalities were identified as elderly. It is not possible to precisely determine their individual ages, but cross referencing with contemporary media reports suggests that they ranged between 70 and 90 years old, and nine of them were female. All died in their homes, and several had refused evacuation.
o middle-old (ages 75-84 years) - M/F	Please see above commentary
o Oldest-old (ages more than 85 years)	Please see above commentary
b. During the rescue phase what were the categories of disabilities, or specific needs, that arose?	

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o Movement disabilities *	This data was not requested in this phase.	
o Sensorial disabilities (deafness, blindness) *	This data was not requested in this phase.	
o Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	This data was not requested in this phase.	
o Pregnant women	This data was not requested in this phase.	
o New-born	This data was not requested in this phase.	
o Infant	This data was not requested in this phase.	
o Other that emerged during the analysis of the available documentation or specific investigations conducted	This data was not requested in this phase.	
c. Which of the following categories of disabilities, or specific needs, were managed in the post-emergency phases to give an initial response to people involved?		
o Movement disabilities *	This data was not requested in this phase.	
o Sensorial disabilities (deafness, blindness) *	This data was not requested in this phase.	
o Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	This data was not requested in this phase.	
o Pregnant women **	This data was not requested in this phase.	
o New-born	This data was not requested in this phase.	
o Infant	This data was not requested in this phase.	
o Other that emerged during the analysis of the available documentation or specific investigations conducted	This data was not requested in this phase.	
*Indicate age class (see 3.2.1.a) and gender; ** indicate class age		
3.2.2	**Post event management**	This data was not requested in this phase.

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a.	About point 3.2.1b, were the rescuers prepared to manage the situation?	
	o The rescuers were involved in specific training activities in this field	French firefighters have an excellent reputation for professionalism and high-quality training. They now receive specific training for the rescue of physically less able people in domestic situations, and communication with cognitively disabled, but it has not been possible to identify whether this training postdates the event being considered.
	o Specific documentation has been made available	This data was not requested in this phase.
	o Simulations were conducted also considering the issue of inclusive emergency management	This data was not requested in this phase.
b.	About point 3.2.1c, were the operators prepared to manage the situation considering people with specific needs?	
	o The rescuers were involved in specific training activities in this field	This data was not requested in this phase.
	o Specific documentation has been made available	This data was not requested in this phase.
	o Simulations were conducted also considering the issue of inclusive emergency management	This data was not requested in this phase.
c.	o Specific information activities were carried out on these topics with the involvement of family members, caregivers, and the surrounding community	This data was not requested in this phase.
	o Specific documentation has been made available	This data was not requested in this phase.
	o Simulations were conducted also considering the issue of inclusive emergency management	This data was not requested in this phase.

WP3	Task 3.3 Culture & heritage
3.3.1	What was the extent of the damage with respect to the type of disaster?

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Damage to historic buildings such as chateaux, churches and older/heritage homes was limited. The region has endured flooding for centuries, and although one 90-year-old victim died at a former monastery, damage was mainly to modern building and bridge infrastructure. The area is however famous for Languedoc – Roussillon region wines, and some damage was caused to local vineyards. This was limited, however, as most grapes had been harvested in the 2 weeks prior to the flooding. Nonetheless, land remediation would be required.

Eads, L. Bijou Magazine. (2018). *10 dead as flash floods hit the Languedoc.* thedrinksbusiness.com. https://www.thedrinksbusiness.com/2018/10/10-dead-as-flash-floods-hit-the-languedoc/

3.3.2	What was the extent of the damage with respect to the size of the disaster?

Across the region, 14 people died, 75 people were seriously injured, 1800 were evacuated, whilst 10,000 homes were without drinking water for over 24 hours, and 1500 homes had no electricity supply for several days. 126 municipalities in the Department were declared disaster zones, and Finance Minister Bruno Le Mair estimated that the material damage amounted to €200 million, with the government making €80 million immediately available. Later estimates suggested the damage totalled €269 million.

Retour d'expérience des inondations du 14 au 17 Octobre 2018 dans l'Aude

(Feedback from the floods of October 14 to 17, 2018 in Aude)

Guion de Meritens et al, I. French Government Ministry of Interior. (2019). *Retour d'expérience des inondations du 14 au 17 octobre 2018 dans l'Aude.* Conseil général de l'Environnement et du Développement durable - Inspection générale de l'Administration

3.3.3	How was the human and environmental adaptive response/reaction to the damage?

Most major infrastructure has been successfully re-established, and there has been a distinct effort to include risk mitigation in redevelopment plans, as well as ensuring that regional urbanisation and proposed new developments are more closely linked to the flood risk prevention plans (PPRIs). A combination of national and regional funding was quickly made available to support employment and to pay expenses. Some housing reconstruction was delayed.

3.3.4	How long did it take to recover/retrieve after the disaster in the following categories?

○ Land use

Forestry and tourism continued from Spring 2019. Some forestry damage – and trees deposited by flooding rivers – required 3 years to deal with. Vineyards were uninterrupted.

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○ Repopulation	1800 people were evacuated, predominantly to locations within the region which minimized educational or employment continuity issues. Many were returned home in under 6 months, although around 10% were outside this timescale.
○ Everyday life condition	Local resident quoted elsewhere identifies short disruptions to food shopping, education and work. The most immediate issue for many were damaged bridges affecting local commutes.
○ Social life	The Aude Department provides substantial opportunities for social activities within different communities, which include – but are not limited to - youth clubs/facilities, church and other religious gatherings, and sports and social clubs. These were inevitably affected by the floods but in widely differing ways dependent upon the physical requirements and population spread. Local sports fixtures were disrupted (including boules matches) as repairing recreational facilities was not a priority.
○ Lesson for the mitigation of other disasters	Preplanning to resume normality is critical for maintaining community engagement, and reassuring citizens that returning to normality is a priority. The rapid displacement of relatively small sums of money to facilitate daily life was well regarded, but undoubtedly the experience of the local population who are subject of these inundations on a regular basis -albeit at different sites within the region - increases their resilience and capacity, having some measure of individual plans.
3.3.5	Was there any quantitative correspondence between reaction/effort and damage?
No evidence has been identified from research to date.	
3.3.6	What was the timescale of such correspondence (short-term vs. long-term)?
No evidence has been identified from research to date.	
WP3	Task 3.4 – Risk governance strategy

Type of data		Data/ information/ sources/ reference material
3.4.1	Disaster risk governance mechanisms	
What were the disaster risk governance mechanisms identified in the relevant authorities to manage disaster risk under following categories?		
	○ Knowledge sharing and inclusion of science and technology	At the time of this case study, formal structures for knowledge sharing were limited, and inclusion of academic institutions was ad hoc. Since this time, closer links to science and technology development are developing.
		For example, a project led by the environmental management section of L'Aude Département Local Authority seeks to bring together climate scientists, and satellite imaging specialists with local authority planners. The intention is to use new technology including satellite images and potentially artificial intelligence to become more predictive and proactive in flood prevention activity. This project has drawn support nationally and from elsewhere in Europe including the EU Copernicus earth observation programme and the Space Climate Observatory.
		Wilks, J. (2021). *New pro-active effort to keep communities safe from deadly floods.* euronews.green. <u>https://www.euronews.com/green/2020/12/14/new-pro-active-effort-to-keep-communities-safe-from-deadly-floods</u>
	○ Harmonizing capacities and resources to the needs in risk assessment	Using the excellent research from the below paper it can be seen that the SWOT analysis used by the researchers demonstrates that was last the overall structure is fit for purpose, there are some issues in regard to ensuring capacities and resources meet assessment needs.
		Risk prevention mechanisms are sound, but the high number of related plans means that updates are often not prompt. Government funding and insurance provides excellent support to communities affected by floods, but the claims mechanism and reimbursement criteria often mean that risk reduction improvements cannot be funded and the opportunity to build back better is lost.

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With climate change causing flood threats to vary from historic locations, the funding structure for local authorities sometimes does not reflect the new risks but becomes merely a historic settlement.

There are excellent opportunities to rectify these problems in order to address future issues such as insurance cancellation and public discontent through a lack of confidence in the arrangements.

Kougkoulos, I., Merad, M., Cook, S.J. *et al.* Floods in Provence-Alpes-Côte d'Azur and lessons for French flood risk governance. *Nat Hazards* **109**, 1959–1980 (2021). https://doi.org/10.1007/s11069-021-04905-4

o Institutionalizing partnerships, coordination, and responsibilities

Despite extensive research, it has not been possible to secure sufficient evidence to offer an authoritative opinion on this aspect. From the author's experience, partnership success can vary dramatically from location to location and is often a function of general management ability and focus rather than structure.

o Participatory decision-making mechanisms, inclusive of vulnerable communities, indigenous communities, and volunteers

The French state is a participatory democracy at multiple levels. The existing disaster risk reduction system can best be described as one that is professionally led and organised with minimal involvement of community leadership at an operational level. It is perhaps therefore less than optimal in its inclusivity of vulnerable communities and volunteers.

The existing democratic structure however allows for community participation in choosing the elected representatives who oversee the disaster management structures at the prefecture, department, and national level.

3.4.2	International DRR frameworks

o Leveraging investments in DRR

This has been identified as a weakness earlier in this section where the existing funding arrangements do not easily permit improvements to disaster mitigation. Any new or better options require additional investment above current levels and there is already evidence of fragmentation and underfunding.

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3.4.3	Accountability in disaster governance

What international DRR frameworks (SENDAI, SDG, Paris Agreement) were adopted in DRR projects?	The integrated flood governance approach in France is compliant with the national Disaster Risk Reduction strategy, described in studies as comprising 3 elements.
	Risk Prevention – Hazard analysis, intended to identify for example flood risk, as well as the associated issues such as landslides or infrastructure damage. Following this planning phase, weaknesses in the local environment are identified, including human factors such as age and infirmity, or ageing infrastructure and weak public services. Mitigation measures are then identified which may be physical or structural.
	Emergency management – This is clearly the responsibility of first responders, and planning may be at a local or regional level to identify scenarios and arrange appropriate training for the agencies involved. Warning systems are part of this structure. Could naturally include the warning systems identified for flood prevention.
	Disaster Recovery - in France, this is focused on government support for regions suffering critical incidents, which must achieve a certain level to trigger supporting payments both to local authorities and the individual members of the public affected. This is supported by private sector insurance provision for both individuals and corporate bodies. As a result of the Sendai international approach, afflicted communities and their leadership are encouraged to adopt the concept of "Build Back Better", thus always aiming to increase resilience and resistance to natural or man-made risks. In France this is overseen by a ministerial group, with day-to-day responsibilities carried out by the Ministry of Ecological Transition. This structure is fully compliant with the International Risk Governance Council framework, and supports France's position on the United Nations led SENDAI framework.
	Kougkoulos, I., Merad, M., Cook, S.J. *et al.* Floods in Provence-Alpes-Côte d'Azur and lessons for French flood risk governance. *Nat Hazards* **109**, 1959–1980 (2021). https://doi.org/10.1007/s11069-021-04905-4

What were the provisions to ensure accountability in disaster governance?

○ Consider accountability aspects in the Sendai Framework for Disaster Risk Reduction 2015-2030	The academic works cited in this use case clearly identify the lack of participation by the local population in flood risk reduction - and more widely, in Disaster Risk Reduction generally - to be a weakness of the existing structure. In the researcher's view, this is offset in absolute terms by the 3-tier local democratic process cool but there is no doubt that public participation and interest could be enhanced by a more innovative involvement of the public.
○ Innovative elements of accountability	None evident in this use case.
○ Enabling legislations	Appropriate national statutes govern the DRR structures and activities. There is no evidence that they are unfit for purpose, but could be enhanced as discussed above.
○ Regular monitoring, evaluation, and review	Multiple reports and academic papers have identified that the plans and resources are not consistently reviewed and this is an area of recommendation as a result of this work.
WP4	**Cascades**
1. What is the EU country, covered by CORE partners, preparing for (crisis, war and crisis, disruption)?	Like all EU countries, France routinely prepares for the broadest range of critical incidents including war, civil disobedience, widespread disruptive industrial action, terrorism, and both natural and man-made disasters.
2. What types of disasters is each EU country, covered by CORE partners, preparing for?	Please see Section1. Emergency planning protocols in France as elsewhere will be extremely flexible in the light of new information or intelligence made available at a national level. France has a presidentially led oversight crisis committee, and inter-ministerial arrangements to meet threats from a wide variety of origins. Undeniably, flooding is a strategic issue for France.
3. Who is involved in the preparation process?	France has an identified inter-ministerial group which oversees the defence, civil defence, policing, and healthcare services of the country.

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a.	What kind of approach is adopted in disaster preparedness: e.g., is disaster preparedness centralized (national level) or decentralized (local level); who (which agency) has the leading role in preparedness; guiding policy frameworks and/or strategies and principles; coordination/cooperation mechanisms (and sectors involved)?	Disaster preparedness is both centralised nationally to reflect strategic issues, and there is a framework of local level partnerships and arrangements to deliver services operationally, with national institutional support where appropriate.
b.	Other stakeholders for preparedness?	This is an open-ended list.
c.	EU/UN/INGO?	France is a key member of the United Nations, the European Union and hosts the headquarters of a number of non-governmental organisations.
4	Training and communication preparedness	
a.	What kinds of trainings (including drills and crisis exercises) are done to prepare for a disaster?	At a strategic level there are a series of training plans for all major government led institutions. It has not been possible to secure the full range of these inputs as this would be a significant piece of work, and in many respects subject to national security restrictions. The inadequacy of information would therefore devalue any conclusions reached. The French civil defence organisation is a full signatory to the United Nations arrangements for search and rescue and can therefore call upon worldwide levels of resources in the event of a significant disaster. Units participate in these international exercises.

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b.	Who provides training, for whom and what competencies are covered?	It has not been possible to secure the full range of these inputs as this would be a significant piece of work, and in many respects subject to national security restrictions. The inadequacy of information would therefore devalue any conclusions reached.
c.	What kind of approach is adopted in crisis communication preparedness: e.g., what is communicated to the general public about preparedness, how (means and channels: e.g., preparedness brochure, crisis portals/websites, campaigns, formal/civic/professional education, social media mobilisation) and by whom (leading agency + other partners and stakeholders involved + partnerships with news media)? How are the needs of vulnerable groups taken into account?	The research to date has not discovered any significant strategic structured communication with the public about disaster preparedness. Individual agencies each have websites and online information about their skills and capacities, mainly in response to crises rather than discussing preventative or mitigation measures.
5.	Prepositioning, framework contract and supplier management	
a.	What types of goods are pre-positioned and how are locations selected?	Individual agencies take responsibility for stockpiles of necessary equipment for disaster management. The relevant ministries do not discuss the criteria for locations or the amount of materials stockpiled for national security reasons.
b.	Which organization is responsible for management of pre-positioned stock?	Individual agencies make their own arrangements.

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c.	What are the framework contracts for disaster preparedness, who manages them?	This could not be determined. French national procurement contracts are in accordance with European Union and French law to ensure integrity in the procurement process, and ensure that all equipment is fit for purpose.
d.	How are suppliers who secure the supply for preparedness selected and managed	This could not be determined to the detail necessary for any comment to be authoritative.
6.	How was the preparedness and response mechanism activated for different types of risks?	Across France, police primacy is the single most important issue with the police and other emergency services taking responsibility for declaring a critical incident and ensuring the response is appropriate. Preparedness mechanisms are the responsibility of local government in partnership with the emergency services.
7.	How the event influenced flow, access to and availability (length of shortage, scale, shortage by social group) of:	
	○ Drinking water;	Local authorities have access to bottled and tanker based clean water supplies. These were immediately available and the mains tap system was largely restored within 24 hours.
	○ Energy supply (electricity, coal, fuel etc.);	From both the official reports and the perspective of individuals referenced earlier in this report, energy supplies were interrupted but in virtually all cases restored within a 72-hour time scale.
	○ Food (retail sales, catering, etc.);	Whilst shops within the inundation area were naturally affected, food supplies to the region were not and beyond some temporary difficulties, major supermarkets remained stocked. The issue became one of access for those within the flooded area, who often had to make lengthy diversions to gain supplies. Local authorities supported vulnerable and elderly people by the provision of supplies and by moving at risk people out of the inundation area.

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	○ Health (emergency and long-term provision, psychological medical facilities played a significant role in this use case.	Whilst it has been already mentioned that a significant hospital was taken out of effective service by the flooding there is no evidence to suggest that any shortage of health); Long term provision has been fully restored.
	○ Access to information.	There has been widespread newspaper coverage of this use case; a ministry led debrief; numerous academic papers; and TV programmes exploring the cause and effect off the flooding. Much of this material is also available online, and therefore the public have excellent access to information about the flooding in this region, and the historic issues.
8.	How the event influenced preparedness mechanisms (in terms of training, information flow, communication, prepositioning, supplier management). What were the lessons learned from the case?	The official debrief has provided numerous recommendations which are in the process of being implemented. Retour d'expérience des inondations du 14 au 17 Octobre 2018 dans l'Aude (Feedback from the floods of October 14 to 17, 2018 in Aude) Guion de Meritens et al, I. French Government Ministry of Interior. (2019). *Retour d'expérience des inondations du 14 au 17 octobre 2018 dans l'Aude.* Conseil général de l'Environnement et du Développement durable - Inspection générale de l'Administration.
9.	Have there been any studies conducted on the long-term impact (five or ten years) of this disaster/crisis?	None yet identified.
a.	Was there any long-term health or societal impact?	None yet identified.
b.	Any local supply chain impact?	None beyond the immediate impact of the floods, other than minor routing issues.

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c.	How long did it take for the communities to get back to the original state?	This was dependent on area. Most communities got back to the original state within one or two months of the floods, but individual families have waited longer for house repairs or rebuilding.
d.	Any studies on the long-term resilience of the affected region?	This area is subject to regular flooding and occasional forest fires. As part of the larger region subject to damaging issues of climate change, regional resilience is effectively under constant review.
WP7	**Social media information/misinformation and risk communication**	

Please provide a quality assessment for the accuracy and veracity of information and data used to inform this case study in the following three categories:

a). Media information	No evidence to support a quality assessment has been identified from research to date.
b). Misinformation	No evidence to support a quality assessment has been identified from research to date.
c). Risk communication	No evidence to support a quality assessment has been identified from research to date.

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Annex 7 - Case Study 4 – WILDFIRE

CASE STUDY 4: Wildfire

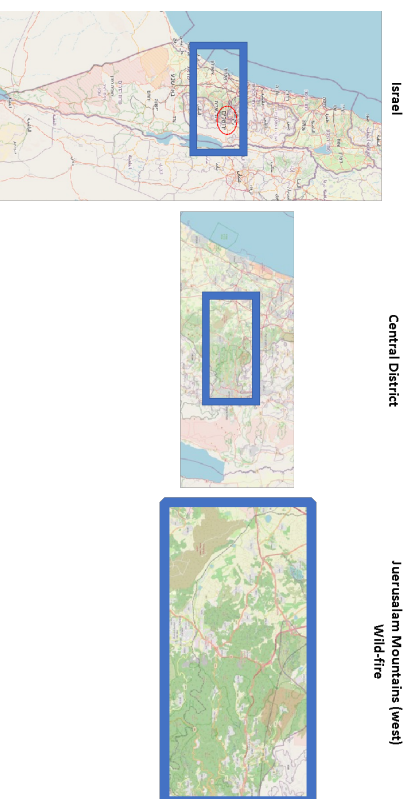| Incident	Wildfire
Location	Israel, Mountains of Jerusalem, Western slopes
Time & Date	15/08/2021 12:00 – 19/08/2021 14:00

Description and timeline of the incident

General : This case-study discuss the wild-fire in the western slopes of Jerusalem mountains, which was one of the largest wild fire in Israel, but due to the first responders operation concluded with no injuries, and minimal property damages.

The wild fire broke out in Jerusalem on August 2021, causing extensive damage to the surrounding areas. The fire in the Jerusalem Hills was a widespread forest fire that occurred in the Jerusalem Hills between August 15 and August 19, 2021. The fire broke out in several locations in the moshav Beit Meir area in the Mateh Yehuda Regional Council. It later spread to Tzuba, Ein Naquba, Ein Rafa, and Givat Ye'arim. This fire is considered the most extensive in the Jerusalem Hills compared to the fires recorded in previous years. According to the conclusions of the fire authority's investigation, this was intentionally manmade.

The map of the interest area (blue square) can be seen in Figure 1. Figure 2 - Map of the interest area

Israel

Central District

Juerusalam Mountains (west)
Wild-fire

(Source: author)

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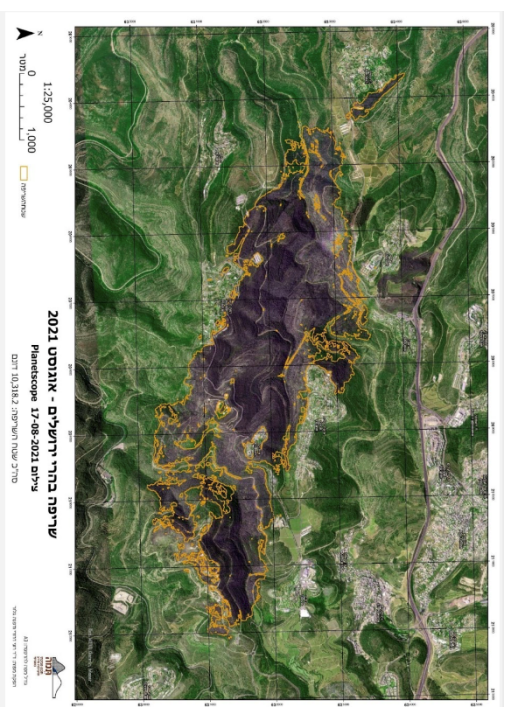
(Source: Oren Amiran Bikes, 2021)

Data & Numbers

- Total about 52 hours of continuous fire-fighting operation.
- Approx. 15,000 dunams of natural woodland were burned.
- Approx. 2,000 people were evacuated from their homes.
- 1,500 firefighters participated in this event (including military reserve forces, and volunteers)
- 1.5 million liters of aerial firefighting materials.
- 451 airstrikes and 238 hours of flying.
- Death and Injuries – None.
- Damages - three houses in this great fire were burned or damaged, and a few more warehouses/buildings at other levels.

(Sources: Knesset News, 2021; Israel Fire and Rescue, 2021; Yaniv, 2021)

Timeline

	15:00 first alerts Fire speed - 4 km/hour 3 separate spots Villages evacuation	More than 100 spots Road no. 1 blocked Permit to go back but later Forced evacuation	Full control Permit to go back More than 50 spots IAF C-130J flight w/ fire retardant		**Final Distinguishing**
	Eastern winds – 6.7 m/sec 31 °C 30% hum	Eastern winds – 5.9 m/sec 31 °C Degree 35% hum	Eastern winds – 5.2 m/sec 29 °C Degree 40% hum	Eastern winds – 2.5 m/sec 29 °C Degree 40% hum	
	15/08/21 Sun	16/08	17/08	18/08	19/08

(Source: Knesset News, 2021; Israeli Meteorological Service [IMS], 2022)

1ˢᵗ day – Sunday 15/08/2021

The fire started on Sunday, 15/08/2021, at noon at only three spots, but due to the high tense eastern winds (up to 6.7 m/sec), the fire expanded fast (almost 4 km/hr) (Israel Fire and Rescue, 2021; Knesset News, 2021).

The weather condition during this week was not extreme, reflecting the average summer in Israel, approx. 30°C with 30-40% humidity. However, the winds during the first three days were tense: 5-7 m/sec (IMS, 2022).

The fire started near the village of Beit Meir, and then bypassed Beit Meir from the east, entering the clefts, and started running through the mountain slopes. The village, Givat Ye'arim, was a pivotal point for the wildfire as it bypassed Givat Ye'arim from the north to the south; one fire front stopped in the Shu'eva area, while the other front continued towards Tzuba, also surrounding Mount Eitan there. The fire continued to move eastwards, with one line stopping in the area between Tzuba and Mount Eitan. The other line stopped behind Mount Eitan, east of Mount Eitan. On this first day, as early as 14:00, evacuations started in Ramat Raziel, Givat Ye'arim, Kislon Sho'eva, and Shoresh (Knesset News, 2021; Golditch et al., 2021; Shlomi & Deutsch, 2021; HML System, 2021).

2ⁿᵈ day – Monday 16/08/2021

On the second day, 16/08/2021, the fire continued towards the outlet of Elite, Ein Aquba Ein Rafa, and even went towards Hadassah Ein Kerem hospital and Even Sapir. The fire had already spread to more than 100 spots.

The wildfire continued spreading as the wind picked up, leading the police to evacuate some residents of Sho'eva as the blaze neared the community. The Israeli Defense Forces (IDF) dispatched several transport helicopters to assist in the evacuation of Giv'at Ye'arim due to the massive forest fire raging outside Jerusalem.

The change in the wind condition (from western winds during the morning to eastern winds afternoon) made the distinguishing operation very complex.

The blaze sent a plume of thick black smoke over Jerusalem, and residents were advised to limit their outdoor activity because of the very high pollution levels. The wildfire is one of the largest in Israel's history, but no one was killed.

Its rapid spread was aided by the dryness of the vegetation in the Jerusalem Hills after a relatively dry winter and a hot summer.

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During the 2nd day, approx. 155 patients needed to be evacuated from the mentally-ill hospital, Eitanim, which is located within the forest. This evacuation was made by using the private cars of the hospital staff as helicopters could not approach the area due to the smoke and buses could not enter the road of hospital. During this evacuation, two hospitalized managed to escape. Due to this, search team operated. They were found several hours later, without any harm. This incident and evacuation process will be elaborated later.

A special fire fighters team also has to be called to conduct very extensive defensive tactics in order to protect the hospital of Ein Kerem because its evacuation was challenging. This procedure involved a massive aerial firefighting operation and 15 firefighting vehicles which used foams and water to prevent fire movement into the hospital. Israel Fire and Rescue Services chief, Dedy Simchi, said the enormous forest fire outside Jerusalem was on the same scale as the 2010 Mount Carmel fire (Knesset News, 2021; Golditch et al., 2021; Shlomi & Deutsch, 2021; HML System, 2021).

The weather condition during this day was 31°C with 30-40% humidity; Wind – approx. 6 m/sec east (IMS, 2022).

3rd day – Tuesday 17/08/2021

The third day of the fire marked the complete control of the fire, decreasing the number of fire spots to only 50. During the third day, large scale cargo airplane participated in the fire distinguishing efforts while dropping special firefighting foam in unique cases. It was part of the first operational experiment of this procedure. Finally, all citizens from the villages returned to their homes (Knesset News, 2021; Golditch et al., 2021; Shlomi & Deutsch, 2021; HML System, 2021).

The weather condition during this day was 29°C, with 40% humidity; Wind – approx. 5 m/sec east (IMS, 2022).

4th and 5th days – Wednesday 18/08/2021 and Thursday 19/09/2021

The fourth and fifth days focused on full control and final extinguishing of the fire. The weather condition during this day was 29°C, with 40% humidity; Wind – approx. 2-3 m/sec east (IMS, 2022).

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Figure 3 - Hot spots central of Israel during the event (Aug. 15, 2021 - Aug.21, 2021)

(Source: NASA-FIRMS, 2021)

Highlighted Events

1. Protecting the villages

   This wildfire emphasizes the importance of the Buffer zone between the villages and the forest. Protecting communities and vital assets are the most important and priority task, despite immense pressures from other parties. The aerial order of battle must act as an operational supporter, that is, the defense of settlements.

2. Evacuation of villages to minimize the risk.

   During this event, ten villages were evacuated (Tzova, Givat Yaarim, Shoava, Ramat Raziel, Beit Meir, Eitanim, Shoresh, Ein-Rafa, Ein-Karem, Ein-Nakova).

3. Mental-ill hospital evacuation

   On the first day of the wildfire (15/08/2021), there was a need to evacuate one large-scale (approx. 160 patients) mental-ill hospital near the wildfire area.

   The hospital is in the Mateh Yehuda-Har Eitan sector, a forested area, partly in pine plantings and partly in natural woodland. On 15/08/2021, after 15:00, a fire broke out near the community of Beit Meir village. About an hour later, reports started arriving from the

Security Department about the direction of the spread of fire that could threaten the hospital and preparations for the feasibility of evacuation began.

About half an hour later, a rapid approach of the fire to the steadfastness was observed. At the same time, all the departments were instructed to prepare for a possible evacuation in accordance with the order of the hospital's evacuation procedure; buses were also ordered for evacuation.

he hospital has only one access route that splits off from the Eshtaol-Jerusalem road, which was in the risk of the fire. While waiting for the buses, the crews and the hospitalized began to spontaneously evacuate the hospital buildings due to the thick smoke seen inside them. The medical teams and patients were concentrated in an area near the entrance to the hospital.

At this stage, the various teams demonstrated dedication, courage, and resourcefulness. They guarded and encouraged the patients while experiencing a real threat to their lives. After more than an hour of disconnection, in which the only access road to the hospital was blocked, the commander of the Moriah station and the Special Patrol Unit (police patrol unit) managed to reach the hospital. They immediately evacuated all those staying there using the employees' private and police vehicles. Adherence to the mission and courage shown by the police officers and the firefighting team that accompanied them part of the way will be emphasized. At approximately 18:30, the complete evacuation of Eitanim Hospital to Kfar Shaul Hospital ended. At approximately 21:00, patients began to be dispersed to the evacuation targets (Eitanim hospital General Manager, G. Lubin, personal communication, November 9, 2021).

Figure 4 - Eitanim hospital during the evacuation (15/08/2021)

(Source: Eitanim GM, 2021)

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WP2	Task 2.2: Natural and manmade disaster case study identification, research, and analysis

What were the public information sharing challenges?

- Due to the fire, there was a need to evacuate villages, some even twice.
- The information sharing was conducted by the village's internal group, public media (TV and Radio), and PA (public address) system.
- During the incident, there was a need to block some roads, as well as one of the main roads in Israel (No. 1 – Tel-Aviv – Jerusalem highway); the information was shared by the radio and television.
- The majority of the evacuation orders were delivered withing the villages internal groups (WhatsApp, Facebook).
- Most of the villages conduct regularly drills, so they are well prepared for those kind of emergency situations (wartime and natural disasters).
- The main challenge was to ensure that all the civilian population received the orders to evacuate, and assure that the police and the villages' emergency team s had enough patrols to try to find un-evacuated civilians. (Israeli Fire and Rescue National Authority, former Commissioner, D. Simhi, personal communication, December 1, 2022; Israeli Fire and Rescue National Authority, Head of Development, L. Melamed, personal communication, December 15, 2022; Israeli Fire and Rescue National Authority, Head of Research and Development, N. Baraki, personal communication, October 16, 2022)

What were the ethical issues?

There were several ethical issues relevant to wildfire, which can be divided into the stages of operation.

- Before the fire – how much can we affect nature, including buffer zone, forest elimination, and even changing the vegetation type? A major issue was infrastructures needed for fire extinguishing, including water hoses, water containers, etc., which affect nature.
- During the fire incident – there was a major dilemma regarding the effort prioritization, and sometimes which areas should be lost during the event as a compromise to other areas (i.e., wildlife, vegetation, and more in those areas chosen to left to burn). Another ethical question was whether to evacuate the village to protect it given that evacuating the village might cause a negative mental impact on the civilians.
- After the incident – ethical dilemma related to restoring nature after the wildfire and how it should be similar to the previous condition.
- One major issue was that, in this fire (and almost all wildfire in Israel), there are no ethical dilemmas concerning human life, as the event mangers don't need to priorities which wild-fire is life risking and which is not (D. Simhi, personal communication, December 1, 2022).

What lessons have been learned?

Fire-fighting operations:

- The importance of forecasting the fire for pre-evacuation of the civilian population.
- The most critical factor is the meteorological condition, which should be monitored during the event.
- Using all means, especially aerial imagery, satellite, UAV, etc., for better situational awareness and coping with the event.
- The dilemma is between leaving a small team in the villages to cope with the fire spots and the need for a full evacuation.

(Knesset News, 2021; D. Simhi, personal communication, December 1, 2022)

Figure 5 - Satellite analysis of the wild fire, made by OroraTech
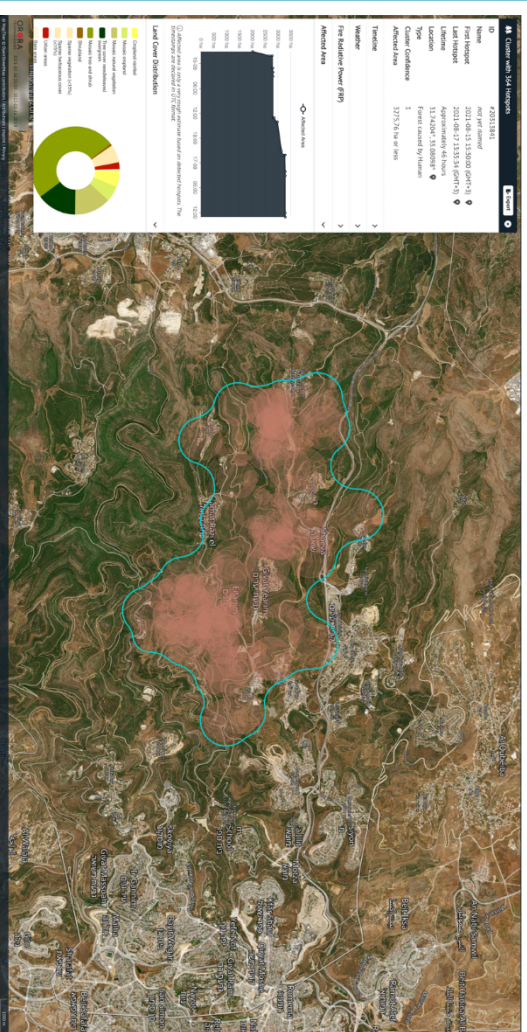
(Source: OroraTech, 2021)

Civilian villages:

- One of the most important factors is the buffer zone between the village and the forest.

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- The use of the pre-installed water sprinkler in the buffer zone proved to be crucial factor.
- Protecting communities and vital assets are the most important and priority task, despite immense pressures from other parties, such as park authorities.
- The aerial order of battle must act as an operational supporter for the defense of settlements. (Asam et al., 2022; Knesset News, 2021; Tzoba, 2021)

Forest services:

- There is a need to change the vegetation type to ones which are more "stable" during the dryness period (Asam et al., 2022).

Evacuation of Eitanim mentally-ill hospital

The hospital had prepared for fire protection for scenarios defined in early preparations as "detachment/ siege contour". In practice, fire infiltration into the hospital was limited in scope and adjacent to the fences. No damage was caused to all the buildings and the electricity, water, computerization, etc., systems.

- Exposing and creating a fire stripe in the hospital's perimeter, its preservation, and expansion from time to time.
- A significant expansion of the hospital's entrance route, including significant clearing in two directions.
- The felling of pine and cypress trees in the hospital area and the creation of extensive areas without the potential for significant flammability or smoke inside and outside the hospital grounds.
- Clearing and constructing a landing pad near the entrance to the hospital.
- Purchase of mobile water cannons and training of security teams for the use of firefighting devices.
- Managing the ongoing working relationships of the security officer and his deputy with the emergency authorities in the area in routine and during emergencies, including joint, periodic assessments and evacuation exercises (Eitanim hospital General manager, G. Lubin, personal communication, November 9, 2021).

What were the cascading effects across events, sectors and supply chain disruptions? Including the inevitability or unforeseen chain of events affecting the response to the disaster? What were the societal vulnerabilities in health and retail sectors?

- There were no noticeable cascading effects due to this event.
- There are pre-arranged contracts for critical suppliers, such as food, transportation, water, logistics, etc.

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- There were no examples of pre-located means or equipment (other than fire hydrants and similar fire-fighting equipment) near the wild fire areas. (D. Simhi, personal communication, December 1, 2022).

What was preparedness² before and after the event with regards to prepositioning, training, framework contracts and supplier management?
- The Israeli Fire and Rescue has a contract for supplying water for distinguishing fires. - The municipality authorities hold the contract for heavy engineering tools that help during the fire, bus service for evacuation. - Alternative places for evacuation arranged at pre-event times, such as student dormitories, hostels, schools, community centers, sport arenas, etc. - On certain days, there is a change in the operational procedures while fire-fighting aircraft look for ignition fires and extinguish them. Also, small firefighter teams should pre-position in the area. (D. Simhi, personal communication, December 1, 2022)

Please provide a list with links of data sources used in the following categories	
Government/Official reports	**Knesset / interior affairs committee** https://main.knesset.gov.il/News/PressReleases/pages/press11102021g.aspx - The Israel Parliament Interior committee meeting (11/10/2021) regarding the wildfire. https://www.nevo.co.il/law_html/law103/24_ptv_612402.htm - The Israel Parliament Interior committee meeting (11/10/2021) regarding the wildfire. https://www.gov.il/he/departments/news/fire_jerusalem_mountains_august_2021 - Formal government update about the fire. **Preparedness for wild-fires -** https://english.mod.gov.il/Departments/Pages/NationalEmergencyManagementAuthority.aspx

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² Disaster preparedness planning includes the fundamental identification of risks, vulnerabilities, the possibilities of influence, organisational resources and capacity, division of responsibilities, developing and agreeing practices and processes as well as implementing an action plan to have the best possible preparedness in case of a disaster.

NGO reports	- Webpage of the Israeli National Emergency management authority.
	https://www.oref.org.il/12634-18026-he/Pakar.aspx
	- Formal instructions for civilians during wild fire
	https://www.oref.org.il/12549-18140-en/Pakar.aspx
	- Preparation for emergency situation, including wild fires – mutual project by municipalities authorities and the Israeli Home Front Command.
	https://www.oref.org.il/12410-en/Pakar.aspx?tab=12634&parentCategory=12633
	- Full instructions and guideline kit for civilians about wild fires – how to prepare and how to operate during large scale event, by Israli Home Front Command.
	https://www.youtube.com/@IsraelFireServices
	- Instruction movies about wild fire, by Israel Fire and Rescue Authority.
	https://www.ramat-hanadiv.org.il/wp-content/uploads/2020/05/-תכנון-בשטח-היער-לאזור-הכפרי-והכנתו.pdf
	- How to build buffer zone at WUI area, in order to minimize the risks from wild fires.
	https://kids.gov.il/oref
	- Kid-media Kit
	https://www.youtube.com/watch?v=nk1IFtsQxeU
	- International cooperation for wildfire
	https://www.gov.il/he/departments/policies/dec378_2021
	- Government decision – Rehabilitation forest after the fire
	https://www.ifpe.com/upload/1607601661.pdf
	- Protecting villages from WUI – regulation
	https://www.parks.org.il/new/esh-3/

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Community interviews/reports	- Damage updates after the wildfire (17-18/08/2021) https://www.youtube.com/watch?v=AR-kQvmvKd8 - Interview with local citizen affected by the wildfire
Eyewitness/first-hand accounts	https://amiramorenbikes.com/2021_0826_burnt-areas/ - Personal blog of nature traveler, including images and field evidences.
News/media reports	https://www.bbc.com/news/world-middle-east-58243631 - News article about the wild fire https://www.timesofisrael.com/topic/fires-in-israel/ - News article about the wild fire https://www.reuters.com/world/middle-east/wildfire-blazes-jerusalem-hills-2021-08-15/ - News article about the wild fire https://www.agri.gov.il/download/files/כנס%20מחקרי%20אש.pdf - Short essay about the increasing dangers of Mega-fires. https://www.kolhair.co.il/jerusalem-news/189668/ - Interview with the Fire and Rescue deputy commander https://www.srugim.co.il/590978-שריפת-ענק-בכיוון-ירושלים-וכוחות/ - First use of large-scale aircraft for fire extinguishing https://www.hamal.co.il/post/-MhJsF6tjUKfBPzYpFNi - First use of large-scale aircraft for fire extinguishing https://www.maariv.co.il/news/israel/Article-859775 - Evacuation of 'Eitanim' hospital (from Maariv newspaper) https://publichealth.doctorsonly.co.il/2021/08/237391/

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	- Evacuation of 'Eitanim' hospital (from medical doctors news) https://jerusalem.mynet.co.il/local_news/article/r100tiysly - Evacuation of 'Eitanim' hospital (from local city news) https://kenes-media.com/לא-הכוננות-לפינוי-החולים-שעות-לפני-הזנק/
Documentaries	None found
Social Media	https://www.facebook.com/kibbutzmovement/videos/583718032640743/ - Kibutz Tzoba – example of how to prevent the fire from entering the village
Satellite/other imagery	https://firms2.modaps.eosdis.nasa.gov/map/#t:adv;d:2021-08-12..2021-08-15;@35.1,31.7,10z - Satellite view of the area of Jerusalem mountains during the fire (12-15 August 2021)
Academic Papers/Reports (Peer Reviewed)	https://magazine.isees.org.il/?p=38821 - Special edition of Ecology & Environment, a journal for science and environmental policy
Academic Papers/Reports (Non-Peer Reviewed)	None found
Public Enquiry Reports/Findings	https://amiramorenbikes.com/2021_0826_burnt-areas/ - Personal blog of nature traveler, including images and field evidences.
Journal/Magazine articles	https://www.davar1.co.il/topic/%D7%A9%D7%A8%D7%99%D7%A4%D7%94-%D7%91%D7%94%D7%A8%D7%99-%D7%99%D7%A8%D7%95%D7%A9%D7%9C%D7%99%D7%9D/ - Special edition about the wildfire, including interviews and future recommendations

(continuation from first row)
- Kibutz Tzoba – example of how to prevent the fire from entering the village, from local newspaper
https://news.walla.co.il/item/3454874
- Kibutz Tzoba – example of how to prevent the fire from entering the village, from local newspaper

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	None found
Online podcasts, blogs, forums & chat rooms	
Official policy recommendations & findings	https://www.mevaker.gov.il/sites/DigitalLibrary/Pages/Publications/73.aspx
	- Israeli State National Comptroller report
	https://www.mevaker.gov.il/sites/DigitalLibrary/Pages/Reports/1225-1.aspx?AspxAutoDetectCookieSupport=1
	- Israeli State National Comptroller report
Other (Please specify)	Personal interviews – former IFRS commissioner, Head of development unit in the IFRS, 'Eitanim' hospital GM

WP2	Task 2.3: Natural and manmade case study social media analysis

What was the role, influence, and impact of social media communications during this incident?

1. Providing information to the general public by the formal spokesperson of the police, fire and rescue services, Magen David Adom (Israel EMS), Government ministries, etc.
2. Promoting knowledge regarding dealing with fire – residential fires and wildfires.
3. Political discussions regarding the elected government
4. Covid-related discussions, comparing the fire to the pandemic, how to deal with it, proper guidance, etc
   (D. Simhi, personal communication, December 1, 2022)

What patterns of interactions between opinion makers and recurring topics in the Twitter debate following the disaster have been identified?

Based on the political situation in Israel, most of the high-rated tweets compared the government involvement and operation in this fire to the previous ones. For example, the Israel PM used Twitter to communicate with the population. One of the most important uses of Twitter is the message to the civilian population that there is a very professional organization that manages this kind of event, and thus by utilizing Twitter, this message can be delivered to the public.

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We identified political debates among supports and opponent of the government; those debates also appeared later in the conventional public communication. (D. Simhi, personal communication, December 1, 2022)

| Please provide a list with links of data sources used in the following categories	
Government/Official reports	This data was not requested in this phase.
Community interviews/reports	No evidence for this has been identified from research to
Eyewitness/first-hand accounts	This data was not requested in this phase.
News/media reports	This data was not requested in this phase.
Documentaries	This data was not requested in this phase.
Social Media	**Twitter search by Fire keyword ('שריפה')** https://twitter.com/search?q=שריפה%20until%3A2021-08-19%20since%3A2021-08-15&src=typed_query&f=live https://twitter.com/search?q=שריפה%20until%3A2021-08-19%20since%3A2021-08-15&src=typed_query&f=live https://twitter.com/search?q=לכידה%20until%3A2021-08-19%20since%3A2021-08-15&src=typed_query&f=live https://twitter.com/search?q=שריפה%20until%3A2021-08-19%20since%3A2021-08-15&src=typed_query&f=live https://twitter.com/search?q=שריפה%20until%3A2021-08-19%20since%3A2021-08-15&src=typed_query&f=live
Satellite/other imagery	This data was not requested in this phase.
Academic Papers/Reports (Peer Reviewed)	This data was not requested in this phase.

Academic Papers/Reports (Non-Peer Reviewed)	This data was not requested in this phase.
Public Enquiry Reports/Findings	This data was not requested in this phase.
Journal/Magazine articles	This data was not requested in this phase.
Online podcasts, blogs, forums & chat rooms	This data was not requested in this phase.
Official policy recommendations & findings	This data was not requested in this phase.
Other (Please specify)	This data was not requested in this phase.

| WP2 | Task 2.4: Natural and manmade case study aerial imagery analysis |

What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform decision-making?

During this event, aerial imagery capabilities were used, including satellite imagery, tactical drones, unmanned aerial vehicles (UAVs), and imagery from command and control helicopters.

The primary usage was to understand the movement of the fire, locate the spots and the fire front, thus forcing the evacuation of villages, and place the forces in the optimal location.

Those means also helped to better understand the fire pattern in those specific topographic conditions and the current weather conditions. The images also allowed remote teams to understand and evaluate the same situation.

The imagery help much with the publication and civilian orders, so they help transferring the message to the communication organization, and public affairs.

What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform the sharing of public information?

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The main usage of aerial imagery was to support the civilian population's resilience, mainly for promoting the operation of the firefighters, aerial firefighting efforts, etc.

Accurate public announcements (i.e., the need for evacuation, etc.) delivered by the dedicated groups within the villages and public radio, etc. were made.

If there is a need to convince the civilian population to align with the government or other organizations' orders, aerial imagery can provide better evidence or justification for evacuation.

There is major need to anchor the imagery to the ground, so the ground forces (fire-fighters, police, etc.) can benefit from it.

Please provide a list with links of data sources used in the following categories	
Government/Official reports	This data was not requested in this phase.
NGO reports	This data was not requested in this phase.
Community interviews/reports	This data was not requested in this phase.
Eyewitness/first-hand accounts	This data was not requested in this phase.
News/media reports	This data was not requested in this phase.
Documentaries	This data was not requested in this phase.
Social Media	This data was not requested in this phase.
Satellite/other imagery	https://firms2.modaps.eosdis.nasa.gov/map/#t:adv;d:2021-08-12..2021-08-15;@35.1,31.7,10z https://ororatech.com - Satellite data of the wildfire region from Nasa - Ororatech – locate ignition of wildfire from satellites.

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Academic Papers/Reports (Peer Reviewed)	This data was not requested in this phase.
Academic Papers/Reports (Non-Peer Reviewed)	This data was not requested in this phase.
Public Enquiry Reports/Findings	This data was not requested in this phase.
Journal/Magazine articles	This data was not requested in this phase.
Online podcasts, blogs, forums & chat rooms	This data was not requested in this phase.
Official policy recommendations & findings	IFRS satellite technology advisor – Betty Littman
Other (Please specify)	This data was not requested in this phase.

