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Strategic crisis management in the EU

Independent Expert Report

Group of Chief Scientific Advisors

Scientific Opinion No.13, November 2022

Research and Innovation

Strategic crisis management in the EU

Group of Chief Scientific Advisors

European Commission
Directorate-General for Research and Innovation
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Chief Scientific Advisors
INDEPENDENT SCIENTIFIC ADVICE FOR POLICY MAKING

Strategic **crisis management** in the **EU**

Improving EU crisis prevention, preparedness, response and resilience

Group of Chief Scientific Advisors
Scientific Opinion No.13, November 2022
(Supported by SAPEA Evidence Review Report No. 11)

Brussels, 22 November 2022

2022 Directorate-General for Research and Innovation

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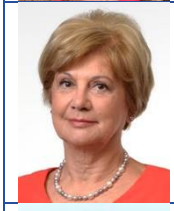	**Éva Kondorosi** Research Director Institute of Plant Biology, Hungarian Academy of Sciences Centre of Excellence, Szeged
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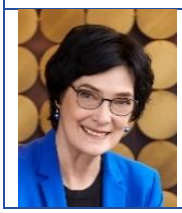	**Eva Zažímalová** Professor of Plant Anatomy and Physiology, president of the Czech Academy of Sciences

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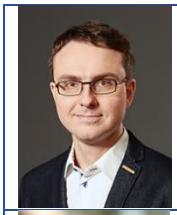	**Janusz Bujnicki** (until 15 November 2020) Professor, Head of the Laboratory of Bioinformatics and Protein Engineering, International Institute of Molecular and Cell Biology, Warsaw
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The scientific advisors in charge of preparing this opinion were Maarja Kruusmaa and Nicole Grobert (lead), Eric Lambert and Nebojša Nakićenović, as well as former advisor acting as an expert, Pearl Dykstra, and Janusz Bujnicki and Carina Keskitalo for reviewing the opinion.

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All of the experts listed in Annex 4 who were consulted or informed the opinion.

EXECUTIVE SUMMARY

In recent years the world has experienced several disruptive events that fit the definition of a 'crisis', including the sovereign debt crisis, COVID-19 pandemic, multiple incidents provoked by the climate change, environmental degradation, and threats arising from Russia's aggression against Ukraine. These events threatened the functioning of our society and required a rapid response despite the great uncertainty regarding their potential evolution and the effectiveness of available countermeasures.

The interconnectedness of our society means that local disruptive events or threats are more likely to escalate into national or international crises. This is one of the reasons why the EU's role in crisis management has expanded, from facilitating coordination and solidarity between Member States, to providing rapid, flexible, and cross-sectoral responses. The added value of EU intervention is higher in transboundary crises and incidents that can overwhelm the response capabilities of individual Member States.

It is imperative that the strategic crisis management architecture of EU institutions be fit for purpose, and that it affords the high-level political capacity to take urgent decisions under conditions of uncertainty, while maintaining public trust and countering the negative side effects of crisis mitigation measures on society as much as possible.

This scientific opinion was requested from the Group of Chief Scientific Advisors (GCSA) by Mariya Gabriel, European Commissioner for Innovation, Research, Culture, Education and Youth, and Janez Lenarčič, European Commissioner for Crisis Management in June 2021. The GCSA was asked to provide the Commission with independent advice based on scientific evidence on how crisis management could be improved at the European level, especially for those large-scale, transboundary crises that are extremely hard for countries to manage alone.

In the opinion, the GCSA has considered both existing and potential cross-sectoral collaborations and arrangements between Member States and EU bodies that could increase the overall resilience of society. It addresses the need for an enhanced systemic approach that is better apt to tackle the interconnected challenges of complex crises. It also provides recommendations regarding how to tackle societal vulnerabilities, improve scientific advice, and to achieve better communication and public engagement in crisis management. The GCSA examined how policymakers could enhance preparedness in critical sectors that are of strategic importance for responding to and recovering from a crisis, improve data sharing among all actors involved in crisis management, and develop financial and economic instruments to rapidly respond to crises. Governance arrangements and instruments for crisis management should encompass the entire timescale of crises, from preparation to

recovery, with an eye on the longer-term consequences of both impacts and mitigation measures.

Drawing on a synthesis of scientific evidence and expert consultations, the GCSA developed a series of policy recommendations.

1. OVERARCHING RECOMMENDATION

The Group of Chief Scientific Advisors recommends that the European Commission develops a roadmap and create synergies and interlinkages between existing and future legislation and instruments to better deal with the increasingly systemic nature of large-scale crises, in a structural manner. Use a holistic approach to maximize synergies and avoid trade-offs and barriers across technologies, regulatory and market measures, and social and behavioural changes.

Over the years, European institutions have developed many instruments to manage crises, ranging from risk prevention to preparedness, response and recovery. More recently, and as a response to the pandemic, new legislation has been passed or is in the process of being approved. As shown in Figure 1, Section 1.3 of this opinion, several instruments and governance mechanisms are or will be available in the very near future. Some are the result of the experience of recent years and months, and are based on lessons learnt and achievements. However, those instruments and mechanisms still need to become part of a systemic framework suited to tackle the crises of the future. We recommend developing a roadmap for such a systemic framework.

1.1. Foresee adaptive instruments to deal with cascading failures and transboundary and cross-sectoral impacts, to overcome the tendency of adding new specific tools at each crisis.
1.2. Consider that facts and values cannot be disentangled in risk and crisis management.

2. RECOMMENDATION

Respond to cascading and transboundary crises by strengthening European governance for strategic crisis management

Strengthening European governance for strategic crisis management will require the creation of more cohesive, supportive and complementary mechanisms for preparedness, response, and recovery, developing stronger synergies across European institutions and between European Institutions and Member States.

2.1. Create crisis management structures that rely on coordinated networks of autonomous entities to bring together human and material resources, share

and analyse information and to develop strategies based on foresight. Develop focal hubs, such as the ERCC, connecting those autonomous entities.

2.1.1. Further develop the ERCC as a core node for different Directorates-General and agencies, and as an enabler of exchange of information and needs across EU Institutions and with Member States.

2.1.2. Complement a flexible high-level framework such as the IPCR with a more structured approach for facilitating the coordination between Member States and the Commission during an acute crisis.

2.1.3. Keep an updated mapping of the capabilities for crisis management within the European Commission, in EEAS, and in the Agencies highlighting the synergies and their location as hubs and parts of the network as described above.

2.1.4. Develop forecasting and anticipatory capabilities to reinforce an integrated and coordinated response.

2.2. Leverage Europe's diverse cultural and social backgrounds to provide the necessary redundancy, flexibility, and creativity to adapt to rapidly changing environments.

2.3. Further strengthen the stockpiling of resources and capabilities in Europe, considering existing reserves in conjunction with evolving hazard predictions as already done by HERA in the health sector.

2.3.1. Share between the Member States costly assets that are unlikely to be used often but may be urgently needed in rare cases. Repeat the needs and preparedness assessment on a regular basis.

2.3.2. Be prepared to look for capabilities that are not only material but also consist of skilled personnel and soft tools related for example to IT systems, data management tools that may be difficult to find but are key for treating ripple effects and cascading consequences across sectors.

2.4. Encourage Member States to conduct resilience assessments based on common indicators, complementing their national risk assessments by taking into consideration the outcomes of the Resilience Dashboard and the work started on the Union Disaster Resilience Goals.

2.5. Further encourage the involvement of local, regional and high level decision-makers in training and emergency exercises to foster cooperation between state institutions, voluntary organisation, and the private sector.

2.6. Provide integrated, holistic, and transdisciplinary scientific advice in crises because of the cross-sectoral nature of crises.

2.7. Integrate a knowledge hub into the governance framework of crisis management to provide essential scientific, legal, organisational, and practitioners' knowledge.

2.8. Define schemes for fast allocation of emergency research funding to trigger rapid research development to solve aspects of the crisis.

2.9. Support the integration of local knowledge in crisis management.

3. RECOMMENDATION

Make critical infrastructures more resilient to cascading effects

Cascading, multi-hazards, systemic failure risks can rapidly affect large areas and multiple sectors. To strengthen and make critical infrastructures and the entities that provide essential services more resilient, the following sub-recommendations should be considered.

3.1. Adopt a systemic approach acknowledging that critical points change dynamically during crises. Complement risk-based crisis management with a resilience-oriented crisis management approach that fully acknowledges the challenges associated with large scale, transboundary, and complex systemic interdependencies.

3.2. Stress-test critical infrastructure and the entities providing essential services for resilience using lessons learnt from real events, near misses, scenarios of incidents and simulated exercises, taking the routine testing in the aviation industry as an example.

3.3. Make critical supply chains more diverse and introduce redundancy, avoiding/reducing dependencies on single regions and/or producers to mitigate shortages and delays of supplies.

3.4. Invest in cybersecurity as a key component of civil protection by developing secure data-sharing tools and platforms because critical infrastructures are increasingly relying on digitalisation.

3.5. Couple existing sustainability and climate change mitigation and adaptation programmes at company, local, and regional levels with measures for business continuity.

3.5.1. Diversify the economy through flexible flow of services and capital, safety nets and arrangements for labour

3.5.2. Develop guidelines and encourage measures aimed at protecting essential workers and guaranteeing occupational safety during a crisis.

3.5.3. Prepare business continuity plans that consider not only physical incidents on individual plants but also the unserviceability of critical infrastructures at the regional, national and international scales.

3.5.4. Foster sustainable practices of resource management including the recycling of materials to reduce dependencies on global supply chains and strengthen local capacities.

3.5.5. Identify "positive risk reduction cascades" (SAPEA 2022, p. 111) of critical infrastructure that can speed up recovery whilst achieving sustainability and adaptation to, e.g., climate change.

3.6. Consider educational facilities as critical infrastructures and consider the continuity of educational programmes at all levels as a key component of societal resilience.

4. RECOMMENDATION:

Make existing EU financial instruments and resources more scalable, rapidly deployable, and efficient

Existing EU finance mechanisms need to be made scalable, rapidly deployable and efficient to address the specific and diverse needs of EU Member States and regions, and to enable immediate support for crisis response. This requires considering possible actions as outlined below.

4.1. Include economic and financial dimensions alongside physical risks in the modelling of crisis scenarios to account for the multiple cascading effects and identify necessary resources that will be needed.

4.2. Encourage the insurance sector to share its knowledge with governments.

4.3. Make legal and financial provisions flexible enough to cover different combinations of threats, vulnerabilities and exposed assets rapidly; for example, the Solidarity and Emergency Aid Reserve could be better used by considering possible future cross-border and compound crisis scenarios.

4.4. Create rapidly accessible financial reserves to prevent systemic crises, which generate large-scale disruptions for economies.

4.5. Develop greater financial capacity for response and recovery through public–private partnerships.

4.5.1. Address insurance gaps at national level, especially in those Member States most exposed to the consequences of natural hazards and climate change.

4.5.2. Develop, in partnership with the insurance industry, innovative insurance products to prevent the systemic breakdown of economic sectors.

4.5.3. Address with the insurance industry the challenges of covering assets that have been considered 'uninsurable' thus far, for example cultural heritage.

4.5.4. Appeal to the environmental, social and corporate governance framework to pull together human resources, equipment and goods to complement public procurement capacity. Expand the use of rescEU to manage private and corporate donations efficiently.

5. RECOMMENDATION

Collaborate closely with society to manage crises effectively

In times of crisis, and especially in long-lasting crises, trust can deteriorate rapidly. Therefore, building and maintaining trust across society before and during crises is important. Many of the following recommended actions rest within the realm of the responsibility of Member States; nevertheless, in full recognition of the subsidiarity principle, the European Commission can provide guidance, promote piloting experiences and support the sharing of good practices.

5.1. Adopt approaches to crisis management that are tailored to cultural and social characteristics of communities, leveraging voluntarism, transparency, respect, inclusiveness and reciprocity.

5.2. Communicate reasons and values behind decisions, possible dissenting viewpoints, and uncertainties clearly, concisely, and consistently.

5.3. Engage with communities to identify and map vulnerabilities and ways of reducing them.

5.4. Co-design tailored assistance for disadvantaged, marginalised and disabled people, bearing in mind that these groups may vary from crisis to crisis.

5.5. Develop psychological support programmes for all those affected by a crisis, including traditional and non-traditional first responders, considering the use of extended self-support networks, digitalisation, and voluntarism.

5.6. Design and maintain environments and welfare services that make those most affected and displaced feel empowered and dignified.

5.7. Facilitate the initiatives of volunteers by swiftly complementing them with formal organisations

6. RECOMMENDATION

Provide interoperable, high-quality data, and easy to communicate information for crisis management

Rather than suffering from lack of data, crisis managers are now faced with the challenge of actionable information (Derczynski et al. 2018) that require innovation in the way IT systems enable managing "flows of information to support the decision-making process in a networked manner" (Meesters 2021)

New and integrated data information systems are currently under development by the European Commission. They should (i) be built on what data are needed, and (ii) what has worked in the past and in recent crises to provide critical information across societal sectors and across EU institutions in a timely manner. Possible actions to improve data and information systems include the following.

6.1. Develop interoperable monitoring, detection, information and alert systems to allow the use and reuse of data and information for multiple purposes, including risk assessments, early warning, early action, enhanced situational awareness, response, and recovery.

6.1.1. Make use of available techniques to manage data from different sources for the early identification of anomalies and to monitor the evolution of crises.

6.1.2. Further develop platforms and services providing information for multi-hazard and multi-risk assessments.

6.1.3. Develop systematic and harmonised tools for post-event collection of damage and loss data.

6.1.4. Involve more national statistical offices and European agencies (Eurostat, the European Foundation for the Improvement of Living and Working Conditions, etc.) for evidence-based crisis management and monitoring of relevant indicators.

6.1.5. Accumulate experience on how to best use social media and collaborate with citizens/virtual volunteers to gather and analyse data.

6.1.6. Take care of legal provisions on privacy protection for managing data for crisis management.

6.2. Provide explainable information together with estimates of its uncertainty, for rapid decision-making in acute crises and to reduce the cognitive loads of decision-makers.

1. INTRODUCTION AND BACKGROUND

1.1. Introduction

The world experiences crises that increasingly involve multiple systems across large areas, and extend globally. These include the 2008 financial crisis, the COVID-19 pandemic, the crises engendered by the war in Ukraine and the crises caused by climate change. A variety of threats related to security, energy, and food supply, as well as climate-related, digital, and socioeconomic factors may trigger future crises (EPRS 2022). The common characteristics of those threats and their impact on societies include the presence of multi-risk factors likely to provoke cascading impacts across increasingly interconnected sectors. The speed of change and the complexity of crises are increasing, and consequent processes are more often irreversible.

Crises are not one-off events that fade into the background once they are over. Each crisis, and our response to it, can permanently change our society for better or worse. In this sense, a crisis can be seen as an opportunity as well as a threat. Crises can trigger profound changes in values, norms, laws and policies. Many achievements could not have been reached without taking risks: an argument for balancing the precautionary approach with the drive to innovation in crisis management.

The transformative character of crises implies that a strategic perspective on crisis management needs to be developed. As a strategic activity, it should not be a limited exercise based on a rigid blueprint (Lagadec 1993; Roux Dufort 2000; Weick 1998). Strategic crisis management addresses preparedness, development of response capacities and resources, and tools for recovery under conditions of considerable uncertainty. Approaches that are more likely to succeed rely on plans and prepared organisations, but with the ability to adapt, change and improvise depending on what the risks are.

Strategic crisis management means to not only manage the acute crisis, but also to integrate a longer-term vision. This scientific opinion considers the systemic aspects of complex crises, and examines how to make societies more resilient and how to support building back better after crises. It requires a comprehensive call on societal resources and capacities, going beyond the traditional coordination of organisations involved in crisis management.

In 2015, three major international agreements set the global goals for the future of humanity, covering the fields of sustainability (Sustainable Development Goals1); natural, social and economic disaster risk reduction (the Sendai framework)2; and mitigation of and adaptation to climate change (the Paris Agreement)3. All three

[1] https://sdgs.un.org/goals
[2] https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030
[3] https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

point to the growing pressure on the Earth, the need to rebalance the relationship between humans and the Earth, and the need to solve blatant unjust inequalities between and within countries, regions, and communities. The European Green Deal that is aiming at delivering the implementation of the agreements above, is endangered by the cascade of crises that we are living through now.

In Europe, crisis management encompasses a large range of capacities that are distributed within EU institutions and Member States. The role of the EU in crisis management is changing. Originally, the EU was not designed to manage acute crises, but over time, the EU has invested in crisis management capacities for sectors such as finance, health, climate change, and data governance. Now, the rise of systemic, interconnected, and cross-border crises means that the EU is expected to do even more. It has a role to play in facilitating coordination and solidarity between Member States, but it is also increasingly asked to provide rapid, flexible and cross-sectoral responses.

The present opinion of the Group of Chief Scientific Advisors (GCSA) aims to provide the Commission with independent scientific advice on how crisis management could be improved at the European level. The first part of this opinion sets the context and provides its scope and objectives as well as the policy landscape relevant for crisis management in the EU.

1.2. Scope and objectives of the opinion

The GCSA provides independent scientific advice to the European Commission to inform policymaking. The advisors work closely with the consortium 'Scientific Advice for Policy by European Academies' (SAPEA). This scientific opinion is published together with an Evidence Review Report by SAPEA (ERR, SAPEA 2022) and is complement by a statement from the European Group on Ethics in Science and New Technologies (EGE): 'Values in times of crisis: Strategic crisis management in the EU' (EGE 2022).

The present opinion was requested by Mariya Gabriel, European Commissioner for Innovation, Research, Culture, Education and Youth, and Janez Lenarčič, European Commissioner fort Crisis Management in June 2021. The background to this request and the specific questions to be answered by the advisors are laid down in the 'Scoping Paper' (Annex 2).

The overarching question put to the GCSA is: 'Based on a broad and multidisciplinary understanding, how can the EU improve its strategic crisis management?'

The Scoping Paper further requests:

- The delimitation of the types of crises for which there is a clear added value of a comprehensive and integrated EU approach whilst respecting subsidiarity,
- the definition of terms that are widely used in the crisis management domain,

- recommendations for an integrated governance and operational framework for those crises in which EU Institutions and bodies can bring the added value.

The recommendations presented by the GCSA are informed by: the ERR (SAPEA 2022), expert elicitation workshops , and literature and rapid reviews as described in Annex 1 which outlines the methodology followed for this opinion.

The recommendations are structured in six sections covering the following:

1. An overarching recommendation setting the principles underlying all subsequent recommendations
2. What should be the characteristics of institutional arrangements and collaborations between Member States, EU organisations, and sectors to achieve an improved crisis management?
3. How can critical infrastructures be made more resilient?
4. Which financial and economic instruments can be put in place to support enhanced crisis management from preparedness to response and recovery?
5. How can citizens be included in crisis management and how achieve trust in institutions and governments?
6. What tools are needed to harmonise and share data among sectors efficiently to deliver better crisis management capabilities and how best design/deliver/implement them?

1.3. A complex policy landscape

The EC was not originally intended to be a crisis manager, yet both its role and capacity in this area were increasingly enlarged, in particular for crises that can overwhelm capacities of individual Member States and for transboundary crises. Over time, legislations, mechanisms, and instruments have been added following lessons learnt and crisis experience. It is challenging to produce an overview of existing policies as those have been dynamically changing, especially in the past two years[4]. In Figure 1, a reasoned landscape of some of the most relevant initiatives is represented. The main components shown in Figure 1 are briefly explained below, further details can be found in Annex 3.

[4] An Inventory of EU Crisis Management Capabilities has been prepared by the Crisis Management Unit of the Secretary General of the EC in June 2022 shared with relevant bodies at the EU and Member States levels.

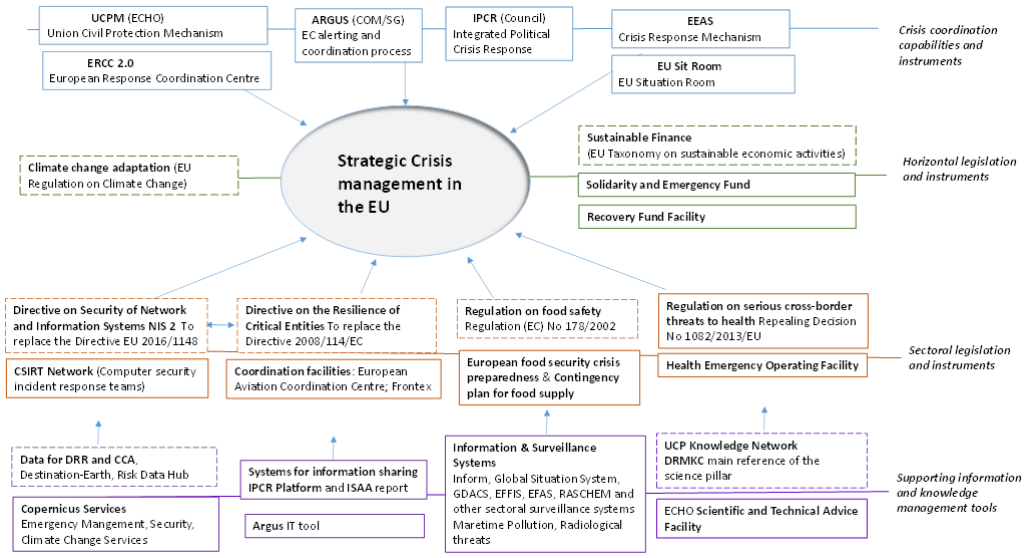

Figure 1. A selection of main instruments, mechanisms and legislation in the field of crisis management at the EU level

In Figure 1 a selection of instruments, mechanisms, and legislation relevant to strategic crisis management at the EU level are organised in four lines. In the first upper line, the blue contoured boxes represent generic instruments and mechanisms that are used to address various types of crises. The second line contoured in green refers to horizontal legislation and instruments that have an impact on several sectors and for different types of action and interventions across the crisis management cycle, from preparedness to response. In the third line, contoured in red are sectoral instruments and legislation. In the last line, contoured in violet data, information and knowledge management systems that are supporting the implementation of legislation, capacities and instruments are shown.

Legislation, mechanisms, and instruments that are aimed at prevention & preparedness of crises are represented in dotted boxes, whereas instruments & capacities applicable in the response phase are shown in plain boxes.

1.3.1. Generic instruments and mechanisms for crisis management

The Union Civil Protection Mechanism (UCPM)[5] is a well-rooted framework reinforced by the new Regulation issued in May 2021[6]. The UCPM is dealing with emergencies that occur inside and/or outside the EU with the provision of aid to the affected countries who request assistance via the Emergency Response Coordination Centre

[5] https://civil-protection-humanitarian-aid.ec.europa.eu/what/civil-protection/eu-civil-protection-mechanism_en
[6] Regulation (EU) 2021/836 of the European Parliament and the European Council.

(ERCC). The ERCC functions as a focal hub where demands for resources are met with response capacities offered by Member States or the RescEU (a reserve of capacities fully financed by the EU).

ARGUS[7] is the Commission's general rapid alert system. It is a process supported by an homonymous IT application bringing together all relevant services and Cabinets to coordinate and to decide on measures in case of a transboundary crisis. ARGUS can be activated in two different phases: 'Phase I' is used for information-sharing on a sector-specific crisis or on a crisis of relatively limited impact on the EU; 'Phase II' is triggered by the President in a case of a major multi-sectoral crisis.

The EU Integrated Political Crisis Response (IPCR) provides Europe with a flexible tool to coordinate between Member States and EU bodies. The European Commission's Secretariat-General, Directorat-General (DG) ECHO, DG HOME and the European External Action Service (EEAS)[8] participate in the IPCR meetings. Other DGs and Agencies participate depending on the nature of the crisis. For example DGs SANTE, HERA, JUST, and CNECT and the European Centre for Disease Prevention and Control (ECDC) took part in IPCR meetings to coordinate during the COVID 19 pandemic. A common shared platform for information exchange and the Integrated Situational Awareness and Analysis (ISAA) report are important elements of the coordination. Depending on the crisis, the ISAA report is drafted by the most relevant DG (such as ECHO, HOME, SANTE).

The EEAS is responsible for managing the repatriations of European citizens caught in major emergencies abroad[9]. EEAS relies on a Situation Room and on a Crisis Platform. The latter is a flexible arrangement aimed at bringing together the relevant EEAS departments as well as other EU Commission DGs (such as ECHO, HOME) depending on the type of crisis. The EEAS is establishing a Crisis Response Centre, expected to be operational at the end of 2022.

1.3.2. Horizontal Instruments and legislations impacting on multiple sectors

The so-called Climate Law[10] and the Sustainable Finance are highlighted as horizontal legislation and instruments that impact on several sectors.

The Climate Law points at adaptation as a key component of the long-term global response to climate change, implying the "identification, classification and prudential

[7] COM(2005) 662 final of 23.12.2005, "Commission provisions on "ARGUS" general rapid alert system".
[8] 2010/427/EU: Council Decision of 26 July 2010 establishing the organisation and functioning of the European External Action Service.
[9] According to the Council Directive (EU) 2015/637 of 20 April 2015 on the coordination and cooperation measures to facilitate consular protection for unrepresented citizens of the Union in third countries.
[10] Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality.

management of material physical climate risks when planning, developing, executing and monitoring projects and programmes for projects" (article 5.5).

In the EU Taxonomy for Sustainable Activities[11] the contribution to climate change adaptation is listed as a criterion to define sustainable economic activities. The EU has also developed specific financial instruments to deal with crisis, such as the Solidarity and Emergency Aid Reserve that provides immediate aid for Member States that have been affected by a large disaster. To counteract the negative impacts on economy of the pandemic, the EU has established the Recovery and Resilience Facility as a key temporary instrument.

1.3.3. Main sectoral and thematic instruments and legislation

Main initiatives on sectoral and thematic instruments and legislations include:

The Regulation on Serious Cross-Border Threats to Health (COM2020 727 Final, 11/11/2020), the creation of the Health Emergencies preparedness and Response Authority (HERA) as well as the strengthened mandates of ECDC and the European Medicines Agency (EMA) constitute important elements of better preparedness for and response to future cross-border health crises. HERA, established by a European Commission Decision on the 16th of September 2021, will complement ECDC and EMA in both preparedness and crisis times.

The Regulation on Food Safety[12], which establishes the European Food Safety Authority (EFSA) and in articles 55 to 57 requires to develop a crisis unit and a plan for crisis management. Crisis management is intended in the Regulation as implying a risk for health. A Contingency Plan for ensuring food supply and food security in times of crisis and a Communication on food security, intended as affordability and availability were issued in December 2021[13] and March 2022 respectively[14].

The Directive on the Resilience of Critical Entities (CER) and the Network and Information Security Directive (the NIS2)[15]. CER will allow Member States and critical entities to better address interdependencies and potential cascading effects of an incident. Eleven sectors will be covered: energy, transport, banking, financial market

[11] Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment.
[12] Regulation (EC) No 178/2002 of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety.
[13] COM(2021) 689 of 12.11.2021 "Contingency plan for ensuring food supply and food security in times of crisis".
[14] COM/2022/133 final of 23.3.2022 "Safeguarding food security and reinforcing the resilience of food systems".
[15] In both cases an agreement on the text has been reached by the Council and the Parliament in May and June 2022 to replace respectively Directive 2008/114/EC and Directive EU 2016/1148.

infrastructures, health, drinking water, wastewater, digital infrastructure, public administration, space, and food. NIS2 is aimed at increasing "the level of cyber-resilience of a comprehensive set of businesses operating in the European Union across all relevant sectors". The NIS2 Directive should facilitate the alignment "of the security and incident reporting requirements and the capabilities of the Member States' relevant competent authorities". Necessary interlinkages between the two Directives are indicated in both. As part of policies aimed at safeguarding the functionality of critical infrastructures, tools to counteract hybrid threats have been at the core of recent initiatives[16] and reports (Giannopoulos et al 2020; Jungwirth et al 2022)

Specifically for the banking sector, a proposal for a 'Digital Operational Resilience Act' (DORA) was made, aiming at guaranteeing that the financial sector in Europe can maintain operations through severe operational disruption.

1.3.4. Building and sharing knowledge, data and information for strategic crisis management in the EU

In 2015, the Joint Research Centre (JRC) of the European Commission established the Disaster Risk Management Knowledge Centre (DRMKC) with the aim of bringing together researchers, projects funded by the EU and international experts to share and co-develop knowledge in the field of disaster management. The Civil Protection Knowledge Network[17], launched in November 2021, is built on two pillars: Science (led by the DRMKC) and the Capacity Development. The Civil Protection Knowledge Network is aimed at growing and becoming referential for civil protection communities at large, including practitioners, officers of Member States, researchers, associations, and organisations from the public and the private sectors.