WP3	Task 3.1 - Critical analysis of past disasters via the identified case studies on their disaster preparedness strategies	
Type of data	**Data/ information/ sources/ reference material**	
3.1.1	**Type of hazards – Understanding the disaster risk**	
a.	What type of hazards were commonly identified in the region (Slow-onset and rapid onset hazards)?	No noticeable hazards or toxic materials in the area of the wildfire
b.	What hazards have resulted in disasters during the past 20 years?	This data was not requested in this phase.
c.	What risk assessment mechanism(s) were used by the relevant institutions for encompassing risk awareness, multi-hazard analysis, vulnerability/capacity analysis, and cascading effects?	When storing hazardous material, legislation needs to exist, such as evacuation plans, monitoring, and protection from military threats (i.e., missiles) or natural disasters (i.e., earthquakes). This preparation is

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d.	What risk modeling and scenarios have been carried out to consider disaster risk and/or any other future threats and cascading effects?	Not relevant for this use case
e.	How the knowledge of indigenous communities and information in social media had been captured for disaster risk perception?	Not relevant for this use-case
3.1.2	**Disaster resilience and preparedness strategies**	
a.	What were the available national and local disaster management plans and systems under following categories?	This data was not requested in this phase.

	o Individual-level activities (e.g., first aid training and response)	Several sources and processes in Israel related to different types of an emergency:
		- multi-age education (from kindergarten to high school)
		  - Yearly national drill (each year different scenario)
		  - Public instructions
		  - Website for information and instruction
		  - Operational practical two days training for search and rescue procedures and first aid

	o Household actions (e.g., stockpiling of equipment and supplies, retrofitting)	The government recommended that each household have an immediate emergency kit, including water, light source, medicine, food, battery-based radio, etc. This kit aims for any emergency, including war-time,

(above: ... controlled and monitored by the relevant government offices.)

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		earthquake, or other.
o	Community efforts (e.g., socially responsible mitigation, training, and awareness campaigns for first respondents and responders, and field exercises)	Each community has trained personnel to cope with emergency events,
o	Governmental strategies (e.g., multi-organizational planning and public private partnerships, early warning systems, contingency plans, evacuation routes, and public information dissemination, allocation of resources)	Most villages have the equipment to deal with emergencies (including Search & Rescue, First aid, etc.)
b.	What provisions were in place for research, education, science, and technology (ex: geospatial, remote sensing) for informed disaster preparedness?	This data was not requested in this phase.
c.	What special provisions were undertaken to ensure pandemic preparedness in disaster preparedness measures?	The COVID pandemic didn't affect much on the disaster preparedness measures. Some general preparation measures helped during the pandemic, such as the trained military reserved forces, the exercise which trained the municipality authorities, C4I systems, and more.
3.1.3	**Mitigation**	
a.	What policies and legislation were available that mainstreamed DRR in the national planning policy?	This data was not requested in this phase.
o	Land use planning and building codes (Ex: Avoid settlement expansion towards hazard prone areas)	In the case of wildfires, there is a national standard related to the buffer zone of the forest. Each village

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needs to keep a clean layer between the external border of the village and the forest to reduce the density of the forest near the village perimeter and hold firefighting equipment for the first response. This standard also deals with industry infrastructure or warehouses while enforcing buffer zone on the outer boundaries of the building

o Critical infrastructure protection and structural design improvements
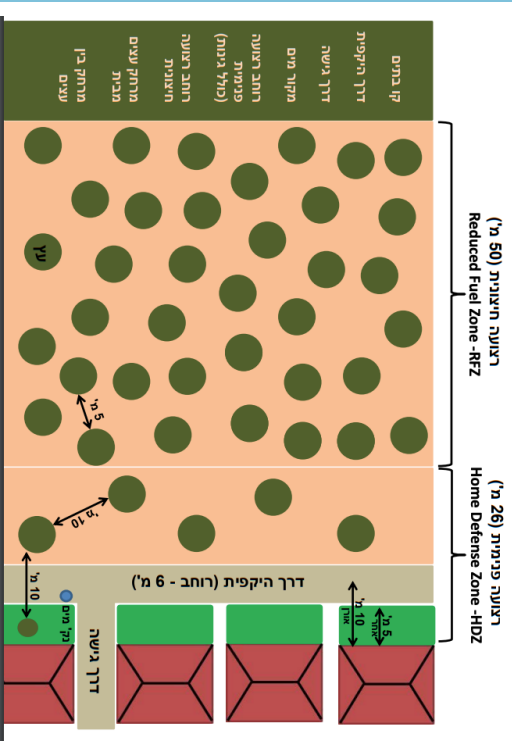
In this use case, there are examples of a similar solution of sprinklers on the edge of the forest, thus, halting and stopping the fire.

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Here is an example of a fire stopped near the village "Beit Yaarim"

During the event, the firefighter should protect the electricity infrastructure due to its significant influence on the water system (i.e., water pumps), which is critical for the firefighting efforts.

o Landscape and environmental arrangement around essential services and infrastructure	This data was not requested in this phase.
o Resilience strategies, including planning and partnership building between sectors	This data was not requested in this phase.
b. What support were provided by media platforms, including social media, during disaster operations?	This data was not requested in this phase.

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c.		What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	Not relevant
3.1.4	**Response**		
a.		What were the available surveillance, early warning, and information management systems for activating response operations under the following conditions?	This data was not requested in this phase.
	○	Support or coordinate disaster operations being conducted by a designated lead agency	This data was not requested in this phase.
	○	Logistics mechanisms and essential supplies for health and relief services	This data was not requested in this phase.
b.		What support were provided by media platforms, including social media during disaster operations?	This data was not requested in this phase.
c.		What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	This data was not requested in this phase.
3.1.5	**Recovery**		
a.		What were the long-term and short-term recovery actions undertaken during each post disaster recovery period, including 'build back better' practices?	This data was not requested in this phase.
	○	Response endeavors such as needs and damage assessments	This data was not requested in this phase.
	○	Community-level involvement and capacity building for disaster recovery	This data was not requested in this phase.

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	o Local administration and coordination for resource mobilization	This data was not requested in this phase.
	o Building redundancy into a DRR plan	This data was not requested in this phase.
b.	How the post disaster infrastructure recovery, including rebuilding, restoration, or reconstruction had taken place?	This data was not requested in this phase.
c.	What plans or provisions were available to minimize the economic impact following a disaster?	This data was not requested in this phase.
d.	What environmental recovery plans were available to manage the impact for eco-systems and related services?	This data was not requested in this phase.
e.	How have the mitigation and resilience-building activities of preparedness been adopted for the next disaster, and the development and implementation of legislation, policies, and practices to avoid similar situations in the future?	This data was not requested in this phase.
3.1.6	Monitoring and evaluation	
	How frequent are plans being reviewed and revised for emergency preparedness, response, and recovery?	Operational plan for fire fighting reviewing more than once a year, before the fire season starts (each summer). Moreover, when the fire index is forecast to be high (implicit high probability of fire), the plans are checked and, if necessary, updated.
WP3	Task 3.2 – Vulnerable categories	

Type of data		Data/ information/ sources/ reference material
	To be included in V3 (June 2022)	To be included in V3 (June 2022)
WP3	**Task 3.3 – Culture and heritage**	
Type of data		Data/ information/ sources/ reference material
	To be included in V3 (June 2022)	To be included in V3 (June 2022)
WP3	**Task 3.4 – Risk governance strategy**	
Type of data		Data/ information/ sources/ reference material
3.4.1	**Disaster risk governance mechanisms**	
What were the disaster risk governance mechanisms identified in the relevant authorities to manage disaster risk under following categories?		This data was not requested in this phase.
	○ This data was not requested in this phase.	This data was not requested in this phase.
	○ This data was not requested in this phase.	This data was not requested in this phase.
	○ This data was not requested in this phase.	This data was not requested in this phase.
	○ This data was not requested in this phase.	
	○ This data was not requested in this phase.	

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	○ Leveraging investments in DRR	This data was not requested in this phase.
3.4.2	**International DDR frameworks**	
	What international DDR frameworks (SENDAI, SDG, Paris Agreement) were adopted in DRR projects?	Not relevant
3.4.3	**Accountability in disaster governance**	
	What were the provisions to ensure accountability in disaster governance?	This data was not requested in this phase.
	○ Consider accountability aspects in the Sendai Framework for Disaster Risk Reduction 2015-2030	Relevant information couldn't be found
	○ Innovative elements of accountability	Relevant information couldn't be found
	○ Enabling legislations	Relevant information couldn't be found
	○ Regular monitoring, evaluation, and review	Relevant information couldn't be found
WP4	**Cascades**	

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1.	What is the EU country, covered by CORE partners, preparing for (crisis, war, and disruption)?	This data was not requested in this phase.
2.	What types of disasters is each EU country, covered by CORE partners, preparing for?	Wild-Fire
3.	Who is involved in the preparation process?	This data was not requested in this phase.
	○ What kind of approach is adopted in disaster preparedness: e.g., is disaster preparedness centralized (national level) or decentralized (local level); who (which agency) has the leading role in preparedness; guiding policy frameworks and/or strategies and principles; coordination/cooperation mechanisms (and sectors involved)?	In Israel, several organizations are responsible for preparedness for an emergency. At the national level – Israel Fire and Rescue is responsible for the regulation and standards of fire protection; the government ministries are responsible for the budget. The forest authorities (The national park and nature reserves and KKL-JNF are responsible for the guidelines for preparing for wildfire). At the national level also, the police are responsible for the overall command and control during this event, and the Israel Defence Force (IDF) takes responsibility in case of a large-scale emergency. Several government ministries are responsible for the relevant task, i.e., the education ministry for training and emergency, the health ministry for hospitals, etc. All the government ministries are integrated for an emergency by the National Emergency Management Agency (NEMA) within the ministry of defense in Israel. At the local level – the local municipal authorities are responsible for the preparedness, including the buffer zone and other equipment needed for this event (according to the regulation). Each national organization has its local branch operating during the event.
	○ Other stakeholders for preparedness?	This data was not requested in this phase.

4	Training and communication preparedness	
	○ EU/UN/INGO?	Not Relevant
a.	What kinds of trainings (including drills and crisis exercises) are done to program is held by local authorities throughout the country. Through this program, the prepare for a disaster?	Project 360 is a project conducted by the Home Front Command with the goal of preparing civilians to handle threats and emergencies such as rocket attacks and earthquakes. The authorities, residents, volunteers, and emergency responders will work together to improve emergency readiness to save lives.
		International drill held in 2017,
		On October 24-25, 2017, the international exercise "Forest Fires of the Middle East" (MEFF) was held under the auspices of several EU countries and with the participation of Jordan, Israel, and the Palestinian Authority. The multinational exercise was conducted with the participation of Italy, France, and Spain, and on behalf of Israel are representatives of the Ministry of Public Security, the Israel Police, the Fire and Rescue Commission, Magen David Adom, the Home Front Command, the Ministry of Foreign Affairs, the National Emergency Authority (NEMA) and the Jewish National Fund. The joint exercise's aim, financially supported by the European Commission's emergency training system, is to improve the skill and share professional knowledge in emergency management while saving lives and preserving nature regardless of nationality and borders. The exercise includes more than 400 active participants from participating countries to collaborate on firefighting and humanitarian aid. The National Emergency Authority (NEMA) coordinates the coordination between the bodies. According to the scenario, a large fire breaks out, developing into a regional disaster (the fire may develop into other disasters from one country to another).
b.	Who provides training, for whom, and what competencies are covered?	This data was not requested in this phase.

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c.	What kind of approach is adopted in crisis communication preparedness: e.g., what is communicated to the general public about preparedness, how (means and channels: e.g., preparedness brochure, crisis portals/websites, campaigns, formal/civic/professional education, social media mobilization) and by whom (leading agency + other partners and stakeholders involved + partnerships with news media)? How are the needs of vulnerable groups taken into account?	This data was not requested in this phase.
5.	**Prepositioning, framework contract, and supplier management**	
a.	What types of goods are pre-positioned and how are locations selected?	This data was not requested in this phase.
b.	Which organization is responsible for management of pre-positioned stock?	Local municipalities Government ministries for each field (hospital, electricity, water, etc.) First responders organization Army (for bases)
c.	What are the framework contracts for disaster preparedness, who manages them?	This data was not requested in this phase.
d.	How are suppliers who secure the supply for preparedness selected and managed	This data was not requested in this phase.
6.	How was the preparedness and response mechanism activated for different types of risks?	During the event, the firefighters and other first responders received high priority levels for critical supplies – water for fire extinguishing, energy (also for

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7.	How the event influenced flow, access to, and availability (length of shortage, scale, shortage by social group) of:	the water pump), food, RF spectrum, etc. This prioritization is managed by NEMA.
	○ Drinking water;	This data was not requested in this phase.
	○ Energy supply (electricity, coal, fuel, etc.);	This data was not requested in this phase.
	○ Food (retail sales, catering, etc.);	This data was not requested in this phase.
	○ Health (emergency and long-term provision, psychological health);	This data was not requested in this phase.
	○ Access to information.	This data was not requested in this phase.
8.	How the event influenced preparedness mechanisms (in terms of training, information flow, communication, prepositioning, supplier management). What were the lessons learned from the case?	This data was not requested in this phase.
WP7	**Social media information/misinformation and risk communication**	
	Please provide a quality assessment for the accuracy and veracity of information and data used to inform this case study.	
	This data was not requested in this phase.	

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Annex 8 - Case Study 5 – INDUSRIAL ACCIDENT

CASE STUDY 5: *Industrial Accident*	
Guidance notes are provided in red text offering additional description and direction of the response/s required in each field.	
Incident	Visakhapatnam ("Vizag") Industrial Accident – Styrene Vapour Release
Location	LG Polymers Plant, Venkatapuram Village, Visakhapatnam, Andhra Pradesh, India,
Time & Date	02:30hrs – 03:00hrs, Tuesday 7th May 2020
Description and timeline of the incident	

The polymers plant at Venkatapuram was established in 1961 to produce alcohol rather than petrochemicals. The plant and machinery went through various ownerships with different activities until 1997 when the site was acquired by the LG Polymers group from South Korea, who managed it through an Indian subsidiary company. From this time, the main products manufactured at the site have been various types of polystyrene, and the constituent chemicals are produced and stored at the site.

The site comprises a total area of 213 acres, producing around 450 tonnes of product for the Indian and export markets. The main constituent – Styrene - is notoriously unstable, and has featured in a number of fatal accidents around the world, but not previously in India. It is a colourless liquid with a flashpoint as low as 31 degrees centigrade. Staff should not be exposed to more than 50 parts per million on a daily basis, and 700 ppm will induce immediate danger of death.

(Government of Andhra Pradesh. 2020. *The Report of The High-Power Committee On The Styrene Vapour Release Accident at M/s LG Polymers India Pvt. Ltd).*

Usually, the major risk with this polymer is identified as its flammability, and this was reflected in the standardised response plans for the plant. Styrene is normally held in the relatively stable format of a monomer, but when exposed to relatively moderate heat, the molecular structure changes in an exothermic reaction, which will then continue to a flammable level without an additional heat source. To prevent this, storage tanks are normally refrigerated.

As stated, whilst there have been other significant incidents outside India, previous problems were unknown in the country. This being said, India has a poor record in industrial safety (recognised by national government and media), which most tragically led to the Bhopal disaster of 1984, in which over 3787 people died, and 500,000 are still living with the consequences. These figures are deemed to be conservative. In 2020 alone, 167 people are recorded as having died in industrial accidents, and this is accepted as an underestimate.

The plant has extended significantly since acquisition by LG Partners, and now buildings can be found up to the site boundary. Adjacent to the site, the local communities have been developed and many homes are to be found immediately outside the boundary fence of the site. Whether permission for the onsite developments was correctly obtained has been disputed.

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This major incident originated in a specific styrene storage tank number M6, containing 1937 metric tonnes of the styrene monomer. This tank was constructed in 1967 and initially used for the storage of alcohol producing molasses. It was converted for styrene storage in 1977. Due to the COVID lockdown, the factory was closed from 25th of March 2020, and staff were retained on maintenance duties. By 4th of May, the factory was preparing to restart production.

Styrene vapour is first identified as being released from the storage tank at around 02:40 hours on 7th May 2020. By 02:55hours, a vapour cloud had formed. Styrene gas is heavier than air and opaque in higher concentrations. An automatic alarm sounded in the control room, and the vapour release became uncontrolled. The reasons for this release are complex and can perhaps be summarised as poor tank design; poorly carried out maintenance; outdated storage technology; ineffective temperature measurement and control; insufficient refrigeration; staff failure, and poor tank contents management.

(Government of Andhra Pradesh. 2020. *The Report of The High-Power Committee On The Styrene Vapour Release Accident at M/s LG Polymers India Pvt. Ltd).*

Other contributory factors also remain possible. As has been identified in many other major incidents, there will be multiple causes and contributory factors over an extensive period. For example, the Hillsborough disaster, as well as being the result of ineffective crowd management, was undoubtedly exacerbated by stadium design, poor maintenance of safety facilities, the unforeseen consequences of anti-hooliganism fencing, and an ineffective or non-existent safety inspection process. All parallels with this incident.

(Taylor, Ll. (1989). *Hillsborough Taylor Interim Report* (Cm 765). Home Office, UK).

The actual time that the styrene release was identified by the on-site staff is disputed. It was not until 03:26hrs that calls were made to external services fire, police, and ambulance to alert them to the issue – by citizens rather than by the plant staff. Police response was very swift, although the fire service has been criticised for not arriving on scene until 21 minutes after the call. From this moment until dawn, the communities around the Venkatapuram industrial plant are subject of a rapid but chaotic evacuation focused on approximately 300 families, in a toxic environment. This work was led by staff of the National Disaster Response Force experienced in Chemical, Biological, Radiological and Nuclear (CBRN) issues who arrived at 06.45hrs on the same day. They discovered that the styrene cloud was still present within the factory and using their own personal protective equipment (PPE), entered and liaised with LG Chemicals staff. They later also measured styrene gas levels and took water samples from the villages surrounding the plant.

Casualties are identified as 12 fatalities, and 585 people requiring hospital treatment.

The initial on-site response focused on bringing the temperature of the styrene within the tank back down to a safe level, reducing the risk of explosion, and reducing the outflow of the poisonous gas through the vents. This was initially broadly successful, but as the day continued, the

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temperature reduction strategy had to be suspended for technical reasons and it was feared that there would be a resurgent problem during the evening. This led to a very intensive wide scale evacuation, but ultimately the situation was brought under control.

The local police state that they were on site in response to a claim of a pungent gas leakage in under 3 minutes. The thick gas vapours prevented them entering the polymer plant. Senior officers arriving shortly after identified numerous residents collapsed on the roads, and relays of ambulances, police and private vehicles conveyed victims to multiple local hospitals. Local government officials also attended. At this point there was no general evacuation of any wider area, and this did not take place until the evening when an explosion or further gas leakages were feared.

By 10th of May, styrene levels had reduced to safe levels, and the local authorities assisted returning citizens with the advice as to cleaning houses, and the use in public spaces of appropriate equipment to wash away remaining traces.

The absence of an explosion or fire meant that the existing infrastructure was largely recoverable for use within 72 hours of the incident occurring.

The local and national government combined to provide financial support to the families of the deceased and other victims.

A significant inquiry team ("The High-Level Committee") was appointed within 72 hours and much of this case study is derived from their report, and from those of the agencies who submitted papers. This inquiry however focused almost exclusively on the technical reasons for the leakage and the culpability or otherwise of LG Polymers and the authorities responsible for licencing and inspection of the facilities. There is virtually no reference in their report to the victims of the critical incident, and their analysis of the emergency services response is limited to the receipt of reports from the local police and emergency services commanders.

(Government of India National Disaster Response Force. 2020. *Chemical Gas Leak at Vishakhapatnam*).

(Government of Andhra Pradesh. 2020. *The Report of The High-Power Committee On The Styrene Vapour Release Accident at M/s LG Polymers India Pvt. Ltd*).

WP2	Task 2.2: Natural and manmade disaster case study identification, research, and analysis

What were the public information sharing challenges?

A significant issue was the lack of effective warning for the public. This was a relatively short-term hazard for a population in close proximity to the source of the crisis. The nature of the chemicals within the plant demands that the warning messages are swift and unambiguous, and the planned method of communication is a simple siren to alert the population to leave the area immediately. This method has been trialled and repeatedly exercised, but on the night of the incident itself the alarm was not sounded by the staff within the plant. Much has been made of this failure by the LG staff, but it is noticeable that no one else such as local police commanders thought to question the lack of an alarm at the time, or suggest that it be sounded. This suggests that there was a distinct lack of training and joint working prior to the incident.

Mass media are still popular sources of information, particularly mass circulation local newspapers. Younger people in the communities are active users of social media for personal exchanges, and it is not uncommon for newsworthy stories to become viral, even when receiving no official

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credibility. The authorities' precautionary evacuation of a wider area later in the evening of 7th of May was initially perceived as being in response to a further leak, for example.

What were the ethical issues?

The High-Power Commission report into the disaster has identified apparent failures by the management of the polymer plant to ensure safe structures for the storage of the harmful gas, and a failure to maintain the facility to the most modern standards. Staff at the site were using unsafe routine working practises, which led directly to the gas release. As the incident unfolded, staff appeared to be either untrained or did not, for unspecified reasons, utilise their training to mitigate the issues and protect the population. There appear to have been failures by the public officials responsible for inspecting the plant and certifying its safety. There are therefore a number of ethical issues in respect of corporate social responsibility, and the duty of care of public bodies for citizens.

What lessons have been learned?

The focus of the primary official report (Government of Andhra Pradesh. 2020. *The Report of The High-Power Committee On The Styrene Vapour Release Accident at M/s LG Polymers India Pvt. Ltd)*.

into the major incident was almost entirely into the physical and working environment within the plant, and are therefore both site specific and in line with existing good practise guidelines for the management of this and similar hazardous materials in an industrial environment. Emergency services response analysis is limited to the publication of reports submitted to the "High Power Committee" by local police and fire services. In response to these documents, the committee limits itself to the pointed comment that the local fire service has recently changed its name to include responsibility for disaster response, and makes the suggestion that the organisation acquires the skills and equipment to fulfil this function. Additional post event academic and pressure group studies suggest that the high-powered committee may have placed too much reliance upon information supplied by LG Industries. There is a marked absence of any official follow up reports, with commentary now defaulting to pressure groups and media.

Evidence drawn from media reporting of concerns raised by local NGOs (Bhattarcharjee, S. (2022, May 6). Andhra Pradesh: Two years on, styrene monomer still haunts people of Vizag . *The Hindu)*, suggest that substantial economic pressure on the local communities - characterised by their poverty - caused residents to return to their villages before the full range of safety clean-up processes were completed. There are reports of families attempting to live their daily lives whilst repeatedly cleaning styrene residue from their homes and garments. Whilst immediate payments were made to local farmers and food suppliers, this has effectively ceased.

Beyond these issues, experts at MTO Sakerhet have identified a range of good practice measures and recommendations that can mitigate or prevent future incidents of this type. Some 15 recommendations will be available including storage, staff training and involvement, community warning and response. These will be drawn together in the analysis phase of these case studies since they go well beyond the limited

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recommendations of the High-Power Committee, which are not only limited to the styrene industry, but in some cases are site specific to this plant in India.

In summary, it is hard to identify what lessons have been directly learned from this incident in the local area. The researchers could identify no evidence of significant changes in local arrangements.

What were the cascading effects across events, sectors, and supply chain disruptions? Including the inevitability or unforeseen chain of events affecting the response to the disaster? What were the societal vulnerabilities in health and retail sectors?

Due to the nature of the chemical involved the initial critical incident was effectively resolved within 36 hours with local residents returning to their homes, which could be made habitable and risk free by effective washing with large quantities of water alone, although the addition of the chemical sodium hypochlorite is beneficial.

The area is predominantly residential with some small retail or handcrafting businesses. There were a handful of small-scale livestock farms which required specialist support. Short term styrene exposure at the levels experienced in this incident would not be expected to lead to long term health issues if limited to the airborne polymer alone. Immediate treatment for styrene exposure is based on rinsing and flushing any points of contact, and where inhalation is suspected, lung function may be supported until recovery. Longer term health effects for styrene inhalation and contact are not clinically established and ideally there would be a continuing health monitoring programme since styrene is identified as a potential carcinogenic.

However, there was extensive soil and water supply contamination in the affected area. Over the following days, there were repeated attempts to treat water sources and public land, but the economic pressure on the local population meant that they returned to their homes before this was considered complete.

Longer term, the quickly established longer term monitoring systems have been closed, and there is local discontent about health provision. Specialist support has not been received, and there have been further deaths attributed to the leak.

What was preparedness before and after the event with regards to prepositioning, training, framework contracts and supplier management.

Local first responder agencies such as police and fire service had no specific training in respect of the chemicals produced and stored at the plant. It was apparent that there were generic LG plans for response, but these appear to have been primarily structured around an explosion at the plant rather than a vapour release. Certainly, none of the responding emergency services had appropriate protective equipment (PPE), and it was not until the arrival of a team from the National Disaster Response Force (NDRF), who had appropriate breathing apparatus and chemicals to treat the styrene contamination that a coherent search and rescue got underway.

Indian legislation requires that the staff at the facility are fully trained in ameliorative tactics for the chemicals stored on site, and that relevant equipment and chemical treatment stores are pre-placed and available. It was apparent in the immediate aftermath of the incident that, equipment, training, and leadership were all lacking.

There was a lack of preparedness for vapour release: The Onsite emergency plan prepared by LG Polymers lacked any measures to combat Styrene vapour leak but only provided for fire occurrences and other accident scenarios. The LG polymers had no Emergency Plan for Styrene vapour release.

Please provide a list with links of data sources used in the following categories

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Community interviews/reports	None identified in research phase.
Eyewitness/first-hand accounts	Not identified in research phase.
News/media reports	Bhattacharjee, S. (2020, June 6). Visakhapatnam gas leak	How negligence and violations led to a deadly disaster . The Hindu. https://www.thehindu.com/news/cities/Visakhapatnam/visakhapatnam-gas-leak-how-negligence-and-violations-led-to-a-deadly-disaster/article61675181.ece Bhattacharjee, S. (2022, May 6). Andhra Pradesh: Two years on, styrene monomer still haunts people of Vizag . The Hindu. https://www.thehindu.com/news/cities/Visakhapatnam/andhra-pradesh-two-years-on-styrene-monomer-still-haunts-people-of-vizag/article6538733.ece Rao, U. (2022, March 11). Perceived poverty jumps in Andhra Pradesh, Telangana: Report . Times of India. https://timesofindia.indiatimes.com/city/visakhapatnam/perceived-poverty-jumps-in-ap-telangana-report/articleshow/90137206.cms Rao, G. J. (2022, January 8). Vizag beaches turn into death traps, 233 swept away in last four years . The New Indian Express. https://www.newindianexpress.com/states/andhra-pradesh/2022/jan/08/vizag-beaches-turn-into-death-traps-233-swept-away-in-last-four-years-2404370.html Chhabra, R. (2022, January 29). 162 Workers Died in Industrial Accidents in India in 2021. NewsClick. https://www.newsclick.in/162-workers-died-industrial-accidents-india-2021
Documentaries	None identified in research phase.
Social Media	None identified in research phase.
Satellite/other aerial imagery	None identified in research phase.

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Academic Papers/Reports (Peer Reviewed)	Dhara, V. R., Digumarti, R., Sridhar , G. R., & Gassert, T. H. (2021). The styrene gas disaster – lessons to learn and the way forward. *Dr. NTR University of Health Sciences, 10*(3), 117 -128. https://www.jdrntruhs.org/text.asp?2021/10/3/117/339805
Academic Papers/Reports (Non-Peer Reviewed)	Süngü, A. (2022). *Understanding smartphone usage in low-income markets.* London Business School. https://www.london.edu/news/understanding-smartphone-usage-in-low-income-markets-2006
Public Enquiry Reports/Findings	Taylor, Ll. (1989). *Hillsborough Taylor Interim Report* (Cm 765). Home Office, UK. https://commons.wikimedia.org/wiki/File:Hillsborough_Taylor_Interim_Report_Cm765.pdf
Journal/Magazine articles	None identified in research phase.
Online podcasts, blogs, forums & chat rooms	None identified in research phase.
Official policy recommendations & findings	None identified in research phase.
Other (Please specify)	None identified in research phase.

WP2	**Task 2.3: Natural and manmade case study social media analysis**

What was the role, influence, and impact of social media case study social media communications during this incident?

There is no evidence to date that social media communication had any role or influence during the initial release. Research suggests that due to the poverty of the area, access to social media remains limited. (Süngü, A. (2022). *Understanding smartphone usage in low-income markets.* London Business School, and Magic Bus Charity:2022. *Venkatapuram.*

Whilst pressure groups and charities are involved in the area and draw attention to the issues, the local people themselves rely more upon traditional means of communication.

Further research will be conducted once this has been discussed between CORE Project partners, if appropriate. Relevance to a European project is perhaps limited.

What patterns of interactions between opinion makers and recurring topics in the Twitter debate following the disaster have been identified?

There is significant debate continuing amongst NGOs, academic institutions, and local government. To date this appears to be hosted through traditional local media rather than social media.

Please provide a list with links of data sources used in the following categories

Government/Official reports	No relevant open sources identified in research phase.

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Community interviews/reports	No relevant open sources identified in research phase.
Eyewitness/first-hand accounts	No relevant open sources identified in research phase.
News/media reports	No relevant open sources identified in research phase.
Documentaries	No relevant open sources identified in research phase.
Social Media	No relevant open sources identified in research phase.
Satellite/other imagery	No relevant open sources identified in research phase.
Academic Papers/Reports (Peer Reviewed)	No relevant open sources identified in research phase.
Academic Papers/Reports (Non-Peer Reviewed)	No relevant open sources identified in research phase.
Public Enquiry Reports/Findings	No relevant open sources identified in research phase.
Journal/Magazine articles	No relevant open sources identified in research phase.
Online podcasts, blogs, forums & chat rooms	No relevant open sources identified in research phase.
Official policy recommendations & findings	No relevant open sources identified in research phase.
Other (Please specify)	No relevant open sources identified in research phase.

WP2 | **Task 2.4: Natural and manmade case study aerial imagery analysis**

What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform decision-making?

There is no doubt that in a vapour leak of this type, the ability to quickly deploy a UAV over the affected zone would be of immense value in efficiently allocating staff for search and rescue operations, and ensuring that an appropriate cordon was put in place. Unfortunately, command and control protocols in this region are not fully developed, and the infrastructure is not available to make use of this technology. Whilst senior officers are trained in Gold/Silver/Bronze (Strategic/Tactical/Operational) command tiers, this has yet to be fully adopted in the operational environment and indeed from the local services' own reports, it is apparent that all units simply made their way to the scene and were briefed on the ground by the most senior officer available and an operational plan emerged through trial and error. Over 15 officers of the local police were hospitalised as a result of styrene inhalation.

What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform the sharing of public information?

Given the need for speed in immediate evacuation of the affected area, there would initially be little value in satellite imagery or UAV deployment in respect of sharing information with the public. Once the initial evacuation phase was completed however the ability to patrol the area using

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UAVs would offer reassurance to residents that their properties were safe and secure, and allow emergency services to carry out follow up searches and missing person enquiries with a much higher degree of safety. In turn this would have allowed emergency services to respond to concerns expressed by local citizens more safely and effectively.

Please provide a list with links of data sources used in the following categories	
Government/Official reports	No relevant open sources identified in research phase.
NGO reports	No relevant open sources identified in research phase.
Community interviews/reports	No relevant open sources identified in research phase.
Eyewitness/first-hand accounts	No relevant open sources identified in research phase.
News/media reports	No relevant open sources identified in research phase.
Documentaries	No relevant open sources identified in research phase.
Social Media	No relevant open sources identified in research phase.
Satellite/other imagery	No relevant open sources identified in research phase.
Academic Papers/Reports (Peer Reviewed)	No relevant open sources identified in research phase.
Academic Papers/Reports (Non-Peer Reviewed)	No relevant open sources identified in research phase.
Public Enquiry Reports/Findings	No relevant open sources identified in research phase.
Journal/Magazine articles	No relevant open sources identified in research phase.
Online podcasts, blogs, forums & chat rooms	No relevant open sources identified in research phase.
Official policy recommendations & findings	No relevant open sources identified in research phase.
Other (Please specify)	Lecture notes and training materials from training delivered at IPS National Police Academy by report author.

WP3	**Task 3.1 - Critical analysis of past disasters via the identified case studies on their disaster preparedness strategies**
Type of data	**Data/ information/ sources/ reference material**
3.1.1	**Type of hazards – Understanding the disaster risk**
a.	What type of hazards were commonly identified in the region (Slow-onset and rapid onset hazards)?	Visakhapatnam District is one of the nine coastal districts of Andhra Pradesh, and is stated to be a "regular victim of natural disasters". Most of the limited planning is focused on sea origin flooding, coastal erosion, and occasional tsunami. Despite extensive industrialization,

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b.	What hazards have resulted in disasters during the past 20 years?	with a long history of shipbuilding and steel making, there are no available documented plans for industrial accidents. In this regard, the region is no different to India as a whole.
		Information is difficult to come by in respect of any specific problems or critical incidents apart from the vapour leak subject of this case study. European researchers need to be aware that risk perception is different in India. For example, road death statistics are not gathered with the same accuracy as within Europe, thus making comparisons more difficult, and a recent article in the New Indian Express newspaper identified 233 deaths by drowning at the short Visakhapatnam coastline over the last four years. Between 30 and 200 police officers are posted every day to prevent casualties, as well as municipally employed lifeguards. There is no controversy or calls for more concerted action, as there would be in a similar European beach scenario.
c.	What risk assessment mechanism(s) were used by the relevant institutions for encompassing risk awareness, multi-hazard analysis, vulnerability/capacity analysis and cascading effects?	None identified in research carried out to date.
d.	What risk modelling and scenarios have been carried out to consider disaster risk and/or any other future threats and cascading effects?	None identified in research carried out to date.
e.	How the knowledge of indigenous communities and information in social media had been captured for disaster risk perception?	None identified in research carried out to date.
3.1.2	**Disaster resilience and preparedness strategies**	
a.	What were the available national and local disaster management plans and systems under following categories?	
	○ Individual-level activities (e.g., first aid training and response)	The National Disaster Management Plan is a comprehensive document produced by national government and published in 2016. It is a high-level plan which requires all ministries, agencies, and local government bodies to develop in respect of their individual responsibilities. There is no evidence that this document was taken into account in any preparations prior to the vapour leak on Tuesday 7th of May 2020.

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	The Andhra Pradesh State Disaster Management Authority was in operation since the creation of the master plan. Below them there are district disaster authorities. these bodies are responsible for carrying out approval and supervision of action plans by agencies, and arranging for exercises. One identified source suggested that ten specific disaster management exercises had been carried out prior to this critical incident, but it would appear that none were related to this issue and there is no coherent documentation to suggest whether this work was effective.	
	o Household actions (e.g., stockpiling of equipment and supplies, retrofitting)	None identified in research carried out to date.
	o Community efforts (e.g., socially responsible mitigation, training, and awareness campaigns for first respondents and responders, and field exercises)	None identified in research carried out to date.
	o Governmental strategies (e.g., multi-organisational planning and public private partnerships, early warning systems, contingency plans, evacuation routes, and public information dissemination, allocation of resources)	None identified in research carried out to date.
b.	What provisions were in place for research, education, science, and technology (ex: geospatial, remote sensing) for informed disaster preparedness?	None identified in research carried out to date
c.	What special provisions were undertaken to ensure pandemic preparedness in disaster preparedness measures?	All pandemic provisions (Social distancing, mask wearing) in force within the affected area were immediately suspended.
3.1.3	Mitigation	
a.	What policies and legislation were available that mainstreamed DRR in the national planning policy?	

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	○ Land use planning and building codes (Ex: Avoid settlement expansion towards hazard prone areas)	The state of Andhra Pradesh has numerous planning and developmental codes for land use, and planning guides should have precluded the development of the villages towards the plant. It is part of a local ongoing investigation as to why these plans were not adhered to.
	○ Critical infrastructure protection and structural design improvements	National regulations apply for the design and maintenance of chemical facilities. There is substantial evidence that this plant was never updated nor modernised in accordance with those regulations. These changes should have been noted and inspected by local authority staff, and it is apparent that these inspections were not carried out. Criminal proceedings - a lengthy process in India - are underway.
	○ Landscape and environmental arrangement around essential services and infrastructure	Notionally included in the National Disaster Management Plan, but no evidence of local application in this case.
b.	Resilience strategies including planning and partnership building between sectors	In the experience of the Saher researcher, interagency cooperation is minimal across India. Even within agencies such as the police, collaboration between different units is often very difficult to achieve given the scale and culture of the organisations.
	What support were provided by media platforms including social media during disaster operations?	None identified in research carried out to date
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	To the contrary, all COVID-19 restrictions were suspended during the duration of the immediate response to this emergency.
3.1.4	**Response**	
a.	What were the available surveillance, early warning, and information management systems for activating response operations under the following conditions?	
	○ Support or coordinate disaster operations being conducted by a designated lead agency	It has not been possible to identify evidence of a clearly designated lead agency. From research outside this project however, police primacy is conceptually recognised across India. It is clear however that in this specific case study, the police had little understanding of the issues they were dealing with and there were no standard operating procedures.

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	○ Logistics mechanisms and essential supplies for health and relief services	There are no common surveillance, early warning or information management systems operating either within or across agencies at a local or state level. At a national level, the foundation of the National Disaster Response Force provides for the deployment of trained staff with appropriate equipment and logistical support to areas suffering a natural or man-made crisis. In this case study, support was more limited and provided by local authority facilities, with the NDRF limited to search operations at the plant and nearby, together with using CBRN trained staff to accompany Government scientific support staff in assessing the consequences.
b.	What support was provided by media platforms including social media during disaster operations?	None identified in research carried out to date.
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	All COVID-19 restrictions were suspended during the duration of the immediate response to this emergency.
3.1.5	Recovery	
a.	What were the long-term and short-term recovery actions undertaken during each post disaster recovery period including 'build back better' practices?	Damage assessments and community needs were carried out by staff drawn from the local authority. Due to the nature of this case study, there was little physical damage to infrastructure, although water supplies and housing needed extensive decontamination. There is evidence that whilst water supplies where is stored for short periods through tankers for example this was effectively concluded within five days, and there is substantial evidence that many groundwater areas were not effectively di contaminated prior to residents returning to the area.
	○ Response endeavours such as needs and damage assessments	All provision is determined on an expert lead and top-down basis. Whilst the High-Level Committee invited calls and emails from all interested parties to contribute to their report, at no time do they quantify how many enquiries were received and how many issues were
	○ Community-level involvement and capacity building for disaster recovery	

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		acted on. The residential population of the affected area has low levels of literacy and minimal access to IT.
	○ Local administration and coordination for resource mobilisation	The local government provided coordination of mobilised resources on an ad hoc basis for no more than 36 hours following the vapour release.
b.	○ Building redundancy into a DRR plan	Research offers no evidence of creation of redundancy or additional capacity in this area. Researcher experience shows that this is normally considered outside the capacity of agencies.
	How the post disaster infrastructure recovery including rebuilding, restoration, or reconstruction had taken place?	Infrastructure recovery which included additional clinics and hospital support were promised and initially some facilities were provided. It is now reported that this support has now been withdrawn, leading to local protests.
c.	What plans or provisions were available to minimise the economic impact following a disaster?	Immediate funding was provided to the families of the deceased, together with financial support for the farmers who lost livestock, or who were forced to dispose of crops, milk, or similar product. The local agricultural authority promised additional support, but it is suggested in local media that this has not been forthcoming.
d.	What environmental recovery plans were available to manage the impact for eco-systems and related services?	In the absence of state-wide planning for a major incident of this nature, there was no specific eco-system or environmental recovery plan. Individual agencies responsible for agriculture and water supply made a post incident damage assessment and suggested remedial measures, which according to recent media reports have not been completed.
e.	How have the mitigation and resilience-building activities of preparedness been adopted for the next disaster, and the development and implementation of legislation, policies, and practices to avoid similar situations in the future?	There is no evidence to suggest that the plant and its surroundings are subject of extensive planning for future incident mitigation. The immediate use of the criminal law against the plant management and indeed the national leadership of LG chemicals in India means that legal issues are the priority for the company and local government.
3.1.6	**Monitoring and evaluation**	

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How frequent are plans being reviewed and revised for emergency preparedness, response, and recovery?	India is a signatory to the Sendai Framework for Disaster Risk Reduction. It has established the National Disaster Response Force which is deployed across the country in 15 separate states. At a state level, there is less evidence of effective coordinated emergency preparedness, response, and recovery plans.

WP3	Task 3.2 – Vulnerable categories
3.2.1	**Identify people vulnerable categories in the different phases of disaster management**
a.	In the analysed context, what were the consequences (death or injury) with respect to the following age groups and gender?

o New-born (ages 0-4 week)	There is insufficient evidence available to accurately answer this section. Indeed, the actual number of fatalities is disputed - with differing sources suggesting that 11, 12, or 15 people lost their lives. Additionally, research suggests that at least two local residents died, with their families attributing their death to the effects of the vapour release. Coroners' reports are not publicly available yet, and it may actually be the case that Coroners' enquiries have not begun let alone concluded. Anecdotal evidence suggests that at least two persons died through falling into a canal and drowning; one person died through falling into a well; and a 19-year-old man died when he fell from a first-floor window. All the casualties were suffering loss of vision from the effects of the gas. At least one infant died through suffocation. We cannot state with certainty therefore the age, gender, and physical characteristics of the casualties. It is noteworthy that the official reports pay little regard to the victims themselves, but given the scale of Mortality rates across India, it is perhaps unsurprising that an event of this scale has received scant attention.
o Infant (ages 4 week - 1 year)	Please see comment above.
o Toddler (ages 1-3 years) - M/F	Please see comment above.
o Pre-schooler (ages 3-5 years) - M/F	Please see comment above.
o School aged child (ages 6-13 years) - M/F	Please see comment above.
o Adolescent (ages 14-18 years) - M/F	Please see comment above.
o Young adult (ages 19-29) - M/F	Please see comment above.

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	o Adult (ages 30-64 years) - M/F	Please see comment above.
	o youngest-old (ages 64-74 years) - M/F	Please see comment above.
	o middle-old (ages 75-84 years) - M/F	Please see comment above.
	o Oldest-old (ages more than 85 years)	Please see comment above.
b.	During the rescue phase what were the categories of disabilities, or specific needs, that arose?	
	o Movement disabilities *	Please see comment above.
	o Sensorial disabilities (deafness, blindness) *	Please see comment above.
	o Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	Please see comment above.
	o Pregnant women	Please see comment above.
	o New-born	Please see comment above.
	o Infant	Please see comment above.
	o Other that emerged during the analysis of the available documentation or specific investigations conducted	Please see comment above.
c.	Which of the following categories of disabilities, or specific needs, were managed in the post-emergency phases to give an initial response to people involved?	
	o Movement disabilities *	Please see comment above.
	o Sensorial disabilities (deafness, blindness) *	Please see comment above.
	o Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	Please see comment above.
	o Pregnant women **	Please see comment above.
	o New-born	Please see comment above.
	o Infant	Please see comment above.
	o Other that emerged during the analysis of the available documentation or specific investigations conducted	Please see comment above.
	*Indicate age class (see 3.2.1.a) and gender; ** indicate class age	
3.2.2	**Post event management**	
a.	About point 3.2.1b, were the rescuers prepared to manage the situation?	

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	○ The rescuers were involved in specific training activities in this field	The initial rescuers were drawn from local police and fire service staff. There is no evidence to suggest they had received any specific training, but used their common sense to protect themselves as far as possible, and there was evidence of great bravery in their willingness to enter a visibly dangerous area in order to effect rescues. At least 15 members of staff were hospitalised, and some continue to suffer respiratory issues. The members of the National Disaster Response Force who arrived later were in possession of appropriate breathing apparatus and have been trained in casualty recovery.
	○ Specific documentation has been made available	None identified in research carried out to date.
	○ Simulations were conducted also considering the issue of inclusive emergency management	None identified in research carried out to date.
b.	About point 3.2.1c, were the operators prepared to manage the situation considering people with specific needs?	
	○ The rescuers were involved in specific training activities in this field	No evidence has been identified from research to date.
	○ Specific documentation has been made available	No evidence has been identified from research to date.
	○ Simulations were conducted also considering the issue of inclusive emergency management	No evidence has been identified from research to date.
c.	Were people with specific needs and their family members or caregivers prepared to manage that emergency?	
	○ Specific information activities were carried out on these topics with the involvement of family members, caregivers, and the surrounding community	No evidence has been identified from research to date.
	○ Specific documentation has been made available	No evidence has been identified from research to date.

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WP3	Task 3.3 Culture & heritage	
	o Simulations were conducted also considering the issue of inclusive emergency management	No evidence has been identified from research to date.
3.3.1	**What was the extent of the damage with respect to the type of disaster?**	
	There is no suggestion that there was damage to the culture and heritage of the local people.	
3.3.2	**What was the extent of the damage with respect to the size of the disaster?**	
	No evidence has been identified from research to date.	
3.3.3		
	No evidence has been identified from research to date.	
3.3.4	**How long did it take to recover/retrieve after the disaster in the following categories?**	
	o Land use	The local small scale farming operations were compensated for the loss of livestock, products, and land use on an immediate financial grant basis. Evidence from public media suggests that this has not continued beyond the first year, raising fears therefore that food products are contaminated, and the land has not been correctly remediated.
	o Repopulation	The population returned to their homes within 36 hours.
	o Everyday life condition	The affected villages are described as comprising low quality housing mainly of light timber and wattle and daub construction. Some have tin roofs and more substantial foundations, but this is an area that NGOs and other charitable organisations categorise as highly impoverished, and the residents' day-to-day condition before the disaster was not to a high quality. With poor existing healthcare, there is a substantial risk that their condition will further deteriorate.
	o Social life	There is no evidence to suggest that this has been affected in any way by the critical incident.
	o Lesson for the mitigation of other disasters	There are a number of good practise guidelines for the mitigation of disasters, and it is respectfully suggested that there is nothing positive to be learned from the management of this specific case study. Further analysis will focus on lessons derived from the absence of such provision at this incident.