Advanced data and information systems are essential for crisis management at different spatial levels and temporal phases and required by all the above-mentioned legislative initiatives and instruments. The Copernicus Earth Observation Program is a pillar of monitoring and crisis management services, such as IFFIS (European Forest Fire Information System) and EFAS (European Flood Awareness System), and the Emergency Management and the Security Services. Different information systems are currently under development within the Commission for early warning and situational awareness, such as the Global Situation System. Other systems are aiming at providing analytical tools for risk assessment and management. For example, the Inform Platform, recently updated, provides worldwide indicators on hazards, exposure and vulnerabilities whilst the Risk Data Hub (JRC) is more focused on the European Space. Destination Earth (DG CNECT) is a very ambitious project to

[16] EC Secretariat General, Joint Staff Working Document, EU operational protocol for countering hybrid threats 'EU Playbook', SWD(2016)227, 2016.
[17] Commission Implementing Decision (EU) 2021/1956 of 10 November 2021 on the establishment and organisation of the Union Civil Protection Knowledge Network.

provide a digital model of the Earth to be used to better model impacts of climate change and weather-related extremes.

1.4. Scientific background and conceptual framework

1.4.1. The Evidence Review Report (ERR) by SAPEA

The central contribution that informed the present opinion was the ERR developed by SAPEA (SAPEA ERR 2022), which contains a comprehensive analysis of the scientific evidence related to the questions set in the Scoping Paper scoping questions:

- An introduction to the topic of strategic crisis management, framed in the context of multiple overlapping crises. Terms and concepts are defined, distinguishing between sudden onset, creeping and protracted crises
- The analysis of current arrangements at the European level to deal with crises, and the evolution of such arrangements in response to increased transboundary and cross-sectoral threats
- The challenges to existing arrangements in the light of the new landscape of threats. A taxonomy is proposed to cover emerging crises, clustering them in systemic breakdowns, global and pervasive, socially induced and socially amplified risks
- Scientific advice during crises, based amongst others on the scientific opinion by the GCSA (see 1.4.2) and the evidence review report by SAPEA (SAPEA ERR 2019) on 'Making Sense of Science under Conditions of Complexity and Uncertainty'
- The multiple facets of trust, mainly between governments and citizens, including an in-depth reflection on how inequalities may undermine strategic crisis managementsci
- The tools that are particularly useful to prepare for crisis, including tools for supporting, anticipating, and predicting threats and their possible impacts on society
- Case studies on forest fires, cybersecurity, bio-threats, and migration, with illustrations of challenges that cover logistics, economic, and political fields
- The policy options that can be derived from the evidence review, addressing in particular the need for enhanced preparedness and tackling of large systemic crises.

1.4.2. Previous scientific opinions of the GCSA and related SAPEA evidence review reports relevant to strategic crisis management

Given that strategic crisis management touches upon many policy areas, some of the previous GCSA Opinions are also relevant for improving policies and action in preventing, preparing, responding and recovering from crises.

- The scientific opinion on "**Cybersecurity in the European single digital market**" (GCSA 2017) mentions a clear need to address the inherent vulnerabilities in digital systems. As cyberattacks cannot be totally avoided, it is

crucial to focus on how systems are built to limit the possible damage, improve detection of threats and repair as fast as possible when the attack occurs. It also points at the need to adopt a systems engineering approach starting from the design stage to reduce vulnerabilities from early on and to increase the number of trained experts and match their qualifications and skills to the evolving needs of cybersecurity. The opinion also addresses data-literacy education and building European citizens' awareness as a cornerstone of cybersecurity. Finally, the opinion stresses the strategic autonomy of the EU as a key to ensure that hardware and software components used in critical infrastructures are trustworthy, secure and guarantee the protection of personal data.

- The scientific opinion on "**Scientific Advice to European Policy in a Complex World**" (GCSA 2019) aimed at providing a reliable and trusted guide on how scientific evidence can assist the decision-making process, taking into account uncertainties of scientific information and knowledge. According to the opinion, the assessment of complex emerging issues can also benefit from foresight and horizon scanning, as these methods can help mitigate the risk of missing "early warnings".
- The advent of the COVID-19 crisis in 2020 was an opportunity to learn from experience to date about giving scientific advice on an ongoing crisis. The "**Statement on scientific advice to European policymakers during the COVID-19 pandemic**" (GCSA et al 2020(a)) and the scientific opinion "**COVID-19, future pandemics and other crises in the global context**" (GCSA et al 2020(b)) address lessons learnt from the COVID-19 pandemic and pointed at the lack of preparedness. It also highlighted the strengthened resilience in the response and recovery shown by Europe.
- In the scientific opinion on "**Adaptation to health effects of climate change in Europe**" (GCSA 2020) it is argued that responses to climate change must combine mitigation approaches to reduce emissions of greenhouse gases, together with adaptation actions to address the consequences that cannot be avoided. Achieving these goals requires the capacity to influence, change and transform society to make it more resilient.
- The scientific opinion on **"A strategic approach to energy transition in Europe"** (GSCA 2021) recommended to develop flexible, efficient, and resilient energy system for delivering clean, accessible, and affordable energy services by integrating decarbonised sources. It also called for an inclusive participation of all relevant stakeholders considering the protection of the most fragile against high energy prices. In a subsequent **"Statement on energy prices in Europe: Put people at the centre of energy policy"** (GSCA 2021), it was stressed that Europe and the Memember States should not develop new dependencies and risks (e.g. rare earths meaning that circularity is the key) on the pathway toward energy security and independence.

1.5. Conceptual framework

The ERR (SAPEA ERR 2022) defines "***strategic crisis management***" as focusing on strategic issues in preparedness, rapid decision-making capability and resources in the response, and resilience in the recovery. It also refers to the extent to which

crisis management considerations are integrated into the strategic vision and management of the European Commission and other EU Institutions and bodies.

Figure 2 provides a visual representation of the main terms that are used in this scientific opinion.

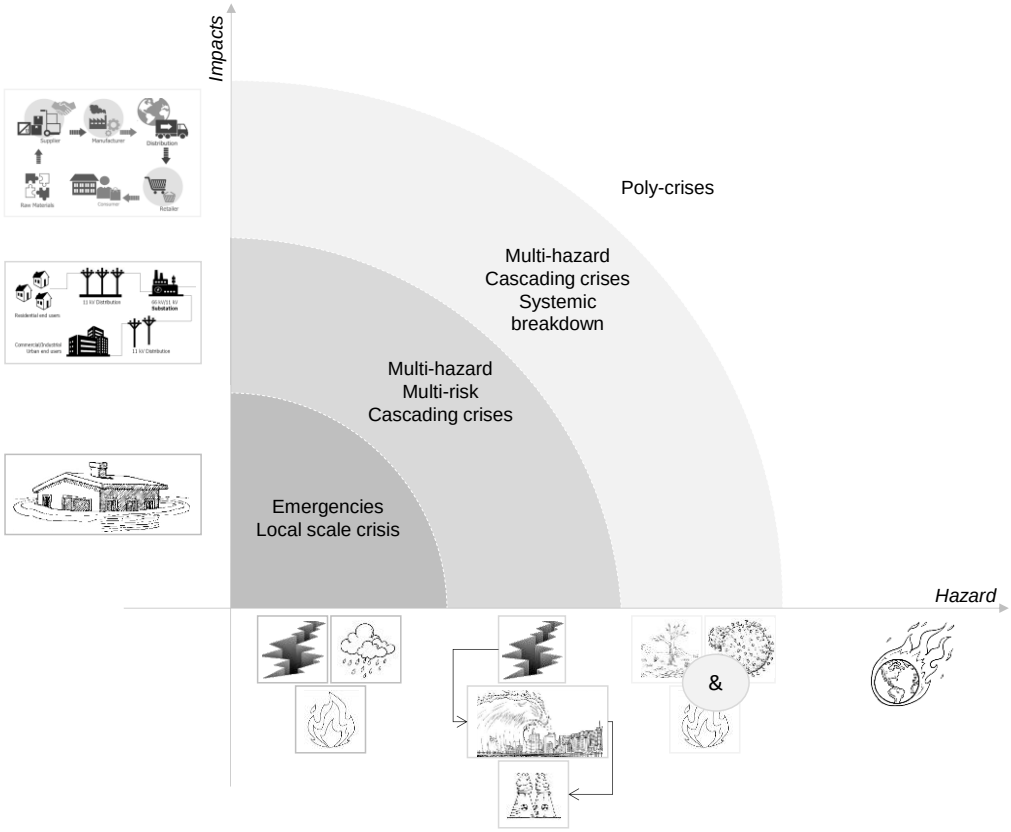

Figure 2. The increasing complexity of global crises

"***Emergency*** *is defined as an imminent, serious situation requiring immediate action. Emergencies tend to occur with some sort of regularity, which has allowed professionals to prepare a response to particular sorts of emergencies*" (SAPEA ERR 2022).

Crisis is different from an emergency in that it "*occurs when people perceive a severe threat to the fundamental values or functioning of a society or system, requiring an immediate response that must be delivered under conditions of (deep) uncertainty*" (SAPEA ERR 2022).
A recently released ISO standard on crisis management, defines crisis as an "*abnormal or extraordinary event or situation that threatens an organization or*

community and requires a strategic, adaptive and timely response in order to preserve its viability and integrity"[18].
The ERR also underlines the need to consider the temporal scale of crises, which may be further classified as:

- "***Sudden onset crises***" that occur abruptly as for example explosions or earthquakes. In contrast to their rapid onset, their negative impact can be often foreseen and prepared for. Despite of the fact such crises come as a surprise to decision makers, underlying vulnerabilities to threats are ignored over longer periods of time that Turner (1978) labelled as "incubation" of crises. (SAPEA ERR 2022);
- "***Creeping crises***" originate from a slowly developing threat that has not been acted upon by decision-makers.

The ERR argues that the present crisis landscape is characterised by increased risk of ***systemic breakdown***. The causes of such ***systemic breakdown*** cannot be easily identified as they stem from multiple interconnected factors, some of which can be in one component of a system (therefore at a local level) but many of which emerge only when larger scales (regional, national or global) are considered. Often such risks of systemic breakdown are global and pervasive, driven by human activities that promote rapid environmental or cultural changes, without proper knowledge of all the trigger points.

Systemic breakdowns are also often characterised by ***social amplification***. Social amplification is almost inevitable for risks that produce ripple socio-economic impacts trespassing geographic borders and sectoral boundaries. It is also favoured by the wide use of social media.

The risk of systemic breakdown is due to the complex nature of crises that occur in a world in which systems are highly interconnected and tightly coupled. Concepts such as cross-border, transboundary, cascading and escalating impacts, domino effects (Rinaldi et al 2001) allude to such complexity. The latter is also due to the multi-hazard multi-risk nature of the current risk landscape, in which threats are co-existing, co-occurring and overlapping in a short period of time (Zchau 2017).
In cascading and complex multi-hazard and multi-risk situations, the attribution of impacts and losses becomes challenging not only for analysts but also for decision makers who are looking for turning points on which to intervene. As stated in the ERR, "*crisis managers need not only look for unexpected small changes in system-*

[18] *ISO 22361 Security and resilience – Crisis management – Guidelines for strategic capability*. As stated in the scope, ISO 22361, provides "guidelines for crisis management to help organizations plan, establish, maintain, review and continually improve a strategic crisis management capability."

environment-interactions but also for simultaneous failures in different systems that are functionally connected".
The ERR introduces the term "***poly-crisis***" that according to Renn et al (2022) indicates "*a macro-crisis of interconnected failures*" that may provoke "*irreversible degradation of Earth's vital natural and social systems*".

Prompt crisis management may avoid that the situation escalates into a **disaster**, that is defined as a "*severe disruption of normal functioning of a system, leading to widespread losses and impacts that overwhelm the response capacity of a system or society*".

Risk is an intrinsic element of crises denoting a situation or an activity that may provoke highly negative impacts. Risk assessment is the procedure aimed at assessing both the stakes (the potential negative impacts) and the levels of uncertainties.

Vulnerability is defined as how prone a system or an asset to be damaged is. As such it is a key component of risk as it refers to the physical weakness of assets, as well as to fragilities of social, economic, and environmental systems, factors and processes.

Resilience refers to the capacity of systems to recover at a certain pace and includes the possibly of reaching better conditions with respect to the pre-crisis. Based on Elmqvist et al (2019), the ERR highlights that "*multiple possible development pathways or trajectories*" are typical of complex adaptive systems. Resilience can be seen as the capacity to adhere to, or simply strengthen, a specific positive pathway.

The definitions above reflect the scientific understanding of multi-hazard, multi-risk, cascading impacts and their intrinsic components. The JRC DRMKC's effort to develop a full taxonomy[19] is important as it aims at creating a fully structured repertoire of terms, concepts and understandings in the field of risk and crisis management. It is based on an iterative exercise aimed at conceptualizing the knowledge that oversees the search and interpretation of terms. Such an exercise is building on a large body of knowledge from a vast array of sources, European and international institutions, researchers and academicians. The taxonomy is an important step to provide a common, structured classification to be shared among different DGs, agencies, and organisations toward developing a full ontology in the field of risk and crisis management.

[19] https://drmkc.jrc.cec.eu.int/knowledge/drm-taxonomy

2. RECOMMENDATIONS

2.1. Overarching recommendation 1

The Group of Chief Scientific Advisors recommends that the European Commission develops a roadmap and create synergies and interlinkages between existing and future legislation and instruments to better deal with the increasingly systemic nature of large-scale crises, in a structural manner.

Over the years, European institutions have developed many instruments to manage crises, ranging from risk prevention to preparedness, response and recovery. More recently, and as a response to the pandemic, new legislation has been passed or is in the process of being approved. As shown in Figure 1, Section 1.3 of this opinion, several instruments and governance mechanisms are or will be available in the very near future. Some are the result of the experience of recent years and months, and are based on lessons learnt and achievements. However, those instruments and mechanisms still need to become part of a systemic framework suited to tackle the crises of the future. We recommend developing a roadmap for such a systemic framework.

2.1.1. Foresee adaptive instruments to deal with cascading failures and transboundary and cross-sectoral impacts, to overcome the tendency of adding new specific tools at each crisis.

Crisis management is always a strategic rather than tactical endeavour (Lagadec 1995; Guilhou and Lagadec 2002; Roux-Dufort 2000). Fully respecting the subsidiarity principle, strategic crisis management refers here to the capacity of EU institutions and bodies to support Member States to tackle in a more integrated and better coordinated manner those crises that are likely to overwhelm any individual nation's response capacity. This means coupling systemic governance framework with the operational instruments, skills and expertise that are required by the nature of each specific crisis with its ramifications and ripple effects in different sectors. It includes the skills and expertise that are already available in EU institutions and bodies, and in Member States, and new ones that will be needed in the future as a consequence of new types of threats and/or underestimated exposure and vulnerabilities. The potential unintended consequences of mitigation measures should be foreseen and addressed, carefully weighing the potential long-term impact of such measures on society against the expected benefits.

2.1.2. Consider that facts and values cannot be disentangled in risk and crisis management.

The recommendations of this opinion are based on the fact that in crisis management, facts and values are intimately interlaced with each other and cannot be disentangled (Beck 1992). For example, defining accepted risk is not only a technical exercise based on probabilities but implies a judgement on the severity of potential impacts.

The latter varies among individuals and cultures. The recommendations imply adherence to fundamental values of democracy, equity and solidarity (EGE 2022): they have been conceived with these values in mind, and these values are preconditions for implementing the recommendations.

2.2. Recommendation 2 - Respond to cascading and transboundary crises by strengthening European governance for strategic crisis management

Strengthening European governance for strategic crisis management will require the creation of more cohesive, supportive and complementary mechanisms for preparedness, response, and recovery, developing stronger synergies across European institutions and between European Institutions and Member States.

2.2.1. Create crisis management structures that rely on coordinated networks of autonomous entities to bring together human and material resources, share and analyse information and to develop strategies based on foresight. Develop focal hubs, such as the ERCC, connecting those autonomous entities.

2.2.1.1. Further develop the ERCC as a core node for different Directorates-General and agencies, and as an enabler of exchange of information and needs across EU Institutions and with Member States.

After the launch of the ERCC 2.0 initiative in May 2021, and during the Ukraine crisis, the ERCC has gained a key role as an operational crisis management hub with enhanced anticipatory and analytical capacity, coordinating amongst EC Services, and linking demand and offer from Member States including private sectors' offer. In-kind donations from the private sector included medicines, electrical equipment, and generators.

2.2.1.2. Complement a flexible high-level framework such as the IPCR with a more structured approach for facilitating the coordination between Member States and the Commission during an acute crisis.

A structured approach for the coordination with Member States should build on the complementary capacities of civil protection and humanitarian aid components (ERCC), on mechanisms related to security and relations in complex external contexts (EEAS), and any relevant Agency or EC service depending on the specifics of the threat and crisis.

Major cross-sectoral and complex crises require mechanisms to coordinate political responses. Examples of dilemmas to be managed are between robustness in financial accountability and speed to address the urgent needs of those hit by the crisis, or the (apparent) dilemma between energy security and sustainability. As discussed in the ERR (SAPEA 2022), governance arrangements have been reshaped in the wake of crises. At EU level, the IPCR work in close interaction with the ERCC, the EEAS, and any relevant EC service or Agency depending on the nature of the threat and

crisis. Since the COVID-19 crisis and the poly-crises triggered by the invasion of Ukraine are still ongoing, it is difficult to predict how the coordination mechanisms will develop further. To tackle this challenge it is essential to develop robust coordination mechanisms that aid relevant coordination hubs of the networked capacities and to keep the latter open to new capacities as and when required.

A recent study examines the positive aspects of the EU level response to COVID-19 as well as its weaknesses (Vila Maior and Camisão 2022). On the positive side, Member States have recognised the added value of a coordinated European response. Negative aspects included the initial delays due to unpreparedness and lack of collective sense-making of the wide implications of the incumbent threat posed by the infection. Remedying both would require a combination of operational and political foresight and preparedness capacity. It would benefit from "collegiality, learning and exchange of knowledge" between EU institutions and bodies, and between the latter and Member States, respecting the Member States' sovereignty (Hollis 2010, p. 324). The ERR expresses the need for "an EU institution that owns and drives the further enhancement of the EU's risk and crisis management capacities, or that serves as a central Hub for crisis management initiatives" and proposes different options for realising this (SAPEA 2022, p. 73). Nowell et al (2018) propose a 'core–periphery' structure as an effective configuration able to overcome the shortcomings both of too hierarchical or too loose networks. A 'core-periphery' structure combines the flexibility of a network that can include new capacities when those are required and the needed cohesion and stability provided by core coordination structures.

2.2.1.3. Keep an updated mapping of the capabilities for crisis management within the European Commission, in EEAS, and in the Agencies highlighting the synergies and their location as hubs and parts of the network as described above.

The governance of crisis management in Europe is complex . To develop synergies, the specialized capacities of different members of the network need to be known and further developed if needed. For example, the Directorate-General for Health and Food Safety, the newly established Health Emergency Preparedness and Response Authority, the European Centre for Disease Prevention and Control and the European Medicines Agency proved to be crucial for the management of the pandemic. The Agencies are currently developing an interagency framework to deliver scientific support in case of crises, based on the experience gained during the COVID 19 pandemic (EU-ANSA 2022). It is a challenge to coordinate between so many bodies, to get the maximal benefit of their capacities in a timely manner. The coordination can be done using a limited number of focal hubs, leveraging on those that already exist and proved to function. Depending on the threats (including compound ones), they should be able to call on a wide range of expertise. The updated mapping of such competences should facilitate the early identification of personnel and units to be integrated in the hubs during a crisis, but also strengthen the link with corresponding agencies and bodies in Member States.

2.2.1.4. Develop forecasting and anticipatory capabilities to reinforce an integrated and coordinated response.

Developing forecasting and anticipatory capabilities to be shared between the IPCR and the other crisis management nodes and hubs of EU institutions across the entire cycle, from preparedness to recovery, may have two positive effects. First, it may help de-escalate the crisis to a much more manageable incident (as was the case, for example, with the millennium bug in 2000). Second, in large-scale crises, it would help to be more prepared to find solutions to fast-evolving situations.

2.2.2. Leverage Europe's diverse cultural and social backgrounds to provide the necessary redundancy, flexibility, and creativity to adapt to rapidly changing environments.

The complexity of the governance of EU crisis management can be seen as a challenge but also as a great advantage, as it provides the opportunity to respond swiftly and specifically to threats and consider vulnerabilities specific to Member States and Regions. Response diversity can be considered as both a necessity to account for different combinations of hazards, exposure, vulnerabilities and capacities, and as a resource in its own right. For example, fighting forest fires in different regions may require different approaches because of natural conditions, type of vegetation or population density. Diversity in responses provides a larger spectrum of means and solutions from which good practices are more likely to emerge. Adaptive, flexible management that is context-sensitive reinforces mutual trust between communities and decision-makers and between Member States and EU institutions and bodies. It also leads to greater acceptance of mitigation measures.

2.2.3. Further strengthen the stockpiling of resources and capabilities in Europe, considering existing reserves in conjunction with evolving hazard predictions as already done by HERA in the health sector.

2.2.3.1. Share between the Member States costly assets that are unlikely to be used often but may be urgently needed in rare cases. Repeat the needs and preparedness assessment on a regular basis.

2.2.3.2. Be prepared to look for capabilities that are not only material but also consist of skilled personnel and soft tools related for example to IT systems, data management tools that may be difficult to find but are key for treating ripple effects and cascading consequences across sectors.

2.2.4. Encourage Member States to conduct resilience assessments based on common indicators, complementing their national risk assessments by taking into consideration the outcomes of the Resilience Dashboard and the work started on the Union Disaster Resilience Goals.

Performing peer reviews and developing common and shared metrics of resilience (considering for example the outcomes of the Resilience Dashboard and the work started on the Union Disaster Resilience Goals under the May 2021 Regulation 2021/836) would permit improved prediction and analysis of cross-border threats and impacts. Following such assessments, it will be easier to estimate what level of coordination and what type of capacities would be needed for the response and the recovery.

2.2.5. Further encourage the involvement of local, regional and high level decision-makers in training and emergency exercises to foster cooperation between state institutions, voluntary organisation, and the private sector.

Enhance the existing training and exercise activities under the UCPM and in particular the Civil Protection Knowledge Network, and encourage cross-border exercises between Member States with the involvement of EU bodies, namely the IPCR, the ERCC, EEAS, and the crisis cells in different DGs and Agencies pertinent to the simulated crisis. Such exercise should involve the whole array of decision makers at all levels of government, including higher levels as currently done in the G7 initiative on pandemic led by Germany or NATO exercises.

2.2.6. Provide integrated, holistic, and transdisciplinary scientific advice in crises because of the cross-sectoral nature of crises.

Scientific advice must address different knowledge needs across the different phases. As highlighted in our previous opinion on Scientific advice to European policy in a complex world (SAM 2018), a broad transdisciplinary (Bhaskar et al 2010) approach is needed in the early stages of crises. This may help to identify the correct focus of further scientific advice and avoid leaning towards the most immediately obvious but limited expertise, which could undermine the capacity to fully appraise cascading implications and longer-term effects. For example, during the COVID 19 pandemic, in many countries scientific advice was mostly or solely concentrated on immediate immunological and epidemiological advice and therefore did not consider enough the effects on mental health, economy and education. If large amounts of literature and studies exist or can be used, science advisors must make a large effort to synthesise these, focusing on facts, data, and indicators they consider essential. Such a synthetic overview help avoid the cognitive load that is associated with conflicting, disparate and fragmented information, permitting them to focus only on what is key.

The newly established Scientific and Technical Advisory Facility (STAF) under the ERCC 2.0 initiative based on European Scientific Partnerships, which is currently providing 24/7 scientific advice on natural hazards and nuclear threats, is a step in this direction.

2.2.7. Integrate a knowledge hub into the governance framework of crisis management to provide essential scientific, legal, organisational, and practitioners' knowledge.

Knowledge in the field of crisis management is abundant and distributed among many actors, including scientists, public officers, and practitioners in different sectors, etc.. Often such knowledge is tacit, difficult to formalise, share, and keep in the collective memory. Relevant knowledge can be provided also by the private sector, depending on the type of crisis and the specific needs to combat it. For example, transporters and material and machinery suppliers all have key information and knowledge that can become very relevant for both the response and the recovery. In the area of civil protection and disaster risk management, this role should be played by the recently established Civil Protection Knowledge Network. Its aim is to strengthen the efficiency and effectiveness of training and exercises, to promote innovation and dialogue, and to enhance cooperation in prevention, preparedness and response between national civil protection authorities and services of the Member States. The Civil Protection Knowledge Network builds on two main pillars, Science, led by the JRC DRMKC, and Capacity Building. The Civil Protection Knowledge Network was already conceived as a hub that connects first responders, disaster risk managers, scientists, and decision-makers and matches their needs for expertise and good practices with state-of-the-art methodologies, tools, solutions, and resources. The Civil Protection Knowledge Network should also harness regional research to deal with specific exposures and vulnerabilities and support interregional collaboration for transboundary crises.

It would be worthwhile to revisit the idea included in the Barnier Report (2006) of a training institute for civil protection and humanitarian aid as one of the pillars of the UCPM. It could complement or be seen as an extension of the activities of the Civil Protection Knowledge Network as implemented today. The educational facility would become a physical space for meeting and developing common training, educational and research programs to improve trust, knowledge sharing and interoperability across Member States.

2.2.8. Define schemes for fast allocation of emergency research funding to trigger rapid research development to solve aspects of the crisis.

Schemes to call for swiftly deployable research during the outbreak of a crisis are an established practice in some countries, for example in the United States. In Europe, Horizon 2020 issued exceptional calls in early 2020 to quickly develop research for providing tools for managing the pandemic. The JRC conducted operational research on amongst others on the detection of COVIS-19. It would be useful to have predefined schemes that can be triggered whenever a crisis may be envisaged or is

occurring, to coalesce groups of researchers rapidly in both the domains of the specific threat and the various interconnected sectors. The identification of operational research needs should follow the same transdisciplinary approach that is recommended for advisory committees.

2.2.9. Support the integration of local knowledge in crisis management

While acknowledging that the activation and integration of local knowledge must be done by Member States and Regions, a potential role for the EU could be in training and setting standards for participation across the EU. Local knowledge, sometimes referred to as vernacular or citizens' knowledge, was recognised long ago as a vital part of effective crisis management (Becker et al 2008). It is highly context-based and provides unique information on environmental and territorial characteristics in terms of vulnerabilities and opportunities for responses. Local knowledge is also important as it can provide early warning regarding abrupt changes in environmental patterns (Riedlinger and Berkes 2001). The Arctic Climate Impact Assessment (ACIA) report (2005) lists various examples of local knowledge that permits to track changes in the habits of animals, in the appearance of new species, of warmer seasons starting earlier than used to be the case in the past. There are frameworks that provide room for such local knowledge to be used in prevention, for example in the experience of the use in river contracts for integrated water management (Scaduto 2016). Through new technologies, this knowledge can be shared across borders and provide important inputs for managing transboundary crises, for example, related to resources located in one country but needed in the bordering one. Embedding local knowledge in crisis management has the advantage of empowering local communities, making them feel part of the overall endeavour, and increasing their trust in formal organisations and state administrations.

2.3. Recommendation 3 - Make critical infrastructures more resilient to cascading effects

Cascading, multi-hazards, systemic failure risks can rapidly affect large areas and multiple sectors. To strengthen and make critical infrastructures and the entities that provide essential services more resilient, the following sub-recommendations should be considered.

2.3.1. Adopt a systemic approach acknowledging that critical points change dynamically during crises. Complement risk-based crisis management with a resilience-oriented crisis management approach that fully acknowledges the challenges associated with large scale, transboundary, and complex systemic interdependencies

Risk-based management relies on the assumption that risks can be identified, expected damages can be predicted in terms of their severity and probability, and risk reduction and mitigation measures can suffice to guarantee safety and functioning despite some level of disruption. Resilience thinking stems from the

recognition that the full identification of, and defence against threats is impossible. Resilience requires buffer capacity, dynamic adaptation to changing conditions, and learning from failures, near misses and successes. Resilience needs to be prepared for, in line with the Union Disaster Resilience Goals , and financed adequately, practised during crises, and sustained in recovery. The interdependency and interconnectedness of critical infrastructures must be fully addressed in emergency and contingency planning, which is currently too sectoral or too generic. Critical infrastructure providers develop plans for the facilities they are responsible for, overlooking their dependency on other critical infrastructures. Plans prepared by jurisdictions at different levels often do not fully integrate challenges that may derive from the lack of availability of critical infrastructures for the interventions and measures they have planned to counteract emergencies.

2.3.2. Stress-test critical infrastructure and the entities providing essential services for resilience using lessons learnt from real events, near misses, scenarios of incidents and simulated exercises, taking the routine testing in the aviation industry as an example.

Widely used in several sectors (Linkov et al 2022), stress testing has been increasingly looked at as a useful exercise to assess the robustness of critical infrastructures. It also implies resilience to shocks that are likely to significantly disrupt their individual functioning and cause large-scale and cross-sectoral effects. Stress testing for resilience complements more traditional approaches that are focusing mainly on the physical characteristics of critical infrastructures. Instead, stress testing favours a more systemic analysis of the overall conditions of their functioning, fully acknowledging human and organisational factors. Stress testing should also cover the emergency and contingency plans that are usually prepared by critical infrastructure providers, as this can identify false assumptions on which the plans may have been developed.