3.3.5	**Was there any quantitative correspondence between reaction/effort and damage?**
No evidence has been identified from research to date.	
3.3.6	**What was the timescale of such correspondence (short-term vs. long-term)?**
No evidence has been identified from research to date.	
WP3	**Task 3.4 – Risk governance strategy**
Type of data	**Data/ information/ sources/ reference material**
3.4.1	**Disaster risk governance mechanisms**
What were the disaster risk governance mechanisms identified in the relevant authorities to manage disaster risk under following categories?	
o Knowledge sharing and inclusion of science and technology	There is no evidence to suggest this level of sophistication in the disaster risk management arrangements locally. Subsequent to this critical incident, arrangements have been made at the local university for academics in the appropriate chemical engineering discipline to continue their studies into the issues raised. It has also been suggested that the local teaching hospital might wish to study the long-term potential health issues of exposure to styrene. There is a dearth of clinical evidence around the long-term impacts of exposure to this chemical.
o Harmonizing capacities and resources	There is no evidence to suggest this level of sophistication in the disaster risk management arrangements locally.
o Institutionalizing partnerships, coordination, and responsibilities	There is no evidence to suggest this level of sophistication in the disaster risk management arrangements locally.
o Participatory decision-making mechanisms, inclusive of vulnerable communities, indigenous communities, and volunteers	There is no evidence to suggest this level of sophistication in the disaster risk management arrangements locally. The local village communities are described as being predominantly drawn from the Dalit caste, and whilst activists have taken up their cause, the response to the critical incident has not led to significant change
o Leveraging investments in DRR	No evidence of this has been identified from research to date.
3.4.2	**International DDR frameworks**

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What international DDR frameworks (SENDAI, SDG, Paris Agreement) were adopted in DRR projects?	At a national level the Indian government is a keen protagonist in the worldwide debates around climate change and environmental protection. They are signatories to the SENDAI arrangements. Like other emerging economies however, there are issues to resolve around fossil fuel use and continued growth for the economy of India. In terms of disaster planning and management there is a disconnect between the national arrangements and those at a local level.
3.4.3 Accountability in disaster governance	
What were the provisions to ensure accountability in disaster governance?	
o Consider accountability aspects in the Sendai Framework for Disaster Risk Reduction 2015-2030	Although these are identifiable in official government documentation, there is no relevance to the management of this case study.
o Innovative elements of accountability	This data was not requested in this phase.
o Enabling legislations	This data was not requested in this phase.
o Regular monitoring, evaluation, and review	No evidence of this has been identified from research to date.
WP4 Cascades	
1. What is the EU country, covered by CORE partners, preparing for (crisis, war and crisis, disruption)?	Not strictly applicable as a non-EU country. National crisis management plans are focused on natural disasters such as earthquakes, flooding etc., and infrastructure failures such as railway accidents, urban fire risk and building collapse.
2. What types of disasters is each EU country, covered by CORE partners, preparing for?	As WP4.1
3. Who is involved in the preparation process?	Overarching national plans envisage a multi-agency response, led and coordinated by the State Police (IPS Leadership) until the arrival of the NDRF who will then take leadership. Researcher's own experience in India suggests this ideal model is not fully accepted, with local political interference always being present. Little actual planning or exercises are evident.

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a.	What kind of approach is adopted in disaster preparedness: e.g., is disaster preparedness centralized (national level) or decentralized (local level); who (which agency) has the leading role in preparedness; guiding policy frameworks and/or strategies and principles; coordination/cooperation mechanisms (and sectors involved)?	Since 2016, every state has a Disaster Management Authority, and at a national level, there is a strategic national plan requiring individual ministries to develop their preparedness. The effectiveness of this structure is disputed. The NDRF is well established and resourced, but wider mitigation is unevidenced.
b.	Other stakeholders for preparedness?	Little beyond state actors, and where appropriate (Such as LG in this use case), often lacking resources and commitment.
c.	EU/UN/INGO?	Not applicable.
4	Training and communication preparedness	
a.	What kinds of trainings (including drills and crisis exercises) are done to prepare for a disaster?	Notably absent in this use case as evidenced by the response. The researcher has discussed this actual topic with senior IPS officers for 10 years, and exercises are resource constrained and usually linked to either external requirements (eg. Commonwealth Games preparation), or recent instances of critical incidents and political reaction.
b.	Who provides training, for whom and what competencies are covered?	As outlined in S4a, minimal training. However, it should be recognised that the NDRF have a comprehensive tactical training programme aimed at first responders, providing short courses in rescue focused issues. Numbers attending are limited.
c.	What kind of approach is adopted in crisis communication preparedness: e.g., what is communicated to the general public about preparedness, how (means and channels: e.g., preparedness brochure, crisis portals/websites, campaigns, formal/civic/professional education, social media mobilisation) and by whom (leading agency + other partners and stakeholders involved + partnerships with news media)? How are the needs of vulnerable groups taken into account?	Very limited. Political statements through newspapers and TV channels, and limited to headline statements with little detail, being designed to carry political reassurance messages. The NDRF have a website which reports on their disaster response, rather than guides preparation.
5.	Prepositioning, framework contract and supplier management	
a.	What types of goods are pre-positioned and how are locations selected?	NDRF have 16 locations where rescue equipment and emergency supplies are stockpiled. Each houses 1140+ staff. Locations selected in response to the history of critical incidents nationally.

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b.	Which organization is responsible for management of pre-positioned stock?	NDRF
c.	What are the framework contracts for disaster preparedness, who manages them?	NDRF Procurement.
d.	How are suppliers who secure the supply for preparedness selected and managed	Indian Government procurement regulations. The NDRF use 2 highly detailed technical specification documents for suppliers.
6.	How was the preparedness and response mechanism activated for different types of risks?	Historic data drives the preparation and response criteria. Response is military in style with immediate reconnaissance team determining further response.
7.	How the event influenced flow, access to and availability (length of shortage, scale, shortage by social group) of:	
	○ Drinking water;	Severe immediate shortages mitigated by 36 hour supplies of tanker and bottled water supply. Significant crtuicism of this issue.
	○ Energy supply (electricity, coal, fuel etc.);	Community has limited power supply and reliant upon wood/dung burning for cooking. Relatively unaffected.
	○ Food (retail sales, catering, etc.);	Affected on similar timescale to other issues.
	○ Health (emergency and long-term provision, psychological health);	The local authorities appeared to recognise that there are likely to be significant long term health issues, however the clinical facilities that were initially established to support the local communities have apparently now been withdrawn, and media pressure suggests that the issues here will echo those of Bhopal where there has been what is regarded as a widespread failure to address the long term issues- although the consequences of styrene exposure here are thought to be less severe.
	○ Access to information.	Already limited through local economic conditions and not specifically affected by this critical incident.
8.	How the event influenced preparedness mechanisms (in terms of training, information flow, communication, prepositioning, supplier management).	Given the lack of preparedness mechanisms, it is disappointing that open source media suggests that there has been little or no improvement

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9.	What were the lessons learned from the case?	
	Have there been any studies conducted on the long-term impact (five or ten years) of this disaster/crisis?	Historically, there have been few longer term studies in relation to such incidents in India, on the long-term impact other than by interested NGOs. The scale of this critical incident is unlikely to generate a significant long term study.
a.	Was there any long-term health or societal impact?	Not yet established.
b.	Any local supply chain impact?	Already compromised, and yet to recover.
c.	How long did it take for the communities to get back to the original state?	Not yet fully at the already low "Original" state.
d.	Any studies on the long-term resilience of the affected region?	Not established.
WP7	**Social media information/misinformation and risk communication**	
	Please provide a quality assessment for the accuracy and veracity of information and data used to inform this case study in the following three categories:	
a). Media information	No evidence to support a quality assessment has been identified from research to date.	
b). Misinformation	No evidence to support a quality assessment has been identified from research to date.	
c). Risk communication	No evidence to support a quality assessment has been identified from research to date.	

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Annex 9 - Case Study 6 – TSUNAMI

CASE STUDY 6: **Tsunami**

Guidance notes *are provided in red text offering additional description and direction of the response/s required in each field.*

Incident	**Japan earthquake and tsunami of 2011** **(AKA: Great Sendai earthquake or Great Tohoku earthquake)** Japan earthquake and tsunami of 2011, also called Great Sendai Earthquake or Great Tōhoku Earthquake, severe natural disaster that occurred in north-eastern Japan on March 11, 2011 (Rafferty & Pletcher, 2022). The event began with a powerful earthquake off the north-eastern coast of Honshu, Japan's main island, which caused widespread damage on land and initiated a series of large tsunami waves that devastated many coastal areas of the country, most notably in the Tōhoku region (north-eastern Honshu). The tsunami also instigated a major nuclear accident at a power station along the coast.
Location	Epicentre of earthquake – 80 miles (130km) east of the city of Sendai, North-eastern coast of Honshu Japan's main island at a depth of 18.6 miles (30km) below the floor of the western Pacific Ocean (Sato, 2015). The earthquake was caused by the rupture of a stretch of the subduction zone associated with the Japan Trench, which separates the Eurasian Plate from the subducting Pacific Plate. Tsunami affected areas – A wave measuring some 33 feet high inundated the coast and flooded parts of the city of Sendai, including its airport and the surrounding countryside. According to some reports, one wave penetrated some 6 miles (10 km) inland after causing the Natori River, which separates Sendai from the city of Natori to the south, to overflow. Damaging tsunami waves struck the coasts of Iwate prefecture, just north of Miyagi prefecture, and Fukushima, Ibaraki, and Chiba, the prefectures extending along the Pacific coast south of Miyagi. In addition to Sendai, other communities hard-hit by the tsunami included Kamaishi and Miyako in Iwate; Ishinomaki, Kesennuma, and Shiogama in Miyagi; and Kitaibaraki and Hitachinaka in Ibaraki. The tsunami raced outward from the epicentre at speeds that approached about 500 miles (800 km) per hour. It generated waves 11 to 12 feet (3.3 to 3.6 metres) high along the coasts of Kauai and Hawaii in the Hawaiian Islands chain and 5-foot (1.5-metre) waves along the island of Shemya in the Aleutian Islands chain. Several hours later 9-foot (2.7-metre) tsunami waves struck the coasts of California and Oregon in North America. Finally, some 18 hours after the quake, waves roughly 1

Time & Date	Date of event - March 11, 2011
	2.46PM - Earthquake strikes
	3.27PM - The earthquake sets off a tsunami
	3.35PM - The second wave hits
	7:03PM – Declaration of nuclear emergency
	9.00PM - Evacuation orders issued for the residents living within a 1.9-mile (3 km) radius of the power plant

foot (0.3 metre) high reached the coast of Antarctica and caused a portion of the Sulzberger Ice Shelf to break off its outer edge.

Description and timeline of the incident

Description:

Cabinet_Office_Japan (2011) on March 11, 2011, experienced the strongest earthquake in its recorded history. The Cabinet Office further explained that the earthquake struck below the North Pacific Ocean, 130 kilometres (81 miles) east of Sendai, the largest city in the Tohoku region, a northern part of the island of Honshu. The Tohoku earthquake caused a tsunami. The Tohoku tsunami produced waves up to 40 meters (132 feet) high, causing an impact over 200 square miles of coastal land. An estimated 20,000 people were dead or missing and close to 500,000 people were forced to evacuate. More than 120,000 buildings were destroyed, 278,000 were half-destroyed and 726,000 were partially destroyed, according to the Cabinet Office records. In addition to the thousands of destroyed homes, businesses, roads, and railways, the tsunami caused the meltdown of three nuclear reactors at the Fukushima Daiichi Nuclear Power Plant. The Fukushima nuclear disaster released toxic, radioactive materials into the environment and forced thousands of people to evacuate their homes and businesses under a nuclear emergency.

Times and dates of key events:

The CNN (2011) has reported the series of events associated with the Tohoku earthquake and tsunami in the following order.

March 11, 2011: An earthquake precipitates crisis

- 2:46 pm: The westward moving Pacific Plate, an oceanic tectonic plate, lurches downwards beneath the North American plate caused the earthquake which has a magnitude of 9.1 in the Richter scale.

- 2:49 pm: Japan Meteorological Agency (JMA) issued a Major tsunami warning to the coasts of Iwate, Miyagi, and Fukushima prefectures with estimates of 3 m, 6 m, and 3 m, respectively. After the tsunami was observed at offshore tsunami buoys, JMA revised the contents of

the warning with estimates of 3 m, 6 m, over 10 m, 6 m, 4 m, and 4 m to the coasts of Aomori, Iwate, Miyagi, Fukushima, Ibaraki, and Chiba prefectures, respectively.

- 2:56 pm: Pacific Tsunami Warning Centre issues tsunami warning for the Pacific Ocean from Japan to the U.S. west coast (ITIC, 2011). Tsunami alerts sound in more than 50 countries and territories.

- Within an hour after the quake the first wave up to 30 feet high reached the Japanese coast.

- 3:27 pm: The first wave arrives at the Fukushima Daiichi Nuclear Power Plant in the form of a 13-foot-high wave, which is deflected by a sea wall built to withstand waves up to 33 feet high.

- 7:03 p.m.: Prime Minister Naoto Kan declares a nuclear emergency.

- 9:00 p.m.: The Japanese government issues evacuation orders for the several thousand residents living within a 1.9-mile (3 kilometre) radius of the powerplant.

March 12: Evacuation area expands.

- Shortly before 6 a.m.: Prime Minister Kan orders authorities to widen the evacuation zone to 6.2 miles (10 kilometres).

- Just before 6:30 p.m.: The evacuation area is expanded to a 12.4- mile (20 kilometre) radius.

March 14: Further explosions

- 11:01 a.m.: There's a hydrogen explosion at the Unit 3 reactor. 11 workers are injured, and the building's structure is severely damaged.

March 15

- 6:14 a.m.: A hydrogen explosion occurs at the Unit 2 reactor.

March 17

- The military begins using helicopters to dump seawater onto Unit 3, where radiation levels are at 17 millisieverts per hour.

March 20: Things start to stabilize.

- Temperatures stabilize at Units 5 and 6, bringing about the safe harbour of "cold shutdown" conditions. Electrical power is restored to Unit 2.

April 11

- A new earthquake, of magnitude 7.0, rocks eastern Japan. For 50 minutes, Fukushima loses power, preventing cooling water from reaching Units 1, 2, and 3.

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April 12: Atomic disaster declaration

- The International Atomic Energy Agency rates the Fukushima Crisis a disaster magnitude of 7, the highest of their scale.

February 2, 2012

- Nearly a year after the disaster, the village of Kawauchi—one of nine evacuated municipalities less than 20 kilometres from the plant—announces plans to reopen in the spring.

Nature of the disaster, the damage, and disruption caused, together with information concerning loss of life, casualties, and other associated impacts.

According to the Reconstruction Agency of Japan (2022) the number of confirmed deaths is 19,729 and more than 2,500 people are still reported missing and 6,233 are reported as injured. Less than an hour after the earthquake, the first of many tsunami waves hit Japan's coastline. The tsunami waves reached run-up heights of up to 128 feet (39 meters) at Miyako city and travelled inland as far as 6 miles (10 km) in Sendai (Cabinet_Office_Japan, 2011). The tsunami flooded an estimated area of approximately 217 square miles (561 square kilometres) in Japan, according to the National Oceanic and Atmospheric Administration. The waves overtopped and destroyed protective tsunami seawalls at several locations (Sato, 2015).

The *Report of the Japanese Government to the IAEA Ministerial Conference on Nuclear Safety - The Accident at TEPCO's Fukushima Nuclear Power Stations 2011*) mentioned that the tsunami caused a cooling system failure at the Fukushima Daiichi Nuclear Power Plant, which resulted in a level-7 nuclear meltdown and release of radioactive materials. The report further states that Fukushima was designed for a tsunami smaller than the one took place in 2011. Very low levels of radioactive chemicals that leaked from Fukushima have been detected along the North American coast offshore Canada and California (Estournel et al., 2012). Trace amounts of cesium-134 and cesium-137 (radioactive isotopes) were found in seawater collected in 2014 and 2015 (Hashimoto et al., 2022).

Early warning and preparedness measures

Japan Meteorological Agency (JMA, 2013) monitors seismic activity throughout Japan around the clock. According to the JMA, Japan had already developed sophisticated high-technology tsunami-warning systems that included satellite communications and hundreds of real time monitoring stations. However, on March 11 the community-level response (and community-based warnings) was the key that saved countless human lives (World_Bank, 2014). According to the JMA the residents of Tokyo received a minute of warning before the strong shaking hit the city, thanks to Japan's earthquake early warning system. The country's stringent seismic building codes and early warning system prevented many deaths from the earthquake, by stopping high-speed trains and factory assembly lines.

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Response and relief services

The total number of Japan Self-Defence Forces (JSDF) personnel in operation reached some 107,000 people with about 540 aircraft and nearly 60 vessels (World_Bank, 2014). According to the Japan Cabinet Office, the JSDF rescued approximately 19,000 disaster victims, or nearly 70 percent of those rescued in the Great East Japan Earthquake (GEJE) event. Similarly, there were several governmental and non-governmental organisations who provided transportation assistance to medical teams, patients, and rescue units dispatched from various countries, and livelihood assistance to disaster victims by providing water, food, and other necessities.

Impact on economy and global supply chain as the disaster unfolded.

The 2011 earthquake and tsunami were high-impact events with a low probability of occurrence. The Japan's Cabinet office has estimated the direct economic cost of the event at $360 billion. Considering the enormous damage from the tsunami and widespread geotechnical damage, the GEJE event can be identified as the costliest earthquake in world history (World_Bank, 2014). Japan identified the event as a highly complex phenomenon, the effects of which cascaded to sensitive facilities (Santiago-Fandiño et al., 2018). The effects of the accident at the Fukushima Daiichi nuclear power plant have compromised Japan's energy supply, imperilled its environment, and threatened public health. According to the World_Bank (2014) report, the direct damage to major Japanese industries rocketed through supply chains around the world. In the second quarter of 2011, Japan's GDP dipped 2.1 percent from the previous year, while industrial production and exports dropped even more sharply— by 7.0 percent and 8.0 percent, respectively. Japan experienced a trade deficit for the first time in 31 years (Sasaki & Yoshida, 2018). In the wake of the tsunami, businesses that relied on Japanese electronics and automotive parts faced disruptions and delays in production, distribution, and transportation.

Lessons learnt and recovery measures.

Certain improvements would have made the Japanese reaction even more effective. Following is the three key lessons identified in the post-disaster studies of GEJE (World_Bank, 2014).

- The studies have identified that collective and individual decision making in emergencies could be improved by spreading a better understanding of the nature and limitations of risk assessment among local authorities and the population at large.
- The coordination mechanism among various groups including governments (national, prefectural, and local), civil society organizations (CSOs), and private entities should be well established before launching DRM mechanisms.
- The DRM plans including disaster preparedness and post disaster response measures should assess and prioritise the challenges of the vulnerable groups including elderly, children, and women. Culturally sound solutions that take account of special needs among segments of the population should be planned to enhance resilience and facilitate recovery and reconstruction.

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Based the above key lessons six thematic clusters of knowledge notes have been identified to further improve DRM strategies in Japan. The six knowledge notes are as mentioned below.

1. Structural measures
2. Non-structural measures
3. Emergency response
4. Reconstruction planning
5. Hazard and risk information and decision making
6. Economics of disaster risk, risk management, and risk financing

WP2	Task 2.2: Natural and manmade disaster case study identification, research, and analysis

What were the public information sharing challenges?

The Great East Japan Earthquake resulted in profound damage and confusion to the communication system of the affected area (Yamamura et al., 2014). According to this study by Yamamura et al. (2014), during the acute phase after the Great East Japan Earthquake of 2011, medical teams mostly used mobile phones, laptop computers, and satellite phones to communicate. During the first 7 days after the disaster, the communications infrastructure was severely disabled, and it was difficult to use mobile and landline phones and computers with Internet service with the communication system.

In Japan, it is required that the multichannel access (MCA) radio system be used for hospital-to-hospital or hospital-to-local authority communications (Yamamura et al., 2014). However, the DMATs could not use MCA for their activities in the field during the disaster, and the system has limits on call times and locations where it can be used. While the national broadcaster, NHK, and others provided extensive coverage of the disaster, due to the scope of the emergency they were often unable to provide more localised information (Appleby, 2013). According to a post-disaster survey conducted by NHK in the Tohoku region, the broadcaster failed to provide sufficient information about supplies of food, water, gasoline, and electricity (Ritsu, 2013).

In the worst affected fishing towns, many internet servers were damaged and often even where the internet could still be accessed, many of those over 60 did not know how to (Rajib et al., 2012c). As a result, community radio stations were essential for survival and other information in these neighbourhoods. During the first fortnight of the disaster, when no other information source was available, the audience numbers for local

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radio stations peaked. According to a survey conducted by the Japan Commercial Broadcasters Association (Hidaka et al., 2022), radio was consistently ranked the most useful source of information from the day of the disaster right through until the end of the first week.

However, many community radio stations were already struggling to secure advertisers and had limited financial supports (Hidaka et al., 2022). According to Hidaka et al. (2022) the temporary emergency licence allowed stations to broadcast commercials to cover running costs, but on a non-profit basis. But due to the situation some stations such as H@! FM and Radio Ishinomaki - decided not to broadcast commercials for weeks. This resulted in zero revenue for them and others like them and strained the resources of already underfunded stations.

While Japan has developed the most sophisticated tsunami-warning system in the world, the system underestimated tsunami height on March 11 and may have misled the evacuees and increased human losses (World_Bank, 2014). Some local government offices received the initial 3-metre tsunami warning from JMA, but power cuts then prevented them from receiving subsequent warnings that the waves would be over 10 metres high. According to Okumura et al. (2021) the Japanese media were lacking in two main capabilities. First, they lacked the ability to assess, based on the limited information coming from the government and TEPCO, on what could be going on within the Fukushima reactors and how serious the risks of consequent radiation exposure could be. The other was their lack of preparedness to confront the government and TEPCO effectively, and to force them to disclose more information in a timely manner.

Although volunteer technical communities around the world responded to the Japanese disaster, it was a smaller international response than that to the 2010 earthquake in Haiti (Appleby, 2013). Partly this can be attributed to Japan's own ability to respond to domestic disasters. Where emergency services and support structures are available, affected communities turn directly to them rather than going online. If no services are immediately available, online resources may be the next option, provided the individuals seeking them have internet connectivity. The international volunteer technical communities' involvement may also have been limited by the language barrier, as much of the emergency related information was only released in Japanese.

Awareness of NGOs was comparatively low in Japan before the disaster. As a donor, rather than a recipient of aid, Japan's national disaster response plan did not consider the role of NGOs. Numerous national and international NGOs began relief operations to support the Japanese government, but the common perception was that they were "volunteer groups". This hindered their efforts in the early stages of the disaster.

What were the ethical issues?

In an urgent official statement issued April 28, 2011, the Japanese Society of Psychiatry and Neurology (JSPN) claimed that many unnecessary, overly burdensome, ethically questionable, and/or exploitative research projects – not only medical but also social and behavioural – had been conducted in the stricken areas immediately after the disaster (Matsui & Tashiro, 2014). Among them, the largest and most controversial was the

biobanking project, involving a genetic epidemiological study implemented by the Tohoku Medical Megabank Organization (ToMMo) at Tohoku University, one of Japan's elite universities. The ethical analysis of this project demonstrates that it still has many unresolved ethical problems in its design and its implementation of the just distribution of benefits. It may also unduly burden and/or potentially exploit a vulnerable population in crisis.

What lessons have been learned?

Assessing risks and communicating them clearly and widely helps citizens make timely decisions to protect themselves (World_Bank, 2012). The digital technology is providing new insights and information that can be shared around the world to help the vulnerable in future disasters and crises. The rise in the number of smart phones, mobile internet and access to social media is transforming the world in an unprecedented manner. As the experiences of Japan's survivors demonstrates the internet can play a crucial role in the aid effort during a natural disaster. However, the reality of the digital divide in these situations must not also be underestimated (Peary et al., 2012). Getting information to people on the side of the digital divide, where there is no internet, may help them survive in times of crisis and help communities rebuild after immediate danger has passed. Informal communication tools include local knowledge such as tendenko, practiced on the Sanriku coast, where self- evacuation without waiting for family members and others is encouraged as soon as a large ground shaking is felt. These types of approaches and local knowledge based on experiences with large tsunamis should be preserved and passed from generation to generation. Participatory DRM planning by the local community is an effective way of communicating risk. Different forms of communication may have to be used for different age groups. The local social structure can be leveraged to facilitate emergency planning, for example, by enlisting local leaders in their various roles and functions.

What were the cascading effects across events, sectors, and supply chain disruptions? Including the inevitability or unforeseen chain of events affecting the response to the disaster? What were the societal vulnerabilities in health and retail sectors?

Fukushima Daiichi Nuclear Power Station Four nuclear power stations comprising 14 units were located close to the epicentre of the March 11 earthquake (Hashimoto et al., 2022). The earthquake caused all operating units to shut down automatically. Large tsunamis hit all sites within an hour of the main shock, damaging several of them. The worst affected sites were Fukushima Daiichi and Fukushima Daini.

Existing countermeasures to address nuclear power accidents do not reflect a thorough understanding of the complexity of nuclear power station systems. The excuse that the event was "beyond assumption" is unacceptable.

The Great East Japan Earthquake and tsunami increased the risks of hydrometeorological disasters (Shaw et al., 2012a). The Great East Japan Earthquake (GEJE) caused extensive damage to coastal and river infrastructure and diminished the level of protection they provided against floods and storm surges, thereby increasing the risk of hydrometeorological disasters. The level of protection against storm surges and flooding was

significantly diminished in the Sendai Plain. The area below means sea level more than tripled (from 3 square kilometres [km2] to 16 km2) after the earthquake, as revealed in the MLIT's laser profiling survey. The MLIT produced subsidence maps and revised downward the water levels at which it issues flood warnings.

Fear of radiation

More than 80 percent of the population in Fukushima City fear radiation; according to a city government survey, that fear was growing even a year after the accident.

Because decontamination of radioactive areas takes a long time, at the end of 2011, the municipal governments of Namie, Okuma, Futaba, and Tomioka began planning "temporary towns," or migrant communities, for those ousted from their original municipalities. Municipal governments and public facilities as well as residents were relocated to these temporary towns.

Furthermore, water and power supply systems were damaged in most of the disaster-affected areas, and in some places were not restored even after one month.

Neither Tokyo Electric Power Company, the operator of the nuclear stations, nor the regulatory authorities had prepared for accidents as serious as those caused by the enormous tsunamis that followed the GEJE.

Given the magnitude of the disaster and the number of evacuees, most evacuation facilities lacked sufficient supplies of food, water, clothes, and blankets.

Local governments, whose facilities in some cases were wiped out by the disaster, had little experience working with other organizations on a large scale, and they received insufficient support from the central government in managing the new forms of cooperation. Consequently, coordination with international relief agencies and donors offering relief assistance was not properly carried out.

Although more than two years have passed, the people of Fukushima are still struggling with the effects of the nuclear accident that prompted a physical and mental health crisis for area residents (The, 2019). Many suffered the stress of sudden displacement and prolonged evacuation, fears over the possible health effects of continued exposure to low-level radiation, an exodus from the area, dissolving communities, and conflicts with host communities.

What was preparedness before and after the event with regards to prepositioning, training, framework contracts and supplier management.

Governmental strategies (e.g., multi-organisational planning and public private partnerships, early warning systems, contingency plans, evacuation routes, and public information dissemination, allocation of resources)

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Japan has a culture of preparedness, where training and evacuation drills are systematically practiced at the local and community levels and in schools and workplace (Nakaya et al., 2018). Kamaishi City has been conducting DRM education programs since 2005 in cooperation with Gunma University (Shaw et al., 2012b). The program engages the local community in preparing disaster risk maps and holds evacuation drills four times a year one joint drill with the elementary and junior high school and one annual drill with the local community.

In Kesennuma, students at the Hashikami Junior High School are taught DRM as part of the ESD program (Shaw et al., 2012b). The school served as an evacuation center for more than 1,500 people after the GEJE, which occurred just before graduation. Local governments conduct tsunami evacuation drills every year on days commemorating past large-scale tsunamis, and residents learn how to evacuate safely and quickly from their own houses to designated shelters.

Preparation for disasters caused by powerful hazards is a primary part of the knowledge imparted at school, especially through fire simulation exercises (Shaw et al., 2012b). This activity is mandatory since it figures in the Fire Service Act of July 24, 1948, as well as in the regulation implementing this law taken by the Cabinet on March 25, 1961, and the ministerial regulation for application of April 1, 1961 – the latter requiring a minimum frequency of two per year.

Many institutions – even all the public schools in some municipalities such as Kagoshima – also organize at least one earthquake simulation exercise every year, and the number can be as high as six for primary and secondary schools in Tokyo.

This also includes university level training. Hyogo University, in the prefecture devastated by the earthquake of 1995, has recently set up a program for training experts with the opening of postgraduate studies relating to resilience and governance following disasters.

In addition to some 100,000 training sessions carried out every year by voluntary disaster prevention organizations, prefectures and municipalities regularly organize exercises at the request of the Fire and Disaster Management Agency (Shaw et al., 2012b).

There are also many awareness centers which, like the Tokyo Rinkai Disaster Park, allow visitors to prepare to experience an extreme natural phenomenon such as a large earthquake as well as its catastrophic consequences, especially through survival trials.

In Osaka, the Tsunami and Storm Surge Disaster Prevention Station has a room projecting a 180° film that prepares spectators to experience a tsunami following an earthquake in the Nankai Trough, and a study room for acquiring the right knowledge and learning more about the actions to take to increase chances of survival.

After the GEJE, roads were recovered early on to secure an emergency transportation network (Koshimura & Shuto, 2015). The Tohoku Shinkansen (bullet train) resumed operations between Tokyo and Nasushiobara (the southern section) on March 15, and between Shinaomori and Morioka (the northern section) on March 22. By April 29, the entire Tohoku Shinkansen line was in operation, as were most of the other railways except

for those along the coast (Sagara & Ishiwatari, 2012). The Sendai Airport rehabilitation operation began two days after the earthquake, and by March 15, four days after the earthquake, the airport was being used by rescue and emergency supply rotorcraft. Although water supply services were resumed for about 90 percent of residents within one month of the disaster, the aftershocks on April 7 and 11 temporarily increased the number of households without water.

Regarding building relocation and reconstruction, disaster risk management (DRM) consists of three components (World_Bank, 2014): disaster prevention facilities, community relocation to safer ground, and evacuation facilities. This approach was reflected in the government's basic policy on reconstruction, after the GEJE Reconstruction Council's report recommended a shift in DRM from prevention to risk reduction.

Since the Sanriku region has often sustained severe tsunami damage, its local governments and communities have developed a high level of disaster preparedness (Rajib et al., 2012a). Local governments conduct tsunami evacuation drills every year on days commemorating past large-scale tsunamis, and residents learn how to evacuate safely and quickly from their own houses to designated shelters.

The Japanese government is reinforcing DRM systems by introducing land-use regulations based on lessons learned from the GEJE (Rajib et al., 2012b). The Act on Building Communities Resilient to Tsunami was legislated in December 2011 to prepare for low-probability, high-impact tsunamis. The goal of the act is to protect human lives at all costs.

Land use planning and building codes (Ex: Avoid settlement expansion towards hazard prone areas)

Non-structural measures

In the 1940s and 1950s Japan was repeatedly ravaged by typhoons and earthquakes. In particular, the Isewan Typhoon in 1959 caused tremendous damage; in 1961 the Disaster Countermeasures Basic Act was passed (Makoto, 2012). According to Makoto (2012) the Central Disaster Management Council was established to formulate the overall policy for DRM and to function as the national coordinating body for disaster management.

The Basic Disaster Management Plan is the master plan and the basis for DRM activities in Japan (Suganuma, 2006). It is prepared by the Central Disaster Management Council in accordance with the Disaster Countermeasures Basic Act. Major revisions to the plan included the addition of a new section on tsunami disaster management. Fundamental improvements in disaster management for tsunamis and earthquakes in the light of the GEJE:

- Requirements to prepare for low probability and large- scale earthquakes and tsunamis.
- More careful consideration of multi-hazard and multilocation disasters.

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- Mandatory inclusion of DRM in urban land use.
- Raising of public awareness about evacuation, DRM measures, and hazard maps.
- Additional investments nationwide for capacity building of each counter measure.
- More resources to be invested in understanding disaster risk and developing innovative systems for monitoring earthquakes and tsunamis.
- Communication tools such as tsunami early warning systems to be strengthened.
- Additional reinforcement and retrofitting of homes and buildings to reduce earthquake damage.

History of building codes in Japan

Due to its location and tectonic settings, Japan is prone to large earthquakes. The Great Kanto Earthquake in 1923 caused some of the most serious damage in Japanese history, as fires consumed a large part of Tokyo, killing more than 100,000 people. Based on the lessons learned from the disaster, a seismic design code was introduced in the building code of 1924, the first national seismic design code applied anywhere in the world (Aoyama, 1981). The importance of retrofitting buildings is demonstrated by the fact that buildings designed under the 1981 building code and retrofitted buildings performed well in the GEJE, whereas most of the damaged buildings were constructed before 1981 and had not undergone any retrofitting.

Critical infrastructure protection and structural design improvements

Structural measures

Structures such as dikes play a crucial role in preventing disasters by controlling tsunamis, floods, debris flows, landslides, and other natural phenomena (World_Bank, 2014). According to the World_Bank (2014) report when the tsunami hit eastern Japan in March 2011, 300 km of coastal dikes, some as high as 15 meters high, had been built. Prefectural governments, which have the main responsibility for building the dikes (supported by national subsidies that cover two-thirds of the cost), built 270 km of the total, with the national government building the remaining 30 km.

The national government also had developed technical standards, guidelines, and manuals for use in the design and construction of coastal structures (Ishiwatari & Sagara, 2012). In response to the economic damage caused by the Great East Japan Earthquake (GEJE)— ¥300 billion ($3.75 billion) in destroyed dikes— the government has invested several hundred billion yen in dike construction in the Iwate, Miyagi, and Fukushima prefectures. It has also invested ¥400 billion ($5 billion) in constructing bay mouth breakwaters in major ports, such as Kamaishi, Kuji, and Ofunato, to protect them from tsunamis.

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The disaster-affected region had frequently sustained devastating damage from tsunamis, including the Sanriku tsunamis of June 1896 and March 1933, and a tsunami caused by a massive earthquake off the coast of Chile in May 1960. The 1933 Showa Sanriku Tsunami was the first disaster to provoke modern tsunami countermeasures at the initiative of the central and prefectural governments. According to the report by Ishiwatari and Sagara (2012) certain breakwaters were also effective in mitigating damage from the tsunami. The breakwater at the mouth of Kamaishi Bay in Kamaishi City, Iwate, was completed in 2009, at a total cost of some ¥120 billion ($1.5 billion). It was the world's deepest breakwater. Although destroyed by the GEJE tsunami, the breakwater reduced the tsunami's force, and therefore its height, by about 40 percent and delayed its arrival by some six minutes, allowing more time for people to evacuate to higher ground.

The following multi-functional infrastructures have also being identified by Ishiwatari and Sagara (2012) as effective mitigatory measures.

- Expressways and roads mitigated damage resulting from the Great East Japan Earthquake (GEJE). The East Sendai Expressway, a 24.8-kilometer (km) toll road running through the Sendai Plain, about 4 km off the coast and at an elevation of 7 to 10 meters, acted as a secondary barrier or dike and prevented tsunamis from penetrating further inland (Figure 18).

- Roadside service stations, service areas, and parking areas along highways also helped in the disaster management effort, providing bases of operation for rescue teams and evacuation shelters for residents.

- When Iwaizumi Town in the Iwate Prefecture was severely hit by the massive tsunami, an evacuation stairway constructed at the Omoto Elementary School two years before saved the lives of 88 children.

After the GEJE, emergency measures were implemented to restore coastal dikes to prevent coastal flooding from storm surges. Emergency rehabilitation was first implemented along about 50 of the 190 km of damaged coastline. Those 50 km were selected because of the important facilities and properties in the area, or because of the urgency of restoring livelihoods, industrial activities, transportation, and agricultural activities.

Landscape and environmental arrangement around essential services and infrastructure

Japan is surrounded by 1,640 km2 of a forested green belt distributed along its sandy coast. For more than four centuries Japan has been developing this green belt composed mainly of Japanese black pine (Rajib et al., 2012a). Japan's Forest Law stipulates that disaster risk management (DRM) forests should be planted in coastal areas to prevent damages from wind, airborne sand, and tsunamis.

Resilience strategies including planning and partnership building between sectors.

Policies and regulations related to industrial development, industry competitiveness, industrial land use planning, and DRM collectively provide an enabling environment for key resilient industry solutions (Patel et al., 2017). The Cabinet Office, responsible for mainstreaming DRM in sectoral

policies and institutions; and the Ministry of Economy, Trade, and Industry (METI), responsible for policies and institutions for promoting industry competitiveness including SMEs, are key players in creating an enabling environment for resilient industry in Japan.

Support or coordinate disaster operations being conducted by a designated lead agency.

Tsunami warnings

During a powerful earthquake, the Japan Meteorological Agency's system consults its database containing nearly 100,000 simulations, chooses the closest result and quickly broadcasts a tsunami advisory (chūihō) for waves that might be between 20 cm and 1 m above normal sea level, or a tsunami warning (keihō) for waves that might be taller than 1 m (World_Bank, 2014).

"TSUNAMI TENDENKO"

This is a well-known saying in the Tohoku region. Roughly translated it means: "if a tsunami comes, run to safety, don't go to find others" (Appleby, 2013). This local wisdom is passed down through generations and is considered to have saved many lives. Still, during the Great East Japan Earthquake, there were several cases where people ignored this, going back to help elderly residents or family members evacuate.

In addition to the existing advisories and warning messages, the Japan Meteorological Agency set up an emergency warning system (tokubetsu keihō) on August 30, 2013, notably following the damage caused by the Ise Bay typhoon in 1959, the March 11, 2011, tsunami, and rain from the 12th typhoon of 2011 (Kodera et al., 2016).

Logistics mechanisms and essential supplies for health and relief services

Depending on the degree of the disaster, it is planned for local authorities and the government to respond by setting up disaster management centres (World_Bank, 2014). The police, firefighters or self-defence forces can reinforce the arrangement (Hasegawa, 2013). The immediate rescue and relief operations were conducted hand in hand by the fire fighters, volunteer fire corps, police, coast guard, and Self-Defence Forces to cope with the unexpected scale of the disaster (Cabinet Office 2011c, Japan Coast Guard 2012, Ministry of Defence 2011b, 2012, National Police Agency 2011). The fire fighters, volunteer fire corps, police, and coast guard in the damaged areas were in the forefront of rescue and relief operations, immediately after the first earthquake hit the areas. The Japan Self-Defence Forces (JSDF) also responded to the nuclear accident, engaging mainly in pumping water for cooling used fuel pools, decontaminating personnel and vehicles, and monitoring amounts of airborne radiation.

Following its experience with the Kobe earthquake, the Fire and Disaster Management Agency created fire response teams to mobilize firefighting departments across Japan (World_Bank, 2021). This study has identified that most fire departments in devastated areas had lost their radio equipment or base of communications. Considering this experience, the Fire and Disaster Management Agency decided to provide the teams with

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additional mobile communications equipment. Interperceptual emergency police rescue units and Disaster Medical Assistance Team (DMAT) have been set up in prefectures nationwide, based on the experience with the Kobe earthquake (World_Bank, 2021). In response to the GEJE, these rescue units conducted such activities as search and rescue and the securing of emergency transportation routes. The DMAT conducted emergency operations during the critical period, especially within 48 hours of the event. The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) established the Technical Emergency Control Force (TEC FORCE) in 2008 (World_Bank, 2021). The TEC- FORCE is a specialized group made up of ministry staff that helps disaster- affected municipalities to quickly assess damages, identify measures to prevent additional damage, and provide technical assistance for rehabilitation and emergency response activities. Japanese Red Cross Society (JRCS) is designated as a public relief organization under disaster response law and is the biggest humanitarian organization in Japan (IFRC, 2018). Domestic nongovernmental organizations (NGOs) and non-profit organizations (NPOs) have played a significant role in carrying out disaster management activities (World_Bank, 2014). As of January 20, 2012, there were 712 organizations participating in the Japan Civil Network for Disaster Relief in East Japan.

Please provide a list with links of data sources used in the following categories

Government/Official reports	*White Paper on Disaster Management 2011 - Executive Summary (Cabinet_Office_Japan, 2011)* *https://reliefweb.int/report/japan/white-paper-disaster-management-2011-executive-summary*
NGO reports	*Connecting the last mile, The role of communications in the great east Japan earthquake (Appleby, 2013)* *https://internews.org/wp-content/uploads/legacy/InternewsEurope Report Japan Connecting the last mile Japan 2013.pdf*
Community interviews/reports	*Interviews with survivors of Tohoku earthquake provide insights into fatality rate (Ando et al., 2011)* *https://doi.org/10.1029/2011EO460005*
Eyewitness/first-hand accounts	*Japan earthquake eyewitness interview (CBS, 2011)* *https://www.youtube.com/watch?v=I5L94vGwMNM*
News/media reports	*On This Day: 2011 Tohoku Earthquake and Tsunami ((NCEI), 2021)* *https://www.ncei.noaa.gov/news/day-2011-japan-earthquake-and-tsunami*

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Documentaries	*Watch: 3 documentaries on the 2011 Tohoku earthquake and tsunami (Time-out-Plc, 2021)* *https://www.timeout.com/tokyo/film/watch-documentaries-on-the-2011-tohoku-earthquake-and-tsunami*
Social Media	*Social media usage during disasters and social capital: Twitter and the great East Japan earthquake (Kaigo, 2012)* *https://www.mediacom.keio.ac.jp/publication/pdf2012/KCR34_02KAIGO.pdf*
Satellite/other aerial imagery	*Space-based response to the 2011 Great East Japan Earthquake: Lessons learnt from JAXA's support using earth observation satellites (Kaku et al., 2015)* *http://dx.doi.org/10.1016/j.ijdr.2014.12.009*
Academic Papers/Reports (Peer Reviewed)	*Enhancing Community Resilience Through Capacity Development After GEJE: The Case of Sendaishi-chiiki Bousai Leaders (SBLs) in Miyagi Prefecture (Sakurai & Sato, 2018)* *https://doi.org/10.1007/978-3-319-58691-5_7*
Academic Papers/Reports (Non-Peer Reviewed)	*Tsunami source uncertainty estimation: The 2011 Japan tsunami (Dettmer et al., 2016)* *https://doi.org/10.1002/2015JB012764*
Public Enquiry Reports/Findings	*Public inquiries in Japan: Inquiries into the Fukushima nuclear disaster from a UK law perspective (Horasawa, 2019)* *https://ukaji.org/2019/09/12/public-inquiries-in-japan-inquiries-into-the-fukushima-nuclear-disaster-from-a-uk-law-perspective/*
Journal/Magazine articles	*Powerful Quake and Tsunami Devastate Northern Japan (Fackler, 2011)* *https://www.nytimes.com/2011/03/12/world/asia/12japan.html*
Online podcasts, blogs, forums & chat rooms	*What Happened Next: The Japanese Tsunami, 2011 (Compass, 2017)* *https://www.bbc.co.uk/sounds/play/w3cswd3b*
Official policy recommendations & findings	*The official report of The Fukushima Nuclear Accident Independent Investigation Commission - Executive summary (Japan, 2012)*

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Other (Please specify)	*https://www.nirs.org/wp-content/uploads/fukushima/naiic_report.pdf*
WP2	Task 2.3: Natural and manmade case study study social media analysi	*No other materials*

What was the role, influence, and impact of social media communications during this incident?

During the 2011 East Japan Earthquake and Tsunami, newly popular social media such as Twitter and Facebook served as a lifeline for directly affected individuals, a means of information sharing, and a way for people inside and outside Japan to volunteer and to provide information-based support to affected individuals (Watanabe et al., 2021). Social media was used to perform vital relief functions such as safety identification, displaced persons locating, damage information provision, support for disabled individuals, volunteer organization, fund-raising, and moral support systems. During the 2011 East Japan Earthquake and Tsunami, newly popular social media such as Twitter and Facebook acted as a lifeline for directly affected individuals, a means of information sharing, and a way for people inside and outside Japan to volunteer and to provide information-based support to those affected individuals (Peary et al., 2012). Following is some of the dominant social media platforms which were actively functioning during the 2011 GEJE and tsunami.

- Twitter – Popular in Japan. Highly public. Concise and fast information is easily shareable, and user driven. High level of anonymity. One-way relationships possible. Character amount limits. Had problems with rumours.
- Facebook - Popular amongst foreign community. Less public. Not so popular in Japan. Low level of anonymity. More likely to have personal friends. Resending shared information not always straight forward. It has groups and is good for group networking.
- Mixi - Popular in Japan. Japanese language only. Sharing information is less fluid. New group creation related to the disaster was locked to centralize info. Directed users to Google Person Finder.
- Email - Popular in Japan. Japanese language only. Sharing information is less fluid. New group creation related to the disaster was locked to centralize info. Directed users to Google Person Finder.
- SMS - Cell phone based. At the time in Japan, not for cross-network use so use was minimal. Used widely outside Japan to collect donations. Highly valuable in disasters in general. Character amount limits.
- Wikis – Crowd-sourced. Information rich. Accessible by even low-level users. Collaboration usually is by higher level users. Commonly used as Info list. Innovative.

- Blogs - Commonly used. Common for info lists, but usually created by one person, differing from wikis. Information shared in social media links to them.

- Smartphone applications - Must have smartphone to utilize. Offers GPS functionality. Mobile. High flexibility. Not commonly used by lower-level users.

- Maps - When aggregating other information, easily useable to understand a complex situation using crisis-mapping. Requires a computer to use easily. Usable on smartphones but somewhat difficult.

With approximately 35 million account holders in Japan, Twitter is the most popular social networking site in that country. This makes Japan the third largest Twitter user in the world behind the USA and Brazil. Official statistics show that the number of Twitter messages grew exponentially during the earthquake (World_Bank, 2012).

	Average before earthquake	After 2.46pm, March 11, 2011
Tweets-per minute in Japan	3000	11000
Direct messages per minute from Japan to world	200	1000

What patterns of interactions between opinion makers and recurring topics in the Twitter debate following the disaster have been identified?

In a 2011 report on how Twitter was used, researcher Akihito Kobayashi points out that collaboration was key as Twitter use grew during the Great East Japan Earthquake (Appleby, 2013). For instance, a Twitter hash tag - #j-jhelpme - created at 16:03 on March 11 by a user in southern Japan became a focal point for requests for assistance and was quickly re-tweeted.

Many media outlets, at national, regional, and local level, used Twitter (Peary et al., 2012). One of the main regional newspapers in the disaster affected region, Kahoku Shimpo in Sendai, used Twitter to update residents while they were unable to print (Appleby, 2013). According to Appleby (2013) various public bodies including the government, their ministries and local municipalities also used Twitter to circulate information and updates. The report further states the use of twitter account in official communication as mentioned below.

- Four days after the earthquake the Japanese government set up its first ever twitter account - @Kantei_Saigai which means Prime Minister's office, Disaster - and within days it was being followed by 200,000 users. The account's most re-tweeted message in the weeks

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after the disaster was the Chief Cabinet Secretary's announcement on March 15, 2011: "There is a severe shortage of gasoline, fuel and oil in the disaster affected areas, but supplies are stable in the rest of the country. Please refrain from panic buying or hoarding supplies." (Translated from the Japanese).

- Six days after the disaster the Tokyo Electric Power Company, the owner of the crippled Fukushima nuclear power plant, also set up a Twitter account – @OfficialTEPCO – this got over 117,000 followers within the first six hours. The move was not without controversy especially as the Japanese public had begun to distrust official announcements from TEPCO and the government about the risks of radiation at the reactor.