Critical infrastructure providers and governmental organisations should share data and information collected about failures, lessons learnt in real events, losses to critical infrastructures – and, as a result, on the unserviceability of critical infrastructures. Such data-sharing is essential for improving current practices and is aligned with the new requirements of the proposed Directive on the Resilience of Critical Entities.

2.3.3. Make critical supply chains more diverse and introduce redundancy, avoiding/reducing dependencies on single regions and/or producers to mitigate shortages and delays of supplies.

Critical infrastructures and economies rely heavily on supply chains for materials, flows of energy and resources, and skilled personnel. The current energy crisis clearly points to over-dependency on a few suppliers, chosen mainly based on cost, free market and efficiency criteria, as a major source of vulnerability. Awareness on critical vulnerabilities has prompted as a start the EC initiatives on the Chips Act. The diversification of supply chains and introduction of redundancy, while less efficient

from a short-term economic perspective, are nevertheless conducive to resilience and adaptation capacity in the medium and longer term. It should therefore be encouraged. Current crises are demonstrating the importance of both short- and long-term perspectives, balancing costs, benefits, and risks over long-time horizons rather than focusing on the immediate return on investments.

2.3.4. Invest in cybersecurity as a key component of civil protection by developing secure data-sharing tools and platforms because critical infrastructures are increasingly relying on digitalisation.

A recent study (Luiijf and Klaver 2021) has highlighted that the internet and digital tools have turned telecommunication into a key system for several sectors, including other critical infrastructures. Dependence on digital services has significantly increased in the last decade, making it clear that both physical networks and data need to be protected as assets and made resilient to various threats, including hybrid and compound threats.

2.3.5. Couple existing sustainability and climate change mitigation and adaptation programmes at company, local, and regional levels with measures for business continuity.

2.3.5.1. Diversify the economy through flexible flow of services and capital, safety nets and arrangements for labour.

2.3.5.2. Develop guidelines and encourage measures aimed at protecting essential workers and guaranteeing occupational safety during a crisis.

2.3.5.3. Prepare business continuity plans that consider not only physical incidents on individual plants but also the unserviceability of critical infrastructures at the regional, national and international scales.

2.3.5.4. Foster sustainable practices of resource management including the recycling of materials to reduce dependencies on global supply chains and strengthen local capacities.

2.3.5.5. Identify "positive risk reduction cascades" (SAPEA 2022, p. 111) of critical infrastructure that can speed up recovery whilst achieving sustainability and adaptation to, *e.g.,* climate change.

The scientific literature in the domain of resilient economy suggests that diversification of economic sectors is an important precondition for resilience. For example, locating enterprises in different areas can compensate for an incident occurring in one area. Even in global crises, not all areas are affected equally (for example, the timing of lockdowns during the pandemic did not fully coincide geographically and were not equally severe in all regions and countries in Europe). Furthermore, flexible flows of services and capital are needed to provide fast support to businesses experiencing hurdles in a crisis, as well as safety nets and

arrangements for labour. This will allow businesses to overcome the crisis until markets and production fully recover.

In June 2020, Regulation (EU)2020/85 was approved, establishing a list of environmentally sustainable activities. The activities are based on six objectives, among which climate change adaptation and the transition towards a circular economy are of particular relevance to this opinion. Adaptation requires measures that make economic activities better equipped to manage the consequences of climate change, considering not only their premises but also the territory in which they are located and therefore their dependence on resources and critical infrastructures that may be disrupted by extreme events. Sustainable use of resources, a criterion of the EU Taxonomy for Sustainable Activities, is closely integrated with resilience. It requires buffering and emergency capacity (water reservoirs, generators, etc.) during a crisis, and reducing dependency on global supply chains (e.g. repair materials) during the response period. During recovery, sustainability means recycling and sparing components of machinery and goods, and nurturing the human skills needed to make use of them (e.g. skills of recycling, repair and reuse of materials and equipment).

Occupational safety during crises may become a challenge especially for essential workers. The notion of essential workers should be intended as dynamic, given the changing nature of crises. For example, during the COVID-19 pandemic, whilst health care sector workers were considered in the front line of the crisis, less attention was paid to those in the essential retail sectors or teachers. As crises are likely to put particular strain on workers of those sectors, specific guidelines and provisions must be carefully thought in advance and revised based on lessons learnt.

2.3.6. Consider educational facilities as critical infrastructures and consider the continuity of educational programmes at all levels as a key component of societal resilience.

The scope of critical infrastructures should include services that are vital for the community, especially in the longer term, such as educational services. Their disruption is likely to have long-term impacts that last more than one generation, as studies have shown that the educational levels of children are strongly correlated with those of their parents (Baez et al. 2010; Frankenberg et al. 2013). The disruption to educational services that has been experienced by the current young generation is likely to be echoed in future ones.

2.4. Recommendation 4 - Make existing EU financial instruments and resources more scalable, rapidly deployable, and efficient

Existing EU finance mechanisms need to be made scalable, rapidly deployable and efficient to address the specific and diverse needs of EU Member States and regions, and to enable immediate support for crisis response. This requires considering possible actions as outlined below.

2.4.1. Include economic and financial dimensions alongside physical risks in the modelling of crisis scenarios to account for the multiple cascading effects and identify necessary resources that will be needed.

Risk assessments conducted as the basis of emergency plans or programmes for critical infrastructures often focus on physical damage or unserviceability. They rarely contemplate ripple effects on economies and society and potential longer-term financial impacts, such as inflation (Parker 2018) or the failure of certain economic activities or sectors to fully recover even years later. Assessments of the costs to be sustained by different sectors as a consequence of climate change and extreme events are developed separately to support banks and financial institutions. Instead, economic and financial consequences of crises should always be integrated in risk assessments in order to estimate not only the potential chain of cascading impacts of threats, but also the potential unintended negative consequences of crisis mitigation measures that are envisaged to combat the crisis.

2.4.2. Encourage the insurance sector to share its knowledge with governments.

The insurance sector at large, including insurance brokers, reinsurance, and service providers such as modellers, has become an active dispenser of vulnerability reduction solutions for those who are insured. Various initiatives have been developed by EU Institutions to assess the role the insurance industry plays and could further play in efforts to reduce risks from multiple hazards (European Commission 2013; Eiopa 2022). Increasingly, opening the "black box" of catastrophe risk modelling is considered a necessity as done for example by the Oasis initiative that brings together members from re-insurance companies providing an open source catastrophe modelling platform. According to a study by the Geneva Association (Golnaraghi 2018), among the 62 insurance companies that were surveyed, 38 % consider climate change their core business and 29 % consider it an issue that is rapidly shifting from purely a sustainability topic to their core business. Through data collected by companies in surveys before and after extreme events, advanced knowledge can be developed on risks and on damage trends, as eminent good practices show .

2.4.3. Make legal and financial provisions flexible enough to cover different combinations of threats, vulnerabilities and exposed assets rapidly; for example, the Solidarity and Emergency Aid Reserve could be better used by considering possible future cross-border and compound crisis scenarios.

A study conducted for the European Parliament analysed the use of the Solidarity and Emergency Aid Reserve, during the pandemic (Hochrainer-Stigler et al. 2022). One important recommendation relates to the capitalisation of the fund, which, despite a certain flexibility permitting the rollover of the unspent amount from one year to another, is still not sufficient in comparison with the needs evaluated based on recent disasters. In the meantime, public procurement in crisis conditions is a relatively new field of research that would benefit from further studies (Atkinson and Sapat 2012).

The need to act fast and to show that governments can rapidly address urgent needs must be balanced against the equally compelling requirement to act in a transparent and accountable way, minimising the risks of corruption and undue practices favouring certain providers and neglecting bid and competition practices. The case studies that have been scrutinised so far may support the design of innovative solutions and pre-procurement efforts that could complement stockpiling, especially for perishable goods or goods that require large facilities to stock (Storsjö and Kachali 2016).

2.4.4. Create rapidly accessible financial reserves to prevent systemic crises, which generate large-scale disruptions for economies.

Although the Solidarity and Emergency Aid Reserve is extremely important and valuable for alleviating the immediate needs linked to a crisis, it is not usable for longer-term recovery, for which other instruments have been designed recently, such as the Recovery and Resilience Facility of NextGenerationEU. The Facility constitutes a rather unique fund, in terms of both allocated capital and amplitude of scope; however, future crises will require rapidly deployable funds, adaptable to different combination of threats, vulnerabilities, response and recovery needs. When designing such financial provisions mechanisms, one must be careful about the conditions for obtaining funds (which could be conditional on interventions achieving substantial vulnerability reduction, at least to known threats) and also timeliness and coverage eligibility. As pointed out in a recent Report of the World Bank (2021), there is a need to allocate adequate reserves for such funding and the "governance disbursement and the procedures of these funds should be clearly defined". The conditions should not be bound to overly specific types of uses or threats but should instead be adaptable to the new needs emerging as a consequence of a crisis or bundle of crises. The type of aid to be provided to the private sector should be based on in-depth analyses of what has and has not worked in the past, for example during the pandemic and the recovery from it. In terms of predicting the required amount, although financial needs for natural hazards can be predicted relatively well based on analyses of trends of recent years, the same does not apply to large-scale crises because of the large variety of their initial triggers.

2.4.5. Develop greater financial capacity for response and recovery through public–private partnerships.

2.4.5.1. Address insurance gaps at national level, especially in those Member States most exposed to the consequences of natural hazards and climate change.

2.4.5.2. Develop, in partnership with the insurance industry, innovative insurance products to prevent the systemic breakdown of economic sectors.

2.4.5.3. Address with the insurance industry the challenges of covering assets that have been considered 'uninsurable' thus far, for example cultural heritage.

In the insurance industry, quite a few initiatives can be taken. First, the insurance gap should be reduced in EU Member States, especially those that are particularly prone to disasters and to the envisaged consequences of climate change. It will be increasingly difficult if not impossible for states to guarantee adequate compensation for losses in the absence of adequate reserves, both public and private. Second, in the last few years there have been many initiatives calling for innovation in the insurance sector itself so it can become better able to respond to new demands of insurance for risks and assets that have been traditionally considered uninsurable, e.g., cultural heritage, or threats such as pandemics. In a recent European Insurance and Occupational Pensions Authority (EIOPA) staff paper (2021), the authority explores and opens the floor to investigations of possible solutions to manage systemic risks to the economy and the financial sector, for instance, adopting a multi-peril approach.

2.4.5.4. Appeal to the environmental, social and corporate governance framework to pull together human resources, equipment and goods to complement public procurement capacity. Expand the use of rescEU to manage private and corporate donations efficiently.

The private sector at large can be a crucial provider of indispensable goods, professional skills and financial resources for the management of a crisis. Private donors are increasingly willing to help and volunteer in times of crisis in many different ways, providing human skills and material resources. The transport, construction and waste management sectors can also complement the efforts of public procurement. In this regard, specific arrangements and schemes must be designed that benefit from the experience gained during the current Ukraine crisis. The latest requests from Ukraine, coming from various government services, include agricultural supplies, pontoon bridges, heavy machineries for debris cleaning, equipment for protecting cultural heritage.

2.5. Recommendation 5 - Collaborate closely with society to manage crises effectively

In times of crisis, and especially in long-lasting crises, trust can deteriorate rapidly. Therefore, building and maintaining trust across society before and during crises is important. Many of the following recommended actions rest within the realm of the responsibility of Member States; nevertheless, in full recognition of the subsidiarity principle, the European Commission can provide guidance, promote piloting experiences and support the sharing of good practices.

2.5.1. Adopt approaches to crisis management that are tailored to cultural and social characteristics of communities, leveraging voluntarism, transparency, respect, inclusiveness and reciprocity.

Large crises such as the pandemic and the poly-crises triggered by the invasion of Ukraine have an impact on every citizen, albeit with different levels of severity. Because of the social and cultural diversity of Member States and regions, measures to combat negative impacts should consider the needs and specificities of local communities. Managing crisis with the hard measures that may be needed requires trust. Transparency, accountability and respect are the pillars on which trust is built whereas trust itself is bidirectional, from society to decision-makers and vice versa.

2.5.2. Communicate reasons and values behind decisions, possible dissenting viewpoints, and uncertainties clearly, concisely, and consistently.

Communication among different societal actors, including between scientists and the public, scientists and decision-makers, and decision-makers and the public, is a key element of building trust and maintaining it. Decisions made under the pressure of a crisis must be communicated carefully and adopt all the caveats that decades of research on risk communication have highlighted (Covello et al 1986; Balog-Way et al 2020). As risk issues always imply an assessment in which values and facts are tightly coupled, the values that are underlying decisions must be made explicit. Dissenting viewpoints, for example among scientists, should be transparently expressed, respected and presented, within the limits of a scientifically rigorous discussion, as a key element of knowledge formation, particularly when uncertainties are high. The reasoning behind the decision must be clearly, concisely explained, and the evolution and changes to the decision itself must be communicated, showing consistency both across time and in the light of new knowledge and emerging facts.

2.5.3. Engage with communities to identify and map vulnerabilities and ways of reducing them.

Pilots projects funded by the European Commission, and good practices developed by public administrations across Member States, have shown successful engagement with communities to co-map vulnerabilities. In this co-mapping, scientific knowledge on threats and vulnerabilities has been successfully merged with communities' knowledge based on their everyday experience of their territories. Such co-mapping is the foundation of a participatory approach to the planning, reducing risks ahead of crises and addressing pre-existing structural problems in the recovery. In mapping vulnerabilities attention must be given also to assets that may not be functionally key to manage a crisis, but fundamental for the recovery and the well being of a community as for example cultural heritage (see box 1).

2.5.4. Co-design tailored assistance for disadvantaged, marginalised and disabled people, bearing in mind that these groups may vary from crisis to crisis.

Developing co-mapping exercises with associations and groups representing disadvantaged, marginalised and disabled people is particularly important, as they are the only ones who can express what makes them vulnerable in specific situations. There are good practices tailored to different disabilities and approaches that avoid stereotypes. Not only people with restricted mobility must be considered. For example special signalling of emergency escape routes or gathering points must be foreseen for vision or hearing impaired. One should avoid a fixed perception and understanding of what makes some social groups particularly vulnerable, as such conditions are dynamic during the evolution of crises and vary from crisis to crisis, depending on the features of the threats, and the conditions at which cascading and cross-sectoral impacts occur. For example, during heatwaves not only the elderly and sick people are particularly at risk of dehydration, but also young workers of the construction industry whose activity is mainly outdoor.

2.5.5. Develop psychological support programmes for all those affected by a crisis, including traditional and non-traditional first responders, considering the use of extended self-support networks, digitalisation, and voluntarism.