However, the ever-changing advice about evacuation zones, public health guidance and the overall lack of information led to accusations that the government and the power company were withholding information (Appleby, 2013). Meanwhile Twitter was allowing users to access information from various sources and engage in discussions and debates with others online, whether they knew them personally or not (Cho et al., 2013). By using the disaster-related hash tags, users could take part in a global discussion, in real-time. According to the J Government platform, there are now over 104 official twitter accounts run by national and local governmental bodies as well as other independent public authorities.

Please provide a list with links of data sources used in the following categories

Government/Official reports	*White Paper on Disaster Management 2011 - Executive Summary (Cabinet_Office_Japan, 2011)* *https://reliefweb.int/report/japan/white-paper-disaster-management-2011-executive-summary*
NGO reports	*Connecting the last mile, The role of communications in the great east Japan earthquake (Appleby, 2013)* *https://internews.org/wp-content/uploads/legacy/InternewsEurope_Report_Japan_Connecting_the_last_mile_Japan_2013.pdf*
Community interviews/reports	*Interviews with survivors of Tohoku earthquake provide insights into fatality rate (Ando et al., 2011)* *https://doi.org/10.1029/2011EO460005*
Eyewitness/first-hand accounts	*Japan earthquake eyewitness interview (CBS, 2011)* *https://www.youtube.com/watch?v=I5L94vGwMNM*
News/media reports	*On This Day: 2011 Tohoku Earthquake and Tsunami ((NCEI), 2021)*

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Documentaries	*https://www.ncei.noaa.gov/news/day-2011-japan-earthquake-and-tsunami* *Watch: 3 documentaries on the 2011 Tohoku earthquake and tsunami (Time-out-Plc, 2021)* *https://www.timeout.com/tokyo/film/watch-documentaries-on-the-2011-tohoku-earthquake-and-tsunami*
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Satellite/other imagery	*Space-based response to the 2011 Great East Japan Earthquake: Lessons learnt from JAXA's support using earth observation satellites (Kaku et al., 2015)* *http://dx.doi.org/10.1016/j.ijdrr.2014.12.009*
Academic Papers/Reports (Peer Reviewed)	*Enhancing Community Resilience Through Capacity Development After GEJE: The Case of Sendaishi-chiiki Bousai Leaders (SBLs) in Miyagi Prefecture (Sakurai & Sato, 2018)* *https://doi.org/10.1007/978-3-319-58691-5_7*
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Journal/Magazine articles	*Powerful Quake and Tsunami Devastate Northern Japan (Fackler, 2011)* *https://www.nytimes.com/2011/03/12/world/asia/12japan.html*
Online podcasts, blogs, forums & chat rooms	*What Happened Next: The Japanese Tsunami, 2011 (Compass, 2017)* *https://www.bbc.co.uk/sounds/play/w3cswd3b*

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Official policy recommendations & findings	The official report of The Fukushima Nuclear Accident Independent Investigation Commission - Executive summary (Japan, 2012) *https://www.nirs.org/wp-content/uploads/fukushima/naiic_report.pdf*
Other (Please specify)	No other materials
WP2	**Task 2.4: Natural and manmade case study aerial imagery analysis**

What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform decision-making?

As Japan copes with the aftermath of the earthquake and tsunami, earth reconnaissance satellites and aerial reconnaissance aircraft and unmanned vehicles are deployed to the area to assist emergency operations with real time situational assessment and efficient response to the events of the highest priority (Kaku et al., 2015). Aerial manned and unmanned Intelligence Surveillance and Reconnaissance (ISR) systems dispatched to the area in support of the relief operations include the U-2 high-altitude, all-weather surveillance and reconnaissance aircraft from the Reconnaissance Squadron and RQ-4 Global Hawk remotely piloted aircraft from the Operations Group's Detachment at Andersen Air Force Base, Guam (Eshel, 2011). U-2 has been deployed to capture high-resolution, broad-area synoptic imagery, by using an optical bar camera producing traditional film products which are developed and analysed after landing (Griffin, 2014).

A Tsunami sediments study has been carried out by the British Geological Survey (BGS) using high-resolution satellite imagery from before and after the tsunami, combined with the state-of-the-art digital mapping system (BGS•SIGMAmobile) and traditional field mapping expertise (Tappin, 2011). The findings of the study have the potential to improve the ability to discriminate between high-energy sediments in the geological record that were laid down by tsunami and those laid by storms. This can help scientists to better understand older earthquake events, including their magnitude and frequency.

As part of the International Charter for Space and Major Disasters, the United States Geological Survey (USGS) coordinated a volunteer effort comprised of ten organizations to aid in the response to the disaster (Messinger et al., 2011). This study was aimed to assist the Japanese government with printable, large-format maps of the affected areas that highlighted regions of destruction and, where possible, the 'inundation line' (i.e., the extent the tsunami moved inshore). Where available before and after imagery were used to provide visual change-pairs for additional context for the relief workers. Space-based Worldview-2 sensor (DigitalGlobe) 3 was used to collect images in eight spectral bands from

the visible to the near infrared (NIR). Pre-earthquake images were obtained from (January 16, 2011) Worldview-2 multispectral images for Hachinohe, the lesser damaged of the two sites. Post-earthquake images were obtained on March 14, 2011. A large-area map was produced using the NIR band to highlight vegetation and water-affected areas. A series of NIR image-derived maps were produced covering Kesennuma using Worldview-2 imagery on March 13, 2011, two days after the earthquake. In this case, the damage was extensive and ranged further inland. Flooded areas were still visible, particularly in the NIR bands. A post-earthquake GeoEye4 panchromatic image of Kesennuma was used to accurately identify the spatial features. Visual inspection was used to delineate the extent of the debris field. Several map layers were produced displaying the large-area image with the debris field extent identified as well as a close-up image of the region of interest. To aid in the damage assessment at the Fukushima Dai'ichi Nuclear Power Station, Worldview-2 high-resolution panchromatic images were used from March 12, 2011, after the earthquake and tsunami, but before the explosions at the power station. A second Worldview-2 image over the area was collected on March 17, 2011, after three of the reactor buildings had suffered damage. The before and after images were combined into a high-resolution map and distributed to relief workers on the evening of March 18, 2011, within 24h of image collection. On March 19, 2011, a GeoEye panchromatic image was used to produce an image pair showing the nuclear plant from both perspectives, providing better context for the extent of the damage to the facility.

The 2011 events at the Fukushima Daiichi Nuclear Power Plant (FDNPP) released considerable quantities of highly radioactive material into the global environment. The University of Bristol launched a study in direct response to the incident at Fukushima, is the combined low-altitude multi-rotor unmanned aerial vehicle coupled with a lightweight radiation detection and mapping system (Martin, 2016). Via this system, it was possible to determine the spread of contamination with sub-meter resolution as well as attributing the species responsible. The results were used to determine the distribution of such contamination not only in response to disaster-release scenarios but also for the potential application to wider monitoring following a nuclear dispersion incident.

Taiwan's National Space Organization (NSPO) of the National Applied Research Laboratories (NARLabs) used FOR-MOSAT-2, and Thailand's Geo-Informatics and Space Technology Development Agency (GISTDA) used THEOS, to survey the coast on 12 March (Kaku et al., 2015). The Indian Space Research Organisation (ISRO) also observed the Sendai area using CARTOSAT-2 on 14 March, in addition to FORMOSAT-2. FORMOSAT-2 is unique because it follows the same orbit every day and continued to monitor affected zones every day. The result of these studies was used in following response activities.

1. Satellite images overlaid on maps to search for and rescue missing persons.
2. To show areas flooded by the tsunami and the situation of houses and buildings.

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3. Value-added results (analysed by specialists) for evaluating the overall scenario and detecting debris, landslides, and collapsed houses and buildings.

Information from images on places where 'no damage' has occurred is also valuable to assess availability of access roads.

What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform the sharing of public information?

Big data visualization technology can help enhance the resilience of industries with complex, diverse, and vast supply chains (Koshimura, 2016). Supply chain mapping and visualization using big data and the IoT could be a valuable tool for understanding supply chain vulnerability as well as informing decisions and actions on risk mitigation, quick recovery, and enhancing industry competitiveness.

Technology tools such as RESAS and LEDIX can provide beneficial information for disaster-preparedness policy making (World_Bank, 2020). By helping users to understand disaster risk in the context of interconnected business activities, technology tools can aid in the design of policies that engage various stakeholders to collaborate in designing and implementing solutions for resilient industry. OpenStreetMap volunteers also created a map with 500,000 roads that was shared on the National Research Institute for Earth Science and Disaster Prevention's website. Local volunteers donate their time to trace satellite images made available for the purpose (World_Bank, 2014). Aerial photographs were used in an innovative way to determine compensation payments from local governments and pay-outs of earthquake insurance.

Please provide a list with links of data sources used in the following categories

Government/Official reports	*White Paper on Disaster Management 2011 - Executive Summary (Cabinet_Office_Japan, 2011)* https://reliefweb.int/report/japan/white-paper-disaster-management-2011-executive-summary
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Community interviews/reports	*Interviews with survivors of Tohoku earthquake provide insights into fatality rate (Ando et al., 2011)* https://doi.org/10.1029/2011EO460005

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Eyewitness/first-hand accounts	*Japan earthquake eyewitness interview (CBS, 2011)* *https://www.youtube.com/watch?v=I5L94vGwMNM*
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Online podcasts, blogs, forums & chat rooms	*What Happened Next: The Japanese Tsunami, 2011 (Compass, 2017)* *https://www.bbc.co.uk/sounds/play/w3cswd3b*
Official policy recommendations & findings	*The official report of The Fukushima Nuclear Accident Independent Investigation Commission - Executive summary (Japan, 2012)* *https://www.niirs.org/wp-content/uploads/fukushima/naiic_report.pdf*
Other (Please specify)	*No other materials*

WP3	**Task 3.1 - Critical analysis of past disasters via the identified case studies on their disaster preparedness strategies**
Type of data	**Data/ information/ sources/ reference material**
3.1.1	**Type of hazards – Understanding the disaster risk**
a.	What type of hazards were commonly identified in the region (Slow-onset and rapid onset hazards)?	Japan's exposure to disaster risks is one of the highest in the world (Vink & Takeuchi, 2013). World_Bank (2020) report provides an overview of major disasters and disaster risk management measures in Japan between 1995 and 2018. Accordingly, urban, and industrial centres in the Tokyo and Nankai regions (which include Wakayama, Osaka, and Kochi prefectures) face a 70–80 percent chance of large-scale earthquakes within the next 30 years, including the Nankai Trough Earthquake (M8 or more) and the Tokyo Inland Earthquake (M7 or more). Future massive storm surges and large-scale river floods are expected to cause devastating impacts to the large metropolises of Tokyo, Osaka, and Nagoya, which are also key manufacturing hubs (Tanaka et al., 2021). Since June 2017, the Japan Meteorological Agency counts 111 active volcanoes in the territory (Heimburger, 2018). According to Heimburger (2018) 101 are terrestrial and 10 are submarine. It should be noted that 11 of the volcanoes on this list are in the northeast of the large northern island of Hokkaido, in the area claimed by Japan but administered by Russia.
b.	What hazards have resulted in disasters during the past 20 years?	Great east Japan earthquake and tsunami 2011 The tsunami had reached 8 to 10 km or more off the coastline towards inland around Kitakami River and Old Kitakami River in Ishinomaki City (Nakajima & Koarai, 2011). The survey reported by Mori et al. (2011) states that in low-lying regions such as the Sendai Plain, the height reached by tsunami decreases as the distance becomes greater off the coastline, which is something to consider when

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		designing regional plans with a consideration of the elevation. In the northern part of Miyagi Prefecture, which is a ria coast, the tendency varies with each gulf. For instance, the shore of Kesennuma Gulf (with the mouth of the bay facing south, the gulf is shaped narrow from north to south) does not seem to differ from the low-lying regions such as the Sendai Plain. On the contrary, at locations such as the shore of Shizugawa Gulf (with the mouth of the bay facing east, the gulf is horn-shaped) in Minamisanriku Town, there is a tendency for the elevation to increase as the distance becomes greater off the coastline (Sato, 2015).
c.	What risk assessment mechanism(s) were used by the relevant institutions for encompassing risk awareness, multi-hazard analysis, vulnerability/capacity analysis and cascading effects?	In Japan, the responsibility for risk assessment rests with government agencies at multiple levels (Cabinet_Office_Japan, 2011). Implementing agencies at the national, prefectural, and municipal levels normally conduct risk assessment to inform their planning and the design of preventive measures.
d.	What risk modelling and scenarios have been carried out to consider disaster risk and/or any other future threats and cascading effects?	In Japan, countermeasures against earthquakes and tsunamis have been based on the risks associated with five large earthquakes that have occurred over the past several hundred years (World_Bank, 2014). Hazard maps are prepared and made available for various hazards such as earthquakes, tsunamis, floods, landslides, liquefaction, and volcanic eruption.
e.	How the knowledge of indigenous communities and information in social media had been captured for disaster risk perception?	Recent experiences from the Great East Japan Earthquake (GEJE) showed that when the local community was involved in planning for disaster preparedness, and people took ownership of their own safety plans, they were better prepared and better able to take the necessary actions to protect themselves (Edgington, 2022).

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		In Aneyoshi District, Miyako City, Iwate Prefecture, villagers who followed the practices of their ancestors survived and saved their properties from the tsunami (Suppasri et al., 2013). A stone monument, set up after the 1933 Showa Sanriku Tsunami, is 60 meters above sea level—20 meters higher than the level of the 1933 tsunami. Communities in the Sanriku region have built 150 monuments to raise public awareness among future generations. According to the World_Bank (2014) report, community- based DRM activities are well integrated in the daily lives of the residents, ensuring that awareness of natural hazards is maintained, for example, by marking the anniversary of a large catastrophe with disaster drills, and linking awareness raising activities with local festivals.
3.1.2	**Disaster resilience and preparedness strategies**	
a.	What were the available national and local disaster management plans and systems under following categories?	
	1. Individual-level activities (e.g., first aid training and response)	https://link.springer.com/content/pdf/10.1007/s10726-012-9320-8.pdf?pdf=button
	2. Household actions (e.g., stockpiling of equipment and supplies, retrofitting)	https://www.scirp.org/html/3-1590239_46101.htm Towards a people-centred housing recovery after the triple disaster (Bacon & Hobson, 2014).
	3. Community efforts (e.g., socially responsible mitigation, training, and awareness campaigns for first respondents and	Community action is essential to maintaining the coastal green belt (Rajib et al., 2012a). Local communities had historically developed and maintained the green belt to protect their houses and agricultural lands from coastal hazards.

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	responders, and field exercises)	
4. Governmental strategies (e.g., multi-organisational planning and public private partnerships, early warning systems, contingency plans, evacuation routes, and information dissemination, allocation of public resources)		Regarding building relocation and reconstruction, disaster risk management (DRM) consists of three components (World_Bank, 2014): disaster prevention facilities, community relocation to safer ground, and evacuation facilities. This approach was reflected in the government's basic policy on reconstruction, after the GEJE Reconstruction Council's report recommended a shift in DRM from prevention to risk reduction.
		Since the Sanriku region has often sustained severe tsunami damage, its local governments and communities have developed a high level of disaster preparedness (Rajib et al., 2012a). Local governments conduct tsunami evacuation drills every year on days commemorating past large-scale tsunamis, and residents learn how to evacuate safely and quickly from their own houses to designated shelters.
		The Japanese government is reinforcing DRM systems by introducing land-use regulations based on lessons learned from the GEJE (Rajib et al., 2012b). The Act on Building Communities Resilient to Tsunami was legislated in December 2011 to prepare for low-probability, high-impact tsunamis. The goal of the act is to protect human lives at all costs.
b. What provisions were in place for research, education, science, and technology (ex: geospatial, remote sensing) for informed disaster preparedness?		A local disaster management plan provides the provisions for development or improvement of DRM facilities, investigation and research, education, drills and other preventive measures, collection, and dissemination of information, issuing and disseminating of forecasts and warnings, evacuation, firefighting, flood fighting, rescue, hygiene, and other emergency measures and rehabilitation efforts.
c. What special provisions were undertaken to ensure pandemic preparedness in		After the 2011 earthquake, medical care providers (MCPs) considered the possible spread of gastroenteritis, diarrhea, and other illnesses (Daito et al., 2013) caused by contaminated drinking water and food (McCurry, 2011). The gastroenteritis occurred sporadically, not epidemically, at the stricken areas during acute and subacute stages after the disaster (Takahashi et al., 2012). In June

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	disaster preparedness measures?	2011, food poisoning caused by Clostridium perfringens occurred through the food provisions of support staff living outside the stricken areas (Takahashi et al., 2012). Volunteers attempted to undertake maximum precautions against food contamination. In April 2010, 10 members formed a study group on guidelines for first steps and emergency triage to manage elderly evacuees of natural disasters. Two types of guidelines were established (Takahashi et al., 2012): one for MCPs and another for non-MCPs (NMCPs) (the latter including, for example, volunteers, helpers, and family members taking care of elderly relatives), public health nurses (PHNs), or certified social workers (CSWs). The guidelines had three chapters as follows: (1) features and prevention of critical diseases in the elderly in evacuation areas; (2) signs of acute diseases in the elderly; and (3) symptoms of anxiety in the elderly at shelters. After the 2011 earthquake, 20,000 guideline booklets were sent by members of the JGS and the Japan Medical Association Team (JMAT) to NMCPs, PHNs and CSWs working in Iwate, Miyagi, and Fukushima. The Tohoku Regional Infection Control Network acted functionally and collaboratively on the activities at the shelters and hospitals at the stricken areas (Kanamori et al., 2011). This network had four main activities: (1) infectious disease consultation; (2) infection control educational programs and training; (3) infection control interventions; and (4) regional cooperation with local government against infectious diseases.
3.1.3	**Mitigation**	
a.	**What policies and legislation were available that mainstreamed DRR in the national planning policy?**	
	• Land use planning and building codes (Ex: Avoid settlement expansion towards hazard prone areas)	Non-structural measures In the 1940s and 1950s Japan was repeatedly ravaged by typhoons and earthquakes. In particular, the Isewan Typhoon in 1959 caused tremendous damage; in 1961 the Disaster Countermeasures Basic Act was passed (Makoto, 2012). According to Makoto (2012) the Central Disaster Management Council was established to formulate the overall policy for DRM and to function as the national coordinating body for disaster management.

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The Basic Disaster Management Plan is the master plan and the basis for DRM activities in Japan (Suganuma, 2006). It is prepared by the Central Disaster Management Council in accordance with the Disaster Countermeasures Basic Act. Major revisions to the plan included the addition of a new section on tsunami disaster management. Fundamental improvements in disaster management for tsunamis and earthquakes in the light of the GEJE:

- Requirements to prepare for low probability and large- scale earthquakes and tsunamis.
- More careful consideration of multi-hazard and multilocation disasters.
- Mandatory inclusion of DRM in urban land use.
- Raising of public awareness about evacuation, DRM measures, and hazard maps.
- Additional investments nationwide for capacity building of each counter measure.
- More resources to be invested in understanding disaster risk and developing innovative systems for monitoring earthquakes and tsunamis.
- Communication tools such as tsunami early warning systems to be strengthened.
- Additional reinforcement and retrofitting of homes and buildings to reduce earthquake damage.

History of building codes in Japan

Due to its location and tectonic settings, Japan is prone to large earthquakes. The Great Kanto Earthquake in 1923 caused some of the most serious damage in Japanese history, as fires consumed a large part of Tokyo, killing more than 100,000 people. Based on the lessons learned from the disaster, a seismic design code was introduced in the building code of 1924, the first national seismic design code applied anywhere in the world (Aoyama, 1981). The importance of retrofitting buildings is demonstrated by the fact that buildings designed under the 1981 building code and retrofitted buildings performed well in the GEJE, whereas most of the damaged buildings were constructed before 1981 and had not undergone any retrofitting.

• Critical infrastructure	Structural measures

protection and structural design improvements	Structures such as dikes play a crucial role in preventing disasters by controlling tsunamis, floods, debris flows, landslides, and other natural phenomena (World_Bank, 2014). According to the World_Bank (2014) report when the tsunami hit eastern Japan in March 2011, 300 km of coastal dikes, some as high as 15 meters high, had been built. Prefectural governments, which have the main responsibility for building the dikes (supported by national subsidies that cover two-thirds of the cost), built 270 km of the total, with the national government building the remaining 30 km.
	The national government also had developed technical standards, guidelines, and manuals for use in the design and construction of coastal structures (Ishiwatari & Sagara, 2012). In response to the economic damage caused by the Great East Japan Earthquake (GEJE)— ¥300 billion ($3.75 billion) in destroyed dikes— the government has invested several hundred billion yen in dike construction in the Iwate, Miyagi, and Fukushima prefectures. It has also invested ¥400 billion ($5 billion) in constructing bay mouth breakwaters in major ports, such as Kamaishi, Kuji, and Ofunato, to protect them from tsunamis.
	The disaster- affected region had frequently sustained devastating damage from tsunamis, including the Sanriku tsunamis of June 1896 and March 1933, and a tsunami caused by a massive earthquake off the coast of Chile in May 1960. The 1933 Showa Sanriku Tsunami was the first disaster to provoke modern tsunami countermeasures at the initiative of the central and prefectural governments. According to the report by Ishiwatari and Sagara (2012) certain breakwaters were also effective in mitigating damage from the tsunami. The breakwater at the mouth of Kamaishi Bay in Kamaishi City, Iwate, was completed in 2009, at a total cost of some ¥120 billion ($1.5 billion). It was the world's deepest breakwater. Although destroyed by the GEJE tsunami, the breakwater reduced the tsunami's force, and therefore its height, by about 40 percent and delayed its arrival by some six minutes, allowing more time for people to evacuate to higher ground.
	The following multi-functional infrastructures have also being identified by Ishiwatari and Sagara (2012) as effective mitigatory measures.

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	- Expressways and roads mitigated damage resulting from the Great East Japan Earthquake (GEJE). The East Sendai Expressway, a 24.8-kilometer (km) toll road running through the Sendai Plain, about 4 km off the coast and at an elevation of 7 to 10 meters, acted as a secondary barrier or dike and prevented tsunamis from penetrating further inland (Figure 18). - Roadside service stations, service areas, and parking areas along highways also helped in the disaster management effort, providing bases of operation for rescue teams and evacuation shelters for residents. - When Iwaizumi Town in the Iwate Prefecture was severely hit by the massive tsunami, an evacuation stairway constructed at the Omoto Elementary School two years before saved the lives of 88 children.
• Landscape and environmental arrangement around essential services and infrastructure	After the GEJE, emergency measures were implemented to restore coastal dikes to prevent coastal flooding from storm surges. Emergency rehabilitation was first implemented along about 50 of the 190 km of damaged coastline. Those 50 km were selected because of the important facilities and properties in the area, or because of the urgency of restoring livelihoods, industrial activities, transportation, and agricultural activities. Japan is surrounded by 1,640 km2 of a forested green belt distributed along its sandy coast. For more than four centuries Japan has been developing this green belt composed mainly of Japanese black pine (Rajib et al., 2012a). Japan's Forest Law stipulates that disaster risk management (DRM) forests should be planted in coastal areas to prevent damages from wind, airborne sand, and tsunamis.
• Resilience strategies including planning and partnership building between sectors	Policies and regulations related to industrial development, industry competitiveness, industrial land use planning, and DRM collectively provide an enabling environment for key resilient industry solutions (Patel et al., 2017). The Cabinet Office, responsible for mainstreaming DRM in sectoral policies and institutions; and the Ministry of Economy, Trade, and Industry (METI), responsible for policies and institutions for promoting industry competitiveness including SMEs, are key players in creating an enabling environment for resilient industry in Japan.

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3.1.4	Response
a.	What were the available surveillance, early warning, and information management systems for activating response response operations under the following conditions?

• Support or coordinate disaster operations being conducted by a designated lead agency

Tsunami warnings

During a powerful earthquake, the Japan Meteorological Agency's system consults its database containing nearly 100,000 simulations, chooses the closest result and quickly broadcasts a tsunami advisory (chūihō) for waves that might be between 20 cm and 1 m above normal sea level, or a tsunami warning (keihō) for waves that might be taller than 1 m (World_Bank, 2014).

"TSUNAMI TENDENKO"

This is a well-known saying in the Tohoku region. Roughly translated it means: "if a tsunami comes, run to safety, don't go to find others" (Appleby, 2013). This local wisdom is passed down through generations and is considered to have saved many lives. Still, during the Great East Japan Earthquake, there were several cases where people ignored this, going back to help elderly residents or family members evacuate.

In addition to the existing advisories and warning messages, the Japan Meteorological Agency set up an emergency warning system (tokubetsu keihō) on August 30, 2013, notably following the damage caused by the Ise Bay typhoon in 1959, the March 11, 2011, tsunami, and rain from the 12th typhoon of 2011 (Kodera et al., 2016).

• Logistics mechanisms and essential supplies for health and relief services

Depending on the degree of the disaster, it is planned for local authorities and the government to respond by setting up disaster management centres (World_Bank, 2014). The police, firefighters or self-defence forces can reinforce the arrangement (Hasegawa, 2013). The immediate rescue and relief operations were conducted hand in hand by the fire fighters, volunteer fire corps, police, coast guard, and Self-Defence Forces to cope with the unexpected scale of the disaster (Cabinet Office 2011c, Japan Coast Guard 2012, Ministry of Defence 2011b, 2012, National Police Agency 2011). The fire fighters, volunteer fire corps, police, and coast guard in the damaged areas were in the forefront of rescue and relief operations, immediately after the first earthquake hit the areas. The Japan Self-Defence Forces

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	(JSDF) also responded to the nuclear accident, engaging mainly in pumping water for cooling used fuel pools, decontaminating personnel and vehicles, and monitoring amounts of airborne radiation. Following its experience with the Kobe earthquake, the Fire and Disaster Management Agency created fire response teams to mobilize firefighting departments in devastated areas had lost their radio equipment or base of communications. Considering this experience, the Fire and Disaster Management Agency decided to provide the teams with additional mobile communications equipment. Interperceptual emergency police rescue units and Disaster Medical Assistance Team (DMAT) have been set up in prefectures nationwide, based on the experience with the Kobe earthquake(World_Bank, 2021). In response to the GEJE, these rescue units conducted such activities as search and rescue and the securing of emergency transportation routes. The DMAT conducted emergency operations during the critical period, especially within 48 hours of the event. The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) established the Technical Emergency Control Force (TEC FORCE) in 2008 (World_Bank, 2021). The TEC- FORCE is a specialized group made up of ministry staff that helps disaster- affected municipalities to quickly assess damages, identify measures to prevent additional damage, and provide technical assistance for rehabilitation and emergency response activities. Japanese Red Cross Society (JRCS) is designated as a public relief organization under disaster response law and is the biggest humanitarian organization in Japan (IFRC, 2018). Domestic nongovernmental organizations (NGOs) and non-profit organizations (NPOs) have played a significant role in carrying out disaster management activities (World_Bank, 2014). As of January 20, 2012, there were 712 organizations participating in the Japan Civil Network for Disaster Relief in East Japan.
b.	What support was provided by media media during disaster operations?	media platforms including social	Details are included in the WP7: Social media information/misinformation and risk communication section
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	The incident took place before the COVI-19 outbreak, however, there are several disease outbreak control measures undertaken during the disaster response.
3.1.5	**Recovery**	

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a.	What were the long-term and short-term recovery actions undertaken during each post disaster recovery period including 'build back better' practices?	
	• Response endeavours such as needs and damage assessments	Following a disaster, satellite data are the first to become available, followed by aerial photographs, which provide more detailed images (Kaku et al., 2015). As early as five days after the tsunami, the GSI announced the first estimate of the total inundation area as 400 square kilometres (km2), based on manual interpretation of aerial photographs taken on March 12 and 13. One month after the event, on April 18, the government officially announced the total inundation extent to be 561 km2. The increase reflected the availability of additional aerial photographs and high-resolution optical satellite images of areas previously not covered.
	• Community-level involvement and capacity building for disaster recovery	The Sendaishi-chiiki Bousai Leader (SBL) Program was launched in 2012 as a capacity development initiative in Sendai City, Miyagi Prefecture (one of the severely affected municipalities in the Tohoku region), in response to the 2011 Great East Japan Earthquake (GEJE) (Sakurai & Sato, 2018). The Program emphasizes strengthening each community's disaster resilience by fostering locally based leaders to promote sustainable disaster risk reduction activities within existing chonaikai (neighborhood association) networks.
	• Local administration and coordination for resource mobilisation	Municipality and prefecture governments play a leading role in disaster response in Japan. The national government acted immediately by setting up a response office four minutes after the earthquake, and an Emergency Disaster Response Headquarters, headed by the prime minister, within 30 minutes (World_Bank, 2014). The early responders can be categorized into two groups (Bisri, 2016): Japan- based (mainly Tokyo based) NGOs specializing in international relief operations even before the GEJE, and Japanese NGOs and NPOs based in different parts of Japan that address domestic needs. The Japan Platform, a platform for international emergency humanitarian aid, mobilized funding for relief operations within three hours of the earthquake. The Japan National Council of Social Welfare set up volunteer centres in the affected municipalities. The social welfare councils in municipalities nationwide sent more than 30,000 person- days of staff to operate the volunteer centres.

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	• Building redundancy into a DRR plan	The Sanriku Expressway being constructed along the seashore in the tsunami- affected Iwate and Miyagi prefectures contributed to the recovery of this area (Suppasri et al., 2012). But the evaluation of the cost-effectiveness of such redundant infrastructure (that is, a road used as part of a DRM facility) has never been considered before in Japan. The Japanese government is now trying to modify its evaluation methodology to include the potential benefits of road projects from the perspective of disaster management and DRM (World_Bank, 2020). Accordingly, industrial firms and parks can play a significant role in minimizing the impacts of infrastructure disruptions by utilizing new technologies that allow redundant access to critical infrastructure such as water and power.
b.	How the post disaster infrastructure recovery including rebuilding, restoration, or reconstruction had taken place?	After large-scale disaster events in Japan, such as the Great East Japan Earthquake in 2011, reconstruction plans are developed, where the recovery of industries and businesses often serves as a central pillar to build back the life and livelihood of disaster-affected communities. Specialized coordination agencies, such as the Reconstruction Agency (RA) and the National Resilience Promotion Headquarters, have also been established in Japan with targeted efforts to accelerate resilient industry (Leelawat et al., 2015). The Reconstruction Agency, an agent of the Japanese government, has created initiatives that help create venues for local SMEs in damaged areas to gather information for exchange, and has provided subsidies for them to hire outside disaster recovery experts. Since 2010, Sendai City and the Sendai General Construction Association have maintained a Post Disaster Emergency Response Partnership Agreement (Keicho, 2012), whereby member firms (approximately 80) of the construction association provide post disaster operations for debris clean-up and the reconstruction of roads.
c.	What plans or provisions were available to minimise the economic impact following a disaster?	National governments play a significant role to play in establishing policies and guidelines to advance the preparedness of industries against disasters through the promotion and incentivization of business continuity planning and management (World_Bank, 2020). At the subnational level, local governments play an integral role in catalyzing the development of areawide BCPs to complement firm-level BCPs, identifying strategic areas where a coordinated and collaborative approach can be implemented for maintaining business continuity after a disaster event.

d.	What environmental recovery plans were available to manage the impact for eco-systems and related services?	The Great East Japan Earthquake and Tsunami on March 11 in 2011, caused immense damage to marine ecosystems and marine products (fisheries and mariculture), both nearshore and offshore, on the Pacific coast of north-eastern Japan (the Tohoku region) (Kijima et al., 2018). Accordingly, the TEAMS (Tohoku Ecosystem-Associated Marine Sciences) project was created as a project at the national level.
		Apart from the ongoing natural restoration process, Japan's government has decided to support and enhance the process that has developed and has enacted important statutes and statutory frameworks for this purpose, including the 2012–2020 National Biodiversity Strategy, which turns on certain fundamental components, such as the valuation of ecosystems services, and implementation of Environmental Impact Assessments and Environmental Strategic Assessments, among others (Santiago-Fandiño & Mas, 2018). As result of intense interaction between the stakeholders and the government, many of the initial decisions regarding the characteristics of these structures have been revised, although their impact on the environment will certainly remain large and often unpredictable.
e.	How have the mitigation and resilience-building activities of preparedness been adopted for the next disaster, and the development and implementation of legislation, policies, and practices to avoid similar situations in the future?	In Japan, countermeasures against earthquakes and tsunamis have been based on the risks associated with five large earthquakes that have occurred over the past several hundred years (World_Bank, 2014). Hazard maps are prepared and made available for various hazards such as earthquakes, tsunamis, floods, landslides, liquefaction, and volcanic eruption.
3.1.6	**Monitoring and evaluation**	
WP3	**Task 3.2 – Vulnerable categories**	
How frequent are plans being reviewed and revised for emergency preparedness, response, and recovery?		This data was not requested in this phase.

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3.2.1	Identify people vulnerable categories in the different phases of disaster management
a.	In the analysed context, what were the consequences (death or injury) with respect to the following age groups and gender? https://internationaleducation.gov.au/international-network/japan/PolicyUpdates-Japan/Documents/KeyMEXTStatistics_pdf.pdf
	Ensuring sensitivity
• New-born (ages 0-4 week)	*Overall details are included.*
• Infant (ages 4 week - 1 year)	*Overall details are included.*
• Toddler (ages 1-3 years) - M/F	*Overall details are included.*
• Pre-schooler (ages 3-5 years) - M/F • School aged child (ages 6-13 years) - M/F	Among children in coastal zones, in 2011, the death rate of children younger than 10 years in areas affected by the earthquake and tsunami increased by 40%. From 2008 to 2014, according to the Data Warehouse for Healthcare and Welfare Plan (DWH) database, a total of 1748 deaths occurred among children aged 0–9 years in Iwate, Fukushima, and Miyagi (0–4 years: 1 345; 5–9 years: 403). In 2011, a total of 717 deaths occurred among children aged 0–9 years in the three prefectures (Iwate: 168; Miyagi: 452; and Fukushima: 97) (Tashiro et al., 2018). The results further demonstrate the mortality rate of children younger than 10 years was significantly higher than those before and after 2011 in coastal zones. Moreover, the mortality rate of children aged 0–4 years was higher than that of children aged 5–9 years. Furthermore, the mortality rates of boys were higher than those of girls in the coastal zone. According to the statistics published by Ministry of Education, Culture, Sports, Science and Technology (MEXT) (Tohoku Earthquake and Tsunami– Impact on Education, 2011) the student and staff impact can be mentioned as below. • 341 dead • 232 injured • 931 missing 1 international student confirmed amongst the dead. Of those confirmed dead:

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- 43 kindergarten students
- 122 primary students
- 116 secondary students
- 36 university students
- 24 teachers/staff.

Numbers of schools and institutions closed in affected areas:

- 1,451 public
- 298 privates
- 2 nationals.

6,751 schools and institutions with damaged infrastructure (details not available):

- 857 kindergartens
- 2,793 primary schools
- 1,460 junior high schools
- 851 senior high schools
- 7 secondary schools (combined junior and senior)
- 157 special schools
- 37 junior colleges
- 279 vocational schools
- 18 research institutes
- 215 national universities
- 77 other institutions.

77,184 international students were in affected areas affected by the earthquake and tsunami, over half Japan's international enrolments:

- 8,789 in Miyagi, Fukushima, and other Prefectures where the earthquake was strongest.
- 15,981 in Iwate, Gunma, and other badly affected Prefectures
- 52,414 in Aomori, Akita, Tokyo, and other affected Prefectures.

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• Adolescent (ages 14-18 years) - M/F	Children and adolescents younger than 19 years accounted for 6.5% of the deaths, and there were 229 survivors younger than 18 years who lost both their parents in the disaster and 1295 who lost one of their parents (Hayashi & Tomita, 2012).	
• Young adult (ages 19-29) - M/F	*Overall details are included.*	
• Adult (ages 30-64 years) - M/F	*Overall details are included.*	
• youngest-old (ages 64-74 years) - M/F	The immense impact of the disaster is signified by the fact that 56% of those who lost their lives were aged 65 and over and 89% of the post-disaster related deaths were among people aged 65 years and over (HelpAgeInternational, 2013).	
• middle-old (ages 75-84 years) - M/F	*Overall details are included.*	
• Oldest-old (ages more than 85 years)	*Overall details are included.*	
b. During the rescue phase what were the categories of disabilities, or specific needs, that arose?		
• Movement disabilities *	An ageing society and post-disaster community security (Bacon & Hobson, 2014). Although half the respondents fled with family members, many, especially those with reduced mobility and those over 75 years old, faced difficulties reaching the evacuation sites and reported a range of barriers along designated evacuation routes. About 20% of older people did not know where the nearest evacuation sites were, or how to get there (HelpAgeInternational, 2013).	
• Sensorial disabilities (deafness, blindness) *	*Overall details are included.*	
• Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	*Overall details are included.*	
• Pregnant women	*Overall details are included.*	
• New-born	*Overall details are included.*	
• Infant	*Overall details are included.*	
• Other that emerged during the analysis of the available documentation or specific investigations conducted	*Overall details are included.*	
c. Which of the following categories of disabilities, or specific needs, were managed in the post-emergency phases to give an initial response to people involved?		
• Movement disabilities *	*Overall details are included.*	

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• Sensorial disabilities (deafness, blindness) *	*Overall details are included.*
• Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	*Overall details are included.*
• Pregnant women **	*Overall details are included.*
• New-born	*Overall details are included.*
• Infant	*Overall details are included.*
• Other that emerged during the analysis of the available documentation or specific investigations conducted	Volunteer health teams helped address the initial service gaps in the aftermath of the disaster, yet 27% of those surveyed reported difficulties in obtaining medical assistance and 29% reported difficulties accessing hospitals (HelpAgeInternational, 2013).
*Indicate age class (see 3.2.1.a) and gender; ** indicate class age	*Overall details are included.*
3.2.2 **Post event management**	
a. About point 3.2.1b, were the rescuers prepared to manage the situation?	
• The rescuers were involved in specific training activities in this field	Life after the triple disaster: human security and the future (Bacon & Hobson, 2014)
• Specific documentation has been made available	*Overall details are included.*
• Simulations were conducted also considering the issue of inclusive emergency management	*Overall details are included.*
b. About point 3.2.1c, were the operators prepared to manage the situation considering people with specific needs?	
• The rescuers were involved in specific training activities in this field	*Overall details are included.*
• Specific documentation has been made available	*Overall details are included.*
• Simulations were conducted also considering the issue of inclusive emergency management	*Overall details are included.*
c. Were people with specific needs and their family members or caregivers prepared to manage that emergency?	*Overall details are included.*

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• Specific information activities were carried out on these topics with the involvement of family members, caregivers, and the surrounding community	*Overall details are included.*
• Specific documentation has been made available	*Overall details are included.*
• Simulations were conducted also considering the issue of inclusive emergency management	*Overall details are included.*

WP3	Task 3.3 Culture & heritage
3.3.1	**What was the extent of the damage with respect to the type of disaster?**

Post-disaster recovery and the cultural dimension of human security (Bacon & Hobson, 2014)

The damage inflicted upon cultural heritage was also very significant and wide-ranging. Speaking only of designated national cultural properties, more than 754 items are confirmed to have been damaged, including five national treasures, 160 important cultural properties, ninety historic sites and buildings as well as hundreds of paintings, carvings, craft goods, ancient documents, and ethnological and archaeological artefacts (Damage to cultural properties in the great east Japan earthquake, 2011). According to a detailed survey by Iwate Prefecture; a prefecture with significantly large human damage; 25 prefectural designated cultural properties (including 7 structures and 9 art objects) and 70 municipally designated cultural properties (including 27 structures including historical sites and 10 art objects) were affected by the disaster (Okamura, 2015). According to the survey by ICOMOS (2011), there are six categories of cultural property damage listed.

1. Tangible cultural properties Structure (Architectures) Works of fine arts & applied crafts.
2. Intangible cultural properties Drama, Music, Craft technique, etc
3. Folk cultural properties Tangible Folk Cultural Properties Intangible Folk Cultural Properties
4. Monuments Historic Sites Place of Scenic Beauty Animals, Plants, Geological & mineral formations.
5. Cultural landscape
6. Groups of traditional buildings Historic town or villages

3.3.2	**What was the extent of the damage with respect to the size of the disaster?**

More details included in the WP2 Task 2.2: Natural and manmade disaster case study identification, research, and analysis.

3.3.3	**How was the human and environmental adaptive response/reaction to the damage?**

More details included in the 3.1.4 Response section

3.3.4	**How long did it take to recover/retrieve after the disaster in the following categories?**
• Land use	More details included in the 3.1.5 Recovery section
• Repopulation	This data was not requested in this phase.

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• Everyday life condition	This data was not requested in this phase.
• Social life	This data was not requested in this phase.
• Lesson for the mitigation of other disasters	This data was not requested in this phase.
3.3.5 Was there any quantitative correspondence between reaction/effort and damage?	
This data was not requested in this phase.	
3.3.6 What was the timescale of such correspondence (short-term vs. long-term)?	
This data was not requested in this phase.	
WP3	**Task 3.4 – Risk governance strategy**
Type of data	**Data/ information/ sources/ reference material**
3.4.1 Disaster risk governance mechanisms	
What were the disaster risk governance mechanisms identified in the relevant authorities to manage disaster risk under following categories?	
• Knowledge sharing and inclusion of science and technology	Hazard and risk information and decision making (World_Bank, 2012)
• Harmonizing capacities and resources to the needs in risk assessment	Mismanaging risk and the Fukushima nuclear crisis (Bacon & Hobson, 2014)
• Institutionalizing partnerships, coordination, and responsibilities	The Disaster Countermeasures Basic Act stipulates the Disaster Management Planning System (Suzuki & Kaneko, 2013). As a fundamental plan for the country, the Basic Plan for Emergency Preparedness is prepared by the Central Disaster Management Council based on the Basic Act on disaster control measures (Tanaka, 2012). The Basic Plan for Emergency Preparedness covers comprehensive and long-term disaster reduction issues such as disaster management-related systems, disaster reduction projects, early and appropriate disaster recovery and rehabilitation, as well as scientific and technical research. Disaster management councils are established as overall coordination organs for institutionalizing and planning disaster management in the national government, prefecture governments, and municipality governments (Tanaka, 2012). These

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		councils are in nature advisory bodies but possess unique characteristics of disaster management councils to prepare disaster management plans. According to Tanaka (2012) the Central Disaster Management Council is established in the Cabinet Office headed by the Prime Minister. Likewise, the prefecture disaster management councils and the municipality disaster management councils are headed by governors and mayors, respectively.
	• Participatory decision-making mechanisms, inclusive of vulnerable communities, indigenous communities, and volunteers	More details are included in the Training and communication preparedness section.
	• Leveraging investments in DRR	More details included in the 3.1.5 Recovery section
3.4.2	**International DDR frameworks**	
What international DDR frameworks (SENDAI, SDG, Paris Agreement) were adopted in DRR projects?		The Sendai Framework for Disaster Risk Reduction at Five: Lessons from the 2011 Great East Japan Earthquake and Tsunami (Maly & Suppasri, 2020)
3.4.3	**Accountability in disaster governance**	
What were the provisions to ensure accountability in disaster governance?		
	• Consider accountability aspects in the Sendai Framework for Disaster Risk Reduction 2015-2030	The Sendai Framework for Disaster Risk Reduction at Five: Lessons from the 2011 Great East Japan Earthquake and Tsunami (Maly & Suppasri, 2020)
	• Innovative elements of accountability	Following the accident, the International Atomic Energy Agency announced measures to further improve nuclear safety, emergency preparedness, and radiation protection of people and the environment worldwide, and a new Japanese regulation authority with clearer responsibilities and greater powers to enforce new standards was established (The, 2019). On October 30, 2011, the NAIIC Act (officially, the Act regarding Fukushima Nuclear Accident Independent Investigation Commission) was enacted, creating an independent commission to investigate the Fukushima accident with the

	authority to request documents and request the legislative branch to use its investigative powers to obtain any necessary documents or evidence required (Japan, 2012). This was the first independent commission created in the history of Japan's constitutional government. In this report there are seven recommendations urging urge the National Diet of Japan to thoroughly debate and deliberate on the future nuclear safety.
	Monitoring of the nuclear regulatory body by the National Diet
	Reform the crisis management system
	Government responsibility for public health and welfare
	Monitoring the operators
	Criteria for the new regulatory body
	Reforming laws related to nuclear energy.
	Develop a system of independent investigation commissions
● Enabling legislations	The report by Law Library Of Congress (2013) discusses various legislation and actions taken by the Japanese government following the March 2011 earthquake and tsunami, such as applying existing emergency measures, victim support provisions, and nuclear crisis measures, as well as managing disaster debris, undertaking reconstruction efforts, and passing post-earthquake legislation aimed at preparing the country for future disasters. A reconstruction agency was created to coordinate various reconstruction efforts (World_Bank, 2014). Based on post-earthquake assessments of the effectiveness of the existing nuclear regulatory authority, a new nuclear regulatory agency and new standards for nuclear power plants were created. Among other disaster measure laws and ordinances, the Disaster Countermeasures Basic Act is the most fundamental legislation covering the disaster management and related legal framework (Suzuki & Kaneko, 2013). Outline of the Disaster Management Operation Plan of the Ministry of Defence (Suzuki & Kaneko, 2013)

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- Regular monitoring, evaluation, and review

-
  Part 1: General provision

  Part 2: Preparedness for disasters

  Part 3: Emergency responses to the disasters

  Part 4: Measures at the time of large-scale disasters

  Part 5: Strengthened Disaster Management Plan for the Tokai Earthquake

  Part 6: Plan for Promoting the To-Nankai and Nankai earthquakes countermeasures.

  Part 7: Measures at the time of nuclear emergency

  The Basic Plan for Emergency Preparedness was revised drastically in December 2011 by taking account of the experiences at the time of the Great East Japan Earthquake (Makoto, 2012). An independent chapter on tsunami preparedness was newly created in the new plan. The following new stipulations are added:

  Establishing a new system in which relief supplies can be reached to the disaster areas surely.

  Stipulation of coordination procedures by the national government or/and prefecture governments in relocating disaster victims over the boundaries of prefectures or municipalities.

  Stipulation of passing the disaster experiences down from generation to generation and conducting disaster preparedness education.

  Private voluntary disaster management groups as well as experts in disaster management are to be added to the present members in the Regional Disaster Management Council.

  Municipalities can request to the prefecture governments; prefecture governments can request to the national government necessary relief supplies. Moreover, when deemed necessary, prefecture and national governments can deliver the relief supplies without requests.