While crisis management typically focuses on physical health of the victims, crises have considerable direct and indirect long-term impacts on psychosocial wellbeing (see box 2). A holistic crisis response should integrate adequate psychosocial support to all those affected by the crisis, including the professionals involved in crisis response. This support should ideally involve and empower those that are affected and respect the social and cultural realities on the ground. Digital tools may aid coordination between civil society, professionals, and volunteers and may offer innovative ways of reaching the affected faster and more inclusively.

2.5.6. Design and maintain environments and welfare services that make those most affected and displaced feel empowered and dignified.

The crisis triggered by the invasion of Ukraine required the Union Civil Protection Mechanism to provide massive sheltering solutions for refugees. Although living in a refugee camp is always a very stressful experience for people who already had to leave their houses, families and friends, efforts should be made to alleviate such stress and, more importantly, to guarantee good standards of hygiene, privacy and access to basic services. Food and clothes are rarely a problem; however, privacy and sanitation are often limited in shelters. Access to services for children and psychological support for sheltered people is often offered by volunteers, a practice that should be further encouraged .

2.5.7. Facilitate the initiatives of volunteers by swiftly complementing them with formal organisations

In many MS and at the EU level with the EU Aid Volunteering initiative, the role of volunteers in crises is officially listed and their activities are formally embedded in civil protection. This participation of citizens in crisis management is often essential and will be even more so in the future. Therefore, in the spirit of empowering both the communities affected and volunteers wishing to support them, a larger role could be envisaged also for emergent groups. The latter are informal organisations that emerge during the crisis and may turn into an important asset (Dynes et a. 1972). Research on these groups dates back to the 1960s, albeit going through significant changes and expansion to include actors from the economic sector, such as construction companies or large-scale distribution companies (Strandh and Eklund 2018). Recent research points to a more nuanced understanding of the 'landscape of volunteering' (McLennan et al. 2016), which considers the entire array of contributions, ranging from those that are embedded in certified associations to those that emerge as a form of civic solidarity in the aftermath of a disaster (EGE 2022). Another important emerging type of volunteerism is digital, for example online communities mapping both damages and needs. An 'all society' approach to crisis management should take advantage of online tools and social media to coordinate and share information between volunteers and public institutions.

BOX 1: The preservation of cultural heritage throughout crises

Cultural heritage connects the past to the future (Romao, 2020); it is a fundamental part of the identity of communities, made of material and immaterial elements that pertain to the local landscape and often to the geomorphology of places (Margottini and Spizzichino 2014). The United Nations Educational, Scientific and Cultural Organization (UNESCO) defines cultural heritage as 'the legacy of physical artefacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations' (UNESCO Website). It is therefore no surprise that such heritage is sometime contested and that it can be both the target of war destruction and a vehicle of peace (EEAS 2021). It may seem a luxury to invest effort and resources into the preservation of cultural heritage through crises. However, Vale and Campanella (2005) clearly highlighted that physical recovery and reconstruction alone do not suffice or may even be rejected by the population: symbolic and intangible aspects enshrined in cultural heritage are equally important for communities' healing from the trauma of crises. While Ukrainian cities are bombed, and hospitals and other critical facilities are destroyed, there have been requests from Ukraine to find ways and tools to save its cultural heritage.

Cultural heritage is not only a source of intangible benefits; it has increasingly become an important economic asset for visitors and researchers. The preservation of cultural heritage generates a highly skilled and advanced economy (Bigio 2014). UNESCO launched its strategy for risk reduction at World Heritage properties in 2007. That triggered a large-scale mapping effort in many countries; in 2012, mayors from

cities throughout Europe adopted the **"Venice Declaration on Building Resilience at the Local Level towards Protected Cultural Heritage and Climate Change Adaptation Strategies"**. The Directorate-General for European Civil Protection and Humanitarian Aid Operations has funded several projects on cultural heritage at risk, as well as the Horizon 2020 and Interreg programmes.

Research and lessons learnt provide some key points for the preservation of cultural heritage in times of crises.

- It is essential to have in place a transparent and well-established classification system of cultural heritage sites related to international criteria, such as that of UNESCO but considering also national and even regional classifications.
- Valagussa et al. (2021) and Caciotti et al. (2021) highlight the importance of developing *ad hoc* risk assessment and mapping for cultural heritage. An example of a web-based geographical information system collecting more than 500 sites from different Member States can be found on the Protection of European cultural heritage from geo-hazards website (http://www.prothego.eu/). Direct surveys on, and in-depth study of the history of the artefacts are necessary to complement larger-scale mapping efforts in order to establish safeguarding measures (Santangelo et al., 2022). The maps can be made dynamically, accounting for the evolution of the hazard and, linking the current systems with the Copernicus programme, as illustrated by Bonazza et al. (2022).
- 'safe havens' and shelters can be provided to safeguarding movable assets from incumbent threats. These are spaces with appropriate environmental conditions secured against theft and damage perpetrated voluntarily or involuntarily. Such safe havens and shelters could also be equipped with laboratories and areas in which skilled personnel can enact first interventions, preserving assets until full restoration is possible. For the safe evacuation to the safe havens and shelters, skilled personnel within the police, fire departments or other units are needed.
- Preservation is often thought of as involving only the physical assets. This still remains a key part; however, digital preservation is also important for at least two reasons. First, it provides a memory preserving the image in itself, and the proof of its existence. Second, during reconstruction, highly sophisticated scans can be a basis for restoration or even full reconstruction. An EU-funded project, for example, has volunteered to allocate free space on European servers to digital images of both movable and unmovable Ukrainian cultural heritage (for more information, see https://www.4ch-project.eu/sum/).

BOX 2. Mental health and crises

The impact of a crisis can lead to shock, anxiety, post-traumatic stress disorder, or depression. It can also be indirect by, e.g. disrupting social networks and routines, causing displacement, loss, and heightened financial insecurity (Norris et al. 2008; SAPEA, 2022 (pp. 114, 116); Marquez 2016).

Many contemporary crises are directly related to existing inequalities or are even products thereof. People in precarious situations are more often and more strongly affected by crises (e.g. losing more resources) and may have less access to, and less success in mobilising adequate support after an incident (Norris et al. 2008; SAPEA 2022 (chapter 6); OECD 2021). These factors correlate with mental health symptom severity, making precariousness a social and a medical risk factor [European Commission 2020 (chapter 3; p. 79); Boin et al. 2001; Norris et al. 2008; SAPEA 2022, (chapter 6); Marquez 2016).

- **An integrated, long-term psychosocial response** that tracks levels of wellness may also serve to identify those in need of professional support and guide resource allocation more equitably and effectively (Norris et al. 2008; Boin et al. 2001; Hugelius, K. et al. 2021). Those with pre-existing mental health issues may receive less or less appropriate care and may be at higher risk of adverse effects on mental health, as crisis management often focuses most strongly on physical support (SAPEA, 2022 (p. 112)).

- Various authors and guidelines recommend **avoiding separating established social circles and families**, which leads to considerable (additional) stress (Komlósi et al. 2015; Hugelius et al. 2021). Long-term displacement may severely disrupt social networks and support availability and impact mental health particularly strongly (Norris et al. 2008; Komlósi et al. 2015; WHO 2022; Marquez 2016).

- An important element to improve the mental well-being of affected communities is to **include the latter in planning, communication, and execution**. Grassroots action facilitates experiences of empowerment and self-sufficiency, but it requires a bottom up approach (Komlósi et al. 2015; Norris et al. 2008). Not involving the affected (e.g. in rebuilding plans) may lead to, or enhance experiences of isolation, depression, and post-traumatic stress, as well as feelings of distrust towards authorities, impeding recovery (Boin et al. 2001; Dückers 2017; Komlósi et al. 2015; SAPEA, 2022 (p. 117-118)).

- The design of psychosocial response should consider **inclusive community and individual approaches** and focus not only on clinical interventions but also on community development, resilience training, stress management, coaching, and mediation, with the aim of creating environments where people can recover (Hugelius et al. 2021; Komlósi et al. 2015; Marquez 2016). Some interventions can also be delivered by non-specialist workers (e.g. volunteers) (Chowdhary 2016; Marquez 2016).

- Lastly, a holistic crisis response requires to **provide adequate training and psychosocial support to all professionals involved** (e.g. firefighters, law enforcement, emergency and intensive health care personnel, psychologists). They are directly affected by crises and at high risk of developing mental health and behavioural issues (e.g. stress disorders, depression, anxiety, substance use disorders) (Katzmann et al. 2021; Hugelius et al. 2021; Greenberg et al. 2021). Adverse effects can last for years, also impacting their abilities to help others. Regular and holistic training (e.g. stress-management and self-care strategies) and support

mechanisms for exposed workers make crisis response and health care systems more resilient (Katzmann et al. 2021; Hugelius et al. 2021).

2.6. Recommendation 6 - Provide interoperable, high-quality data, and easy to communicate information for crisis management

Rather than suffering from lack of data, crisis managers are now faced with the challenge of actionable information (Derczynski et al. 2018) that require innovation in the way IT systems enable managing "flows of information to support the decision-making process in a networked manner" (Meesters 2021)

New and integrated data information systems are currently under development by the European Commission. They should (i) be built on what data are needed, and (ii) what has worked in the past and in recent crises to provide critical information across societal sectors and across EU institutions in a timely manner. Possible actions to improve data and information systems include the following.

2.6.1. Develop interoperable monitoring, detection, information and alert systems to allow the use and reuse of data and information for multiple purposes, including risk assessments, early warning, early action, enhanced situational awareness, response, and recovery.

There are various initiatives to develop new or improve existing tools and platforms ongoing within the EU Commission. An important caveat for all this effort is understanding that crisis management adds complexity to otherwise widely used data and information sharing and management systems, whilst data and information management create further stress and burdens on crisis managers (Meesters 2021). Data awareness and preparedness (SAPEA 2022) is key. However, there must be also the capacity to adapt existing tools to new needs and/or new actors. Data management entails at least three levels that must work in conjunction: operational/technical, organizational, and legal. Interoperability is not only a technical issue but also an organizational one. Reuse of data for multiple purposes is important as it avoids duplication of efforts and permits to take full advantage of tools that already exist or between which synergies can be envisaged. Ongoing initiatives such as Destination Earth and the Risk Data Hub should be integrated and open to multiple usages across the crisis phases, independently from their original mandate. Those systems may be used, for example, to measure the targets of the Sendai framework, which is a commitment made by the EU in partnership with the UN. They can also be used to design ad hoc scenarios for both crisis preparedness and emergency planning.

2.6.1.1. Make use of available techniques to manage data from different sources for the early identification of anomalies and to monitor the evolution of crises.

Europe has made a huge investment in Earth-monitoring capabilities, ranging from the Copernicus to the Galileo programmes, which complement a vast array of local

instruments that monitor different phenomena on an everyday basis: volcanic activity, landslides, pollution, etc. In order to make full use of these data of immense value, there is a need to develop new user-oriented services, for example, to provide updates regarding the evolution of environmental variables, land uses, the built environment and infrastructures. To develop such services, databases of different types that have been developed for a variety of purposes are needed. Interoperability between those datasets is crucial to develop new user-oriented services.[20] The Copernicus programme has the advantage of providing updates on a dynamic situation regarding not only hazards but also exposure and vulnerability. It sometimes contradicts official assessments provided, for example, for flood directive reporting or local and regional risk management plans as those may be based on outdated information. Guidelines and good practices could be provided by the European Commission to solve apparent contradictions between 'officially' recognised information and conditions observed through the Copernicus programme services.6.1.2. Create shared situation awareness by exchanging near real-time information between existing crisis communication and information systems, Develop tools for reporting updates about the crisis to all concerned organisations.

Different initiatives are ongoing to improve the information-sharing platform within the Commission (new ARGUS) and to facilitate the work of crisis managers in getting fast alerts and overviews of evolving crises (the Common Emergency Communication and Information System and the Global Situation System). Synergies between such initiatives and the IPCR portal should be sought to foster shared governance.

Among the tools for sharing information on ongoing crises among the IPCR participants, the integrated situational awareness and analysis system (ISAA) proved to be particularly relevant. The tool, currently in PDF form, would benefit from being transformed into a fully digital document, developed according to modern standards of information technology, easy to update and from which it is easy to extract specific information whenever needed.

2.6.1.2. Further develop platforms and services providing information for multi-hazard and multi-risk assessments.

Monitoring and hazard assessment capabilities have thus far been developed through separate projects and programmes for different threats. The abovementioned Copernicus and Galileo programmes are the cornerstone of such efforts. The Copernicus programme services have been a real game changer for emergency and crisis management. More can be done, from early warning to response and recovery. It requires further integrating information on urban exposure and on other vulnerability indicators.

Using and reusing data collected at different phases of a crisis can be useful to improve pre-event risk assessment and produce scenarios t for future crises, as is

[20] Hristidis et al 2010

being done in the Risk Data Hub. An important requirement is that those tools become increasingly multi-hazard and multi-risk to support the development of forecasting and assessment of cascading impacts better. The design of those ambitious tools and capabilities requires strong involvement of crisis and risk managers of involved sectors to fully embed their knowledge (Mao et al 2019).

2.6.1.3. Develop systematic and harmonised tools for post-event collection of damage and loss data.

The European Commission has invested significant research and practice efforts in this domain, both to develop historic damage and loss databases (currently within the Risk Data Hub) and to enhance data gathering after each event. International standards, such as the post-disaster needs assessment (PDNA), that have been co-developed by the World Bank, European Commission, and the UN could serve as a basis for more harmonised and comparable data collection to, among other things, measure the indicators for the Sendai targets.

2.6.1.4. Involve more national statistical offices and European agencies (Eurostat, the European Foundation for the Improvement of Living and Working Conditions, etc.) for evidence-based crisis management and monitoring of relevant indicators.

National statistical offices have already proven their capacity to quickly track important indicators during and after a crisis, for example mortality rates or impact on the economy. This capacity should be better integrated in overall threat and impact detection, monitoring, and recovery plans. In fact, such data, with both their granularity and large-scale coverage, are extremely useful to gain insights into the evolution of protracted crises and to identify and prioritise needs for recovery.

2.6.1.5. Accumulate experience on how to best use social media and collaborate with citizens/virtual volunteers to gather and analyse data.

Social media have proved to be an important source of information during crises. The potential of such information is multifaceted. Social media data reveal feelings and attitudes about the consequences of a crisis and its management and can provide crucial insights into local situations that may go unnoticed by official organisations. They constitute both a valuable resource and a challenge in terms of reliability and credibility. Many successful efforts have leveraged crowdsourced information and used it in a coordinated fashion thanks to digital volunteers. A systematic review of 15 years of studies on the matter highlights both the positive aspects of crowdsourced media and their limitations and constraints (Reuter and Kaufhold 2018). More research and practical applications are needed to fully unleash the potential of crowdsourced social media data and better discern the purposes they serve. They certainly constitute a valuable instrument for actively involving citizens in crisis management.

2.6.1.6. Take care of legal provisions on privacy protection for managing data for crisis management.

Al Ackar and Raymond (2016) highlight the importance of taking care of rules and legislation on data privacy protection while handling sometime very sensitive information. The need to protect individuals from inappropriate use of such data must be balanced against the need to collect and manage it for rescue purposes. The issue is not trivial. For instance, apparently strict interpretations of data privacy laws by local governments hindered rescue activities during Great East Japan 2011 earthquake (EERI 2011).

2.6.2. Provide explainable information together with estimates of its uncertainty, for rapid decision-making in acute crises and to reduce the cognitive loads of decision-makers.

In the acute phase of a crisis, information is the essence. Yet timeliness, reliability and precision must be weighed against each other, especially in the face of large uncertainties that characterise in particular the first phases of a crisis. Providing explainable information in an easy-to-grasp manner, including data visualization, is first and foremost needed for understanding real-time data. It concerns all data from the data platforms described earlier. Explainable information is essential not only for decision makers but also for the public at large. During the COVID 19 pandemic, the cognitive load was extreme across society as a whole, especially because uncertainty was often used to generate controversies.

ANNEX 1 – METHODOLOGY

The Group of Chief Scientific Advisors (GCSA) has been asked to provide a scientific opinion on strategic crisis management in Europe. The background to the request and the specific question to be answered are laid down in the 'Scoping Paper' (Annex 2). The recommendations presented here by the GCSA build upon the Evidence Review Report (ERR, SAPEA 2022) developed by SAPEA, additional literature, and expert and stakeholder consultations (see Annex 4).

The scoping of the question included a (grey) literature search and was aided by consultations with scientific experts and expert practitioners, a limited web search and a scoping workshop. On this basis a Scoping Paper (Annex 2) was prepared, in consultation with DG ECHO and various agencies and Directorates General that hold responsibility on different aspects of crisis management at the EU level.

The scientific advisors agreed to take up the work as detailed in the Scoping Paper (June 2021). On behalf of the GCSA, Nicole Grobert and Maarja Kruusmaa co-led the scientific opinion, Nebojsa Nakicenovic, Eric Lambin and Pearl Dykstra (from the CGSA alumni group) contributed to its development.

SAPEA formed an expert Working Group lead by Prof. Tina Comez, that gathered and synthesised the scientific evidence, including expert knowledge, in the form of a peer-reviewed Evidence Review Report (ERR). SAPEA organised an expert workshop with independent scientific experts who discussed the first draft of the ERR.

What can be considered as evidence in the field of crisis management is discussed first in ERR. Then evidence-based practice is considered in the context of crisis management.In the last decade, a number of initiatives have attempted to provide an overview of the state of the art in disaster and crisis management. New encyclopaedias have been drafted (Natural Hazards, see Bobrowsky 2013; Crisis Management see Penuel et al 2013) in the last decade. The JRC led two Science for Disaster Risk Managment Reports (DRMKC, 2017 and 2020), bringing together hundreds of researchers to provide an overview of what can be considered as referential knowledge in the field of disaster risk reduction.

In a recent literature review, Wolbey et al (2021) have looked into the last twenty years of research. Interesting findings on the crisis management literature in particular suggest a shift from research mainly based on documents towards primary data production, obtained through surveys and interviews. They also identified a progressive shift from single case studies analysis towards more comparative ones, providing the ground for more explanatory type of results. They found that a number of most quoted papers in the field of crisis management are dealing with conceptual issues, such as definitions, models and tools for analysis and assessment. Quoting the seminal work of Quarantelli (94-98), they also highlight the need to readjust and

revise more conceptual and methodological frameworks to deal with the changing landscape of crises, a pledge that can be found also in the ERR (SAPEA, p.37). Crisis management is a field that is not only evolving to include new knowledge but is also readjusting and readapting its focus and methods to respond to the new challenges brought by more complex crises.

The evidence gathered for this opinion results therefore from the SAPEA ERR supplemented with further academic and 'grey' literature reviews (including therefore reports developed by different EU Institutions and international organisations such as the World Bank and the UN), expert elicitation, covering academic experts, policy-experts and expert practitioners (see Annex 4).

The SAM Secretariat helped the Scientific Advisors in organising a discussion with policy-experts of the European Commission on the scientific evidence and policy relevance and an expert 'sounding board meeting' on the draft scientific opinion.

The SAM Secretariat aided the Scientific Advisors in organising a stakeholder meeting, where the SAPEA Evidence Review Report and the draft of the scientific opinion were presented by the SAPEA Working Group members and the Scientific Advisors, respectively.

Finally, the SAM Secretariat aided the Scientific Advisors in organising a meeting with policy officers from different DGs and Agencies to discuss the draft of the scientific opinion in order to address ongoing relevant development in different policy areas pertinent to crisis management.

This scientific opinion was thus informed by various sources of evidence, notably:

1. Scoping Paper 'A systemic approach to the energy transition in Europe' (SAM 2020)

2. Scoping workshop 'Strategic Crisis Management in Europe' (SAM 2021)

3. Review of the scientific literature by SAPEA – (SAPEA, 2022) on the following topics: Psychological and mental health aspects of crises; Data and Information Management to support crisis management; Cultural Heritage threatened by disasters.

4. SAPEA Expert workshop – March 2022;

5. Expert workshop on Cascading impacts on critical infrastructures (organised by the GCSA with the support of SAM)- April 2022;

6. Expert workshop on Economic aspects of crises and instruments for a resilient economy (organised by the GCSA with the support of SAM)- June 2022;

7. Sounding Board Meeting – July 2022;

8. Stakeholders Meeting – 2022;

9. Policy officers Meeting - 2022

Meeting reports or summarising notes are published online.

ANNEX 2 – SCOPING PAPER

Scientific Advice Mechanism

Scoping paper

Strategic crisis management in the EU
Improving EU crisis prevention, preparedness, response and resilience

22 June 2021

1. The issue at stake

The COVID-19 pandemic has been a major global shock and has exposed a lack of preparedness. It has been a health crisis which has led to a larger social and economic crisis.

Many advisory and task force groups were established or called upon to mobilise the best available knowledge and evidence to inform the policy response to the COVID-19 crisis[21]. The health crisis response has included biomedical research and vaccine development done at unprecedented speed and efficacy, and a major overhaul of the EU framework to deal with future health crises - including improved preparedness for, and management of, future pandemics[22]. The response to the broader socioeconomic crisis includes massive funds for the recovery in the short and mid-term (see Annex).

While only beginning to recover from the aftermath of the pandemic, the EU and the European societies must be prepared for a range of other future natural or human-made shocks which include and go beyond major health threats. They may be related e.g. to climate, environmental, energy, digital, socioeconomic, or security dimensions. They are likely to be interrelated and to co-occur, to have cascading negative impacts on other domains, and to be a part of global threats.

Improving EU crisis management has thus become an essential issue for protecting and enhancing the present and future wellbeing of EU citizens. We define 'crisis' as an intense shock or imminent threat that have severe and wide-ranging impacts and require urgent response[23]. Strategic crisis management, however, must extend its scope beyond emergency response. It must include crisis prevention, preparedness, and resilience in the face of crises (which includes the ability to absorb the shocks and recover from them by bouncing forward).

[21] Bodies set up specifically for COVID-19 included notably: the Advisory Panel on COVID-19; Peter Piot as the Special Advisor to President Von der Leyen on the response to the coronavirus and COVID-19; JRC Coronavirus Task Force, a task force on COVID-19 research and innovation led by DG Research and Innovation. Other existing structures also contributed knowledge and advice to the process, notably: the European Centre for Diseases Prevention and Control (ECDC); the European Medicines Agency (EMA): the Group of Chief Scientific Advisors; the European Group on Ethics in Science and New Technologies (EGE); the EC Expert Group "Economic and Societal Impact of Research and Innovation" (ESIR)

[22] The joint opinion 'Improving pandemics preparedness and management' by the EC's Group of Chief Scientific Advisors, the European Group on Ethics in Science and New Technologies (EGE), and Peter Piot, Special Advisor to President Von der Leyen on COVID-19, was among the sources which informed that overhaul.

[23] The definition is consistent with the EU political and legislative definition (see the Annex), and those identified through the initial review of scientific literature; see esp. Tagarev, T and V. Ratchev (2020) "A Taxonomy of Crisis Management Functions". *Sustainability* 12: 5147. https://doi.org/10.3390/su12125147

The EU has reacted to past or ongoing crises (e.g. in disaster relief, climate change, food safety, energy security) mainly through boosting sectoral mechanisms and policies. The 2019-2024 European Commission has set itself, yet before the Covid-19 pandemic, the ambition for '[the] approach to crisis management [to] become more consistent and better integrated'[24]. There is now the Commissioner for Crisis Management, responsible for the policy fields of civil protection and humanitarian aid. Responsibilities include 'promoting and developing an integrated approach to crises so that policies address urgent relief and longer-term solutions'[25]. The Commission has also increased its ambition to embed strategic foresight into its policymaking in order to anticipate diverse crises and influence future scenarios (see Annex).

Supporting that policy ambition with evidence-based advice implies an urgent need to investigate – based on the best available cross-disciplinary expertise – improvements to the overarching EU crisis management framework. Such a framework must be able effectively to anticipate various major threats, risks and crises, help to prevent them by addressing their root causes which make the EU and citizens vulnerable to emergencies, respond to them effectively when they do occur, as well as to absorb and recover from major shocks, based on robust, future-proof policies. The framework must be able to integrate Commission-internal and external crisis management actions effectively.

In addition, the conceptual frameworks which have been used to inform EU policies related to crisis management require critical re-examination. One of the chief concerns is that various sectoral policy strategies in the EU use different concepts and terms (e.g. crisis, resilience, adaptability, disaster risk management/reduction, emergency response) for similar issues – which may lead to fragmentation or limitation of knowledge, evidence and expertise that inform the overall EU crisis strategy, as well as to fragmented crisis management mechanisms and operations[26]. Each conceptual framework and its terminology capture different aspects and consider others problematic, and the way they frame a policy problem already suggests particular solutions.

2. The request to the Group of Chief Scientific Advisors

The present scoping paper formulates a request for independent scientific advice by the EU Commissioner for Innovation, Research, Culture, Education and Youth, acting on behalf of the College of EU Commissioners, to the Group of Chief Scientific

[24] https://ec.europa.eu/commission/commissioners/sites/default/files/commissioner_mission_letters/mission-letter-janez-lenarcic_en.pdf
[25] https://ec.europa.eu/commission/commissioners/2019-2024/lenarcic_en
[26] See e.g. Mercer, J. (2010) 'Disaster risk reduction or climate change adaptation: are we reinventing the wheel?' *Journal of International Development: The Journal of the Development Studies Association*, 22(2), 247-264.

Advisors (GCSA), who will collaborate with the European Group on Ethics and New Technologies (EGE).

The request is made in response to GCSA own initiative, i.e. to prior advice to the Commission by the GCSA Chair, recommending that the Group is consulted on the policy issue defined below[27].

The Group of Chief Scientific Advisors, in collaboration with the EGE, is asked to produce a scientific opinion addressing the following main question:

Based on a broad and multidisciplinary understanding, how can the EU improve its strategic crisis management?

The scientific opinion should be delivered by the end of Q2 2022.

The opinion should present recommendations for a coherent, comprehensive, cross-sectoral EU strategic policy and operational framework for crisis management (defined broadly to encompass crisis preparedness and response as well as prevention and resilience).

It should respect the EU competence and remit, and the principle of subsidiarity.

The recommendations should be demonstrably applicable to a broad range of threats and crises, including e.g. those concerning health, climate, the environment, socioeconomics, or security – supported by case studies. They must be consistent with the EU fundamental values and freedoms, and social rights.

The opinion should rely on the work of the Science Advice to Policy by European Academies (SAPEA) consortium, which should be tasked with developing a comprehensive and cross-disciplinary evidence review for that purpose (including natural sciences, social sciences, and the humanities). The existing EU sources knowledge and evidence (as outlined in the Annex) should be used as part of the evidence base, but not duplicated.

The opinion should be guided by the following set of questions, which should also guide the evidence review work.

[27] In accordance with Article 2A of the Commission Decision C(2015)6946 of 16.10.2015 on the setting up of the High Level Group of Scientific Advisors as amended by Commission Decision C(2018)1919 of 5 April 2018

Overarching questions

EU added value and subsidiarity

What new EU-level policy would have the most added value:

- for which types and sources of threats (e.g. climate-, health-, security-, -related;),
- for which stages of crises (e.g. prevention, preparedness, response, recovery),
- for which time scales (e.g. short-, mid-, long-term)?

What are the differences and commonalities between crisis management mechanisms in Member States, and at lower levels of government, including science advice to policymaking in crises? How do they affect crisis management at the EU level?

How to improve intelligence on the differences in preparedness at national and sub-national levels which affects the EU level?

What is the role and impact of regional research and innovation on crisis management at the EU level?

What could the EU do more – while respecting subsidiarity – to support crisis management at these levels for major cross-border and/or trans-boundary threats, including the support for cross-sectoral resilience?

Clear definitions for a comprehensive approach

Crises, disasters, emergencies, risks; resilience, adaptation, absorption, recovery: what do these concepts share? Can they be integrated in a comprehensive EU framework that draws on the totality of relevant scientific knowledge?

Integrated EU crisis management framework

What improvements can be made to the overarching EU-level crisis governance and operations that can apply to any type of crisis or threat, including unknown risks?

Which types of known threats merit a classic risk-based approach at the EU level? How best to integrate them in the above multi-hazard crisis management system?

What types of intelligence can support EU crisis management better? In particular, how to improve further:

- the use of strategic foresight in crisis prevention and preparedness;
- the potential of reference scenarios and emergency exercises;
- harmonised data standards for sharing at the EU level;
- science advice to EU policymaking in crises?

How better to integrate crisis preparedness and response, and long-term crisis prevention and resilience, into a single coherent crisis management framework?

Equality, trustworthiness and participation

How can EU policies in crisis management mitigate impacts that increase inequalities among regions and social groups?

How do social inequalities within the EU impact crisis management at the EU level?

What can be achieved at the EU level to promote the trustworthiness of crisis management mechanisms, and citizen participation?