WP4	Cascades	
1.	What is the EU country, covered by CORE partners, preparing for (crisis, war and crisis, disruption)?	European context

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2.	What types of disasters is each EU country, covered by CORE partners, preparing for?	The six case studies
3.	Who is involved in the preparation process?	According to the Cabinet_Office_Japan (2021) the following institutions are involved in the Disaster Management process in japan
		Bank of Japan
		Cabinet Office (Japan)
		Government of Japan
		Emergency Operation Centre
		Japan Finance Corporation
		Japan International Cooperation Agency
		Ministry of Economy, Trade, and Industry
		Ministry of Internal Affairs and Communications
		Ministry of Land, Infrastructure, Transport and Tourism
		National Disaster Risk Reduction Management Council
		National Institute for Land and Infrastructure Management
		National Oceanic and Atmospheric Administration
		Technical Emergency Control Force
a.	What kind of approach is adopted in disaster preparedness: e.g., is disaster preparedness centralized (national level) or decentralized (local	More details are included in the 3.1.2 Disaster resilience and preparedness strategies section.

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	level); who (which agency) has the leading role in preparedness; guiding policy frameworks and/or strategies and principles; coordination/cooperation mechanisms (and sectors involved)?	
b.	Other stakeholders for preparedness?	Who and Why: Stakeholders and Incentives (World_Bank, 2020)
c.	EU/UN/INGO?	The following organisation were identified from the Who and Why: Stakeholders and Incentives section of the World_Bank (2020) report. Emergency Mapping Team International Federation of Red Cross and Red Crescent Societies Japan NGO Centre for International Cooperation Japanese Earthquake Reinsurance Company Japanese Government Bond Japanese Red Cross Society Japan Meteorological Agency Japan Research Institute Japan Self-Defence Forces Japan Society of Material Cycles and Waste Management Japan Water Works Association Ministry of Agriculture, Forestry and Fisheries

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		National Broadcasting Corporation (Japan)
		Tokyo Stock Exchange
		Union of Kansai Governments
		United Nations Development Programme
		United Nations Environment Programme
		United Nations Children's Fund
		United Nations–World Bank
4	Training and communication preparedness	
a.	What kinds of trainings (including drills and crisis exercises) are done to prepare for a disaster?	Japan has a culture of preparedness, where training and evacuation drills are systematically practiced at the local and community levels and in schools and workplace (Nakaya et al., 2018). Kamaishi City has been conducting DRM education programs since 2005 in cooperation with Gunma University (Shaw et al., 2012b). The program engages the local community in preparing disaster risk maps and holds evacuation drills four times a year one joint drill with the elementary and junior high school and one annual drill with the local community. In Kesennuma, students at the Hashikami Junior High School are taught DRM as part of the ESD program (Shaw et al., 2012b). The school served as an evacuation center for more than 1,500 people after the GEJE, which occurred just before graduation. Local governments conduct tsunami evacuation drills every year on days commemorating past large-scale tsunamis, and residents learn how to evacuate safely and quickly from their own houses to designated shelters.
b.	Who provides training, for whom and what competencies are covered?	Preparation for disasters caused by powerful hazards is a primary part of the knowledge imparted at school, especially through fire simulation exercises (Shaw et al., 2012b). This activity is mandatory since it figures in the Fire Service Act of July 24, 1948, as well as in the regulation implementing this law taken by the Cabinet on March 25, 1961, and the ministerial regulation for application of April 1, 1961 – the latter requiring a minimum frequency of two per year.

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	Many institutions – even all the public schools in some municipalities such as Kagoshima – also organize at least one earthquake simulation exercise every year, and the number can be as high as six for primary and secondary schools in Tokyo. This also includes university level training. Hyogo University, in the prefecture devastated by the earthquake of 1995, has recently set up a program for training experts with the opening of postgraduate studies relating to resilience and governance following disasters. In addition to some 100,000 training sessions carried out every year by voluntary disaster prevention organizations, prefectures and municipalities regularly organize exercises at the request of the Fire and Disaster Management Agency (Shaw et al., 2012b). There are also many awareness centers which, like the Tokyo Rinkai Disaster Park, allow visitors to prepare to experience an extreme natural phenomenon such as a large earthquake as well as its catastrophic consequences, especially through survival trials. In Osaka, the Tsunami and Storm Surge Disaster Prevention Station has a room projecting a 180° film that prepares spectators to experience a tsunami following an earthquake in the Nankai Trough, and a study room for acquiring the right knowledge and learning more about the actions to take to increase chances of survival.	
c.	What kind of approach is adopted in crisis communication preparedness: e.g., what is communicated to the public about preparedness, how (means and channels: e.g. preparedness brochure, crisis portals/websites, campaigns, formal/civic/professional education, social media mobilisation) and by whom (leading agency + other partners and stakeholders involved + partnerships with news media)? How are the needs of vulnerable groups taken into account?	More details are included in the WP7 Social media information/misinformation and risk communication section
5.	Prepositioning, framework contract and supplier management	

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a.	What types of goods are supplies, procurement, distribution, shipping, communication, facilities, equipment, materials, funding (Makoto, 2012).	A local disaster management plan provides for the provision for coordination, stockpiling of food and pre-positioned and how are locations selected?
		Based on the simulations, contingent emergency stocks of basic goods— packages of water, food, household goods (such as tableware, kitchen wrap, tissues, towels, toothbrushes, masks, and blankets) and emergency medicines for the first three days following the disaster should be stored locally, typically at community- level schools and centre.
b.	Which organization is responsible for management of pre- positioned stock?	In Japan delivery of relief goods is the responsibility of the prefectural governor, who responds to requests from the municipalities (Makoto, 2012). According to the post-disaster plan, delivery of relief goods was to be executed using depots at two levels: prefectural and municipal. By April 20, the national goods distribution component had mobilized 26 million meals, 8 million bottles of beverages, and 410,000 blankets using 1,900 trucks, 150 aircraft, 5 helicopters, and 8 ships.
c.	What are the framework contracts for disaster preparedness, who manages them?	More details are included in the 3.1.2 Disaster resilience and preparedness strategies section
d.	How are suppliers who secure the supply for preparedness selected and managed	After the GEJE, roads were recovered early on to secure an emergency transportation network (Koshimura & Shuto, 2015). The Tohoku Shinkansen (bullet train) resumed operations between Tokyo and Nasushiobara (the southern section) on March 15, and between Shinaomori and Morioka (the northern section) on March 22. By April 29, the entire Tohoku Shinkansen line was in operation, as were most of the other railways except for those along the coast (Sagara & Ishiwatari, 2012). The Sendai Airport rehabilitation operation began two days after the earthquake, and by March 15, four days after the earthquake, the airport was being used by rescue and emergency supply rotorcraft. Although water supply services were resumed for about 90 percent of residents within one month of the disaster, the aftershocks on April 7 and 11 temporarily increased the number of households without water.

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6.	How was the preparedness and response mechanism activated for different types of risks?	
7.	How the event influenced flow, access to and availability (length of shortage, scale, shortage by social group) of:	More details are included in the 3.1.4 Response section
	• Drinking water;	Furthermore, water and power supply systems were damaged in most of the disaster-affected areas, and in some places were not restored even after one month.
	• Energy supply (electricity, coal, fuel etc.);	Neither Tokyo Electric Power Company, the operator of the nuclear stations, nor the regulatory authorities had prepared for accidents as serious as those caused by the enormous tsunamis that followed the GEJE.
	• Food (retail sales, catering, etc.);	Given the magnitude of the disaster and the number of evacuees, most evacuation facilities lacked sufficient supplies of food, water, clothes, and blankets.
	• Health (emergency and long-term psychological health);	*Overall details are included.*
	• Access to information.	*Overall details are included.*
8.	How the event influenced preparedness mechanisms working with other organizations on a large scale, and they received insufficient support from the central government in managing the new forms of cooperation. Consequently, coordination with international relief agencies and donors offering relief assistance was not properly carried out. (in terms of training, information flow, communication, prepositioning, supplier management). What were	Local governments, whose facilities in some cases were wiped out by the disaster, had little experience

9.		Have there been any studies conducted on the long-term impact (five or ten years) of this disaster/crisis?	the lessons learned from the case?
		Overall details are included.
a.	Was there any long-term health or societal impact?	Although more than two years have passed, the people of Fukushima are still struggling with the effects of the nuclear accident that prompted a physical and mental health crisis for area residents (The, 2019). Many suffered the stress of sudden displacement and prolonged evacuation, fears over the possible health effects of continued exposure to low- level radiation, an exodus from the area, dissolving communities, and conflicts with host communities.

Fear of radiation. More than 80 percent of the population in Fukushima City fear radiation; according to a city government survey, that fear was growing even a year after the accident.

Because decontamination of radioactive areas takes a long time, at the end of 2011, the municipal governments of Namie, Okuma, Futaba, and Tomioka began planning "temporary towns," or migrant communities, for those ousted from their original municipalities. Municipal governments and public facilities as well as residents were relocated to these temporary towns. |
| **b.** | Any local supply chain impact? | Fukushima Daiichi Nuclear Power Station Four nuclear power stations comprising 14 units were located close to the epicentre of the March 11 earthquake (Hashimoto et al., 2022). The earthquake caused all operating units to shut down automatically. Large tsunamis hit all sites within an hour of the main shock, damaging several of them. The worst affected sites were Fukushima Daiichi and Fukushima Daini.

Existing countermeasures to address nuclear power accidents do not reflect a thorough understanding of the complexity of nuclear power station systems. The excuse that the event was "beyond assumption" is unacceptable. |

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c.	How long did it take for the communities to get back to the original state?	More details are included in the 3.1.5 Recovery section
d.	Any studies on the long-term resilience of the affected region?	The Great East Japan Earthquake and tsunami increased the risks of hydrometeorological disasters (Shaw et al., 2012a). The Great East Japan Earthquake (GEJE) caused extensive damage to coastal and river infrastructure and diminished the level of protection they provided against floods and storm surges, thereby increasing the risk of hydrometeorological disasters. The level of protection against storm surges and flooding was significantly diminished in the Sendai Plain. The area below mean sea level more than tripled (from 3 square kilometres [km2] to 16 km2) after the earthquake, as revealed in the MLIT's laser profiling survey. The MLIT produced subsidence maps and revised downward the water levels at which it issues flood warnings.

WP7	**Social media information/misinformation and risk communication**

Please provide a quality assessment for the accuracy and veracity of information and data used to inform this case study in the following three categories:

a). Media information	Studies such as Sakaki et al. (2010, 2013), Earle et al. (2011), and Lin et al. (2016) focused on tweets associated with natural disasters such as earthquakes and extreme weather conditions. Sakaki et al. (2010, 2013) developed an earthquake reporting system in Japan using Twitter messages. Their system was able to detect 93% of earthquakes (seismic intensity of 3 and more), as reported by Japan meteorological agency (JMA). They used simple linguistic features such as word count, and context of target event words etc. to train an SVM-based classifier for detecting earthquakes. Particle filter was employed to predict the location of the detected event. The system was much faster than the JMA broadcast announcements in sending notifications to the public after sensing an earthquake. The Twitter timeline of government organizations clearly reveals their fundamental responsibilities in terms of responding to disasters, sharing information on crises, providing energy security and implementing anti-earthquake measures (Cho et al., 2013).
b). Misinformation	The institute NICT developed a system for analysing information, which today can indicate contradictory tweets during a disaster, using an icon to encourage Internet users to be vigilant about some reported facts.

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	Following the earthquake, a fire and explosion happened in Cosmo Oil Refinery, which was extinguished after 10 days. Rumours spread on Twitter that hazardous substances were floating in the air and would come down with rain. An example is "A fire occurred at Plant of Cosmo Oil will cause of rain with toxic substance. Pay attention to rain. Must carry Umbrellas." Later the rumour was reported to be baseless both by the Japanese Government and Cosmo and this was also reflected in tweets such as "Oil co. Cosmo says rumours spreading about toxic rain from tank fire in Chiba are false http://www.cosmo-oil.co.jp/ 'There is no such fact'". From around 11AM on March 12, 2011, the number of Tweets begins to increase again, however from around 3PM, Tweets negating the rumour begin to increase as well and by March 13, the false rumours decrease rapidly (Kaigo, 2012).

Meanwhile, retweeting is a function that anyone can instantly share someone else's tweet. This function is a key for rapid and wide information spread but also an unprecedented form of information sharing compared to a traditional information network (Kitazawa & Hale, 2021). Overall, retweets account for around 60% in most prefectures, which is consistent with findings that approximately 50–60% of posts on Twitter during the 2011 Japanese earthquake and tsunami were retweets.

In the 2011 White Paper of Information and Communications in Japan, a keyword analysis using Google Realtime Search was employed to investigate false rumours during the Great East Japan Earthquake.

Right after the March 11, 2011, earthquake, drinking water, foods with long shelf life, gas cartridges, gasoline fuel, toilet paper and tissue paper were in shortage because people began receiving false information. |
| **c).** Risk communication | Communication about the unfolding disaster should have been more interactive among local communities, governments, and experts. The distribution of hazard maps and early warnings should be integrated with local awareness groups and community leaders. In the event, the magnitude of the tsunami was underestimated, which may have led people to delay their evacuation, if only for fatal few minutes. If local governments and community members had been more aware of DRM technologies and their margins of error, fewer lives might have been lost. |

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Annex 10 - Case Study 7 – PANDEMIC in Finland

CASE STUDY 7: **Pandemic**

Incident	COVID-19
Location	*Global – focus on Finland*
Time & Date	*December 2019 – June 2020*

Description and timeline of the incident

The corona crisis is caused by the SARS-CoV-2 -corona virus causing a disease named covid-19. It was first detected in Wuhan, China, in the end of the year 2019. The focus here is on the first seven months of the pandemic: from December 2019 to June 2020. In that time span, Hanken focuses on Finland, and the national level government response that took place, including a summary of key events and some reflections on how the health care system managed the crisis.

In Finland, the Finnish Institute for Health and Welfare (THL) got a notification about the novel virus on the 31st of December 2019 when the WHO launched in their early warning system information about the unusual strain of pneumonia identified in Wuhan, China through their early warning system. Since then, the Finnish Institute of Health and Welfare started to assess the severity of the spreading of the virus. The first situational report focused on the spreading of the virus was released on the 20th of January 2020. At that point, the risk of the virus spreading to Finland was considered low. The Government Situation Centre started to publish a daily situation update on the coronavirus to the authorities on the 24th of January 2020. The THL published the first instructions regarding the coronavirus for citizens on the 29th of January in social media. The first case was diagnosed in the end of January when a Chinese tourist was admitted to Lapland Central Hospital and tested for the novel virus. On the last day of January 2020, the heads of preparedness of all ministries convened for an extraordinary meeting focused solely on the coronavirus. The message from the THL in that meeting was that Finland had to immediately be prepared for a global pandemic and the spreading of the disease to Finland and that cross-sectoral preparedness had to be activated immediately. (Safety Investigation Authority, 2021.)

The first meeting of the Finnish Government on the coronavirus situation took place on the 26th of February when THL gave its first threat assessment to the Government. In that meeting the establishment of a covid-19 coordination group was decided. The first confirmed case of a

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Finnish individual contracting the coronavirus was on the 26th of February 2020 in an individual who had returned from a trip to Milan. A Prime minister's announcement to the Parliament on the preparedness of Finland for covid-19 was given on the 27th of February. Authorities and many other actors tried to assess the impact of covid-19 for their activities and plans for a pandemic were updated. The Finnish national Rescue Association and many other organizations communicated about the need to have an emergency supply kit in every household, that is, necessities for 72 hours. (Safety Investigation Authority, 2021.)

The covid-19 coordination group had its first meeting on the 4th of March 2020 and stated that the risk of the pandemic spreading was high and that the events in Italy could reoccur anytime anyplace. The representatives of all the ministries explained about preparedness measures in their sector. For example, the Ministry of Social Affairs and Health announced that there would be a corona information point in the airports and harbors where passengers could get information about the coronavirus. Moreover, a nation-wide Corona-info telephone service was opened on the 4th of March at the Public Service Info of the Digital and Population Data Services Agency. In their review on the 5th of March 2020, the THL stated that Finland is preparing for a potentially more extensive pandemic, but in many ways, life continued quite normally in the first half of March. Around the 11th of March after WHO declared the epidemic as a pandemic, and the risk estimate of ECDC regarding coronavirus was raised from moderate to high, things started to evolve faster, and the need to evoke Emergency Powers Act was also discussed. On their 12th of March cabinet meeting, the Government decided about recommendations for preventing the spread of the coronavirus. For example, all public events with more than 500 attendees were recommended to be cancelled. Wider restrictions, such as closing of schools or a ban on arranging events, would require invocation of the Emergency Powers Act. Finally, the Finnish Government declared the state of emergency on the 16th of March based on economic grounds and the grounds in conformance to an infectious disease laid down in the Emergency Powers Act in Finland. Following this, measures for handling the covid-19 situation, including closing of schools, and switching to distance education and working, was communicated to the whole Finnish nation via a live TV broadcast, which became a regular and frequent communication format of the Government. (Safety Investigation Authority, 2021.)

The declaration of the emergency conditions and Government alignments initiated extensive measures in all levels of public administration. Moreover, also companies and other organizations initiated their own measures, citizens tried to orientate with a new situation, and elderly persons and those belonging to risk groups started to isolate themselves while many Finns switched to a distance work mode. Finns travelling abroad were recommended to return to Finland immediately. The first death linked to the coronavirus in Finland was dated to the 20th of March 2020 in the Hospital District of Helsinki and Uusimaa. (Safety Investigation Authority, 2021.)

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April marked a time of restrictions in Finland. An operations Centre of Prime Minister's Office (PMO) focused on the covid-19 situational picture started to operate on the 1st of April. Its task was to improve situational picture and to monitor the impacts of Government policies and decisions on the covid-19 situation. The first Kansalaispulssi survey commissioned by the Government was published: 89 % of the respondents felt that the information they had received about the effects of the coronavirus on their everyday lives had been good or reasonably good. The plan was to continue monitoring citizens' feelings and opinions on a regular basis every three weeks. A national testing strategy was published on the 9th of April based on a principle of test-trace-treat. Several organizations mediated instructions given by authorities via different kinds of campaigns and provided advice and help to citizens in coping with everyday lives, e.g., volunteers assisted people belonging to risk groups in running errands and buying groceries. THL estimated that social distancing had slowed down the epidemic in Finland. The capacity strain was at the highest in the week 15 (6.-12.4.) when there were simultaneously 83 patients in the intensive care units. After mid-April the number of intensive care patients started to steadily go down and the reduction of the capacity of intensive care was initiated. (Safety Investigation Authority, 2021.)

The public debate about the use of face masks and a possible recommendation to use one intensified in April. On the 17th of April the communication department of the Prime Minister's Office launched a strategic communication campaign called Finland Forward to support societal resilience. According to the THL report on the 25th of April, there were 186 deaths in Finland the median age of the deceased being 84 and over 90% of them having one or more chronic diseases. On the 28th of April the Chancellor of Justice addressed the way decisions were made by the Government: decisions were made urgently in informal cabinet meetings in the form of policies instead of through drafting by public officials. The Government had to go back to better documented drafting and decision-making procedures. A report by the Exit Group of the Confederation of Finnish Industries (EK) was published on the 29th of April and proposed measures for Finland to exist the corona crisis. By the end of April, it became clear that different parts of Finland had a very different epidemic situation: while situation was the worst in the Hospital District of Helsinki and Uusimaa and the Länsi-Pohja Hospital District, there were many quiet areas in other parts of Finland. (Safety Investigation Authority, 2021.)

May 2020 marked a switch to the hybrid strategy and gradual dismantling of restrictions in Finland. In its resolution on the 6th of May, the Government stated that it was possible to follow the hybrid strategy and shift from extensive restrictions to more targeted measures with the goal of causing as little harm as possible to people, businesses, society, and the implementation of fundamental rights. In June after the End COVID-19 Finland taskforce had proposed that authorities recommend wearing of facemasks in public premises, the Government in its 3rd of June informal cabinet meeting made a policy on face masks in Finland: it was not a general recommendation, but the Government suggested that face masks could be used to protect others at locations where close contacts could not be avoided. Many organisations started to prepare a return to normal conditions. On June 16 the emergency conditions ended based on the estimation of the Government that the pandemic could be

controlled with the regular powers of authorities. In the light of an international comparison, Finland managed well the first wave of corona epidemic. (Safety Investigation Authority, 2021.)

WP2	Task 2.2: Natural and manmade disaster case study identification, research, and analysis

What were the public information sharing challenges?

The communication and information sharing by authorities in Finland during the covid-19 crisis has been largely considered successful. However, some challenges and points for further improvement have been reported too. For example, regarding wearing of face masks, conflicting messages and point of views among different authorities and experts appeared. Moreover, there were too many parties giving advice. In addition, experts criticised each other's opinions publicly creating further confusion. Consequently, also media coverage on the topic was at times confusing. Moreover, reports from other countries and changing WHO recommendations further complicated the big picture. As a result, it was difficult for the public to understand whether the authorities recommended the use of a face mask during this period or not. (Selin, 2020.)

Farooq et al. (2021) explain how the COVID-19 pandemic amplified the influence of information reporting on human behavior, as people were forced to quickly adapt to a new health threatening situation by relying on new information. Drawing from protection-motivation and cognitive load theories, the authors of the paper formulated a structural model eliciting the impact of the three online information sources: (1) social media, (2) official websites, and (3) other online news sources; on motivation to adopt recommended COVID-19 preventive measures. The model was tested with the data collected from university employees and students (n = 225) in March 2020 through an online survey and analyzed using partial least square structural equation modeling (PLS-SEM). The authors observed that social media and other online news sources increased information overload amongst the online information sources in Finland. This, in turn, negatively affected individuals' self-isolation intention by increasing perceived response costs and decreasing response efficacy. The study highlighted the role of online information sources on preventive behaviors during pandemics. (Farooq & al., 2021.)

Finell et al., (2021) report the findings of a qualitative study that studied COVID-19-related experiences among respondents from three migrant groups living in Finland: Somali-, Arabic- and Russian-speakers (N = 209). The data were collected by telephone interviews over four weeks in March and April 2020. Using inductive thematic analysis, the authors identified seven themes that illustrated respondents' multifaceted lived experiences during the first phase of pandemic. The themes depicted respondents' difficulties and fears, but also their resilience and resources to cope, both individually and collectively. Experiences varied greatly between individuals and migrant groups. The main conclusion was that although the COVID-19 pandemic may have been an especially stressful experience for migrant populations, it may also have provided

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opportunities to deepen cooperation and trust within migrant communities, and between migrants and their country of settlement. The analysis suggested that cooperation between local authorities and migrants, trust-building and effective information-sharing can foster positive and functional adaptations to disease-related threats and changing social environments. (Finell et al., 2021)

The HERoS project (EU Horizon 2020) describes the efforts to identify sources of data from which we can gather insights about what kinds of needs (informational and tangible) citizens have shared during the COVID-19 pandemic. The report also provides a state of the art in measuring the impact of fact-checking, highlighting a gap in which our knowledge of misinformation spread patterns is disconnected from how we approach the diffusion of fact-checking information. See HERoS deliverables D4.1 COVID-19 misinformation tracking and D4.2 Crowdsourced information clustering for more information (Burel et al., 2021; Burel et al., 2020; Harith et al., 2022).

What were the ethical issues?

This paper explains how during the COVID-19 pandemic, hospital staff have experienced a variety of mental health challenges. European research on anxiety and stress among hospital workers during the pandemic is limited. This study aimed to describe the anxiety levels of Finnish hospital workers during the COVID-19 pandemic. The paper concluded that hospital staff experienced a variety of work-related stress and anxiety issues that should be visible to hospital administrators and policymakers alike. The anxiety was independent of whether the worker was directly involved in caring for or in any way coming into contact with COVID-19 patients. (Mattila et al., 2021.)

Oksa et al. (2021) explain how the COVID-19 crisis has changed the conditions of many all over the globe. One negative consequence of the ongoing pandemic is anxiety brought about by uncertainty and the COVID-19 disease. Increased anxiety is a potential risk factor for wellbeing at work. This study investigated psychological, situational, and socio-demographic predictors of COVID-19 anxiety using longitudinal data among Finnish workers. The article suggests that increased anxiety can disrupt wellbeing at work, emphasizing the organizations' role in maintaining an inclusive and caring work culture and providing technical and psychological support to workers during crisis.

Lohiniva et al. (2021) explore the forms and outcomes of coronavirus and COVID-19-related social stigma and the experiences of people who were home quarantined or isolated in Finland during the spring 2020. The study included 64 participants from 24 households. Perceived stigma among respondents was driven by fear and blame for infection, and it manifested in various ways leading to a reluctance to disclose their coronavirus status to others. Self-stigma developed from conflicting information and advice about coronavirus and COVID-19 led to difficulties in interacting with others outside of the house and reluctance to meet people after quarantine and isolation. Quarantine and isolation experiences

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included uncertainty, health concerns, and boredom. Communication with others in similar situations was perceived vital, whereas discussions with family members about worries and fears related to coronavirus and COVID- 19 was not preferred. (Lohiniva et al., 2021)

Häyry (2021) argues that the role of bioethicists amidst crises like the COVID-19 pandemic is not well defined. As professionals in the field, they should respond, but how? The observation of the early days of pandemic confinement in Finland showed that moral philosophers with limited experience in bioethics tended to apply their favourite theories to public decisions, with varying results.

Mesiäislehto et al.'s (2022) paper examines the gendered impacts of the crisis in relation to three dimensions: 1) employment 2) working conditions and reconciliation of paid work and family life and 3) the distributional impacts of the unemployment shock and the policy measures adopted to mitigate these impacts. Similar to many other countries, in Finland the restrictive measures of the pandemic led to rapid decrease in employment particularly among female-dominated industries, such as services (e.g. restaurants, bars and shops) and tourism. Despite government's explicit commitment to gender mainstreaming and gender equality, gender perspectives were not visibly present in its Covid-19 response.

Using a microsimulation approach, this paper evaluates the distributional consequences of the Covid-19 pandemic in Finland Using up-to-date administrative data on incomes and employment developments in 2020 at the entire population level. Inequality, as measured by the Gini index, increased, but only marginally (at one-digit level). The welfare state insured up to 85 per cent of the possible poverty and inequality reduction due to Covid-19. (Kyyrä, et al., 2021.)

Drawing on a selective review of published literature, the HERoS project (EU Horizon 2020) explores the theoretical constructs from organization sciences, public administration and political sciences, and feedback from experts in three countries (Netherlands, Finland and Italy). See the section 2.3.3 in the HERoS deliverable D1.1 Recommendations for governance and policies in the n-COV-2019 response. (Boersma, et al., 2022; Brakel., et al., 2022)

What lessons have been learned?

This report by the Finnish Innovation Fund Sitra focuses on the key actions taken by the government during the first half of the 2020 coronavirus period, evaluates the changes in how power is used in exceptional situations and makes recommendations for future crises. Regarding preparedness, it says that preparations and plans existed, and exercises had been conducted, but a key problem was that the knowledge remained in the host organization or among the organisations operating in the same sector where it had been produced instead of being shared and used for inter-sectoral learning. Moreover, experts felt that there was room for improvement in the quality of the preparedness plans, which in practice

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means that plans were not binding enough, but rather planning guidelines drafted for regional authorities and other organisations. The follow up of how they were implemented was inadequate. A recommendation for the future is that more attention should be paid to the quality of crisis exercises conducted at different levels and contexts. In crisis exercises, worst-case scenarios are needed instead of likely scenarios.

In crisis response, challenges emerged in sharing information across different administrative branches. In the future, contacts are needed across national borders, so in international organisations, and across sectoral borders. Although Finland has adopted the concept of comprehensive societal security, in practice, analysing and preparations are conducted in silos within the borders of branches and ministries. This is an important point that needs to be tackled as future crises are likely to be of intersectoral and international concern. (Mörttinen, 2021.)

National Audit Office of Finland explains the lessons learnt from the security of supply perspective from the covid-19 in Finland. According to the report, the pandemic risk management was successful even though preparedness was in principle for other kinds of crises, such as a military threat or smaller scale events, such as major accidents. The massive demand of protective equipment and the long duration of the crisis were issues that there were no preparations for. Besides material preparedness, security of supply is important also in ensuring adequate resources in terms of, e.g., personnel in critical sectors, such as health care, and human resources. In the future, as Finland is not able with its resources to be prepared in detail for all the possible crises, the security of supply measures need to be planned in a way that as many as possible kinds of exceptional conditions can be responded to. (National Audit Office of Finland, 2021.)

Tiirinki et al., (2020) report a study which had as an objective to describe and analyse the impact of the coronavirus disease COVID-19 on health policy, social- and health system, and economic and financing system to prevent, treat, contain and monitor the virus in Finland.

The coronavirus disease 2019 (COVID-19) crisis resulted in unprecedented changes in the spatial mobility of people across societies due to the restrictions imposed. In this paper, the focus is on urban–rural mobility and the influence of multi-local living on population dynamics in Finland during the COVID-19 crisis in 2020. This study highlights the need to improve crisis preparedness by: (1) acknowledging the growing importance of multi-local living, and (2) improving the use of novel data sources for monitoring population dynamics and mobility. (Willberg, et al., 2021.)

Sorkkila and Aunola (2022) explain how during the covid-19 crisis, different personality characteristics may have influenced parental wellbeing in different ways. The study combined variable and person-oriented approaches and examined relationships between resilience, parental burnout, and perfectionism during the lockdown. The results of the study suggest that resilience may help parents overcome burnout at times of crises.

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Ranta et al., (2021) highlight the inequality of the effects of covid-19: the pandemic has radically influenced young adults as they exhibit significant personal concerns in age-related life domains. Strong youth policies are needed for youth empowerment, mental health and career advancement in the pandemic aftermath.

Salin et al., (2020) report a study that aimed to examine how families with children coped during the COVID-19 lockdown in Finland and what kind of coping strategies they developed. The results showed that Finnish families employed coping strategies on three levels: macroenvironmental, relationship, and individual.

"D1.2 Lessons learned and best practices" builds on HERoS' Deliverable 1.1 'Recommendations for governance and policies in the COVID-2019 response'. This deliverable contains three parts. Part A drives on extensive qualitative research in three European countries (the Netherlands, Finland, and Ireland). Part B presents best governance practices and challenges in cross-border medical supply chain. It takes lessons learned from the EU joint procurement and the COVAX initiative for the purchase and distribution of COVID-19 vaccines. Part C reflects on the social network Municipio Solidale in Rome the charity work in the years of the COVID-19 pandemic. Part D provides the best practices from deployment of UK-MED and PCPM's Emergency Medical Teams (EMTs). Also, regarding lesson learned, please see the following publications by the HERoS team (Falagara and Kovács, 2020; Kees and Robert, 2020).

What were the cascading effects across events, sectors, and supply chain disruptions? Including the inevitability or unforeseen chain of events affecting the response to the disaster? What were the societal vulnerabilities in health and retail sectors?

Rönkkö et al., (2021) explain how multinational and complex, global supply chains may be extremely vulnerable to sudden crises, such as the recent covid-19 pandemic. In this study, the resilience of supply chains was evaluated by studying three globally operating Finnish b2b manufacturing companies during the covid-19 pandemic. As a result, essential methods to survive during crises and increase the resilience of supply chains were discovered. The results can be utilised in preparing for future crises.

The HERoS project (EU Horizon 2020) developed a methodology to estimate the economic impact of the cpvod-19 shock. It investigates how the covid-19 shock is propagated through a network of global supplier-customer relationships, capturing interdependencies between suppliers and customers along the supply chain, allowing us to estimate the cascading effects of the COVID-19 shock. See HERoS Deliverable D3.4 Methodology for economic impact assessment of supply chain disruptions for more information. Also, please see the following publication by the HERoS team (Falagara, et al., 2022).

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The impact of COVID-19 on food supply chain disruption can be summarized as following:

- Harvests: As spring arrives, crops are rotting in the fields. Europe's asparagus growers, for instance, are dramatically short of staff, with migrant workers from Eastern Europe unable to come to their farms due to border restrictions - or simply afraid to risk infection.

- Logistics: Food transport, meanwhile, is steadily turning into a logistics nightmare. Where produce does get harvested, border controls and air freight restrictions are making international transport of fresh goods extremely difficult – and expensive2.

- Processing: Food processing plants are scaling or shutting down due to containment measures or staff shortages, with their suppliers scrambling to adjust their output. In Canada, for example, poultry farmers collectively acted to reduce their output by 12.6%.

- Go-to-market: Companies that normally sell a significant portion of their output through out-of-home channels (for example soft drink producers) are seeing their sales slashed4.

- Sourcing: Supermarkets, while scoring stellar sales figures, are understaffed and underdelivered. Because of sourcing problems, products based on wide range of ingredients are becoming increasingly difficult to make and are therefore disappearing from store shelves. (Szegedi, nd.)

Logistic sand transport disruption

These measures have consisted mainly of the reintroduction of border checks or closure of the borders with other Member States (with temporary suspension of the Schengen rules on free movement), and in strict confinement measures for parts of national territory (for instance, 'red zones 'where no access is allowed'). These have resulted in blockages to transport routes and long queues at border checks (especially problematic for fresh food), or quarantine measures preventing or limiting access to markets. Restrictions on goods transport have in their turn affected international trade in agri-food products. (Rossi, 2020.)

Shortages of seasonal workers

The looming shortage of seasonal agricultural workers is a major source of concern, as it could severely disrupt food production and processing and will arise because of the restrictions imposed on the free movement of workers from one Member State to other initiatives have been launched to recruit locals who are available to do harvesting work in the fields. (Rossi, 2020.)

Sector specific impact

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Certain horticultural products are very labour intensive and, given the approaching harvesting season, the shortage of seasonal workers is highly alarming. The cancellation of public and private events at which catering services are offered, and the interruption of air travel and the related food retail sector. This will require a shift in the supply chain with volumes of food to be sold through different channel. (Rossi, 2020.)

Supporting livelihood during COVID-19

Some self-employed, including own-account workers and small business owners, are particularly at risk of falling through the cracks of existing social protection schemes in the current crisis. Informal workers remain beyond the scope of most income-support schemes. This includes employees who are not registered for mandatory social security, who are paid less than the legal minimum wage, who are employed without a written contract. France has announced an additional EUR 39 million will be directed to food aid; with an initial EUR 25 million to support food aid associations and a further EUR 14 million to be distributed in emergency food checks. (Scarpetta, 2020.)

Bottlenecks

A first bottleneck relates to the availability of inputs for farming, notably labour for harvesting fruits and vegetables. A second relates to plant shutdowns in the food processing sector, notably in meat processing. A third relates to the ongoing disruption of air freight, which affects high-value perishable products, again notably fruits and vegetables. What these bottlenecks have in common is that they are difficult to overcome in the short run. However, the biggest risk for food security is not with food availability but with consumers' access to food. As millions are losing their livelihoods or experiencing a severe drop in their incomes. Social safety nets and food assistance programs are thus essential to avoid an increase in hunger and food insecurity. (Anonymous, 2020.)

The impact of COVID-19 on health supply chain disruption can be summarized as following:

Italian case - The regional authorities are the primary procurement bodies responsible for acquiring medical supplies. Regional authorities worked to centralize decision-making and critical functions at the regional level to trim costs. This trend was reinforced by national government policies aimed at reducing expenditures and fighting corruption. A month later, the Civil Protection adopted "operational civil protection measures for the management of the epidemiological emergency from Covid-19" activating a national "Civil Protection Operations Committee" and "Regional Crisis Units," which were designed to facilitate coordination between institutional levels involved in purchasing critical medical supplies. In the immediate aftermath of the COVID-19 crisis, agencies conflicted with one another in the acquisition of medical supplies, demonstrating a severe lack of coordination and a great deal of competition that both hindered the success of acquisition and drove up the prices for scarce goods. Due to a lack of expertise in dealing with public health emergencies and the conflicting roles between the national and regional authorities, the latter

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increasingly acted independently and took initiative in purchasing critical goods and services within existing governance frameworks established before the outbreak or developing new approaches. Despite the diversity of regional models adopted, and national-level efforts to consolidate interjurisdictional efforts, severe coordination problems emerged between national and regional authorities. Specific examples included the identification of supply needs and the organization of deliveries. Without national coordination, regional procurement authorities activated an informal network to launch joint tenders, share market information, and exchange good practices. An international rush for supplies produced in global manufacturing hubs, a lack of national production after years of spending cuts, and decades of pressure on procurement authorities to seek cheaper products precipitated the severe medical supply shortage. When Italian manufacturers of luxury brands and other domestic manufacturers in the textile industry started to convert their production lines to accommodate needed health care supplies, the regulatory and authorization processes were exceedingly lengthy. In some cases, procurement officials decided to proceed anyway and circumvent the regulatory requirements. In other cases, officials waited them out. Some of the most innovative regional procuring authorities played more of a strategic role in contracting. They activated a local network of companies and research centres to commence and to intensify the production of critical medical supplies. Their knowledge of the local industry and their relationships with domestic companies made this possible. (Vecchi, et al., 2020.)

Identifying the challenges

While governments and private sector organizations did have disaster plans and stockpiles in place, the pandemic exposed several major supply chain vulnerabilities, including shortages of personal protective equipment (PPE) and testing kits. What's different about the COVID-19 pandemic is the level of uncertainty and the length of the disruption as well as its simultaneous impact on various geographic areas. In addition, unlike most other disruptions, COVID-19 has been affecting not only the supply but also the demand for products and services. There were a variety of factors that led to the health care supply chains' slow response to the COVID-19 emergency. These include:

- Port chokepoints and trucking bottlenecks that slowed down deliveries of critical supplies.
- Not having enough workers to produce and transport products because workers were out sick or were not showing up to work.
- Export bans put in place by countries where protective garments, medical equipment, and pharmaceuticals were manufactured, which limited supply to importing countries.
- Panic buying and stock piling of critical supplies leading to shortages for areas that truly needed the products.
- Lack of overall resiliency in the health care supply chain due to companies pursuing cost-focused strategies at the expense of creating redundancy in the supply chain.

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- Reliance on a few manufacturers of essential products.
- Over-reliance on offshore manufacturing for essential products and raw materials.
- Lack of transparency to assess existing centralized supply, such as the U.S. Department of Health and Human Services' Strategic National Stockpile (SNS); and
- Poor alignment and coordination among federal, state, and local agencies, as well as health care organizations, leading to a fragmented approach to ordering and fulfilment. (Mahmoodi, et al., 2021.)

The tables given below summarise the cascading effect of supply chain disruptions

Supply re-strictions at material and component (sub-) suppliers (Spieske, et al., 2022)

Medtech	Suppliers unable to match demand rise for CT scanner & diagnostic device parts.
	Suppliers of CT scanner & diagnostic device parts unable to maintain production capacity due to lockdowns.
	Suppliers lack financial stability, un-able to finance production increase.
	Suppliers of CT scanner parts increase prices
	Suppliers provide unreliable capacity & delivery data
Medtech and Pharma	Suppliers unable to match demand rise for infusion pump parts, disinfectant & drug ingredients.
	Suppliers of infusion pump parts unable to maintain production capacity due to lockdowns & missing PPE.
	Suppliers lack financial stability, close plants after order drops in other industries.
	Suppliers provide unreliable capacity & delivery data
Private hospitals	Manufacturers of all COVID-19-related products unable to match demand rise.
	Manufacturers of COVID-19-related products unable to fulfil supply contract due to lockdowns & missing PPE.

	Suppliers of PPE increase prices, terminate contracts & neglect quality.
	Suppliers provide unreliable delivery data

Logistics re-strictions at service providers (Spieske, et al., 2022)

Medtech	Restricted sea & air freight capacity, price increases (Asia to EU
	Restricted land freight capacity
Medtech and Pharma	Restricted sea & air freight capacity, price increases (Asia to EU
	Restricted land freight capacity
Private hospitals	NA

Increasing procurement competition with other HCSCs (Spieske, et al., 2022)

Medtech	Competition with manufacturers for limited CT scanner & diagnostic device parts
Medtech and Pharma	Competition with manufacturers for limited diagnostic de-vice parts & drug ingredients
Private hospitals	Competition with hospitals for PPE, dis-infectant, ventilators & drugs

Increasing procurement competition with public authorities (Spieske, et al., 2022)

Medtech	Global authorities place tenders for CT scanners, diagnostic devices & test kits
Medtech and Pharma	Global authorities place tenders for diagnostic devices & test kits.

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		Foreign authorities re-strict export of drug ingredients
Private hospitals	Order losses to global authorities buying up PPE, disinfectant & ventilators.	Foreign authorities re-strict export of COVID-19-related products

The impact of COVID-19 supply chain disruption on critical infrastructure can be summarized as following:

- Most disruptions were due to travel limitations and disrupted supply chains.
- Projects sponsored by foreign entities were severely affected—as they often need foreign engineers and technicians at construction sites. With respect to supply-chain delays, the construction industry is heavily reliant on manufacturers in China, where operations were strongly affected by COVID-19 early on. The global solar PV value chain was particularly hard-hit because manufacturing capacity is concentrated in a few major markets, including China.
- The second most reported reason for project disruption is the non-availability of laborers due to lockdown measures. Countries like the Philippines, India, and Colombia enforced enhanced community quarantines, resulting in labour shortages at construction sites.
- Other reasons include delayed or cancelled tender processes, lower demand projections, and government budget funds reallocation to tackle COVID-19 containment. What we know for sure is that development finance institutions (DFIs) face a test of whether they can live up to the responsibility of ensuring recent development gains are not lost. (Diop, 2020.)

The costs of a crisis may far outweigh incremental investment in resilience.

Widespread job losses are also a result of the crisis, particularly in service sectors; the impact on jobs has been ten times greater than during the global financial crisis of 2008-2009. Investment in infrastructure resilience can avoid economic losses, the need for expensive repairs, as well as preserve lives and protect the environment. (Laboul, et al., 2022.)

Concepts of infrastructure resilience

Infrastructure systems are complex and interlinked – when disasters strike or threats manifest, an outage in power, for instance, can cripple transportation networks and healthcare systems. Severe water shortages in Cape Town, South Africa in 2017 led to extensive economic, health, and safety impacts. Even seemingly small events can have cascading effects in infrastructure due to interdependencies. (Laboul, et al., 2022.)

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Operations, including data protection and digital security, and safety

Assuring that infrastructure can maintain services through periods of stress, including access to labour (while ensuring safety of workers), supply chains, and capital such as working capital facilities or reserves, is essential. The pandemic has caused greater scrutiny of supply chains, and how to manage access to essential goods and other critical inputs when interruptions occur. This can include identifying alternatives or back-ups for critical supplies and maintaining access to infrastructure markets and expertise through contractors that can effectively deliver infrastructure with value-for-money. There is also evidence that the COVID-19 crisis has increased opportunities for cyber-criminals to exploit weaknesses and fears, as more people shift to online activities for work or leisure (OECD, 2020c). Vigilance against cyber-attacks requires constant monitoring and secure data storage, as technologies and tools change and cyber-threats become more sophisticated. The OECD report Good Governance for Critical Infrastructure Resilience notes a progressive shift of critical infrastructure policies from asset protection to system resilience. (Laboul, et al., 2022.)

Financial aspects

COVID-19 has demonstrated the fragility of some financing structures, particularly where high leverage has meant that projects are not resilient to shocks. Access to adequate liquidity and strong balance sheets are some features that helped companies through recent market volatility. Without sufficient compensation for the extra spending and the revenue losses caused by COVID-19, many subnational governments could be forced to sharply cut operational and capital spending. (Laboul, et al., 2022.)

Continuity of service and accessibility

The loss of access to infrastructure functions and services could thus prove detrimental to households and businesses; consequently, avoiding loss of service or accessibility, even if a customer cannot pay.

Expected increased importance of communication infrastructure in the economy and the need to ensure its resilience, quality of service, and accessibility demand for infrastructure services, with usage of communication infrastructure for both work and leisure expanding significantly. This will mean that the resilience of communication infrastructure, and related applications and distribution of content, will become increasingly important.

More people teleworking from home, or close to home in shared work environments may shift demand for more localised, rather than centralised infrastructure, closer to where people live rather than work. large scale and costly investment in public transportation (such as subways), or

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increasing airport capacity, may be re-evaluated given the changing context, while more flexible approaches, such as through bus rapid transit. (Laboul, et al., 2022.)

What was preparedness before and after the event with regards to prepositioning, training, framework contracts and supplier management.

Response of EU

One of the earliest measures taken by the Commission in response to the lockdown in various Member States was to issue guidance on 23 March on opening 'green lane' border crossings to all freight vehicles, whatever goods they were carrying. A week later, on 30 March, the Commission issued further guidelines identifying workers in critical occupations, including health and food workers, for which continued free movement was deemed essential.

For seasonal workers in the agricultural sector, Member States were asked to exchange information on their different needs at technical level and to establish specific procedures to ensure a smooth passage for such workers.

The Commission's response was framed by the very limited resources available in the EU budget in the final year of the 2014–2020 Multi-annual Financial Framework (MFF).

An agricultural crisis reserve had been agreed as part of the 2013 CAP reform, funded each year by withholding a part of farmers' direct payments under the CAP which was then returned to farmers if the fund was not used. The European Parliament's Agriculture Committee urged the Commission to activate this reserve.

Commission's response fell into four categories: greater flexibility in the rules governing the disbursement of CAP payments; temporary derogation from EU competition rules for producer organisations allowing them to plan production; market support intervention; and direct aid. The response to the pandemic has revealed the limitations in the EU's crisis response mechanism particularly where market support may be needed. The EU does not have the budgetary firepower for sustained market intervention. Instead, by relaxing state aid rules, the EU handed over responsibility to Member States which have provided billions of euros in support to their farm sectors.

Policies in the future should support firms in building more robust and resilient supply chains and not undermine food security built on misconceptions about how supply chains performed during the Covid-19 pandemic (Matthews, A)

Recommended strategies for health care supply chain

- Build redundancy in the supply chain and change compensation programs accordingly.
- Utilize technology solutions.
- Create a holistic view of inventory.
- Gain greater upstream visibility by mapping and monitoring the supply network.

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- Diversify the supply base.
- Achieve network agility.
- Improve visibility/transparency of the Strategic National Stockpile (SNS) (Mahmoodi, et al., 2021)

Please provide a list with links of data sources used in the following categories

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NGO reports	*Data could not be found*
Community interviews/reports	*Data could not be found*
Eyewitness/first-hand accounts	*Data could not be found*
News/media reports	*Data could not be found*
Documentaries	*Data could not be found*
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Data could not be found		
Public Enquiry Reports/Findings		• Selin, M. 2020. Viranomaisviestintä koronapandemiassa. Medianäkyvyyden teema-analyysi. Meltwater, Outside Insight. (In Finnish)
Journal/Magazine articles		• Alani, H., Burel, G. & Farrell, T. 2022. Elon Musk could roll back social media moderation – just as we're learning how it can stop misinformation. In: The Conversation.
Data could not be found		
Online podcasts, blogs, forums & chat rooms		
Official policy recommendations & findings		• Diop, M. (2020). What can AI tell us about COVID-19's impact on infrastructure? Available at: https://blogs.worldbank.org/ppps/what-can-ai-tell-us-about-covid-19s-impact-infrastructure (31/01/2023)

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Academic conference paper:

- http://oro.open.ac.uk/71186/1/SocInfopaper.pdf

Other (Please specify)	
WP2	**Task 2.3: Natural and manmade case study social media analysis**

What was the role, influence, and impact of social media communications during this incident?

During the pandemic, a new team for strategic communication started at the Finnish Prime Minister's Office. The task of this team was to support citizen's crisis resilience, considered as one of the vital societal functions in Finland (Security Strategy for Society 2018). A communication project, called Finland Forward was launched to implement this task. The project had as its aim to help people cope with the prolonged crisis, and to strengthen people's resilience to crisis, promote interaction, create a sense of community and help people cope with everyday life through communication. It included various means for communication: campaigns, video material, pod casts, events and daily cooperation with civil society actors, NGOs and companies, all together almost 200 actors and organisations. Social media were widely used as well. Although the

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project approach and the related campaigns were novel and in line with modern approaches to crisis communication theory, they did not reach wide audiences. (Hakala & Ruggiero 2022.)

Pöyry et al., (2021) report how during public health crises, public organizations face a variety of strategic communication challenges, and the outbreak of the COVID-19 pandemic in 2020 is an extreme example. In Finland, the Prime Minister's Office initiated a communication campaign that utilized social media influencers to communicate timely instructions regarding the pandemic. However, it is uncertain how social media influencers adapt to briefings of public organizations given that they typically work with brands that align with their own interests and expertise, which rarely is epidemiology. The authors used the two-step flow of communication model and social influence theory to analyze research data that consisted of 96 Instagram posts, 108 Instagram Stories and 1097 comments. Qualitative content analysis was used to see how the influencers communicated about the pandemic and how their followers reacted. The results suggest that the influencers tried to adapt the messages to their own style, and, instead of committing to the wordings of the campaign, they shared general guidelines and, with their own example, showed how to behave during the pandemic. Their participation in the campaign helped affect social norms during the time of the crisis, which in the case of public health communication is a substantial, strategic goal. (Pöyry et al. 2022.)

Farooq et al. (2021) explain how the COVID-19 pandemic amplified the influence of information reporting on human behavior, as people were forced to quickly adapt to a new health threatening situation by relying on new information. Drawing from protection-motivation and cognitive load theories, the authors of the paper formulated a structural model eliciting the impact of the three online information sources: (1) social media, (2) official websites, and (3) other online news sources; on motivation to adopt recommended COVID-19 preventive measures. The model was tested with the data collected from university employees and students (n = 225) in March 2020 through an online survey and analyzed using partial least square structural equation modeling (PLS-SEM). The authors observed that social media and other online news sources increased information overload amongst the online information sources. This, in turn, negatively affected individuals' self-isolation intention by increasing perceived response costs and decreasing response efficacy. The study highlighted the role of online information sources on preventive behaviors during pandemics. (Farooq et al. 2021.)

The HERoS project (EU Horizon 2020) describes the efforts to identify sources of data from which we can gather insights about what kinds of needs (informational and tangible) citizens have shared during the COVID-19 pandemic. The report also provides a state of the art in measuring the impact of fact-checking, highlighting a gap in which our knowledge of misinformation spread patterns is disconnected from how we approach the diffusion of fact-checking information. See HERoS deliverables D4.1 COVID-19 misinformation tracking and D4.2 Crowdsourced information clustering for more information.

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What patterns of interactions between opinion makers and recurring topics in the Twitter debate following the disaster have been identified?

Deliverable D4.1 COVID-19 misinformation tracking from the EU project HEROS highlights the necessity for understanding the "co-spread" of both misinformation and fact-checking information, to be able to measure the impact of fact-checking on specific misinforming claims temporally and, potentially, at the geographic or platform level.

Please provide a list with links of data sources used in the following categories

Government/Official reports	This data was not requested in this phase.
Community interviews/reports	This data was not requested in this phase.
Eyewitness/first-hand accounts	This data was not requested in this phase.
News/media reports	This data was not requested in this phase.
Documentaries	This data was not requested in this phase.
Social Media	This data was not requested in this phase.
Satellite/other imagery	This data was not requested in this phase.
Academic Papers/Reports (Peer Reviewed)	• Hakala, S., & Ruggiero, A. (2022). Kriisinkestävään yhteiskuntaan. In H. Kantanen, & M. Koskela (eds), Poikkeuksellinen viestintä, *ProComma Academic 9*: 28–46. https://doi.org/10.31885/2022.00001 • Pöyry, E., Reinikainen, H. & Luoma-Aho, V. (2022). The Role of Social Media Influencers in Public Health Communication: Case COVID-19 Pandemic, *International Journal of Strategic Communication 16* (3): 469-484, https://doi.org/10.1080/1553118X.2022.2042694 • Farooq, A., Laato,S., Najmul Islam, A.K.M., Isoaho, J. (2021). Understanding the impact of information sources on COVID-19 related preventive measures in Finland, *Technology in Society*, 65: 101573. https://doi.org/10.1016/j.techsoc.2021.101573 .

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Academic Papers/Reports (Non-Peer Reviewed)		This data was not requested in this phase.
Public Reports/Findings Enquiry		This data was not requested in this phase.
Journal/Magazine articles		This data was not requested in this phase.
Online podcasts, blogs, forums & chat rooms		This data was not requested in this phase.
Official policy recommendations & findings		This data was not requested in this phase.
Other (Please specify)		This data was not requested in this phase.

WP2	Task 2.4: Natural and manmade case study aerial imagery analysis

What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform decision-making?	It has not been possible to identify data focused on Finland to accurately complete the section.
What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform the sharing of public information?	The HERoS project (EU Horizon 2020) analyses the potential benefits of the delivery of medicines using drones in the context of pandemics as well as the factors that hinder its development. See Deliverable D3.2 – Adaptation of workflows for drone deliveries to quarantines.

Please provide a list with links of data sources used in the following categories

Government/Official reports	This data was not requested in this phase.
NGO reports	This data was not requested in this phase.

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WP3	Task 3.1 - Critical analysis of past disasters via the identified case studies on their disaster preparedness strategies
3.1.1	**Type of hazards – Understanding the disaster risk**
Type of data	**Data/ information/ sources/ reference material**
a.	What type of hazards were commonly identified in the region (Slow-onset and rapid onset hazards)?
	This data was not requested in this phase.
Community interviews/reports	This data was not requested in this phase.
Eyewitness/first-hand accounts	This data was not requested in this phase.
News/media reports	This data was not requested in this phase.
Documentaries	This data was not requested in this phase.
Social Media	This data was not requested in this phase.
Satellite/other imagery	This data was not requested in this phase.
Academic Papers/Reports (Peer Reviewed)	This data was not requested in this phase.
Academic Papers/Reports (Non-Peer Reviewed)	This data was not requested in this phase.
Public Enquiry Reports/Findings	This data was not requested in this phase.
Journal/Magazine articles	This data was not requested in this phase.
Online podcasts, blogs, forums & chat rooms	This data was not requested in this phase.
Official policy recommendations & findings	This data was not requested in this phase.
Other (Please specify)	This data was not requested in this phase.

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b.	What hazards have resulted in disasters during the past 20 years?	This data was not requested in this phase.
c.	What risk assessment mechanism(s) were used by the relevant institutions for encompassing risk awareness, multi-hazard analysis, vulnerability/capacity analysis and cascading effects?	This data was not requested in this phase.
d.	What risk modelling and scenarios have been carried out to consider disaster risk and/or any other future threats and cascading effects?	This data was not requested in this phase.
e.	How the knowledge of indigenous communities and information in social media had been captured for disaster risk perception?	This data was not requested in this phase.
3.1.2	**Disaster resilience and preparedness strategies**	
a.	What were the available national and local disaster management plans and systems under following categories?	
	o Individual-level activities (e.g., first aid training and response)	This data was not requested in this phase.
	o Household actions (e.g., stockpiling of equipment and supplies, retrofitting)	This data was not requested in this phase.
	o Community efforts (e.g., socially responsible mitigation, training, and awareness campaigns for first respondents and responders, and field exercises)	This data was not requested in this phase.

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	○ Governmental strategies (e.g., multi-organisational planning and public private partnerships, early warning systems, contingency plans, evacuation routes, and public information dissemination, allocation of resources)	This data was not requested in this phase.
b.	What provisions were in place for research, education, science, and technology (ex: geospatial, remote sensing) for informed disaster preparedness?	This data was not requested in this phase.
c.	What special provisions were undertaken to ensure pandemic preparedness in disaster preparedness measures?	This data was not requested in this phase.
3.1.3	Mitigation	
a.	What policies and legislation were available that mainstreamed DRR in the national planning policy?	
	○ Land use planning and building codes (Ex: Avoid settlement expansion towards hazard prone areas)	This data was not requested in this phase.
	○ Critical infrastructure protection and structural design improvements	This data was not requested in this phase.
	○ Landscape and environmental arrangement around essential services and infrastructure	This data was not requested in this phase.

	○ Resilience strategies including planning and partnership building between sectors	This data was not requested in this phase.
b.	What support were provided by media platforms including social media during disaster operations?	This data was not requested in this phase.
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	This data was not requested in this phase.
3.1.4	**Response**	
a.	What were the available surveillance, early warning, and information management systems for activating response operations under the following conditions?	
	○ Support or coordinate disaster operations being conducted by a designated lead agency	This data was not requested in this phase.
	○ Logistics mechanisms and essential supplies for health and relief services	This data was not requested in this phase.
b.	What support was provided by media platforms including social media during disaster operations?	This data was not requested in this phase.
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	This data was not requested in this phase.
3.1.5	**Recovery**	

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a.	What were the long-term and short-term recovery actions undertaken during each post disaster recovery period including 'build back better' practices?		
		o Response endeavours such as needs and damage assessments	This data was not requested in this phase.
		o Community-level involvement and capacity building for disaster recovery	This data was not requested in this phase.
		o Local administration and coordination for resource mobilisation	This data was not requested in this phase.
		o Building redundancy into a DRR plan	This data was not requested in this phase.
b.	How the post disaster infrastructure recovery including rebuilding, restoration, or reconstruction had taken place?		This data was not requested in this phase.
c.	What plans or provisions were available to minimise the economic impact following a disaster?		This data was not requested in this phase.
d.	What environmental recovery plans were available to manage the impact for eco-systems and related services?		This data was not requested in this phase.
e.	How have the mitigation and resilience-building activities of preparedness been adopted for the next disaster, and the development and implementation of legislation, policies, and		This data was not requested in this phase.

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3.1.6	**Monitoring and evaluation**	
How frequent are plans being reviewed and revised for emergency preparedness, response, and recovery?	practices to avoid similar situations in the future?	This data was not requested in this phase.
WP3	**Task 3.2 – Vulnerable categories**	
3.2.1	**Identify people vulnerable categories in the different phases of disaster management**	
a.	In the analysed context, what were the consequences (death or injury) with respect to the following age groups and gender?	
	O New-born (ages 0-4 week)	This data was not requested in this phase.
	O Infant (ages 4 week - 1 year)	This data was not requested in this phase.
	O Toddler (ages 1-3 years) - M/F	This data was not requested in this phase.
	O Pre-schooler (ages 3-5 years) - M/F	This data was not requested in this phase.
	O School aged child (ages 6-13 years) - M/F	This data was not requested in this phase.
	O Adolescent (ages 14-18 years) - M/F	This data was not requested in this phase.
	O Young adult (ages 19-29) - M/F	This data was not requested in this phase.
	O Adult (ages 30-64 years) - M/F	This data was not requested in this phase.
	O youngest-old (ages 64-74 years) - M/F	This data was not requested in this phase.
	O middle-old (ages 75-84 years) - M/F	This data was not requested in this phase.
	O Oldest-old (ages more than 85 years)	This data was not requested in this phase.

b. During the rescue phase what were the categories of disabilities, or specific needs, that arose?

O Movement disabilities *	This data was not requested in this phase.
O Sensorial disabilities (deafness, blindness) *	This data was not requested in this phase.
O Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	This data was not requested in this phase.
O Pregnant women	This data was not requested in this phase.
O New-born	This data was not requested in this phase.
O Infant	This data was not requested in this phase.
O Other that emerged during the analysis of the available documentation or specific investigations conducted	This data was not requested in this phase.

c. Which of the following categories of disabilities, or specific needs, were managed in the post-emergency phases to give an initial response to people involved?

O Movement disabilities *	This data was not requested in this phase.
O Sensorial disabilities (deafness, blindness) *	This data was not requested in this phase.
O Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	This data was not requested in this phase.
O Pregnant women **	This data was not requested in this phase.
O New-born	This data was not requested in this phase.
O Infant	This data was not requested in this phase.

	o Other that emerged during the analysis of the available documentation or specific investigations conducted	This data was not requested in this phase.
	*Indicate age class (see 3.2.1.a) and gender; ** indicate class age	This data was not requested in this phase.
3.2.2	**Post event management**	
a.	About point 3.2.1b, were the rescuers prepared to manage the situation?	
	o The rescuers were involved in specific training activities in this field	This data was not requested in this phase.
	o Specific documentation has been made available	This data was not requested in this phase.
	o Simulations were conducted also considering the issue of inclusive emergency management	This data was not requested in this phase.
b.	About point 3.2.1c, were the operators prepared to manage the situation considering people with specific needs?	
	o The rescuers were involved in specific training activities in this field	This data was not requested in this phase.
	o Specific documentation has been made available	This data was not requested in this phase.
	o Simulations were conducted also considering the issue of inclusive emergency management	This data was not requested in this phase.

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c.	Were people with specific needs and their family members or caregivers prepared to manage that emergency?	This data was not requested in this phase.
	o Specific information activities were carried out on these topics with the involvement of family members, caregivers, and the surrounding community	
	o Specific documentation has been made available	This data was not requested in this phase.
	o Simulations were conducted also considering the issue of inclusive emergency management	This data was not requested in this phase.
WP3	**Task 3.3 Culture & heritage**	
3.3.1	**What was the extent of the damage with respect to the type of disaster?**	
	This data was not requested in this phase.	
3.3.2	**What was the extent of the damage with respect to the size of the disaster?**	
	This data was not requested in this phase.	
3.3.3	**How was the human and environmental adaptive response/reaction to the damage?**	
	This data was not requested in this phase.	
3.3.4	**How long did it take to recover/retrieve after the disaster in the following categories?**	
	o Land use	This data was not requested in this phase.
	o Repopulation	This data was not requested in this phase.

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○ Everyday life condition		This data was not requested in this phase.
○ Social life		This data was not requested in this phase.
○ Lesson for the mitigation of other disasters		This data was not requested in this phase.
3.3.5 Was there any quantitative correspondence between reaction/effort and damage?		
This data was not requested in this phase.		
3.3.6 What was the timescale of such correspondence (short-term vs. long-term)?		
This data was not requested in this phase.		
WP3 Task 3.4 – Risk governance strategy		
Type of data		**Data/ information/ sources/ reference material**
3.4.1 Disaster risk governance mechanisms		
What were the disaster risk governance mechanisms identified in the relevant authorities to manage disaster risk under following categories?		
	○ Knowledge sharing and inclusion of science and technology	This data was not requested in this phase.
	○ Harmonizing capacities and resources to the needs in risk assessment	This data was not requested in this phase.
	○ Institutionalizing partnerships, coordination, and responsibilities	This data was not requested in this phase.
	○ Participatory decision-making mechanisms, inclusive of vulnerable communities, indigenous communities, and volunteers	This data was not requested in this phase.

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	○ Leveraging investments in DRR	This data was not requested in this phase.
3.4.2	**International DDR frameworks**	
	What international DDR frameworks (SENDAI, SDG, Paris Agreement) were adopted in DRR projects?	This data was not requested in this phase.
3.4.3	**Accountability in disaster governance**	
	What were the provisions to ensure accountability in disaster governance?	
○	Consider accountability aspects in the Sendai Framework for Disaster Risk Reduction 2015-2030	This data was not requested in this phase.
○	Innovative elements of accountability	This data was not requested in this phase.
○	Enabling legislations	This data was not requested in this phase.
○	Regular monitoring, evaluation, and review	This data was not requested in this phase.
WP4	**Cascades**	
1.	What is the EU country, covered by CORE partners, preparing for (crisis, war and crisis, disruption)?	*Finland for COVID-19 case study.*
2.	What types of disasters is each EU country, covered by CORE partners, preparing for?	This data was not requested in this phase.
3.	Who is involved in the preparation process?	National Emergency Supply Agency (hereinafter the NESA) and the National Emergency Supply Organization (hereinafter the NESO), have been the nodal agencies. The actions taken to prevent the spread of the coronavirus were recognised as having a major impact on the economy and employment, but its full scope was difficult to comprehend. The NESO responded to this need for

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		Content
		understanding by maintaining a common situational picture since March, which involved the organisation's sector-specific pools collecting observations from their respective sectors and submitting them to the National Emergency Supply Agency, which used them to compile an overview of the situation and produce common situational picture reports for different branches of Government and the NESO. In addition to this economic situation picture, the NESA's Planning and Analysis Department produced situation pictures on the international impacts of the pandemic. Utilising cooperation networks and international public sources, the resulting report compiled observations from the Nordic countries, the EU, the OECD and NATO, among others.
a.		What kind of approach is adopted in disaster preparedness: e.g., is disaster preparedness centralized (national level) or decentralized (local level); who (which agency) has the leading role in preparedness; guiding policy frameworks and/or strategies and principles; coordination/cooperation mechanisms (and sectors involved)?	During the first wave of the pandemic and the ensuing coronavirus crisis, the NESA also carried out special security of supply measures to safeguard the functioning of services, production and infrastructure considered critical to security of supply amid the state of emergency declared in the spring. These special security of supply measures included providing financial support to passenger car ferries to safeguard flows of goods from Finland to Sweden and Central Europe via the Baltic Countries, which were considered important to security of supply, and the procurement of protective equipment in accordance with procurement proposals received from the Ministry of Social Affairs and Health[3]
b.	Other stakeholders for preparedness?	This data was not requested in this phase.
c.	EU/UN/INGO?	This data was not requested in this phase.
4	Training and communication preparedness	

[3] THE NEW NORMAL OF SECURITY OF SUPPLY Scenarios for a post-COVID world and their impacts on security of supply

a.	What kinds of trainings (including drills and crisis exercises) are done to prepare for a disaster?	This data was not requested in this phase.
b.	Who provides training, for whom and what competencies are covered?	This data was not requested in this phase.
c.	What kind of approach is adopted in crisis communication preparedness: e.g., what is communicated to the general public about preparedness, how (means and channels: e.g., preparedness brochure, crisis portals/websites, campaigns, formal/civic/professional education, social media mobilisation) and by whom (leading agency + other partners and stakeholders involved + partnerships with news media)? How are the needs of vulnerable groups taken into account?	This data was not requested in this phase.
5.	Prepositioning, framework contract and supplier management	
a.	What types of goods are pre-positioned and how are locations selected?	This data was not requested in this phase.
b.	Which organization is responsible for management of pre-positioned stock?	This data was not requested in this phase.
c.	What are the framework contracts for disaster preparedness, who manages them?	This data was not requested in this phase.
d.	How are suppliers who secure the supply for preparedness selected and managed	This data was not requested in this phase.

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6.	How was the preparedness and response mechanism activated for different types of risks?	This data was not requested in this phase.
7.	How the event influenced flow, access to and availability (length of shortage, scale, shortage by social group) of:	
	○ Drinking water;	This data was not requested in this phase.
	○ Energy supply (electricity, coal, fuel etc.);	This data was not requested in this phase.
	○ Food (retail sales, catering, etc.);	The food services sector was especially affected. By the end of February 2021, for example, food and beverage services saw sales fall by 30 percent, , compared to their pre-crisis levels. Small and medium-sized firms were especially hard hit as they do not have the same level of resilience as large firms (due to limited liquidity, limited finance and digital gaps with other large firms)
	○ Health (emergency and long-term provision, psychological health);	This data was not requested in this phase.
	○ Access to information.	This data was not requested in this phase.
8.	How the event influenced preparedness mechanisms (in terms of training, information flow, communication, prepositioning, supplier management). What were the lessons learned from the case?	NESA has launched a strategy project for responding to the development needs highlighted by the ongoing crisis so far. The focus areas of this strategy project include the development of material preparedness and the emergency stockpiling system, programmes for responding to social changes affecting security of supply and the strengthening of analysis and foresight activities focusing on examining the operating environment. Alongside this strategy project, the NESA will also be following the assessments to be carried out on the effectiveness of national preparedness and comprehensive security approaches. Security of supply is part of a larger whole in the context of national preparedness as well. For example, resilience policy becoming the centre of attention of

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	international communities may cause EU-level changes that can potentially have major impacts on security of supply. Developments that could bring about these kinds of changes include the ongoing renewal of the directive on the protection of critical infrastructure (ECI Directive) and the updating of the directive on security of network and information systems (NIS Directive) concerning the security obligations and disruption reporting of digital services. Both of these directives regulate infrastructure, production and services considered critical to society, which in the Finnish operating environment also fall within the purview of security of supply. These developments demonstrate that the long-term planning of security of supply cannot focus exclusively on the changes and consequences of the coronavirus crisis. Instead, the aim should be to understand the strategic operating environment as comprehensively as possible and independent of threats/risks.
9. Have there been any studies conducted on the long-term impact (five or ten years) of this disaster/crisis?	None can be found yet.
a. Was there any long-term health or societal impact?	None can be found yet
b. Any local supply chain impact?	In Finland and around the world, prices have been pushed up by the strong recovery in demand and the concurrent supply chain bottlenecks. The rise in energy prices has also been widespread and substantial. Even so, the inflation outlook continues to be surrounded by significant uncertainty[4]. More detailed data show, for instance, that Finnish enterprises are more actively integrated in global value chains than the OECD's TiVA framework estimates. According to

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[4] Finnish economy's robust growth being slowed by COVID-19 https://www.suomenpankki.fi/en/media-and-publications/releases/2021/economys-robust-growth-being-slowed-by-covid-19-in-finland/

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		more detailed data, the share of foreign value added in exports, which is one of the most important indicators of global value chain integration, is over 10 percentage points higher than the OECD's estimate. When value chain participation is broken down by industries and enterprises' characteristics, differences in value chain integration are also seen within industries. The value chain integration of Finnish enterprises is borne by large enterprises, at least in manufacturing industries.[5]
c.	How long did it take for the communities to get back to the original state?	This data was not requested in this phase.
d.	Any studies on the long-term resilience of the affected region?	None till now
WP7	**Social media information/misinformation and risk communication**	

Please provide a quality assessment for the accuracy and veracity of information and data used to inform this case study in the following three categories:

a).	Media information	This report concludes that communication by the Finnish authorities was in many ways successful in the first period of covid-19 pandemic. However, some exceptions were there. For example, communication about face masks, i.e., PPE, included contradictory messages and statements from different authorities and experts, in a way that the core message was not always clear. Moreover, the content of those messages was sometimes ambiguous. Moreover, too many communicators expressed their views on the topic and their statements were not in line with each other. From the point of view of the audience, it was also difficult to differentiate between official recommendations and statements / opinions of various experts. The report was based on ana analysis of media coverage. (Selin 2020.)

5 Statistics Finland and OECD reports examine the economic development of the COVID-19 period and manufacturing enterprises in global value chains
https://www.stat.fi/uutinen/statistics-finland-and-oecd-reports-examine-the-economic-development-of-the-covid-19-period-and-manufacturing-enterprises-in-global-value-chains

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b). Misinformation	This data was not requested in this phase.
c). Risk communication	This paper explains how understanding risk perceptions of the public is critical for risk communication. It reports how in February 2020, the Finnish Institute for Health and Welfare started collecting weekly qualitative data on coronavirus disease (COVID-19) risk perception that informs risk communication efforts. The process was based on thematic analysis of emails and social media messages from the public and identified factors linked to appraisal of risk magnitude, which are developed into risk communication recommendations together with health and communication experts. (Lohiniva & al. 2020.)

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Annex 11 - Case Study 7 – PANDEMIC in Italy

CASE STUDY 7: *Pandemic in Italy*

Incident	PANDEMIC: COVID- 19 EMERGENCY
Location	The pandemic spread all over the wordl but we will focus on Italy
Time & Date	December 2019 – May 2020

Description and timeline of the incident

Detailed description of the incident: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a novel coronavirus also known as COVID-19, is the cause of the on ongoing global pandemic. The outbreak was discovered in Wuhan, Hubei Province, China, officially confirmed by the Wuhan Municipal Health Commission, on December 31th 2019 (National Health Commission of the People's Republic of China, 2020). As a consequence World Health Organization (WHO) declared that the outbreak constitutes a Public Health Emergency of International Concern (PHEIC) (World Health Organization, 2020a).

SARS-CoV-2 is mainly spread via respiratory droplets, including aerosols, from an infected person who sneezes, coughs, speaks, sings or breathes in close proximity to other people. Symptoms of COVID-19 can vary in severity from none at all (asymptomatic) to: fever, cough, sore throat, general weakness, fatigue and muscle pain, loss of smell and taste. The most severe cases can lead to shortness of breath due to pneumonia and acute respiratory distress syndrome, as well as other complications, potentially leading to death (European Centre for Disease Prevention and Control). Symptoms may appear 2-14 days after exposure to the virus (Juanjuan & All, 2020).

On March 11th 2020 WHO Director-General declares "*118,000 cases reported globally in 114 countries, more than 90 %t of cases are in just four countries, and two of those – China and the Republic of Korea - have significantly declining epidemics. 81 countries have not reported any cases, and 57 countries have reported 10 cases or less*" and "*4,291 people have lost their lives*" and declared COVID-19 a pandemic (World Health Organization, 2020b). On June 28th 2020 at 10:00 CEST WHO reported 9.843.073 cases and 495.760 deaths globally (World Health Organization, 2020c).

COVID-19 in Italy detailed description: Italy was the first Western country to experience a large-scale impact of COVID-19 on human life due to the quick spread of the virus. On January 30th 2020 after WHO declared COVID-19 a PHEIC, the Italian Council of Ministers declared a state of emergency[6], initially for a period of six months, then extended. This included the allocation of national funds necessary for the implementation

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[6] Furthermore, on 17th March, to respond to the inadequate availability of both personal protection equipment (PPE) and ventilators, the Prime Minister appointed a commissioner in charge of coordinating their centralised procurement. On 10th April, a 'committee of experts in economic and social subjects' was established by the Prime Minister to develop plans and guidelines for the

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prevention measures and for the needed Decreto del Presidente del Consiglio dei Ministri (DPC) ordinances. The Department of Civil Protection (which is an operative branch of the Presidency of the Council of Ministers) has been nominated to coordinate and implement the emergency interventions (Il Consiglio dei Ministri, 2020). As recommended by the Technical Scientific Committee (Comitato Tecnico-Scientifico, CTS), preparedness studies were carried out aimed at risk classification and health planning through an inter-institutional collaboration.

Is mandatory to acknowledge that Italy on January 22nd 2020, a national task force to counter COVID-19 was set up and the first guidelines for COVID-19 surveillance was establishing including criteria and methods for reporting cases of SARS-CoV-2 infection.. The aim of the task force was to: i) alert the relevant health facilities; ii)enable airport controls; iii) safely repatriate compatriots from contexts of high transmission of SARS-CoV-2; iv) issue operational guidelines for prevention and restrictions of people's mobility in the event of an epidemic; v) verify implementation of response actions and their compliance with international guidelines (WHO, ECDC); vi) manage confirmed cases in Italy in collaboration with all regional health services, Local Health Units (LHU), hospitals and IRCCSs. (Ministero della Salute, 2020)

On February 20th 2020, with the identification of the first case of locally transmitted COVID-19, Italy passed from a preparedness to an epidemic response phase, with rapid and continuous risk reassessments and the activation of the measures envisaged in the previous planning phase (Ministero della Salute, 2020) when the first deaths were detected in Casalpusterlengo (LO) and in Vo '(PD).

On March 11th 2020 Italy overtook China as the country with the most reported deaths: 631 total deaths and 168 new deaths becoming the first country worldwide to introduce a national lockdown with further restrictions to people's movements, except for essential reasons (e.g. work, health and getting supplies). The first movement and access/exit restrictions around these hotspots, known as 'red zones, involved more than 50,000 people, for 14 days, in 11 town in Veneto and Lombardia Region. (Il Consiglio dei Ministri della Repubblica Italiana, 2020 b). As the epidemiological situation evolved, further ministerial circulars containing additional information and updates were issued strict measures for virus spreading reduction, including stay-at-home orders. (Ministero della Salute)

All infected patients were notified within 24 hours to different authorities through a dedicated online surveillance platform. With the onset of the national COVID-19 outbreak, this surveillance system was adapted to the epidemiological context of local transmission (Ministero della Salute, 2020). At the outset of the COVID-19 outbreak, ISS launched a surveillance system to collect information on all people with COVID-19 throughout

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transition from total lockdown to the wider reopening of the country. The state of emergency had two important implications for the governance of the crisis. First, to guarantee a quick response, the government was allowed to bypass the Parliament in the definition of legislative interventions. The government did so by approving so-called 'decrees of the Prime Minister'. This approach, although legally grounded in the Italian law, blurred the boundaries between the executive and the legislative powers, de facto freezing the Constitutional framework. For this reason, critics have questioned the decision by the government to prolong the state of emergency first until the 31st October and then until the 31st January 2021. Second, the state of emergency introduced the possibility of derogation of existing procurement rules. Italy has very strict procurement rules and the national anti-corruption agency is dedicated to check the legitimacy of procurement bids. The Department of Civil Protection issued new procurement regulations to be valid mainly for the acquisition of PPE, tests and ventilators, simplifying and accelerating the existing procedures.

the country. Data on all COVID-19 cases were obtained from all 19 Italian regions and the 2 autonomous provinces of Trento and Bozen. COVID-19 cases were identified by reverse transcriptase–polymerase chain reaction (RT-PCR) testing for the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The fatality rate was defined as number of deaths in persons who tested positive for SARS-CoV-2 divided by number of SARS-CoV-2 cases. The overall fatality rate of persons with confirmed COVID-19 in the Italian population, based on data up to March 17, was 7.2% (1625 deaths/22 512 cases) (Livingston & Bucher, 2020) This rate is higher than that observed in other countries (WHO, 2020) . The average age of confirmed cases of SARS-cov-2 infection in Italy reported since the beginning of the epidemic is 61 (range 0-100); 110.171 cases are males (45,8%) (Istituto Superiore di Sanità (ISS), Roma, 2020)

Italian Health Care System: Italy has a regionally organized National Health Service (Servizio Sanitario Nazionale, SSN) in which, at national level, the Ministry of Health (supported by several specialized agencies) sets the fundamental principles and goals of the health system, defines a national statutory benefits package of health services guaranteed across the country, and allocates national funds to the regions. The regions are responsible for organizing and delivering health care through local health authorities (Aziende Sanitarie Locali). The health care institutes, at all levels, was structurally unprepared, since they had been previously penalised by reductions in public expenditure (Trading Economics, 2021), the growing shortage of medical and nursing staff, and the fragmentation of the national system into 21 different regional health systems[7], which proved very difficult to coordinate. Each regional health system thus faced the emergency differently, creating a lack of homogeneity in managing infected patients [8] . In all of the regions, however, the following actions became necessary (Snowdon & Saunders, 2021):

1. An increase in the number of beds in the Intensive Care Units (ICU);

2. The activation of Special Units of Continuity—USCA, with the specific mandate to manage homecare patients who did not require hospitalisation;

3. Identification of suitable accommodation facilities and conversion of existing social and healthcare facilities into intermediate facilities for COVID-19 patients;

4. Accelerate the ordinary procedures due to the unavoidable urgency of the necessary purchases, while always maintaining valid efficiency and effectiveness criteria: purchasing of PPE, ventilators and equipment for the provision of intensive care beds. The pharmaceutical supply chain was revealed to be very critical.

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[7] Italian health system is decentralised healthcare system with 19 regions and 2 autonomous provinces (AP) that organise and manage all aspects of healthcare, including contact tracing in the context of COVID-19. At the local level, regions and APs are organised in one or more local healthcare units that coordinate with regional governments for the activities of healthcare delivery, prevention and health protection. Local healthcare units are, in practice, autonomous and can decide how to operatively manage contact tracing in coordination with the requirements set by the regional governments.

[8] Hospitalisation in Lombardy and Piedmont was between 50% and 60% at the beginning of the pandemic period, and then grew and fluctuated between 70% and 80% in the first half of March 2020, while it decreased in the other regions and finally dropped below 20% at the end of April 2020. While Lombardy opted for hospitalisation, other regions such as Veneto opted for less hospitalisation, preferring home isolation instead.

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The unpreparedness to the pandemic exerted various effects in the country, especially in terms of lack of resources and supplies needed for patients care and Healthcare workers (HCWs) safety. Various studies have shown the following critical points in the management the emergency:

- In Aprile 2020 almost 11% of the people infected in the country were HCWs. Many of these infections are likely due to occupational hazard; HCWs becoming infected while caring for patients suggesting the shortage Personal Protective Equipement (PPE); COVID-19 tests were not available for the majority of the HCWs, as well as for the population;

- Nursing homes were particularly hit by the pandemic: excess deaths, prompted the ISS to conduct a targeted survey, which revealed that an average of 9.1% of all nursing homes' residents died in Italy, with a peak of 14% in Lombardy, between 1st February and 14th April, of which about 37.4% officially due to COVID-19 ('Istituto Superiore di Sanità (ISS), Maggio 2020);

- The management of the COVID-19 emergency implied elevated total costs for the admission of infected patients and a significant reduction in ordinary admissions, which were continuously delayed and which, in turn, had a further impact on the increase in health expenditure.

In Europe, Gross Domestic Product declined by a record 21.3 % in France, 19.2 % in Spain, and 17.5 % in Italy in the first quarter of 2020 (also annualized and seasonally adjusted). The second quarter is bound to be even worse (Thomsen, 2022).

W P2	Task 2.2: Natural and manmade disaster case study identification, research, and analysis

What were the public information sharing challenges?

Italy was the first country in Europe to be affected by COVID-19 in a very strong way, and the first one being involved in an "infodemic" which WHO defines is as *"too much information including false or misleading information in digital and physical environments during a disease outbreak"* (World Health Organization, 2020).

Over 50 million Italians (equal to 99.4% of adults), have searched information on the pandemic from various official and non-informal sources, *creating their own personal information program*. Traditional media still dominate in Italy, but web and social media grew in fame. This data sets an example of how a sudden event triggered an unprecedented demand for information on a global level. This thirst for rapid information contributed to create misinformation.

The risk of disinformation is dangerous: 29 million Italians have found news on the web and social networks which then turned out to be false or wrong. For the first time, the media have had difficulty in governing a context of sudden multiplication of demand, due to the pandemic, confirming that they increasingly need reliable and competent external figures (Ital Communication&CENSIS, 2021)

Different elements were involved in the infodemia process:

a. Italy suffers from a *general lack of trust in public institutions* (registered an extreme decline in trust - 21points in one year), and with government and media being the least trusted institutions (Edelman Trust Barometer, 2018); The lack of trust is also marked in relation to science and scientists: italians were found to be more skeptical than other European citizens about the beneficial impact of technoscience (Eurobaromentro, 2010); italians have much less confidence in the impact of technological and scientific innovations on their health (51%), in comparison with the other countries (76.5% on average). Lower rates are also reported for trust in scientists (56.9%), especially when scientific studies deal with controversial research funded by private companies

b. lack of basic information about the virus and its consequences for people's safety, the uncertainty as to how it might be transmitted (Lovari, Spreading (Dis)Trust: Covid-19 Misinformation and GovernmentIntervention in Italy, 2020), therefor fears and rumours;

c. chaotic flow of communication combined with antiscience movements which has gained visibility in the digital realm, being often covered by the mass media and heavily politicized by populist parties;

d. constant public disputes between scientists and politicians, spectacularized by mainstream media, and fuelled by partisan interests;

According to social media monitoring by the Vaccine Confidence Project, 3.08 million messages about COVID-19 were disseminated daily between January and mid-March 2020 (Larson, 2020)

AGCOM found that, as a proportion of disinformation published online, Coronavirus contents rose from 5% in early January to 45% in late March 2020 and the Italian media have produced about 700,000 contents regarding the coronavirus in the same period (Autorità per le garanzie delle Comunicazioni AGCOM, 2020).

In Italy information about COVID-19 came not only through institutional sources but also from the personal social media accounts of the president of some regions, providing more information than the regional administration itself. Many posted the daily Civil Protection Department media conference on their site. Newspapers and news websites dedicated whole sections to COVID-19, often cancelling the subscription costs. Importantly, they informed the public about the limitations and biases of the data and helped people understand what the data did not say. This touched upon a real problem. While the flood of data was crucial for building awareness and consensus on the sacrifices the epidemic imposed on the whole of society, it was also a source of a growing infodemic, or an overabundance of information – some accurate and some not – making it a challenge for people to find trustworthy sources and reliable guidance when they needed it. The fragmentation of the data, particularly on the regional websites, often obscured the rationale for national and regional decisions. In the meantime, most newspapers and broadcast stations (especially television), in a country where television is the only source of information for 42% of the population gave ample space to a variety of pundits and so-called opinionists. With real or hyped-up academic or expert competence, they populated ubiquitous talk-shows dedicated to COVID-19, with controversial statements and public controversies played out live before a bemused public. The scenography

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of spectacular public disagreements and questionable comments of media pundits did much to fuel uncertainty and anxiety in the population. In reaction, the Government set up a task force to counteract false news in the press and on social media (WHO, 2020).

In this problematic context, the Italian Ministry of Health has taken steps to assume a key role from a communicative point of view to respond to the growing requests of citizens and the media, and stem the myriad of inaccurate information circulating online. They assumed a central role by starting to produce messages about the virus in an attempt both to respond to growing demands from citizens and to stem the tide of inaccurate information. Specific attention was devoted to the ministerial website with a COVID-19 section, both in Italian and English, with a thematic page to counter misinformation, named "Attenti alle bufale"(Beware of hoaxe) playing a strategic function in mitigating the and turning it into a thematic page almost completely dedicated to dealing with the emergency, with 93,5% of the messages focused on COVID-19. With the emergency, the number of likers rose from 61,196 on 30 January to 409,145 on April 3, showing the need felt by users to find a reliable institutional source about the virus, but also the strategic function played by this page in mitigating the infodemic. In those two months, the page published 301 posts, 94% of which were about COVID-19, turning into a thematic page to face the emergency (Lovari, Spreading (Dis)Trust: Covid-19 Misinformation and GovernmentIntervention in Italy, 2020).

The Italian Ministry of Health created campaigns about Coronavirus, involving famous people and digital influencers, and using specific hashtags (e.g., #iorestoacasa). Messages countering fake news occupied 7.1% of the institutional flow. These posts were enriched with emoticons, infographics and social cards, frequently integrating the words falso (false) or "fake news" in visuals, and linking to the COVID-19 section in the ministerial website (Lovari & Righetti, La comunicazione pubblica della salute tra infodemia e fake news: il ruolo della pagina Facebook del Ministero della Salute nella sfida sociale al Covid 19, 2020). There were other association that created counter misinformation (FACTA.NEWS)[9]. In April 2020, the Italian government launched a specific task force to promote collaboration with fact-checkers and to encourage citizens' activism in signalling misinformation 70% of all Italian articles monitored by Media Cloud where about COVID-19, meanwhile CrowdTangle affirmed that between January 30th and March 3th 2020 over 2 million and 700 thousand posts in Italian were published on Facebook on this theme, for a total of over 480 million interactions.

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9 ws outlet, Facta , created a portal to which citizens were able to send documents, news, data or claims made by politicians for verification by journalists from January: https://facta.news/storie/2020/06/04/lepidemia-delle-bufale-storia-della-disinformazione-sul-coronavirus-in-italia/. Interest groups, business associations and politicians launched hashtags and social media campaigns such as "We do not stop", "We are stronger than the virus", "We will fight the virus" or #Milanononsiferma [Milan does not stop]. Happy hours were organized "against" COVID-19. Perceptions changed very quickly when the epidemic spread and some of these same politicians were infected. After this, all the attention of the media – and of the public – concentrated on how the epidemic took hold of the country. Other newspapers went into in-depth analysis of local data; Eco di Bergamo, for example investigated the dramatic situation in that province, sounding the alarm bell about a situation that had spiralled out of control (51). Initiatives such as Dataninja and Open Data Italia featured analyses, data visualizations and discussions on the (non) relevance of some types of data. Dozens of citizen groups, such as the IoConto [I matter] committee, lobbied for the release of open data. Various media outlets launched interactive dashboards and newsletters to elaborate and explain the data provided by the Civil Protection Department, helping readers to understand and interpret the flood of data.

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AGCOM conducted an analysis on the entire textual content extrapolated from more than 17 million documents created in Italy (from January 1st 2019 up to March 22nd 2020) by more than 2,000 information sources (national television and radio channels, newspapers, news agencies, websites of traditional publishers, native online news outlets, and related pages and accounts of social networks), and sources of disinformation (websites and social pages/accounts) identified as such by external subjects specialized in debunking activities. The amount of online disinformation produced in Italy was therefore estimated using a subjective methodology, i.e. considering the total number of documents created monthly by the aforementioned sources of disinformation. (Autorità per le garanzie delle Comunicazioni AGCOM, 2020)

The HERoS project (EU Horizon 2020) describes the efforts to identify sources of data from which we can gather insights about what kinds of needs (informational and tangible) citizens have shared during the COVID-19 pandemic. The report also provides a state of the art in measuring the impact of fact-checking, highlighting a gap in which our knowledge of misinformation spread patterns is disconnected from how we approach the diffusion of fact-checking information. See HERoS deliverables D4.1 COVID-19 misinformation tracking and D4.2 Crowdsourced information clustering for more information.

What were the ethical issues?

Several ethical issues have been identified before and during COVID-19 pandemic, in Italy:

1. restrictions on freedom of movements and restrictions on personal privacy due to the lockdown: quarantine and lockdown was a shock to people who had become accustomed to their exercise of democratic liberties. Many journalists, writers and politicians highlighted the importance of the fact that this situation must be limited in time and not extendable, whatever happens, as it affects the inalienable rights of the person (Ignazi, 2020). Not everyone was ready to obey the rules but 80% of Italians agreed with the necessity of restrictions, at the beginning of 2020 (Istituto Nazionale di Ricerca Demòpolis, 2020) (BRISCESE, LACETERA, & MACIS, 2022). The political decision to initially block only some regions of Northern Italy caused a massive exodus to Southern Italy, thus contributing to the spread of the epidemic, even to a small extent in non-infected regions.

    In the aftermath of the declaration of the state of emergency, the Civil Defense Department adopted several ordinances restricting the enjoyment of fundamental rights and freedoms, for the purpose of containing the epidemic and for the safety and health of the citizens. In particular, the ordinance Feb. 3th , 2020-with the prior assent of the Garante per la Protection of Personal Data, No. 15 of February 2nd , 2020 - stipulated in Article 5 that: "in order to ensure the most effective management of the flow and interchange of personal data," entities operating within the National Civil Protection Service and related operational structures may carry out, in compliance with the principles established by Article 5 of Regulation (EU) 679/2016 on the processing of personal data (GDPR) (proportionality, minimization, finality, etc.), processing of data personal data also belonging to the special categories referred to in Article 9 of the GDPR (formerly sensitive data) and even judicial data (art. 10 GDPR) necessary for the performance of the civil protection function in the context of the

emergency. Such data may be communicated to public and private entities, in the event that this is indispensable, for the purposes of containing the epidemic . Choices regarding the adoption of forms of surveillance based on digital technologies are subject to a delicate balancing act of the interests involved, represented on the one hand by the protection of personal data, the dignity of the individual and the integrity of the democratic process, and on the other hand, the protection of life and health (Istituto Superiore della Sanità, 2020).

2. Social distancing unknown effects: The impossibility of visiting loved ones during the hospital stay causes distress for families: in addition to the worries about clinical recovery, they may feel exclusion and powerlessness, anxiety, depression, mistrust in the care team and post-traumatic stress disorder. The impossibility of conducting the daily meetings with families poses a challenge for HCWs which were isolated from their families and forced to manage the consequences of this isolation just like the patients. Only a few weeks after lockdown HCWs started to use devices such as the telephone, tablets or smartphones to "connect "the patients with their relatives. But unfortunately, the patients with acute infection are often unconscious, semi-conscious, or are machine-dependent and hence communication is often significantly limited, if not totally absent. In conditions of danger, restricted communication is a source of intense psychological, physical and emotional stress for all parties involved, and this adds to the anguish and bewilderment caused by the emergency and widespread isolation of all COVID-19 patients. The prohibition to be visited therefore being deprived of receiving comfort through direct contact in particularly difficult conditions means causing intense suffering that has non-negligible ethical implications. The patient's relatives also experience deep suffering and anguish for not being able to support, assist and physically and psychologically accompany their loved ones. This circumstance may be exacerbated if relatives are forced to isolation for having come into contact with the COVID-19 patient (Istutituto Superiore della Sanità - Bioterhics, 2020)

3. Under-reporting and inaccurate deaths registration in Italy (not only): Official statistics on COVID-19 mortality are sensitive to classification, estimation and reporting practice which are not consistent across countries Likewise, the reported mortality is often provided at the national level which results in underestimation of the true scale of the human life impact given that the outbreaks are localised. Comparing COVID-19 deaths across countries, however, is challenging. Most of the existing literature has relied on case-fatality rates (CFR) as a measure of mortality. However, *CFR are not informative for international and historical comparisons.* Since they are calculated as the number of deaths divided by the number of confirmed cases, the absence of accurate estimation of the infection rates in a reference population makes the denominator in the CFR reliant on testing strategies and capacities (Odone, Delmonte, Scognamiglio, & Signarolli, 2020).

In addition, there is not a uniform way of classifying, recording and reporting COVID-19 deaths (García-Basteiro, Chaccour, & et all, 2020). Case-fatality statistics in Italy, in March 2020, are based on defining COVID-19–related deaths as those occurring in patients who test positive for SARS-CoV-2 via RT-PCR, independently from preexisting diseases that may have caused deaths. This method was selected

because clear criteria for the definition of COVID-19 related deaths is not available. Electing to define deaths from COVID-19 in this way may have resulted in an overestimation of the case-fatality rate. The presence of comorbidities might have increased the risk of mortality independent of COVID-19 infection. (Onder, Rezza, & Brusaferro, 2020).

4. The problem of PPE shortage, the GP faced with a choice between protecting his own health and safeguarding the health of others. A first issue recalls the problems related to the GP's intervention in the absence of the Devices Personal Protective Equipment (PPE) that emerged in phase 1 during the course of care for those patients who tested positive for SARS-CoV-2, or who were in the condition of not knowing whether they were carriers of the virus: the overriding sense of duty to intervene in care while avoiding committing hit-and-run has, or can have, the result of safeguarding the health of one's patients at the expense, sometimes, of one's own life. Failure to use PPE can become an objective limiting factor in one's function. To claim that GPs have been exposed to foreseeable risks and, that all those who could not safely and adequately make use of PPE were infected while becoming unwitting propagators of contagion, does not represent a simple accusation. Such considerations are indicative of a systemic underestimation of the operator safety problem and a failure to plan for needs in a state of emergency (Istituto Superiore di Sanità, 2020).

5. Hospital admissions, access to A&E (and subsequent emergency admissions) and other healthcare units, for other conditions, have been noted: a retrospective analysis of patients admitted for acute coronary syndrome at 15 hospitals in northern Italy during the early days of the COVID-19 outbreak revealed a mean rate of 13.3 emergency admissions per day compared to the 18.9 admissions during the previous year (De Filippo, et al., 2020)

Though Italy's health system is highly regarded and has 3.2 hospital beds per 1.000 people (as compared with 2.8 in the United States), it has been impossible to meet the needs of so many critically ill patients simultaneously. Elective surgeries have been cancelled, semielective procedures postponed, and operating rooms turned into makeshift ICUs. With all beds occupied, corridors and administrative areas are lined with patients, some of them receiving noninvasive noninvasive ventilation. Though hospitals are attempting to create Covid-19 units, it's been difficult to protect other patients from exposure. Protecting patients was difficult but was even more difficult protecting healthcare workers, including nurses, respiratory therapists, and those tasked to clean the rooms between patients (Rosenbaum, Facing Covid-19 in Italy — Ethics, Logistics, and Therapeutics on the Epidemic's Front Line, 2020). There for a silent sub-epidemic of people who needed hospital care but did not dare to show up may well rival the carnage directly produced by COVID-19 a collateral damage from delay of less urgent care that truly could not wait, with potentially thousands of missed diagnoses who will deteriorate or appear as late presentations or inoperable. The toll of unaddressed health problems is accompanied by a mounting backlog of procedures that could cost billions to the SSN and may require a substantial amount of extra health care workforce input to bring it under control (Rosenbaum, The Untold Toll — The Pandemic's Effects on Patients without Covid-19, 2020) . Due to the pandemic the Italian health care has been

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razed on the ground: health screening has decreased in 2020: woman cervical screening suffered a decrease from 81% in 2019 to 77.3% in 2020 (CENSIS, 2022), in 2020 410.000 breast cancer operations have been cancelled because the personnel had to assist COVID-19 patients and 1.4 million of breast cancer screening were cancelled, both without having a new timeslot (Nardelli, 2020).

6. As COVID-19 pandemic has spread across the globe wreaking unprecedented disruption, increasing levels of xenophobia and racial discrimination was documented against Asian descent due to misinformation (Chang, Salerno, & Edbert) (The Guardian, 2020) (Walden & Yang, 2020).. In Italy even the President of Veneto Region, in Tv, said " We've all seen the Chinese eat rats" (Zaia, 2020). From January 20th 2020 to March 8th 2020 according to Cronache di Ordinario Razzismo in Italy has been reported 61 cases of harassment (Cronache di Ordinario Razzismo, 2020) (Giuffrida, 2020) (Foderi, 2020) (Artiaco, 2020) (TGR Rai News, 2020);

7. Shortage of ICU beds forced HCWs to decide which case could be checked in and which one not: "It's as if you were asking what to do if an atomic bomb explodes," said Pesenti, the head of Lombardy's intensive crisis care unit. "You declare defeat. We'll try to salvage what is salvageable" (Harlan & Pitrelli , 2020). The tragically limited ICU beds resources were insufficient to save lives that under normal conditions could have been saved and the burden on first responders was excruciating. In a public health emergency, first responders need clear rules to follow. Triage protocols, for example, help first responders to swiftly prioritize patients for different levels of care based on their needs and their ability to respond to treatment given resource constraints (Kaebnick & Haupt, 2020). According to Remuzzi on Aprile 11th "*Intensive care specialists are already considering denying life-saving care to the sickest and giving priority to those patients most likely to survive when deciding who to provide ventilation to*". This attitude has already been criticised by the current President of the Italian Comitato di Bioetica who, in a recent declaration to lay press stated that the Constitution recognises the right of every individual to receive all necessary health care. hey might not recognise that the reality is that intensive care wards are overflowing with patients and that COVID-19 is not a benign disease. Our doctors and nurses are modern heroes in an unexpected war against a difficult enemy (Remuzzi & Remuzzi, 2020).

8. Nearly 10% of reported COVID-19 infections in Italy occurred in HCWs (WHO, 2020) which had to work even if infected, due to shortage of HCWs shortages in the health care sector (CERGAS - Bocconi, 2020) and an ageing medical workforce (in Italy, the share of older doctors increased by 36%, with 55% of all doctors aged 55 or over by 2017) (OECD, 20019) for some time. The International Council of Nurses (ICN) and the Italian Nurses Association (CNAI) in March 2020 warned of the dire consequences of not supplying adequate person protective equipment for nurses working with patients who have COVID-19 (International Council of Nurses , 2020). According to some studies 79% of Italian healthcare workers had received formal training in PPE use at some time. Interestingly, only 21% of the Italian respondents declared to have received training at the time of employment. While is alarming that 48% of responders had received training just because of the COVID-19 pandemic (Iippolito, et al., 2021).

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Art.7 decree-law n. 14/2020 indicates that HCWs exposed to COVID-19 patients are no longer placed in quarantine, but continue to work even if potentially infected. Suspension from work is provided only if symptomatic or positive. The association of medical executives (ANAAO ASSOMED, 2020) on March 16th 2020 wrote an open letter to the Minister of Health and The Prime Minister of Italy expressing the most absolute dissent with respect to the contents of art. 7 of decree-law n.14/2020 is linked to the considerable increase of the clinical risk, for the worker and for the patients, seen the serious and persistent deficiency of PPE, of available PCR tests. Faced with this phenomenon that forces many departments to close, a serious reflection is required on the fact that something did not work in the protection of staff. According to the open letter it was illogical to make an urgent call for hiring new staff, newly graduated and inexperienced, when the existing HCWs, already trained and experienced are not protected. They also mentioned that it was illogical to rush and panic buy respirators if then they will not have personnel to assist patients, perhaps with many of the new respirators occupied by infected health personnel or with serious clinical picture.

9. Cybersecurity Threats in Italy grew: there were 1.767 new malicious coronavirus-related domains per day, in the months of the spread of contagion in the world, there has been a significant increase in phishing sites, with very high values especially at the end of February and from mid-April 2020 onwards. New internet domains related to coronavirus: 86.600 high risk or malicious out of 1.2 million (AGCOM, 2020).

10. Prisoners' activities were limited: prisoners rioted in over 40 prisons across Italy from March 7-10 to protest rules implemented in response to Covid-19 that limited activities, work leave permits, and contact with relatives, as well as chronic overcrowding that put them at higher risk of contracting the disease. 13 inmates died while 69 inmates and over 100 guards were injured during the protests. The government adopted a plan in mid-March to move detainees with less than 18 months left to serve on their sentences to house arrest, and expand the use of semi-liberty regimes (ANTIGONE, 2020) (Human Rights watch).

11. A study conducted by the National Institute for Health, Migration and Poverty found that by mid-June there were 239 confirmed cases of Covid-19 in reception centers for asylum seekers, the majority in centers known as CAS, originally set up as emergency options due to lack of space in the permanent shelter system. In July, 133 residents in a large reception center in former military barracks in Veneto tested positive for the virus (Del Frate & Madiotto, 2020). The government adopted some positive measures to protect migrants and asylum seekers amid the pandemic, such as extending the right to stay in reception centers until the end of the public health emergency for people who would otherwise have had to leave, including children who turned 18, and extending the validity of expired documents given the impossibility of renewal during lockdown. (Human Rights watch).

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12. The global commitment, the controversial opinions within the scientific community and the missing of clear and certain information about both the origin, the transmission, the state of incubation, the persistence and the first reservoir and organ target of the virus rendered still difficult adopting focused, effective and definitive medical solution, that are continuously updated (Ciccotti, et al., 2021).

Drawing on a selective review of published literature, the HERoS project (EU Horizon 2020) explores the theoretical constructs from organization sciences, public administration and political sciences, and feedback from experts in three countries (Netherlands, Finland and Italy). See the section 2.3.3 in the HERoS deliverable D1.1 Recommendations for governance and policies in the n-COV-2019 response.

Also please see the following publications from HERoS team

Boersma, F.K., M. Büscher and C. Fonio (2022). "Crisis Management, Surveillance, and Digital Ethics in the COVID-19 Era", Journal of Contingencies and Crisis Management, 30(1): 2-9. https://onlinelibrary.wiley.com/doi/10.1111/1468-5973.12398

Brakel, R. van, O. Kundina, C. Fonio and F.K. Boersma (2022). "Bridging values: finding a balance between privacy and control. The case of Corona apps in Belgium and the Netherlands", Journal of Contingencies and Crisis Management, 30(1): 50-58. https://onlinelibrary.wiley.com/doi/10.1111/1468-5973.12395

Boersma, F.K., M. Büscher and C. Fonio (2022). "Crisis Management, Surveillance, and Digital Ethics in the COVID-19 Era", Journal of Contingencies and Crisis Management, 30(1): 2-9. https://onlinelibrary.wiley.com/doi/10.1111/1468-5973.12398

What lessons have been learned?

1. Prepare the population to isolation/quarantine due to psychological effect:

   • Psychological impact of quarantine/social isolation: epidemic progressed in Tuscany and some other regions, people were isolated in hotels or other ad hoc locations, with medical assistance. Social isolation increased the percentual of anxiety, depression, feelings of distress *stress and mental health* issues, compounded by unemployment and difficulties in meeting daily needs (Asmundson & Taylor, 2020) (Brooks, Webster, Smith, Woodland, & Wessley, The psychological impact of quarantine and how to reduce it: rapid review of the evidence, 2020) (Rossi, et al., 2020). Physical activity reduced and the consumption of junk food increased. Relationship problems and domestic violence increased. At the beginning of the crisis, there were no guidelines on what individuals could and could not do during isolation and quarantine, so people had to use their own judgement. Organizing isolation and quarantine arrangements was a real challenge, and not just for people who were homeless, refugees or migrants. There were also the large numbers of people living in institutional settings such as long-term-care facilities (like nursing homes, group homes for people with special needs, orphanages, penitentiary institutions and military structures). Isolation and quarantine also had a toll on families in terms of increased violence, depression and distress. To address possible problems of violence, psychological distress or lack of family support for grocery shopping, many initiatives have been taken by municipalities, regions, associations

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and civil society: promotion and strengthening of already existing telephone hotlines for victims of violence, setting up of new telephone lines against loneliness, especially for older people living alone, and neighbourhood shopping services to allow people at high risk to remain at home and to provide groceries to those not able or allowed to go out (Brooks, et al., The psychological impact of quarantine and how to reduce it: rapid review of the evidence, 2020).

- Lockdown and quarantine seem at present the best solutions to limit the spread of SARS-CoV-2: Results suggest that the sequence of restrictions posed to mobility and human-to-human interactions have reduced transmission by 45% (42 to 49%) (Gatto, Bertuzzo, Mari, & Rinaldo, 2020);

2. The supply chain has rapidly converted building of new hospital facilities and intensive care units (ICU) for the care of COVID-19 patients, the procurement of massive quantities of PPEs and other medical devices, and the hiring of additional health care workers has been achieved only a very rapid way: Despite an initial dramatic shortage in PPEs and other devices, 52 contracts with national and international sellers were activated, for a total amount of about 357 million EUR, to buy 350+ million masks, 7.2+ million gloves, 107,000+ protective suits, 100,000+ protective glasses, 2500+ mechanical ventilators and 400 oxygen flow-meters. Tenders were launched and adjudicated in record time thanks to all stakeholders involved working around the clock. In addition to national supplies, regions, local administrations and hospitals have also proceeded to direct purchases or procurement of these goods through donations (Bosa, et al., 2021)

3. The government understood the necessity of increasing the number of healthcare workers therefor there was a general awareness from the public decision-making on the importance of public health investment : Government to introduce several measures [10] in order to face the rapidly rising demand of extra medical and other health care personnel. These measures included inter-regional redistribution of health care personnel, the re-hiring of retired medics, nurses and other health care professionals, the creation of faster recruitment tracks, the possibility to employ personnel on a freelance basis, the hiring of 20,000 health care professionals (3.5% growth in the health workforce): the new hires comprised of more than 4300 additional medical doctors, mainly anaesthesiologists; around 9700 nurses; and 6000 other health care professionals, mainly technical personnel (GIGIO, CITINO, Depalo, Francese, & Petrella, 2020)

4. Esteem and consideration for the work of health care workers has increased;

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10 DL (2020a) Decreto Legge n. 14, art .8 – Disposizioni urgenti per il potenziamento del Servizio sanitario nazionale in relazione all'emergenza COVID-19. In: GOVERNMENT, I. (ed.), DL (2020b) Decreto Legge n. 18 – Misure di potenziamento del Servizio Sanitario Nazionale e di sostegno economico per famiglie, lavoratori e imprese connesse all'emergenza epidemiologica da COVID-19. In: GOVERNMENT, I. (ed.), DPCM (2020a) Decreto del Presidente del Consiglio dei Ministri (DPCM) 17/05/2020 – Disposizioni attuative del decreto-legge 25 marzo 2020, n. 19, recante misure urgenti per fronteggiare l'emergenza epidemiologica da COVID-19, e del decreto-legge 16 maggio 2020, n. 33, recante ulteriori misure urgenti per fronteggiare l'emergenza epidemiologica da COVID-19. In: GOVERNMENT, I. (ed.), DPCM (2020b) Decreto del Presidente del Consiglio dei Ministri (DPCM) 26/04/2020 Ulteriori disposizioni attuative del decreto-legge 23 febbraio 2020, n. 6, recante misure urgenti in materia di contenimento e gestione dell'emergenza epidemiologica da COVID-19, applicabili sull'intero territorio nazionale. In: GOVERNMENT, I. (ed.).

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5. In about a week from national closure, most of the universities started their classes online, by using synchronous and asynchronous platforms in such a massive way that had no precedent (Agasisti & Soncin, 2021). Schools took a bit longer to fully implement the switch, given that no clear indications were immediately provided by the Ministry of Education about how to manage the uncertain situation, and given the much higher level of complexity in re-organising school activities at pre-primary, primary and secondary levels (in Italy there are 8160 schools, of which 1123 are located in the Lombardy region, the most affected area and the one on which our attention will be focused).

6. Covid-19 has been an incentive for the widespread use of telemedicine and in particular in remote diagnosis. Digital Innovation in Healthcare Observatory of the School of Management of the Politecnico di Milano, 47% of the Specialists currently use teleconsultation, a percentage that was just 21% before the pandemic. For instance, the was a project developed to assist people with special needs (Pollock, et al., 2022) (Provenzi, Grumi, & Borgatti, 2020).

7. The Italian health care system is highly decentralized therefor different regions tried different policy responses which has shown that different public health choices made early in the cycle of the pandemic also had a different impact (Zanini, 2020): the most notable example is the contrast between the approaches taken by Lombardy and Veneto, two neighbouring regions with similar socioeconomic profiles. Specifically, while Lombardy and Veneto applied similar approaches to social distancing and retail closures, Veneto took a much more proactive tack towards the containment of the virus. Veneto's strategy was multi-pronged[11] while Lombardy, following the guidance

11 Extensive testing of symptomatic and asymptomatic cases early on: Proactive tracing of potential positives. If someone tested positive, everyone in that patient's home as well as their neighbors were tested. If testing kits were unavailable, they were self-quarantined; A strong emphasis on home diagnosis and care. Whenever possible, samples were collected directly from a patient's home and then processed in regional and local university labs; Specific efforts to monitor and protect health care and other essential workers. They included medical professionals, those in contact with at-risk populations (e.g., caregivers in nursing homes), and workers exposed to the public (e.g., supermarket cashiers, pharmacists, and protective services staff).

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from public health authorities in the central government, opted instead for a more conservative approach. The set of policies enacted in Veneto are thought to have considerably reduced the burden on hospitals and minimized the risk of Covid-19 spreading in medical facilities, a problem that has greatly impacted hospitals in Lombardy. The fact that different policies resulted in different outcomes across otherwise similar regions should have been recognized as a powerful learning opportunity from the start. The findings emerging from Veneto could have been used to revisit regional and central policies early on (Pisano, Sadun, & Zani, 2020). Veneto's results have been noticed by other regions like Campania, Emilia Romagna and Tuscany. In the third week of March they decided to follow Veneto's lead and committed to increasing diagnostic capacity. On March 27, Lombardy decided to lower its testing threshold to include mildly symptomatic cases.

8. The COVID-19 military field hospital in Piacenza (15 km away from CODOGNO-Lodi) was the first COVID-19 health facility in Italy to have all its staff negative for swabbing to detect the presence of COVID-19. The result of this experiment shows that the correct design of the military field hospital, combined with a correct use of PPE and disinfectant solutions, can guarantee the total safety of the medical personnel operating in the military field facilities and to provide to the reuse of effective prevention devices in the absence of them, even in emergency situation. In this contest without negative pressure systems, but correctly designed, together with the adoption of remediation protocols

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for personnel leaving the dirty area, based on the scientific literature (in the absence of NATO protocols specific to the COVID-19 need) has allowed to reduce to zero the contagion among health workers and to assist at the same time 50 COVID-19 patients (Ciccotti, et al., 2021).

9. The Government's emergency legislation made medical masks obligatory only for health-care workers or people working in health settings, workers who had frequent contact with the public and those delivering meals to homes: in practice, however, everyone who could get hold of masks, gloves and hand sanitizer did so, with frantic searches in supermarkets, pharmacies and on the Internet. Prices escalated; masks became a common feature of the city landscape. Regions and municipalities stepped in to extend the obligations on the use of masks, with a fragmented patchwork of different regulations across the country. Most regions enforced the use of masks for wet markets and supermarkets and on public transport; others did so for everywhere, except at home. Supermarket employees would tend to re-use single-use masks daily and wear disposable gloves while touching all surfaces (for example, when giving change or returning credit cards), reducing their effect and adding to a false sense of security.

Some regions decided to procure masks via the Civil Protection Department and distributed them through pharmacies, supermarkets and by post. The use of masks and, to a lesser extent, gloves clearly captured the imagination of the public as a symbol of the protection sought against the invisible threat of the virus.

10. Regional and local authorities activated emergency numbers and free hotlines from which lay people and health professionals answered thousands of calls from the public. Callers were asked about any previous exposure or respiratory infection symptoms, offered advice, referred to their GPs or connected to emergency services for hospitalization. Agreements were made with the Italian Red Cross and other nongovernmental organizations to help out, mobilizing additional staff and vehicles for rapid hospitalization of patients with stroke, chest pain, trauma or obstetric emergencies. This alleviated the stress on hospital staff and reduced waiting times for donning and doffing PPE and sanitizing ambulances after COVID-19 interventions.

11. According to their presumed COVID-19 or non-COVID-19 status and the severity of their symptoms, they were cared for by different teams and could then be routed to home care or to the most appropriate hospital. This reduced the risk of intrahospital contamination as much as possible. Protocols were in place to isolate suspected cases and quickly channel them to the appropriate care setting. After assessment, COVID-19 patients with milder symptoms and non-COVID-19 patients were sent home after establishing links with their GPs and territorial services for active surveillance or hospitals, depending on disease severity. They formally and explicitly involved primary care doctors in the response to COVID-19, allowing them simultaneously to promote the adoption by primary care workers of safety measures like relying on telephone contact to replace face-to-face encounters and adopting safe behaviours such as using PPE where available and handwashing everywhere. This helped to reduce the spread of the infection among primary care health workers and increased the proportion of symptomatic patients that could be cared for at home:

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12. A new dedicated structure was created – the Special Units for the Continuity of Care (USCA): these units, each covering 50,000 inhabitants, were staffed with volunteer medical doctors, nurses and administrative staff and were active 12 hours per day, seven days a week. USCAs were tasked with managing the medical follow-up of home care for less severe cases of COVID-19. They played an important role in case-finding and contact-tracing and served as frontline gatekeepers of the Italian health system, proactively managing suspected COVID-19 cases with home health advice and diagnostic tests. The result was that people were able to receive care, thereby averting the flood of patients from GP and paediatrician offices or emergency departments. The first USCAs were established in Emilia Romagna on 16 March, but the roll-out has remained slow and uneven across regions. On a sample of five regions, coverage ranged between 16% and 56% of the population by the end of April. In some places (though not everywhere), local initiatives extended the USCAs' mandate to cover active surveillance and care in residential facilities.

13. The analysis of the 'Italian case' highlights several areas of rapid response to the crisis, but few actions in the mitigation stage, both at the national and at the global level (Djalante , Shaw, & DeWit, 2020) The WHO's Health EDRM model and the Sendai framework stress the importance of a cultural shift in disaster management, that should be risk-based, proactive instead of reactive, inclusive and community-centred (Sanfelici, 2020)

14. It has been reported that many Italian hospitals lack the infrastructure for effective telehealth platforms, due to supply-chain breakdown and insufficient internet capabilities (Webster, 2020). Italy does not include telemedicine as an essential levels of care granted to all patients within the National Health Service despite the implementation of telemedicine guidelines by the Italian Health Council in 2012. Being one of the first countries to become overwhelmed by COVID-19, Italy was unprepared for the surging requirement of medical resources and personnel, and Italian physicians are urging other countries to avoid hospital-acquired transmission, wherever possible. No advisory on telemedicine was provided by the Italian health authorities until March 24, when an open call for telemedicine and monitoring system technologies were made by the Italian Health Ministry and Ministry for Technology Innovation and Digitalization jointly with the WHO (Italian Government, 2020);

15. prison setting was an element of fragility during COVID-19 pandemic, with a high burden of COVID-19 cases among both the incarcerated individuals and prison staff. The prison setting and prison population need to be included and possibly prioritized in the response during epidemic events (Mazzill, Tavoschi, & et al, 2022)

"D1.2 Lessons learned and best practices" builds on HERoS' Deliverable 1.1 'Recommendations for governance and policies in the COVID-2019 response'. This deliverable contains three parts. Part A drives on extensive qualitative research in three European countries (the Netherlands, Finland, and Ireland). Part B presents best governance practices and challenges in cross-border medical supply chain. It takes lessons learned from the EU joint procurement and the COVAX initiative for the purchase and distribution of COVID-19 vaccines. Part C reflects on the social

network Municipio Solidale in Rome the charity work in the years of the COVID-19 pandemic. Part D provides the best practices from deployment of UK-MED and PCPM's Emergency Medical Teams (EMTs). Also, regarding lesson learned please see the following publications by the HERoS team:

Falagara Sigala, Ioanna; Kovács, Gyöngyi (2020). "Lessons learned from humanitarian logistics to manage supply chain disruptions", Journal of Supply Chain Management. https://onlinelibrary.wiley.com/doi/10.1111/jscm.12253

Boersma, Kees; Larruina, Robert (2020). "Restoring the medical supply chain from below. The role of social entrepreneurship in the production of face masks during the COVID-19 crisis", 18th ISCRAM Conference Proceedings. http://keesboersma.com/wp-content/uploads/2014/09/ISCRAM-2021-WiP-KR.pdf

What were the cascading effects across events, sectors, and supply chain disruptions? Including the inevitability or unforeseen chain of events affecting the response to the disaster? What were the societal vulnerabilities in health and retail sectors?

The emergency caused by the escalation in the COVID-19 pandemic has likely disrupted the lives of all Italians – medically, economically, or socially, and it put a strain on the Italian National Health System and forced purchasing centres to deviate from the ordinary general principles dictated by current legislation (Capuzzo, et al., 2022). The restrictions imposed by the lockdown were additionally tightened in mid-March, and most of the production activities in the country were suspended, causing a large economic shock. The FTSE MIB, the benchmark stock market index for the Italian national stock exchange, closed on 11 March with a 16.92% loss, reaching the lowest peak in its history.

The pandemic situation has inflicted severe shortages of acute healthcare materials, equipment, and resources such as (Capuzzo, et al., 2022) personal protective equipments (PPEs), intensive care unit (ICU) beds, hand sanitisers, and mechanical ventilators. WHO on March 3th 2020 estimates global monthly consumption of 89 million masks, 76 million gloves and 1.6 million goggles (WHO, 2020) so it was a general shortage. This is expected to increase, worsening pressures on health systems that are already under tremendous strain (Bhaskar, et al., 2020)). A public health emergency of this scale and scope is unprecedented in developed countries. The pervasiveness of COVID-19 globally has exposed that many countries are unprepared and ill-equipped to confront this virus due to the lack of access to telemedicine for instance (Bhaskar, Telemedicine Across the Globe-Position Paper From the COVID-19 Pandemic Health System Resilience PROGRAM, 2020).

To proceed in purchasing devices which were necessary to handle the emergency, it was necessary everywhere to accelerate the ordinary procedures due to the unavoidable urgency of the necessary purchases, while always maintaining valid efficiency and effectiveness criteria. The first PPE provided by the government only arrived in mid-March 2020, when the emergency was almost at its peak. The fragility of the supply chain during COVID-19 suggested the creation and implementation of a framework with the maximum interaction between public and private companies in order to no longer witness a failure in this system (Bhaskar, et al., 2020).

A particularly critical market issue was that of personal protective equipment (PPE). PPE proved to be essential for the containment of the epidemic outside hospitals and fundamental in managing the epidemic within health facilities, in particular for the protection of health workers. Lack of adequate ICU facilities. The total number of ICU beds available in the SSN was increased by almost 65% during the acute phase of the response, equivalent to about 3360 additional beds, from around 5300 in 2018 (Gitto, Di Mauro, & Ancarani, 2021). A further 30% expansion (almost 2400 beds) to the already expanded ICU bed numbers has been planned (April 2020) which, if completed, will result in a more than doubled overall pre-pandemic capacity. The growth in the number of ICU beds applied to all regions, but not homogenously, as their needs were dependent on the epidemiological development and severity of the COVID-19 outbreak in each region.

PPE, tests, contact tracing and other medical devices have been essential for enabling an effective response and an efficient prevention of the spread. Since the start of the outbreak, the Civil Protection Department has been coordinating the procurement and distribution of their supplies to the regions. Despite an initial dramatic shortage in PPEs and other devices, 52 contracts with national and international sellers were activated, for a total amount of about 357 million EUR, to buy 350+ million masks, 7.2+ million gloves, 107,000+ protective suits, 100,000+ protective glasses, 2500+ mechanical ventilators and 400 oxygen flow-meters (Civil Protection Department, 2020) In addition to national supplies, regions, local administrations and hospitals have also proceeded to direct purchases or procurement of these goods through other channels (e.g. donations).

The shortage of nurses and medical doctors front lining the emergency response, also in light of the high number of nurses and medical professionals testing positive to COVID-19 (Bellizzi, Panu Napodano, Salaris, Pichierri, & Sotgiu, 2020), forced the Government to introduce several measures in order to face the rapidly rising demand of extra medical and other health care personnel. These measures included inter-regional redistribution of health care personnel, the re-hiring of retired medics, nurses and other health care professionals, the creation of faster recruitment tracks, the possibility to employ personnel on a freelance basis, the hiring of 20,000 health care professionals (3.5% growth in the health workforce); the new hires comprised of more than 4300 additional medical doctors, mainly anaesthesiologists; around 9700 nurses; and 6000 other health care professionals, mainly technical personnel (GIGIO, CITINO, Depalo, Francese, & Petrella, 2020) Further measures included the allocation of 250 million EUR to pay for staff overtime, the possibility for health care facilities to postpone retirement for eligible staff, the possibility for retired doctors and nurses to return to practice on a voluntary basis (in the peak of the crisis in Lombardy, more than 300 retired doctors and 500 retired nurses returned to practice on a voluntary basis), and to request the temporary enrolment of doctors and nurses from the armed forces. Furthermore, hospitals were given the possibility to recruit on a freelance basis, doctors and nurses not yet listed in the Medical Register and medical doctors and nurses practicing abroad under EU directives have also been allowed to work in Italy on a temporary basis.

A report by *Nomisma*, an Italian business consultancy company, estimated that during the COVID-19 emergency, 75% of elective surgeries was postponed. Out of 410,000 surgeries that needed to be rescheduled, 135,700 (33% of the rescheduled surgeries and 79% of the specific DRG) refer to surgeries of the muscular system and connective tissue; 54,000 (13% of the rescheduled surgeries and 56% of the specific DRG) refers to

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surgeries of the cardiovascular system and 39,800 (10% of the rescheduled surgeries and 65% of the specific DRG) refers to surgeries of the digestive system. The remaining 180,000 surgeries refer to the rest of the major diagnostic groups, heavily affected by the emergency with between 70 and 97% rescheduled surgeries (NOSMINA, 2020) (Quotidiano Sanità, 2022) Moreover, the early phase of the emergency was characterised by low level of compliance with and adherence to public health measures. An example of it is the mass flow of people who travelled from the hardest hit northern regions towards the south, before the introduction of the national lockdown in March, after this policy was prematurely leaked to the press, and which may potentially have had a negative impact on the spread of the outbreak in previously unaffected areas) (Bosa, et al., 2021)

The epidemic in Italy has also found territorial medicine to be unprepared, which has not been able to handle the problems of individual people and of people testing positive. Thus, during the days of national quarantine, it is extremely difficult for the population to interact with territorial institutions for all disease-related problems. Based on the Italian experience, it has become evident that western health care systems have been built around the concept of patient-centered care, but an epidemic requires a change of perspective toward a concept of community-centered care (Nacoti, et al., 2020). It has been postulated that >2,500 hospital beds for patients in intensive care units will be needed in only 1 week to treat acute respiratory distress syndrome caused by SARS-CoV-2-pneumonia in Italy) (Indolfi & Spaccarotella, 2020).

The Office of the Military Advisor of the Presidency of the Council, in consideration of the necessity to guarantee the essential services provided by Critical Infrastructures, has provided the precautionary principles, to which Critical Infrastructure Operators are required to comply in order to contain and contrast the spread of the pandemic, while ensuring the continuity of the supply of essential services, the operability of the facilities and the security of the personnel involved.

Law Decree no. 18/2020 authorized the Extraordinary Commissioner for the Epidemiological Emergency to provide funding to companies producing medical devices and personal protective equipment, using INVITALIA as the entity managing the measure.

According to Franchina (Franchina, Calabrese, Scatto , & Inzerilli, 2020) the pandemic emergency has not only produced a strong acceleration of digital transformation, smart working and strong demands related to logistics, but also interesting productive reconversions, together with the consciousness of the complex interrelation through different sectors and their supply chain

ISTAT in May 2020 has provided a wide range of data and information about the by revising and analyzing the Istat dataset updated in May 2020 with regard to the pandemic, it can be observed I that the unavailability of manpower has most directly affected the following sectors in percentage terms:

1. Other mining and quarrying activities; creative, artistipandec and entertainment activities; travel agency, tour operator and reservation services and related activities; libraries, archives, museums and other cultural activities; rental and operative leasing activities; real estate activities; activities concerning lotteries, betting, gambling houses; Sports, entertainment and leisure activities; construction of buildings; Mining of metal

ores; Manufacture of other transport equipment; Manufacture of leather and related products; Manufacture of motor vehicles, trailers and semi-trailers; Manufacture of furniture; Tobacco industry; Metallurgy; Advertising and market research: 100%

2. Manufacture of clothing, manufacture of leather and fur articles: 98,48% 3. Manufacture of fabricated metal products (except machinery and equipment): 93,98% 4. Manufacture of other non-metallic mineral products: 92,85% 5. Food service activities: 90,91% 6. Manufacture of machinery and equipment NCA: 89,48% 7. Textile industries: 86,77% 8. Other personal service activities: 83,46% 9. Wholesale trade (except of motor vehicles and motorcycles): 67,23% 10. Manufacture of rubber and plastic products: 63,67%

Other pieces of equipment were also reported as lacking but by a lower percentage of respondents: gown (44%), hair cups (34%), surgical masks (27%), and gloves (16%). Lack of PPE forced 89% of physicians to come up with strategies to cope with the shortage. Such strategies included: using the same N-95 for long shifts (12 hours and beyond), 47% said they were disinfecting the respirator with alcohol, 27% were re-using the same N-95 for multiple shifts and other strategies included adding a surgical mask either under or on top of the N-95, exposing the respirator to "the sun" or to ozone, making masks on their own at home, and buying respirators of unknown certification (Savoia, et al., 2020)

Macro instruments to mitigate the observed and expected side-effects of the lockdown in The Cura Italia [Heal Italy] Decree of 17 March is a €25 billion plan that included items such as extension of family benefits to 7 million families with an unemployed child under 26 (59), €70 million for e-learning enhancements, re-usable vouchers on services not rendered in the tourism industry, €50 million for people in extreme poverty and for food stamps (60), €30 million to safe houses and help centres for gender violence, incentives given to factories for production of PPE and other medical devices, and a set of other interventions. n The Decreto Liquidità [Liquidity Decree] of 8 April is a €400 billion emergency financial plan to provide immediate liquidity to protect 2 million small- and medium-sized enterprises covering 20 million employees by providing state-guaranteed emergency re-funding to banks for issuing low interest-rate loans; the plan had consequences for 2 million enterprises and 20 038 000 employees. Access to EU economic recovery plans, including the reactivated European Stability Mechanism loans fund of almost €300 billion, was approved on 9 April-2020.

Accordig to Coratella Italy has faced challenges created by a lack of coordination in medical supply chains due to the absence of a common EU health policy; border closures that have disrupted trade (Coratella, 2020)

What was preparedness before and after the event with regards to prepositioning, training, framework contracts and supplier management.

Current structure of constitutional separation of powers plays in risk assessment is one of the main problems of the Italian administrative strategy for the COVID-19 pandemic:

- lack of effective "sharing of powers"
- failure to share administrative regulatory powers among the different levels of government with the participation and cooperation of all institutional actors involved in the emergency decision-making process: the Government, regions and local authorities.

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What is clear from the data: critical situation of the intensive care system in Italy (severely weakened by the pandemic). In order to mitigate the risk of the healthcare system's collapse, the Government should verify the actual capacity of the intensive care system at the national level, cooperating with the Regions and local authorities to ensure that critical care bed availability is efficiently managed. Effective actions shared among all institutional actors and based on an adequate and accurate risk assessment at the national level would avoid saturating the intensive care system in the medium and long term, while the Government should be able to increase capacity in the short term.

Yet, the data on the intensive care system show that the situation was inefficiently managed in the Regions hardest hit by COVID-19, especially in Lombardy, which paid a high price at the local level for the ineffective implementation of the pandemic health plan at the national level. In Italy, the most serious problem is that the Government, although it had already developed its own national prevention plan, neither implemented it effectively nor tried to foster its effective adoption by the Regions and local authorities, disregarding a crucial point of the WHO's Guidelines. Consequently, the failure to implement the national pandemic plan, as we have seen, created the conditions for the collapse of the public health system, with the overcrowding of intensive care units and the consequent loss of life (Vese, 2020)

Please provide a list with links of data sources used in the following categories	
Government /Official reports	Wuhan Municipal Health Commission issued an urgent notification to medical institutions under its jurisdiction, ordering efforts to appropriately treat patients with pneumonia of unknown cause. Timeline of China releasing information on COVID-19 and advancing international cooperation. Link: http://en.nhc.gov.cn/2020-04/06/c 78861 2.htm
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	Covid-19 - Situazione in Italia. Link: https://www.salute.gov.it/portale/nuovocoronavirus/dettaglioContenutiNuovoCoronavirus.jsp?lingua=italiano&id=5351&are a=nuovoCoronavirus&menu=vuoto

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AGCOM Data Science Task Force about online disinformation. Here uou can find information about WHAT PEOPLE WANT TO KNOW and THE PUBLIC DEBATE ON SOCIALE MEDIA- Preliminary results of the researches are published here and are constantly updated . Link: https://agcom-ses.github.io/COVID/social_media.html?lang=en	
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NGO reports	Italian Red Cross Report on response to COVID-19 emergency **Title of the Report:** CRI per le persone, the toll free number of the Italian Red Cross to support isolated people. Link: https://red-social-innovation.com/en/solution/cri-per-le-persone-the-toll-free-number-of-the-italian-red-cross-to-support-isolated-people/
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	2020 Italian Red Cross Report on volunteer activities during Covid -19 emergenci- period 01/01/2020-31/07/2020 :. 106.084 calls and 6.427 sms from citizens, 3.500 psicological support online, 43.000 emergency aid as food, medical drugs delivery, food delivery, etc. Link: https://cri.it/wp-content/uploads/2021/05/REPORT-covid19-4.pdf
	2021 Italian Red Cross EU project on PCR free tests for the population: For free, with no age limit or prescription anyone can undergo PCR test in facilities set up by the Red Cross. Thanks to the Ferrovie Italiane Group that has made the spaces available to the CRI, people can access the service in the stations of Roma Termini, Milano Centrale, Bari, Bologna, Cagliari, Firenze Santa Maria Novella, Palermo, Reggio Calabria, Torino Porta Nuova, Venezia Santa Lucia, Genoa Piazza Principe and Central Naples. The initiative, made possible thanks to the financing of the European Commission, allows at full capacity to carry out up to 3 thousand antigen tests per day throughout the national territory. Link: https://cri.it/tamponi-rapidi-gratuiti/
	National free number open to everyone for support, but also psicological support for Prison Police personnel, Telemedicine for the province of Bergamo, intensified the service totally free of delivery drugs at home in favor of vulnerable people . Link:

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20/05/2020 Italina Red Cross answers to thousands of citizens every day on the toll-free number 800-065510, will report to the LAV all requests for animals in distress: we responded to more than 15,000 requests for help. Link: https://cri.it/2020/05/20/croce-rossa-italiana-e-lav-insieme-nella-fase-due-per-fornire-aiuto-alle-persone-e-alle-famiglie-con-animali-colpite-dallemergenza-coronavirus/

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Save the children report 2020 on The impact of coronavirus on educational proverty. Link: . Link: https://s3.savethechildren.it/public/files/uploads/pubblicazioni/limpatto-del-coronavirus-sulla-poverta-educativa_0.pdf

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China, Europe, and covid-19 headwinds Link: China, Europe, and covid-19 headwinds – European Council on Foreign Relations (ecfr.eu)

Wenzhou people donate for Italy amid COVID-19 outbreak, boost understanding. Link: Wenzhou people donate for Italy amid COVID-19 outbreak, boost understanding - Global Times

Coronavirus, la comunità cinese ha donato 6mila guanti e 2mila mascherine al Piemonte. Link: Coronavirus, la comunità cinese ha donato 6mila guanti e 2mila mascherine al Piemonte (gazzettadalba.it)

Xinhua Headlines: China returns solidarity with Europe in COVID-19 battle. Organized by China's National Health Commission and the Red Cross Society, the group is the third expert team sent abroad by China following previous ones to Iran and Iraq. Link: Xinhua Headlines: China returns solidarity with Europe in COVID-19 battle - Xinhua | English.news.cn (xinhuanet.com)

China sends medical supplies, experts to help Italy battle coronavirus Link: China sends medical supplies, experts to help Italy battle coronavirus | Reuters

How effective is China's 'mask diplomacy' in Europe? Chinese charities have given Italy 500,000 masks, 4 tons of medical material, 1,800 protective suits and 150,000 protective gloves by mid-March.Some days later, Italian Foreign Minister Luigi Di Maio announced the signing of a supply contract with a Chinese company for 100 million masks that will arrive in the coming weeks.This first tranche of aid from China coincided with the stalemate at the EU level on PPEs of the past weeks, which triggered an anti-EU narrative in the country for a few days, fuelled in particular by the far-right parties. Things calmed down as medical equipment was also sent from Egypt, Turkey, Germany, India, Ukraine and Russia. "We need 100 million a month," Di Maio said, explaining that all the Italian embassies around the world are tasked with finding them. A team of experts from the Chinese Red Cross visited Rome to support Italian specialists by sharing experiences, while 53 Cuban doctors and nurses are helping out in the hospital of Crema.How effective is China's 'mask diplomacy' in Europe? – EURACTIV.com

Marzo 2020 Coronavirus: gli aiuti della Cina per l'Italia – autore Denise Ubbriaco. Link: Coronavirus: gli aiuti della Cina per l'Italia (laleggepertutti.it)

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Documentaries	Chinese diplomat: To fight the pandemic, put trust and cooperation before politics. Link: Chinese diplomat: To fight the pandemic, put trust and cooperation before politics – EURACTIV.com
	Coronavirus, dalla Cina arrivano le prime donazioni. Link: Coronavirus, dalla Cina arrivano le prime donazioni (wydv) (informazione.it)
	Cina, le mascherine per l'Italia, la libertà di parola soffocata/China, masks for Italy, freedom of speech suffocated. Link: ITALY - CHINA, masks for Italy, freedom of speech suffocated (asianews.it)
	Tanta solidarietà e qualche insidia: perché la Cina aiuta l'Italia contro il coronavirus Link: Tanta solidarietà e qualche insidia: perché la Cina aiuta l'Italia contro il coronavirus - Limes (limesonline.com)
	Coronavirus, dalla Cina arrivano donazioni di tamponi e mascherine Link: Coronavirus, dalla Cina arrivano le prime donazioni (notizie.it)
	Coronavirus emergency: Huawei donates technology and health supplies Link: Donating Tech and Health Supplies	Huawei Enterprise
	Blackview donates thousands of masks to Italy for the fight against Coronavirus Link: Blackview donates thousands of masks to Italy for the fight against Coronavirus (gizchina.it)
	China donates tons of medical supplies to Italy after being abandoned by EU . Link: China donates tons of medical supplies to Italy after being abandoned by EU (yenisafak.com)
	Censis: 3 millions of Italians don't bealive that COVID 19 exists. Link Covid, il rapporto Censis: "Sempre più famiglie in povertà, cresce la depressione tra gli studenti. Per 3 milioni di italiani il vir
Pandemic: Il mondo ai tempi del Covid by Luca Rosini, Leonardo Lo Franco, 2021. Link: https://www.raiplay.it/video/2021/03/Pandemic-il-mondo-ai-tempi-del-Covid-cb8ee8c8-fb85-4cc5-b3fd-b7371441944ce.html	
LOCKDOWN Generation by Francesco Cinquemani : A group of children from different nations, aged between three and nine, is growing in isolation between deserted streets and online schools. It is the first time in the history of humanity that a similar event has occurred. Link: https://movieplayer.it/film/lockdown-generation_58599/	
Lockdown 2020 – L'italiana Invisibile by Omar Rashid, 2020 : The documentary aims to tell, through the use of virtual reality, the beauty of Italian places that, during the lockdown due to the emergency covid-19, remained untouched by the human presence, condition more unique than rare. Thanks to VR you can find yourself inside these places and admire them in their isolated splendor, something that during the long period of home isolation we could only do through the screens in our homes.	

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The power of virtual reality will make this experience a kind of space-time journey that will allow in the future to relive this unique and, we hope, unrepeatable condition. The project will cover 5 cities: Rome, Milan, Venice, Florence and Naples, focusing mainly on the iconic beauty of these places. Link: https://www.raiplay.it/video/2020/10/Lockdown-2020-LItalia-invisibile-37a92670-ba18-4167-b948-e5a4194eeda0.html

IO RESTO/My place is here by Michele Aiello link: https://www.iorestofilm.it/note-di-regia + https://filmstreaming.page/1355-io-resto-2021.html

Covid 19: I primi 90 giorni di una pandemia by Nolwenn Le Fustec 2022 : Between the discovery, in mid-December 2019, of the first cases of Covid-19 in Wuhan (China) and the publication of the genetic sequencing of the virus - until then kept secret from Beijing - about three weeks have passed: literally, of the precious time thrown away. In mid-January 2020, while a delegation went to China to gather more information about the virus, the WHO chose not to declare the international emergency, for fear of "offending" the Middle Kingdom. This survey retraces all the missed opportunities in the first 100 days of the new Coronavirus pandemic. By calling on political leaders and representatives of the various international bodies involved, the authors break the veil on the balance of power in a crucial period for the fight against the disease, By repudiating the false official communications of the countries concerned and exposing their lack of responsiveness. Link: https://www.arte.tv/it/videos/102236-000-A/covid-19-i-primi-100-giorni-di-una-pandemia/

LA PRIMA ONDA - MILANO AL TEMPO DEL COVID-19/ The first wave - Milan in the time of Covid-19 by Francesco Virga , 2020 - When in the second half of February 2020 the first news arrived in Milan that Covid-19 had chosen the very surroundings of the city to make its appearance in Europe, no one could imagine how and how our lives would quickly change. The city was at the height of its international projection, as one of the most vibrant metropolises in Europe, able to attract attention, investment and humanity from the entire planet. Link: https://www.raiplay.it/video/2022/02/La-prima-onda-18db1073-fbcc-442f-9c99-86798663e5f0.html

Lockdown all'italiana (comedy) - Enrico Vanzina. Link: https://www.mymovies.it/film/2020/lockdown-allitaliana/

A VISO APERTO by **Ambrogio e Luigi Crespi** : It is a sort of road movie between Lombardy, Piedmont and Veneto, an imaginary line that represented the main front line in the battle against the virus. It is the story of a journey inside a territory devastated by the pandemic that thanks to the courage of health managers, doctors and nurses, law enforcement, entrepreneurs and citizens has been able to react and stem the devastating spread of the virus. Link: https://it.chili.com/player/a9fc6846-ff81-4f98-bc10-e9187063a2ef?catalogId=2ea7ef91-1338-48c0-9686-29e68ccfb6bf&entryPoint=Slider

Other episods/documentary on Covid 19 : Link: https://www.discoveryplus.com/it/search/result?q=covid&tab=episodi

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	LA BIENNALE DI VENEZIA: IL CINEMA AL TEMPO DEL COVID, Regia: Andrea Segre, Produzione Rai Cinema, Istituto Luce Cinecittà, 2021. Link: https://filmitalia.org/it/film/158848/
	ISOLATION Notorious Pictures, Registra: Michael Winterbottom, Julia von Heinz, Olivier Guerpillon, Jaco Van Dormael Michele Placido. Link: https://cineuropa.org/it/film/409657/ or https://www.filmtv.it/film/205679/isolation/
	Le 7 giornate di Bergamo Link: https://www.le7giornatedibergamo.it/
	Rebibbia Lockdown di Fabio Cavalli Link: https://www.comingsoon.it/film/rebibbia-lockdown/61368/scheda/
	OPEN.ONLINE - FACT- Checking by Open[186] is an independent journalistic project that aims to monitor false or misleading news spread in Italy and abroad, providing a service of correct information and the tools necessary for citizens to learn to recognize hoaxes, misinformation, misinformation and all other falsehoods that undermine society and the democratic process. Since April 2021 they are members of the IFCN (International Fact-Checking Network).Links with all the misleadings news they managed. Link: https://www.open.online/?s=covid+19
Social Media	Efects on Venice during lockdown: Facebook group called VENEZIA PULITA/CLEAN VENICE. Link: https://www.facebook.com/groups/378156922321320/
	Youtube video by WHO. Title: Sharing Covid-19 experiences: The Italian Response . Link: https://www.youtube.com/watch?v=oDeSCVGi-pM
Satellite/oth er aerial imagery	The Copernicus Atmosphere Monitoring Service (CAMS) combines satellite and ground-based observations to monitor air quality in Europe. This gives indications about human activities during the lockdown, as well as the effects of air quality (including pollens) on respiratory health.

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Over China, the Copernicus Atmosphere Monitoring Service (CAMS) observed a major drop in emissions during February as factories were closed and streets were cleared
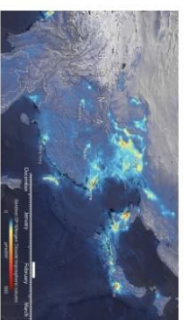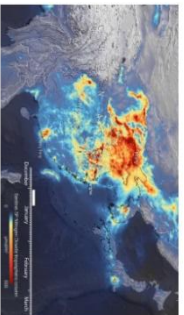
Over Italy, Copernicus satellites have also shown a sharp decrease in emissions during the first months of 2020.
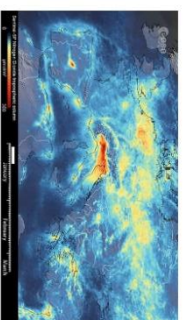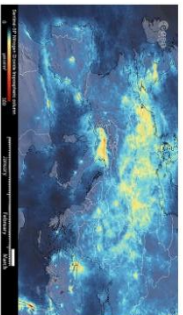
These data, showing the immediate impact of the reduction of traffic and other activities,

ESA (The European Space Agency) published an article regarding the monitoring of air pollution over Europe in the past months using data from the Tropomi instrument from the Copernicus Sentinel-5P satellite. The new images show the nitrogen dioxide concentrations from 13 March until 13 April 2020, compared to the March-April averaged concentrations from 2019. Madrid, Milan and Rome saw decreases of around 45%, while Paris saw a dramatic drop of 54% – coinciding with the strict quarantine measures implemented across Europe (European Space Agency, 2020) Link: https://www.un-spider.org/links-and-resources/covid-19/air-pollution-remains-low-europeans-stay-home

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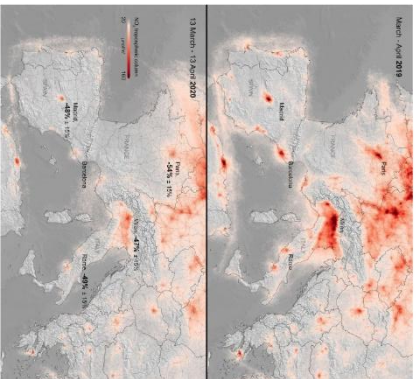
Italian Civil protection used The emergency management service COPERNICUS for mapping the territory during lockdown (European Commission). The Head of the Civil Protection Department has been nominated as national emergency Coordinator and the entire National System has been activated to face the Emergency. From the first day of March, the entire Italian territory has been put on lock-down and further initiatives are being implemented to limit the spread of the disease. The Civil Protection needs to map all the temporary health facilities (such as triage facilities, field hospitals and so on) as well the gathering places in order to have a clear understanding of the current situation of the territory for the subsequent monitoring of activities and public   spaces   during   the   emergency. Another   link:
https://emergency.copernicus.eu/mapping/sites/default/files/thumbnails/EMSR433-AEM-1600070181-r21-v2.jpg

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https://emergency.copernicus.eu/mapping/list-of-components/EMSR433?fbclid=IwAR3cTf5VsIjJAw2EELPfObNyTO395z77ekmh917d2y1DgidZCHSomh7XZSU
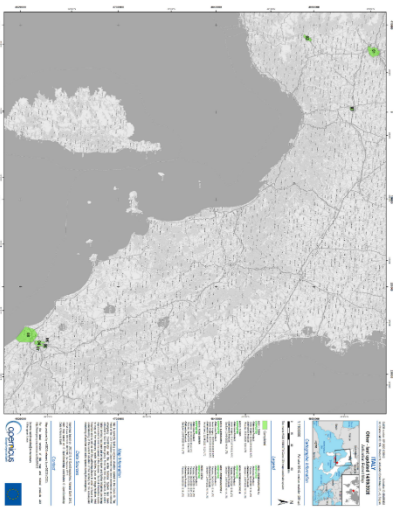
Eu Project: EPICO 19

Website: https://www.epico19.eu/en/the-tool/

Some videos: https://www.youtube.com/watch?v=eUOQHxYGIGc

The EPICO19 project (acronym for Epidemiological and logistic COVID-19 model) is the winner of the "Space in Response to COVID-19 Outbreak" program promoted by the European Space Agency, in collaboration with the Ministry for technological innovation and digitization and support of the Italian Space Agency. The project proposal provides for the development of a web application to support technicians and decision makers in the field of Public Health, for the prediction of the pandemic in progress in terms of cases, hospitalizations and deaths and for the definition of the most effective restrictive measures for the containment of the infection.EPICO19 is part of the demonstration projects on the topic of Health and will focus on the Reggio

Emilia area, in close collaboration with the Reggio Emilia Local Health Authority.

MOBILITY ENGINE

❖ Studiomapp delivered a daily crowding index as a **mobility indicator** using a **multisource and multisensor approach**, combining traffic open data, Copernicus services and VHR satellite/aerial imagery.

❖ VHR satellite and aerial imagery were analysed using Studiomapp's proprietary algorithm that automatically detected and localised up to 22 different types of vehicles. This enabled us to count the number of cars, buses and trucks and estimate the presence of people in hospitals, parking lots, supermarkets, working places, train stations and logistic hubs.

Figure 6- Mobility Engine project EPICO19 retrieved from: https://www.epico19.eu/wp-content/uploads/2022/01/EPICO19 TerrAria-1.pdf

In the presentation of the Project they explained the use of the Satellite images. Link:
https://www.creagen.unimore.it/lepidemiologia-del-covid-19-i-dati-satellitari-e-lintelligenza-artificiale-per-la-lotta-alle-pandemie/ "L'utilizzo delle immagini satellitari ad alta risoluzione – Leonardo Dal Zovo – Studiomap"

3 aprile 2020

Temi Caldi Sos liquidità Mappa contagi Postcovid Video Aiutiamo gli ospedali I numeri utili

Coronavirus
Azienda Tranviaria
Municipale
Leonardo Alberto Dal
Zovo
Angela Corbari
Airbus

ATTUALITÀ
**Ecco come si è svuotata Milano.
Vista dall'alto**

Dal Duomo a piazza stazione, dalle aree dei servizi ai centri commerciali, dalle università a Lampugnano e Lambrate, ecco quante auto si vedono e si contano dall'alto. La ricerca di Studiomapp, società specializzata in geointelligence, sta analizzando gli effetti e l'impatto del Coronavirus su Milano

San Raffaele a Milano

Italian Civil Protection Dashboard on COVID-19 uses Open Data Maps. Link:
https://opendatamds.maps.arcgis.com/apps/dashboards/0f1c9a02467b45a7b4ca12d8ba296596

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Category	Entry
Academic Papers/Reports (Peer Reviewed)	Reduced Rate of Hospital Admissions for ACS during Covid-19 Outbreak in Northern Italy. Link: https://www.nejm.org/doi/10.1056/NEJMc2009166?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed
	Personal protective equipment use by healthcare workers in intensive care unit during the early phase of COVID-19 pandemic in Italy: a secondary analysis of the PPE-SAFE survey. Link: https://air.unimi.it/retrieve/handle/2434/827258/1744752/ippolito_2021_10.1177_2049936121998562.pdf
	Factors associated with access and use of PPE during COVID-19: A cross-sectional study of Italian physicians. Link https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0239024
	How Schools Affected the COVID-19 Pandemic in Italy: Data Analysis for Lombardy Region, Campania Region, and Emilia Region. Link: https://www.mdpi.com/1999-5903/13/5/109
	Response to COVID-19: was Italy (un)prepared? Published online by Cambridge University Press: 05 March 2021. Link: https://www.cambridge.org/core/journals/health-economics-policy-and-law/article/response-to-covid19-was-italy-unprepared/7946552DE995F34E06F426BCBEF494A5
	COVID-19 and the governmentality of emergency food in the City of Turin . Link: https://iris.unito.it/retrieve/e27ce432-bb30-2581-e053-d805fe0acbaa/10-1108_AAAJ-09-2020-4926.pdf
Academic Papers/Reports (Non-Peer Reviewed)	28/02/2020 Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19). Link: https://www.who.int/publications/i/item/report-of-the-who-china-joint-mission-on-coronavirus-disease-2019-(covid-19)
	13/03/2020 Critical Care Utilization for the COVID-19 Outbreak in Lombardy, Italy. Early Experience and Forecast During an Emergency Response. Link: https://jamanetwork.com/journals/jama/fullarticle/2763188#
	Cambridge Core Blog on Italy's response to COVID-19. Overview of June – July 2020 Link: https://www.cambridge.org/core/blog/2020/04/16/italys-response-to-the-coronavirus-pandemic/
	Demòpolis several enquiries in 2020 concerning COVID-19 restrictions (Italian). Link: https://www.demopolis.it/?p=7381
	78% of Italians are worried because of COVID-19 Link: https://www.demopolis.it/?p=7235
	Demòpolis enquiry in 2022 concerning COVID-19 restrictions (Italian). Link: https://www.demopolis.it/?p=10179
Public Enquiry Reports/Findings	Demòpolis several enquiries in 2020 concerning COVID-19 restrictions (Italian). Link: https://www.demopolis.it/?p=8087 + : https://www.demopolis.it/?p=7381
	WHO Preparedness, prevention and control of COVID-19 in prisons and other places of detention Interim guidance 15 March 2020 Link: https://apps.who.int/iris/bitstream/handle/10665/336525/WHO-EURO-2020-1405-41155-55954-eng.pdf?sequence=1&isAllowed=y

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	ISS study on Different impact of the COVID-19 pandemic on Italian and foreign nationals: The most disadvantaged groups might be at a higher risk of morbidity and mortality from SARS-CoV-2 infection, due to living and working conditions, as well as barriers to accessing healthcare. A study by the Istituto Superiore di Sanità, published on the February 2021 issue of the European Journal of Public Health, analyzed data from Italy's COVID-19 integrated surveillance on laboratory-confirmed cases diagnosed between 20 February and 19 July 2020 to assess the impact of the COVID-19 epidemic on non-Italian nationals, including economic migrants, short-term travellers and refugees. Read the full article "Epidemiological characteristics of COVID-19 cases in non-Italian nationals notified to the Italian surveillance system". Link: https://academic.oup.com/eurpub/article/31/1/37/6070147
	Prevenzione e risposta a COVID-19: evoluzione della strategia e pianificazione nella fase di transizione per il periodo autunno-invernale Approfondimento complementare ai documenti generali già resi pubblici su preparedness, pianificazione e contesti specifici . Link: https://www.trovanorme.salute.gov.it/norme/renderNormsanPdf?anno=2020&codLeg=76597&parte=1%20&serie=null
Journal/Magazine articles	Corriere della Sera article about the first two pacients which tested positive to COVID-19 - Title of the Article: Coronavirus, primi due casi in Italia «Sono due cinesi in vacanza a Roma» Sono arrivati a Milano il 23 gennaio. Link:https://www.corriere.it/cronache/20_gennaio_30/coronavirus-italia-corona-9d6dc436-4343-11ea-bdc8-faf1f56f19b7.shtml
Online podcasts, blogs, forums & chat rooms	Written or recorded content for online podcasts, blogs, forums, and chat rooms including radio shows, community groups, interest groups and professional bodies
	Podcast: Paziente Zero: Domande e risposte sul coronavirus Link: https://podcasts.apple.com/it/podcast/paziente-zero-domande-e-risposte-sul-coronavirus/id1501385164
	Podcast: COVID-19 Italy new cases summary-autopodcasts in Spotify. Link: https://open.spotify.com/show/4IzF0AwUQpm7X6BUruYMBH
	JioSaavn Podcast: Emergenza Covid-19: prodotti informative – INAIL. Link: https://www.jiosaavn.com/shows/emergenza-covid-19:-prodotti-informativi/1/Ll8WQAlzH-0
	Podcast BJUI: Covid-19: the situation in Italy link: ht

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	Wired Coronavirus, un podcast per raccontare l'epidemia. Link: https://www.wired.it/scienza/medicina/2020/03/16/wired-coronavirus-un-podcast-per-raccontare-lepidemia/https://www.wired.it/scienza/medicina/2020/03/16/wired-coronavirus-un-podcast-per-raccontare-lepidemia/

According to Bellisario (BELLISARIO, 2020) 12 million people listen to postcasts (135% increase in listening). Link: https://www.iodonna.it/attualita/costume-e-societa/2019/11/22/lavanzata-dei-podcast-in-italia-li-ascoltano-in-12-milioni-ma-1-su-2-non-sa-cosa-siano/ and https://www.iodonna.it/attualita/costume-e-societa/2020/04/01/coronavirus-boom-dei-podcast-in-italia-tra-i-temi-forma-salute-e-musica/

Italian American PodCast: https://italianamericanpodcast.com/updates-from-italy/
Podcast Sanità informazione on COVID-19 Link: https://www.sanitainformazione.it/podcast/rubrica/5-minuti-con/
Cattolicathinks PodCast on COVID-19 Link: https://secondotempo.cattolicanews.it/podcasts-the-psychological-impact-of-covid-19-on-italian-people

RadCliffe PodCast: 24: COVID-19 Lessons And Learnings From Italy With Prof Michele Senni. Link: https://www.radcliffecardiology.com/podcasts/parallax/24-covid-19-lessons-learnings-italy

The Bone&Joint Channel PodCast - COVID-19 Pandemic Podcast Series - The Italian Perspective Link: https://www.youtube.com/watch?v=88QVv-j73EY

Candela PodCast: Nuovo podcast con il Dr. Firas Al-Niaimi Il valore di un dispositivo della serie Gentle Pro durante la COVID-19. Link: http://www1.candelamedical.com/it/article/podcasts/nuovo-podcast-con-il-dr-firas-al-niaimi-il-valore-di-un-dispositivo-della-serie |
| **Official policy recommendations & findings** | On 10 March, the IFRC, UNICEF and WHO issued a new guidance to help protect children and schools from transmission of the COVID-19 virus. The guidance provides critical considerations and practical checklists to keep schools safe. Link: https://www.who.int/news-room/detail/10-03-2020-covid-19-ifrc-unicef-and-who-issue-guidance-to-protect-children-and-support-safe-school-operations |
| **Other (Please specify)** | Norme, circolari e ordinanze dell'area Covid-19 Link: https://www.salute.gov.it/portale/nuovocoronavirus/archivioNormativaNuovoCoronavirus.jsp

Virus Outbreak Pushes Italy's Health-Care System to the Brink . Link: https://www.wsj.com/articles/virus-outbreak-pushes-italys-healthcare-system-to-the-brink-11583968769 |
| **WP2** | **Task 2.3: Natural and manmade case study social media analysis** |

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What was the role, influence, and impact of social media communications during this incident?

According to social media monitoring by the Vaccine Confidence Project, 3.08 million messages about Covid-19 were disseminated daily between January and mid-March 2020 (Larson, 2020)

On social media, in particular, Coronavirus posts increased to 36% of all messages produced by disinformation sources. Despite the commitment of digital companies to stop the spread of misinformation, and notwithstanding the strategic partnerships forged between the WHO and the health ministries of several countries, fake news remained difficult to contain. One study described how misinformation was not uniformly removed by Facebook: 68% of Italian-language misinformation was not labelled to alert users to COVID-19 fake news. Moreover, 21% of the Italian misinformation posts fell into the category of "harmful content" that Facebook has committed to remove, but these posts were still present in early April.[97]

According to AGCOM, the time dedicated to the coronavirus by the major TV channels (Rai 1, Rai 2, Rai 3, Canale 5, Italia 1, Rete 4, La7, TV8 and NOVE) the number of HOURS DEDICATED TO THE CORONAVIRUS BY NEWS&INFORMATION TV PROGRAMMES: from Feruary 1st to 10th March: 709 total: 211 h newscasts + 498 h other news programmes. The incidence on the total hours of the news&information TV programs: 1st to 29th Feb: 28% while from 1 to 10th March: 63% (Autorità per le garanzie delle Comunicazioni AGCOM, 2020)

To the best of our knowledge, this is the first study analysing spatial differences in the social response to COVID-19 in Italy using Twitter data. The study offers insights into the distribution of emotions (fear, anger, and joy) related to the spread of COVID-19 across cities located in the north, center, south, and islands of Italy. The study employed a sentiment analysis to further the understanding of emotions contained in user tweets in response to specific measures and milestones of the lockdown and subsequent phases during the months of March to June 2020. Findings demonstrate a connection between exposure to news and/or significant policy measure events, and how this produces effects on the feelings of the population. In addition, the emotional, perceptive, and cognitive psychological processes produce effects on the manifestation of feelings (positive and negative) when exposed to news events. Scholars have found that there was a rapid worldwide spread of deleterious socioeconomic and psychological impact of the COVID-19 pandemic. A number of psychological problems and important consequences in terms of mental health, such as stress, anxiety, depression, frustration, and uncertainty, during COVID-19 infection, have been additionally documented together with the most relevant psychological reactions of the general population related to the COVID-19 pandemic. The results of this study can allow decision makers to take a step back and re-design institutional communication strategies related to changes in health policies that are aimed at generating positive feelings in the population. Understanding the effects that information produces on the perception and feelings of the population regarding certain events that affect them provides a potential information resource for adjusting health campaigns. Finally, strategies can be proposed that mitigate the appearance of negative feelings in the population as a result of being exposed to certain events/news associated with new political initiatives. Limitations of this study pertain to the selection of the sample size, including the platform used, and the data collection

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timeline. Moreover, t-statistics represent a relatively static representation of regional differences. Multivariate time-series statistics might provide better a more dynamic approach to understanding such processes. Future studies should analyse the specific numerical levels of the sentiment for emotions, alongside any theorized or developed baselines for certain levels of sentiment. Such an analysis could find commonalities in emotional word usage related to statistically significant differences in sentiment levels. Moreover, future research should look more at why some people are more affected by negative news than other news. Finally, in order to develop better predictive models in the future, we suggest including variables that further reflect lockdown levels of individual regions over time. Such variables could be made from close examination of adopted policies, as well as be derived from citizen–government perception–behavior surveys, environmental impacts, finance, and/or management.

Avaaz analized the efficacy of Facebook's efforts to combat this "infodemic" on its main platform and found out that millions of the platform's users are still being put at risk of consuming harmful misinformation on coronavirus at a large scale. Representing only the tip of the misinformation iceberg, we found that the pieces of content we sampled and analysed were shared over 1.7 million times on Facebook, and viewed an estimated 117 million times. Even when taking into consideration the commendable efforts Facebook's Anti misinformation team has applied to fight this infodemic, the platform's current policies were insufficient and did not protect its users. Facebook's current anti-misinformation efforts remain slow and insufficient in limiting the spread of coronavirus misinformation, even when the content is flagged by the platform's very own fact-checking partners. It can take up to 22 days for the platform to downgrade and issue warning labels on false content, even when Facebook's fact-checking partners as well as the World Health Organization and local health authorities, move at a significant pace to issue corrections. These delays mean that millions of users see, interact with, and share the misinformation content before it is labeled and/or removed. Italian, Spanish and Portuguese-speaking users appear to receive significantly fewer warning labels from Facebook, and hence are at greater risk of being exposed to misinformation (AVAAZ, 2020)

ITALY

Population	59m
Internet penetration	93%

WEEKLY REACH OFFLINE AND ONLINE

- Weekly use
  TV, radio & print
- More than 3 days per week
  TV, radio & print
- Weekly use
  online brands
- More than 3 days per week
  online brands

CHANGING MEDIA

Newspaper readership continues to fall steadily while television news viewership has been more stable than in many other countries. The smartphone is now the main device used to get online news with around two-thirds (63%) of our sample using it for news each week.

SOURCES OF NEWS 2013–20

- Online (incl. social media)
- TV
- Print
- Social media

80%
74%
59%
27%
74%
73%
50%
22%
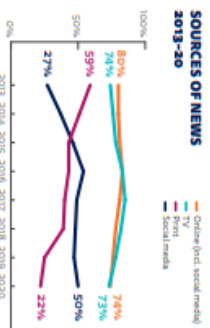
2013 2014 2015 2016 2017 2018 2019 2020

DEVICES FOR NEWS 2013–20*

58%
25%
14%
63%
38%
17%

2013 2014 2015 2016 2017 2018 2019 2020

*2018 figures for computer use were likely overstated due to an error in polling.
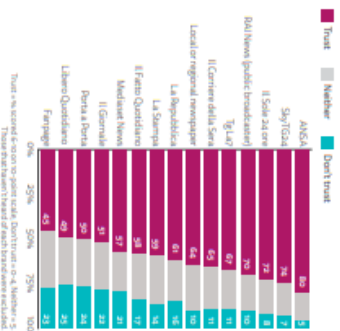
TRUST

Trust in news is particularly low. This long-standing trend is mainly due to the partisan nature of Italian journalism and to the strong influence of political and business interests on news organisations. Brands that are most trusted are generally those that are known for lower levels of political partisanship. Least trusted is the popular digital-born website Fanpage.

DIFFERENT TYPES OF TRUST

	News overall	News / use
	29% (-11) =30th/40	38%
News in search	30%	
News in social	19%	

BRAND TRUST SCORES

- Trust
- Neither
- Don't trust

10% +1
PAY
pay for ONLINE NEWS

TOP SOCIAL MEDIA AND MESSAGING

Rank	Brand	For News	For All
1	Facebook	56% (+2)	75%
2	WhatsApp	29% (+2)	82%
3	YouTube	24% (-1)	67%

Rank	Brand	For News	For All
4	Instagram	17% (+4)	48%
5	Facebook Messenger	9% (+1)	41%
6	Twitter	9% (+1)	18%

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What patterns of interactions between opinion makers and recurring topics in the Twitter debate following the disaster have been identified?

Data sources and pre-processing. A descriptive study was performed using Twitter data and data from the Italian Department of Civil Protection. Indeed, using the rtweet package [31] in R software, tweets posted in Italian between 25 February 2020 and 4 May 2020 and related to conversations about COVID-19 were retrieved daily considering specific trending hashtags (i.e., #COVID19, #COVID_19, #COVID2019, #COVID, #iorestoacasa, #coronavirus, #coronavirusitalia, #COVID-9, #lockdown) as keywords for data extrapolation. After removing duplicates, the remaining sample, a total of 4,988,255 Twitter posts (1,256,890 tweets and 3,731,365 retweets) referring to conversations about COVID-19 shared in Italian during the study time frame, constituted the study database and was then preprocessed (i.e., normalization and cleaning of the text of the tweet, tokenization of the words) using the tidytext R package

During the study period, the mean daily number of posts increased from 21,720 in week 1, tripling in week 2, and doubling again in week 3 when the national lockdown was imposed. The mean number of posts slightly decreased in weeks 4 and 5, with around 50,000 to 60,000 posts per day in the following weeks (How Italy Tweeted about COVID-19: Detecting Reactions to the Pandemic from Social Media, 2022)

Please provide a list with links of data sources used in the following categories

Government /Official reports	This data was not requested in this phase.
Community interviews/r eports	This data was not requested in this phase.
Eyewitness/f irst-hand accounts	This data was not requested in this phase.
News/media reports	This data was not requested in this phase.
Documentar ies	This data was not requested in this phase.
Social Media	This data was not requested in this phase.

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Satellite/other imagery	This data was not requested in this phase.
Academic Papers/Reports (Peer Reviewed)	This data was not requested in this phase.
Academic Papers/Reports (Non-Peer Reviewed)	This data was not requested in this phase.
Public Enquiry Reports/Findings	This data was not requested in this phase.
Journal/Magazine articles	This data was not requested in this phase.
Online podcasts, blogs, forums & chat rooms	Corriere della Sera VIDEO with professor Massimo Galli, Università di Milano-Ospedale Sacco on COVID-19 – December 31st 2020 Title of the Video: Virus, l'infettivologo Galli: «Letale? Ecco i numeri veri del Coronavirus» Link: https://video.corriere.it/virus-italia-cosa-dobbiamo-aspettarci-cosa-possiamo-fare-quanto-pericoloso/7b72f0d0-4425-11ea-b4ca-26f0f6d5d911
Official policy recommendations & findings	This data was not requested in this phase.

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WP2	Task 2.4: Natural and manmade case study aerial imagery analysis
What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform decision-making?	This data was not requested in this phase.
This data was not requested in this phase.	
What positive benefits can be derived from the use of satellite images and Unmanned Aerial Vehicle data during this disaster to inform the sharing of public information?	
This data was not requested in this phase.	
Please provide a list with links of data sources used in the following categories	
Government /Official reports	This data was not requested in this phase.
NGO reports	This data was not requested in this phase.
Community interviews/reports	This data was not requested in this phase.
Eyewitness/first-hand accounts	This data was not requested in this phase.
News/media reports	This data was not requested in this phase.
Other (Please specify)	This data was not requested in this phase.

Documentaries	This data was not requested in this phase.
Social Media	This data was not requested in this phase.
Satellite/other imagery	This data was not requested in this phase.
Academic Papers/Reports (Peer Reviewed)	This data was not requested in this phase.
Academic Papers/Reports (Non-Peer Reviewed)	This data was not requested in this phase.
Public Enquiry Reports/Findings	This data was not requested in this phase.
Journal/Magazine articles	This data was not requested in this phase.
Online podcasts, blogs, forums & chat rooms	This data was not requested in this phase.
Official policy recommend	This data was not requested in this phase.

Type of data	Data/ information/ sources/ reference material
W **P3**	**Task 3.1 - Critical analysis of past disasters via the identified case studies on their disaster preparedness strategies**
3.1 .1	**Type of hazards – Understanding the disaster risk**
a. What type of hazards were commonly identified in the region (Slow-onset and rapid onset hazards)?	This data was not requested in this phase.
b. What hazards have resulted in disasters during the past 20 years?	This data was not requested in this phase.
c. What risk assessment mechanism(s) were used by the relevant institutions for encompassing risk awareness, multi-hazard analysis, vulnerability/capacity analysis and cascading effects?	This data was not requested in this phase.
d. What risk modelling and scenarios have been carried out to consider disaster risk and/or any other future threats and cascading effects?	This data was not requested in this phase.
e. How the knowledge of indigenous communities and information in social media had been captured for disaster risk perception?	This data was not requested in this phase.
ations & findings	
Other (Please specify)	This data was not requested in this phase.

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3.1.2	**Disaster resilience and preparedness strategies**	
a.	What were the available national and local disaster management plans and systems under following categories?	
	○ Individual-level activities (e.g., first aid training and response)	This data was not requested in this phase.
	○ Household actions (e.g., stockpiling of equipment and supplies, retrofitting)	This data was not requested in this phase.
	○ Community efforts (e.g., socially responsible mitigation, training, and awareness campaigns for first respondents and responders, and field exercises)	This data was not requested in this phase.
	○ Governmental strategies (e.g., multi-organisational planning and public private partnerships, early warning systems, contingency plans, evacuation routes, and public information dissemination, allocation of resources)	This data was not requested in this phase.
b.	What provisions were in place for research, education, science, and technology (ex: geospatial, remote sensing) for informed disaster preparedness?	This data was not requested in this phase.
c.	What special provisions were undertaken to ensure pandemic preparedness in disaster preparedness measures?	This data was not requested in this phase.
3.1.3	**Mitigation**	
a.	What policies and legislation were available that mainstreamed DRR in the national planning policy?	
	○ Land use planning and building codes (Ex: Avoid settlement expansion towards hazard prone areas)	This data was not requested in this phase.
	○ Critical infrastructure protection and structural design improvements	This data was not requested in this phase.

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	○ Landscape and environmental arrangement around essential services and infrastructure	This data was not requested in this phase.
	○ Resilience strategies including planning and partnership building between sectors	This data was not requested in this phase.
b.	What support were provided by media platforms including social media during disaster operations?	This data was not requested in this phase.
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	This data was not requested in this phase.
3.1.4	**Response**	
a.	What were the available surveillance, early warning, and information management systems for activating response operations under the following conditions?	Democracy at the local level – In Italy, several regions developed different digital solutions for tracking and containing infection based on the analysis of movements and gatherings generated by anonymous data. For example, Lazio activated a portal for reporting gatherings called "Unique Alert System". The Lazio Region also launched Lazio DrCovid, an app that provides secure bidirectional text-audio communications via smartphone between the citizen and their doctor. In some cases, it is also accompanied by diagnostic kits for home monitoring. Liguria, Lombardy, Sardinia and Umbria have started analysing phone records and interactions. Citizen health status is monitored in regions like Lombardy, which created the "LOM Alert" app. Piedmont has designed "COVID-19 Piedmont Region Platform" for the Regional Crisis Management Unit to track and monitor all the activities concerning patients with COVID-19. Puglia and Tuscany also have regional web platforms that support assistance, care and monitoring of patients from a distance. (OECD - Organisation for Economic Co-operation and Development, 2020)
	○ Support or coordinate disaster operations being conducted by a designated lead agency	

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	o Logistics mechanisms and essential supplies for health and relief services	This data was not requested in this phase.
b.	What support was provided by media platforms including social media during disaster operations?	This data was not requested in this phase.
c.	What special measures were undertaken to ensure a COVID-19 safe environment during disaster operations?	In Italy, testing all 3 300 residents of the town of Vò-Euganeo facilitated taking containment measures that eventually stopped all new infections. Vò-Euganeo was one the first centres of Italy's coronavirus outbreak, and the location of Italy's first virus-related deaths on February 22th 2020. Testing all residents regardless of whether they were exhibiting symptoms resulted in effective quarantining the infected and their contacts once infection was confirmed. This helped the health authorities build a full picture of the pandemic situation and completely stop the spread of the illness in the town. Testing occurred in two rounds. The first round was carried out on the town's entire population in late February, finding 3% of the population infected. Half of the carriers were asymptomatic. All of those infected were isolated. The second round was carried out 10 days later, with results indicating that the infection rate had dropped to 0.3%. Asymptomatic individuals identified in the second round were quarantined. Based on Vò-Euganeo's experience, the Veneto region extended the use of tests (RFI, 2020[94]), and its approach has successfully controlled the pandemic. Its approach included: o Extensive testing: People with symptoms and people who were asymptomatic were tested whenever possible o Proactive tracing: If somebody tested positive, everybody they live with was tested or, if tests unavailable, they were required to self-quarantine. Emphasis on home diagnosis and care: Health care providers went to the homes of people suspected of being ill with COVID-10 and collected samples so they could be tested, keeping them from being exposed or exposing others by visiting a hospital or medical office.

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		Monitoring medical personnel and other vulnerable workers: doctors, nurses, caregivers at nursing homes, and grocery store cashiers and pharmacists were monitored closely for possible infection. On 8 October 2020, Italy's Lazio region decided to put the province of Latina under special measures, including a 14-day lockdown with restrictions on restaurants and bars, religious ceremonies, a ban on visitors at hospitals and care homes but travelling to or from the province was still allowed. Italy is divided into three zones to manage the outbreak at the regional level. On the basis of the increased pressure on hospital beds, the central government imposed new lockdowns in and travel bans from six regions (Lombardy, Piedmont, Aosta Valley, Calabria, Puglia and Sicily), starting on 6 November 2020. (OECD - Organisation for Economic Co-operation and Development, 2020)
3.1.5	**Recovery**	
a.	What were the long-term and short-term recovery actions undertaken during each post disaster recovery period including 'build back better' practices?	
	○ Response endeavours such as needs and damage assessments	This data was not requested in this phase.
	○ Community-level involvement and capacity building for disaster recovery	This data was not requested in this phase.
	○ Local administration and coordination for resource mobilisation	This data was not requested in this phase.
	○ Building redundancy into a DRR plan	This data was not requested in this phase.
b.	How the post disaster infrastructure recovery including rebuilding, restoration, or reconstruction had taken place?	This data was not requested in this phase.
c.	What plans or provisions were available to minimise the economic impact following a disaster?	In **Italy**, the Association of Italian Municipalities (ANCI) developed three scenarios for the loss of municipal revenues due to COVID-19:

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a) A *low risk scenario* with a loss of revenue among municipalities of about EUR 3.7 billion (down 9% compared to 2019). This is based on a relatively rapid exit from the emergency beginning in May 2020, where the largest losses would be concentrated on the sectors directly exposed to the crisis, with other sectors recovering relatively quickly in 2020 or by 2021.

b) A *medium risk* scenario, with an estimated municipal revenue loss of about EUR 5.6 billion (a decrease of 14% from 2019).

c) a *high risk* scenario estimating a loss of EUR 8 billion (a drop of almost 21% over 2019). In this scenario, COVID-19 triggers a major and long running national and international economic crisis that causes recovery difficulties for all economic sectors (ANCI, 2020[58]). Regional governments also face financial difficulties. Most of their expenditure is concentrated on health (85% on average), which will increase. To this is added a drop in receipts from the regional tax on productive output (IRAP), the regional surtax on the personal income tax and the regional tax on vehicles. (OECD - Organisation for Economic Co-operation and Development, 2020)

In Italy, simplification measures were introduced by 14 regions to streamline administrative and regulatory proceduresfor SMEs. These include deferring the application deadlines for public funding programmes and for reporting on investment plans subject to public incentives, and simplifying public procurement (OECD Trento Centre for Local development, 2020[106]). Many regional governments also established and strengthened complementary regional sections to the National Guarantee Fund for SMEs established by the central government. Many

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regions have adopted specific measures to support their SMEs, which be divided into six policy macro-areas: facilitating access to bank credit and reducing related cost; public financing; simplified procedures; labour and welfare; tax relief and planning and budgeting(OECD Trento Centre for Local development, 2020[106]). Among examples are Liguriawhich adopted specific measures to support tourism, trade and craft SMEs; Sicily with the "Sicily Fund" to increase SMEs liquidity, bank guarantees, bank moratoria and late payment schemes; Piedmont (e.g. Finpiemonte single fund and "Bonus Piemonte);Friuli-Venezia Giulia (subsidised loans, suspended payments on revolving funds, non-refundable grants for the tourism, commercial and craft sector, development of smart (tele)working plans); and Campania with its "Plan for the Socio-economic Emergency" focusing largely on micro-enterprises, SMEs and self-employed, etc. (OECD Trento Centre for Local development, 2020[106]; EU Committee of the Regions, 2020[111] (OECD - Organisation for Economic Co-operation and Development, 2020)

fiscal instruments to support subnational finance
In Italy, financial support to local authorities has been allocated mainly by the decree-law n. 34/20 ("relaunch decree") and by decree-lawn. 104/20 ("August Decree"). Some measures include compensations for additional costs incurred by municipalities, provinces and metropolitan cities facing the pandemic (EUR 3.2 billion). Most recently, the central government dedicated EUR 40 million to support those municipalities particularly affected by the health emergency exercise their social and economic functions. In addition, the fund allocates EUR 400 million to local public transport companies and regional railways. The Technical Committee allocated an additional EUR 1.7 billion and EUR 2.6 billion to regions and autonomous provinces, respectively, on the basis of the

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respective loss of tax revenues. These funds are targeted to finance essential expenses in health care, assistance and education and lost tax revenue(IRAP). Finally, a fund was established to support the financial recovery of municipalities with a structural deficit. The Decree N°34/20 also supports the debt of local authorities, by enabling municipalities to renegotiate or suspend mortgages and other forms of loans contracted with banks, financial intermediaries and Cassa Depositi e Prestiti during 2020, and established a fund of EUR 12 billion to ensure an advance of liquidity for the payment of certain liquid and due debts of regional, autonomous provincial and local authorities and national health service bodies in 2020. (Chamber of deputies, n.d.[155] (OECD - Organisation for Economic Co-operation and Development, 2020)

A number of states and regional governments are also developing initiatives to support public investment in their areas, and to support local government investment projects. In Italy, the Lombardy region has introduced a three-year investment plan worth EUR 3 billion. EUR 400 million is earmarked for local authorities and EUR 2.6 billion targets support for the local economy (including EUR 400 million for strategic investments). Of the EUR 400 million for local authorities, Milan and surrounding areas will receive EUR 51 million for public works (roads and schools); the remainder can be spent by other communities on energy efficiency, renewable energy, urban re-development and sustainable development, sustainable mobility, heritage, and hydro-geological works, for example. Separately, the region foresees using the "Lombardy Bond" to finance € 10 million for producing medical and personal protective equipment, and EUR 82 million in bonuses for health workers who have been involved in combating the epidemiological emergency(European Committee of the Regions, 2020[178])(Varese News, 2020[179])(First Online, 2020[180]).

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		Coordinated fiscal response : in Italy, the Ministry of Economy and Finance established a Technical Committee (Tavolo tecnico)in May 2020, chaired by the State Accountant General, and with mixed State/region membership. It is tasked with examining the impact of theCOVID-19 emergency on fulfilling fundamental functions, with reference to the possible loss of revenue relating compared to the expenditure needs of each entity.
d.	What environmental recovery plans were available to manage the impact for eco-systems and related services?	This data was not requested in this phase.
e.	How have the mitigation and resilience-building activities of preparedness been adopted for the next disaster, and the development and implementation of legislation, policies, and practices to avoid similar situations in the future?	This data was not requested in this phase.
3.1.6	**Monitoring and evaluation**	
	How frequent are plans being reviewed and revised for emergency preparedness, response, and recovery?	This data was not requested in this phase.
W P3	**Task 3.2 – Vulnerable categories**	
3.2.1	**Identify people vulnerable categories in the different phases of disaster management**	
a.	In the analysed context, what were the consequences (death or injury) with respect to the following age groups and gender?	

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The data is till 30/06/2020 as reported Covid-19 surveillance (Istituto Superiore di Sanità, 2020) **image** Retrieved: https://jamanetwork.com/journals/jama/fullarticle/2763667

⬚↗ View Large   ↧ Download   (🐦) (f)

Table. **Case-Fatality Rate by Age Group in Italy and China**

Table. Case-Fatality Rate by Age Group in Italy and China[a]

Age groups, y	Italy as of March 17, 2020		China as of February 11, 2020	
	No. of deaths (% of total)	Case-fatality rate, %[b]	No. of deaths (% of total)	Case-fatality rate, %[b]
All	1625 (100)	7.2	1023 (100)	2.3
0-9	0	0	0	0
10-19	0	0	1 (0.1)	0.2
20-29	0	0	7 (0.7)	0.2
30-39	4 (0.3)	0.3	18 (1.8)	0.2
40-49	10 (0.6)	0.4	38 (3.7)	0.4
50-59	43 (2.7)	1.0	130 (12.7)	1.3
60-69	139 (8.6)	3.5	309 (30.2)	3.6
70-79	578 (35.6)	12.8	312 (30.5)	8.0
≥80	850 (52.3)	20.2	208 (20.3)	14.8

[a] Data from China are from Chinese Center for Disease Control and Prevention.[a] Age was not available for 1 patient.

[b] Case-fatality rate calculated as number of deaths/number of cases.

o	New-born (ages 0-4 week)	This data was not requested in this phase.
o	Infant (ages 4 week - 1 year)	This data was not requested in this phase.
o	Toddler (ages 1-3 years) - M/F	This data was not requested in this phase.
o	Pre-schooler (ages 3-5 years) - M/F	This data was not requested in this phase.

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o School aged child (ages 6-13 years) - M/F	This data was not requested in this phase.
o Adolescent (ages 14-18 years) - M/F	This data was not requested in this phase.
	30/06/2020 in Italy
o Young adult (ages 19-29) - M/F	AGE from 20 to 29 Infected people: M: 6.204, F 7.797 Casualties: M. 12, F. 4
o Adult (ages 30-64 years) - M/F	30/06/2020 in Italy AGE from 30 to 59
o youngest-old (ages 64-74 years) - M/F	This data was not requested in this phase.
o middle-old (ages 75-84 years) - M/F	This data was not requested in this phase.
o Oldest-old (ages more than 85 years)	This data was not requested in this phase.
During the rescue phase what were the categories of disabilities, or specific needs, that arose?	
b.	
o Movement disabilities *	This data was not requested in this phase.
o Sensorial disabilities (deafness, blindness) *	This data was not requested in this phase.

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o Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	This data was not requested in this phase.
o Pregnant women	This data was not requested in this phase.
o New-born	This data was not requested in this phase.
o Infant	This data was not requested in this phase.
o Other that emerged during the analysis of the available documentation or specific investigations conducted	This data was not requested in this phase.
Which of the following categories of disabilities, or specific needs, were managed in the post-emergency phases to give an initial response to people involved?	
o Movement disabilities *	This data was not requested in this phase.
o Sensorial disabilities (deafness, blindness) *	This data was not requested in this phase.
o Cognitive disabilities (autism, Down syndrome, Alzheimer, dementia) *	This data was not requested in this phase.
c. o Pregnant women **	This data was not requested in this phase.
o New-born	This data was not requested in this phase.
o Infant	This data was not requested in this phase.
o Other that emerged during the analysis of the available documentation or specific investigations conducted	Migrants: document: Epidemiological characteristics of COVID-19 cases in non-Italian nationals notified to the Italian surveillance system. Link: https://academic.oup.com/eurpub/article/31/1/37/6070147
*Indicate age class (see 3.2.1.a) and gender; ** indicate class age	This data was not requested in this phase.
3.2.2 Post event management	
a. About point 3.2.1b, were the rescuers prepared to manage the situation?	
o The rescuers were involved in specific training activities in this field	This data was not requested in this phase.
o Specific documentation has been made available	This data was not requested in this phase.

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	o Simulations were conducted also considering the issue of inclusive emergency management	This data was not requested in this phase.
b.	**About point 3.2.1c, were the operators prepared to manage the situation considering people with specific needs?**	
	o The rescuers were involved in specific training activities in this field	This data was not requested in this phase.
	o Specific documentation has been made available	This data was not requested in this phase.
	o Simulations were conducted also considering the issue of inclusive emergency management	This data was not requested in this phase.
c.	**Were people with specific needs and their family members or caregivers prepared to manage that emergency?**	
	o Specific information activities were carried out on these topics with the involvement of family members, caregivers, and the surrounding community	This data was not requested in this phase.
	o Specific documentation has been made available	This data was not requested in this phase.
	o Simulations were conducted also considering the issue of inclusive emergency management	This data was not requested in this phase.
WP3	**Task 3.3 Culture & heritage**	
3.3.1	**What was the extent of the damage with respect to the type of disaster?**	This data was not requested in this phase.
3.3.2	**What was the extent of the damage with respect to the size of the disaster?**	This data was not requested in this phase.
3.3.3	**How was the human and environmental adaptive response/reaction to the damage?**	This data was not requested in this phase.

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3.3.4	**How long did it take to recover/retrieve after the disaster in the following categories?**	
o	Land use	This data was not requested in this phase.
o	Repopulation	This data was not requested in this phase.
o	Everyday life condition	This data was not requested in this phase.
o	Social life	This data was not requested in this phase.
o	Lesson for the mitigation of other disasters	This data was not requested in this phase.
3.3.5	**Was there any quantitative correspondence between reaction/effort and damage?**	
	This data was not requested in this phase.	
3.3.6	**What was the timescale of such correspondence (short-term vs. long-term)?**	
	This data was not requested in this phase.	
WP3	**Task 3.4 – Risk governance strategy**	
Type of data		**Data/ information/ sources/ reference material**
3.4.1	**Disaster risk governance mechanisms**	
What were the disaster risk governance mechanisms identified in the relevant authorities to manage disaster risk under following categories?		
o	Knowledge sharing and inclusion of science and technology	This data was not requested in this phase.
o	Harmonizing capacities and resources to the needs in risk assessment	This data was not requested in this phase.
o	Institutionalizing partnerships, coordination, and responsibilities	This data was not requested in this phase.

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○ Participatory decision-making mechanisms, inclusive of vulnerable communities, indigenous communities, and volunteers	This data was not requested in this phase.
○ Leveraging investments in DRR	This data was not requested in this phase.
3.4.2 International DDR frameworks	
What international DDR frameworks (SENDAI, SDG, Paris Agreement) were adopted in DRR projects?	This data was not requested in this phase.
3.4.3 Accountability in disaster governance	
What were the provisions to ensure accountability in disaster governance?	
○ Consider accountability aspects in the Sendai Framework for Disaster Risk Reduction 2015-2030	This data was not requested in this phase.
○ Innovative elements of accountability	This data was not requested in this phase.
○ Enabling legislations	This data was not requested in this phase.
○ Regular monitoring, evaluation, and review	This data was not requested in this phase.
WP4 Cascades	
1. What is the EU country, covered by CORE partners, preparing for (crisis, war and crisis, disruption)?	This data was not requested in this phase.
2. What types of disasters is each EU country, covered by CORE partners, preparing for?	This data was not requested in this phase.
3. Who is involved in the preparation process?	This data was not requested in this phase.
a. What kind of approach is adopted in disaster preparedness: e.g., is disaster preparedness centralized (national level) or decentralized (local level); who (which agency) has the leading	This data was not requested in this phase.

	role in preparedness; guiding policy frameworks and/or strategies and principles; coordination/cooperation mechanisms (and sectors involved)?	
b.	Other stakeholders for preparedness?	This data was not requested in this phase.
c.	EU/UN/INGO?	This data was not requested in this phase.
4	**Training and communication preparedness**	
a.	What kinds of trainings (including drills and crisis exercises) are done to prepare for a disaster?	This data was not requested in this phase.
b.	Who provides training, for whom and what competencies are covered?	This data was not requested in this phase.
c.	What kind of approach is adopted in crisis communication preparedness: e.g., what is communicated to the general public about preparedness, how (means and channels: e.g., preparedness brochure, crisis portals/websites, campaigns, formal/civic/professional education, social media mobilisation) and by whom (leading agency + other partners and stakeholders involved + partnerships with news media)?	This data was not requested in this phase.
	How are the needs of vulnerable groups taken into account?	
5.	**Prepositioning, framework contract and supplier management**	
a.	What types of goods are pre-positioned and how are locations selected?	This data was not requested in this phase.
b.	Which organization is responsible for management of pre-positioned stock?	This data was not requested in this phase.
c.	What are the framework contracts for disaster preparedness, who manages them?	This data was not requested in this phase.
d.	How are suppliers who secure the supply for preparedness selected and managed	This data was not requested in this phase.

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6.	How was the preparedness and response mechanism activated for different types of risks?	This data was not requested in this phase.
7.	How the event influenced flow, access to and availability (length of shortage, scale, shortage by social group) of:	
○	Drinking water;	This data was not requested in this phase.
○	Energy supply (electricity, coal, fuel etc.);	This data was not requested in this phase.
○	Food (retail sales, catering, etc.);	This data was not requested in this phase.
○	Health (emergency and long-term provision, psychological health);	This data was not requested in this phase.
○	Access to information.	This data was not requested in this phase.
8.	How the event influenced preparedness mechanisms (in terms of training, information flow, communication, prepositioning, supplier management). What were the lessons learned from the case?	This data was not requested in this phase.
9.	Have there been any studies conducted on the long-term impact (five or ten years) of this disaster/crisis?	This data was not requested in this phase.
a.	Was there any long-term health or societal impact?	This data was not requested in this phase.
b.	Any local supply chain impact?	This data was not requested in this phase.
c.	How long did it take for the communities to get back to the original state?	This data was not requested in this phase.
d.	Any studies on the long-term resilience of the affected region?	This data was not requested in this phase.
W P7	**Social media information/misinformation and risk communication**	

Please provide a quality assessment for the accuracy and veracity of information and data used to inform this case study in the following three categories:

a). Media information	This data was not requested in this phase.

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| **b).** Misinformation | This data was not requested in this phase. |
| **c).** Risk communication | This data was not requested in this phase. |

Reference List ANNEX 11 – Case Study Pandemic in Italy

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