Case studies
How would the EU management of specific threats and crises under study be improved in the light of the overarching improvements recommended for to the multi-hazard crisis management framework?
Selection methodology
The criteria that are initially adopted for the selection of case studies are:

- Estimated likelihood, scale, impact and complexity
- Estimated state of preparedness
- The degree of cumulative and cascading effects
- The likelihood of co-occurrence with other crises
- The degree to which EU strategy and policy can make a difference
- Non-duplication of existing advice to EU policy

Based on the preliminary analysis of the above criteria, the following case studies are selected:

1) Climate change, environmental degradation including biodiversity loss, and their cascading impacts.
2) Security, including large-scale cybersecurity threats, strategic autonomy and hybrid threats.
3) Serious cross-border health threats (beyond pandemics).

Both the selection criteria and the list of cases studies can be revised in the light of the evidence review.

ANNEX TO THE SCOPING PAPER: THE POLICY CONTEXT AND RELEVANT SOURCES OF EU KNOWLEDGE AND EVIDENCE

A. The policy context

The EU solidarity clause (Article 222 of the Treaty on the Functioning of the European Union, TFEU)[28] stipulates that the Union and its Member States 'shall act jointly in a spirit of solidarity if a Member State is the object of a terrorist attack or the victim of a natural or man-made disaster'. The central EU mechanism for implementing the solidarity clause is the **Integrated Political Crisis Response (IPCR)**, established in 2018 and managed by the Council of the EU**.** It has the task of 'co-ordinat[ing] the political response of Member States for 'major and complex crises, including acts of terrorism'.*[29]* The Decision setting up the IPCR defines a crisis as 'a situation of such a wide-ranging impact or political significance, that it requires timely policy coordination and response at Union political level'.

Under Article 196 of TFEU[30], the EU has supporting and complementary competences in **civil protection**, which covers prevention of and response to 'natural and man-

[28] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A12016E222
[29] https://eur-lex.europa.eu/legal-content/en/TXT/PDF/?uri=CELEX:32018D1993&from=EN
[30] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A12016E196

made disasters within the Union'. In the field of **humanitarian aid**, Article 214 of TFEU commits the EU to '*ad hoc* assistance and relief and protection for people in third countries who are victims of natural or man-made disasters'.

At policy implementation level, the objective of the **Union Civil Protection Mechanism**[31] (UPCM) is to strengthen cooperation between the EU Member States (and 6 other participating countries) in the prevention, preparedness and response to disasters. Assistance is mobilised via the Emergency Response Coordination Centre (ERCC). Countries may commit national resources for emergency response to the European Civil Protection Pool (ECPP). RescEU is a reserve of resources, such as a firefighting and medical evacuation aircraft, stockpiles of medical equipment and field hospitals. In June 2020, as a direct response to the pandemic, the European Commission (EC) has proposed a targeted revision of the UCPM legislative framework, on which a political agreement was reached in February 2021. It aims to offer more comprehensive cross-sectoral emergency management support to Member States and their citizens through a significantly increased budget, better preparedness and more flexible and faster response options.

In November 2020, based on lessons learned from the COVID-19 crisis, and informed by scientific advice[32] the European Commission (EC) has put forward a proposal for a major legislative package called the EU Health Union with a view to overhauling the entire **EU health crisis preparedness and response architecture**. The framework covers **health threats of biological origin (including communicable diseases)** as well as of **chemical, environmental, climate-related and unknown origin**. The core elements of the package, next to revamping the overall EU framework, include extending the mandate of the European Centre for Disease Control and Prevention (ECDC)[33] and of the European Medicines Agency (EMA).[34] It also sets out the main elements of the future EU health emergency preparedness and response authority (HERA) to be proposed by the end of 2021. The European Council conclusions of 11 December 2020 highlight 'the need to pursue work to increase resilience in the area of health, including by taking forward the proposals for a Health Union and making full use of the potential of health data in Europe'.[35] In February 2021, the European Council asked the European Commission to produce a report on lessons learned from the COVID-19 pandemic by June 2021, coordinated by the Secretariat-General. The report intends to be comprehensive rather than sectorial and, will be carried over and continued in the second half of 2021.

[31] https://ec.europa.eu/echo/what/civil-protection/mechanism_en
[32] See esp. the joint opinion 'Improving pandemics preparedness and management'
[33] https://ec.europa.eu/info/sites/info/files/proposal-mandate-european-centre-disease-prevention-control_en.pdf
[34] https://ec.europa.eu/info/sites/info/files/proposal-mandate-european-medicines-agency_en.pdf
[35] https://www.consilium.europa.eu/media/47296/1011-12-20-euco-conclusions-en.pdf

The EU has launched a massive financial response to the COVID-19 crisis and recovery. In addition to the EU budget for 2021-2027, EU leaders have agreed on Next Generation EU, which is a €750 billion temporary recovery instrument. The main part of Next Generation EU is the **Recovery and Resilience Facility**,[36] which offers loans and grants to support longer-term public investments and reforms as well as the green and digital transition. In addition, REACT EU[37] funds shorter-term crisis repair measures. Furthermore, the European Commission has adopted a broad range of specific measures[38], including the vaccine strategy and the vaccination strategy, mobilising further funds for research on biomedical countermeasures, and socioeconomic measures such as temporary support to mitigate unemployment risks as a result of the pandemic (the SURE initiative), as well as special temporary rules on state aid.

In addition, in **public health,** the Communication "On Effective, Accessible and Resilient Health Systems" (2014)[39] is an earlier policy response to what are recognised as growing common challenges facing the European health systems over the preceding decade. While health care systems reform is primarily the national prerogative, the Communication outlines a number of supporting EU initiatives. The Communication identifies a set of factors, which 'helped some health systems safeguard accessible and effective healthcare services for their population'.

The Regulation on **transmissible animal diseases** (2016)[40] lays down rules for, among others, early detection and notification, disease prevention and control, preparedness and the ability to launch a rapid response. In addition, a EU Veterinary Emergency Team (EUVET) is established (2007)[41] to 'assist the Commission in technical veterinary matters relating to the animal disease control measures to be taken in the event of outbreaks of the diseases or suspicion thereof'.

In case of **food and feed safety** crises or incidents, the 'General Food Law' (2002)[42] sets out the legal framework for emergency measures and crisis management to contain risks to human health, animal health and the environment. A 'general plan for crisis management in the field of the safety of food and feed' (2019)[43] is established specifying the practical procedures necessary to manage crises and incidents, including a communication strategy in accordance with the principle of transparency.

[36] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1598607812570&uri=CELEX:52020PC0408
[37] https://ec.europa.eu/info/sites/info/files/com_2020_451_act_v8.pdf
[38] https://ec.europa.eu/info/live-work-travel-eu/coronavirus-response/overview-commissions-response_en
[39] https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX:52014DC0215
[40] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32016R0429
[41] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32007D0142
[42] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32002R0178
[43] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=pi_com:C(2019)1064

In the field of **security,** the Counter-Terrorism Agenda was adopted in December 2020. In 2021, the European Commission will deploy a pool of protective security advisors to advise on the vulnerabilities of public spaces (the EU Protective Security Advisory missions). The Commission will also study the concept of preparing an EU handbook for securing cities from antagonistic drones.

In **cybersecurity**, a key document for incident response is the Commission Recommendation of 13 September 2017 on Coordinated Response to Large Scale Cybersecurity Incidents and Crises ('Blueprint')[44]. Blueprint is based on the rules proportionality, subsidiarity, complementarity and confidentiality of exchanged information (especially crucial for cybersecurity). Although it recognizes all phases of crisis management lifecycle (prevention/mitigation, preparedness, response and recovery), it focuses on response as the most urgent part of this lifecycle. Blueprint describes three levels of incident response – technical (with prevalent role of CSIRT Network), operational (with recently established CyCLONe) and strategic/political (IPCR level). The framework assumes that all three levels must work together for an efficient response.

One of the future elements will Joint Cyber Unit (JCU) that will aim better to protect the EU from the most serious cybersecurity attacks, especially cross-border ones. This includes facilitating instant decision-making during cybersecurity crises decisions, based on thorough analysis of available data.

Blueprint and JCU are based on the concept of sharing information among relevant EU and national stakeholders to boost the EU response to cybersecurity risks and threats.

Cybersecurity certification (covered the EU Cybersecurity Act)[45] has a role in improving the resilience of critical infrastructure. That topic that is currently investigated by the JRC[46]. An earlier scientific opinion of the EC's Group of Chief Scientific Advisers has informed the Cybersecurity Act[47].

Internally to the European Commission, the ARGUS general rapid alert system has been in existence since 2005.[48] Its general aims include (1) 'providing an internal platform enabling the Directorates-general and services of the Commission to exchange, in real time, relevant information on emerging multi-sectoral crises or foreseeable or imminent threat thereof requiring action at Community level, whatever their nature, to facilitate coordination and cooperation and ultimately improve the efficiency and the consistency of the Commission response'; (2) 'making available an appropriate coordination process to be activated in the event of a major crisis, and

[44] https://eur-lex.europa.eu/eli/reco/2017/1584/oj
[45] https://eur-lex.europa.eu/eli/reg/2019/881/oj
[46] https://publications.jrc.ec.europa.eu/repository/handle/JRC120910
[47] https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/scientific-support-eu-policies/group-chief-scientific-advisors/cybersecurity_en
[48] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52005DC0662:EN:HTML

(3) providing the context to communicate effectively with citizens and to offer a balanced, coherent and complete picture of the efforts deployed by the Commission.

Resilience as a guiding concept in EU strategy

As shown in the summary below, the concept of 'resilience' features very prominently, for about 10 years now, in the EU strategies across different policies to guide crisis management.

'Resilience' as a guiding EU policy concept has first emerged in **development policy and humanitarian action.** The 2012 Communication 'The EU Approach to Resilience: **Learning from Food Security Crises'**[49] is the first major policy paper centred on resilience, defined as 'the ability of an individual, a household, a community, a country or a region to withstand, adapt and quickly recover from stresses and shocks'. **Council Conclusions on the EU approach to resilience (2013)[50]** lay out in further detail the EU's approach to resilience (in external action) as one which **'**recognises the need to address the root causes of crises, especially recurrent crises, chronic poverty and vulnerability and to take a long-term perspective which is firmly embedded in local and national policies and linked to complementary action at regional level'. The Action Plan for Resilience in Crisis Prone Countries 2013-2020[51] is an operational follow-up to the 2013 Council conclusions. Resilience and adaptability to change are among key concepts in **the European Consensus on Development (2017)**,[52] which sets out the EU development strategy as a response to the UN 2030 Agenda for Sustainable Development, complemented by the Sendai Framework on Disaster Risk Reduction, and the Paris Agreement on Climate Change.

The Global Strategy for the European Union's Foreign and Security Policy (2016)[53] has taken the concept of resilience further, calling it a 'broad concept encompassing all individuals and the whole of society' which covers 'democracy, trust in institutions and sustainable development, and the capacity to reform'. It has extended the resilience-guided approach to all external action (including security), but also to fostering the EU's own prosperity and democratic values. The Joint Communication 'A Strategic Approach to Resilience in the EU's external action' (2017) [54] is a follow-up to the Strategy.

[49] https://ec.europa.eu/echo/files/policies/resilience/com_2012_586_resilience_en.pdf
[50] https://www.consilium.europa.eu/uedocs/cms_Data/docs/pressdata/EN/foraff/137319.pdf
[51] https://ec.europa.eu/echo/files/policies/resilience/com_2013_227_ap_crisis_prone_countries_en.pdf
[52] https://ec.europa.eu/international-partnerships/system/files/european-consensus-on-development-final-20170626_en.pdf
[53] https://eeas.europa.eu/topics/eu-global-strategy/17304/global-strategy-european-unions-foreign-and-security-policy_en
[54] https://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex:52017JC0021

Since 2012, The EU has been implementing an integrated approach to **critical infrastructure resilience and protection**. In December 2020, the Commission adopted two legislative proposals to enhance physical and cyber resilience of critical entities and networks (i.e. the Directive on the resilience of critical entities and the Directive on measures for high common level of cybersecurity across the Union). In **security research**, Horizon Europe Strategic Plan for 2021-2024 related to crisis management includes the 'Disaster Resilient Societies' (DRS) area. The research will build on a large body of knowledge and technology developed under the Seventh Framework Programme and Horizon 2020.

In **food sustainability**, the Communication 'A Farm to Fork Strategy for a Fair, Healthy and Environmentally-friendly Food System' (2020)[55] is the current EU transition strategy,[56] described as being at the heart of the European Green Deal and as central to achieving the UN Sustainable Development Goals (SDGs). It underlines 'the importance of a robust and resilient food system that functions in all circumstances and is capable of ensuring access to a sufficient supply of affordable food for citizens'. The strategy includes a plan to propose a legislative framework for a sustainable food system (before the end of 2023), with the aim of 'promot[ing] policy coherence at EU and national level, mainstream[ing] sustainability in all food-related policies and strengthen[ing] the resilience of food systems'.

Ensuring **food security** (defined as 'sufficient and varied supply of safe, nutritious, affordable and sustainable food to people at all times, not least in times of crises') is among the pillars of the Strategy. Mitigating the socioeconomic consequences of crises impacting the food chain is emphasised, including ensuring that the European Pillar of Social Rights is respected, especially when it comes to precarious, seasonal and undeclared workers. The Strategy announces the plan to 'assess the resilience of the food system and develop a contingency plan for ensuring food supply and food security to be put in place in times of crisis' (for Q4 2021). Related policy plans include revamping agricultural crisis reserve, as well as setting up a food crisis response mechanism coordinated by the European Commission and involving Member States.

In **climate-change adaptation,** the Commission strategy sets out its new strategy in the communication 'Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change' of 2021.[57] [58] The European Union should adapt to the unavoidable impacts of climate change and become climate resilient by 2050. The Strategy has four principal objectives: to make adaptation smarter, swifter and more systemic, and to step up international action on adaptation to climate change. To achieve this, it intends to (1) push the frontiers of knowledge on adaptation, (2)

[55] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0381
[56] The scientific opinion of the Group of Chief Scientific Advisers, 'Toward a Sustainable Food System' (2020) has informed the strategy. https://op.europa.eu/en/web/eu-law-and-publications/publication-detail/-/publication/ca8ffeda-99bb-11ea-aac4-01aa75ed71a1
[57] https://ec.europa.eu/clima/sites/clima/files/adaptation/what/docs/eu_strategy_2021.pdf
[58] https://ec.europa.eu/clima/policies/adaptation/what_en

adapt faster by rolling out adaptation solutions to help reduce climate-related risk, increase climate protection and safeguard the availability of fresh water, (3) ensure that adaptations are systemic, with a focus on integrating adaptation into macro-fiscal policy, nature-based solutions for adaptation and local adaptation action and (4) scale up international finance and through stronger global engagement and exchanges.

In **energy policy**, energy security has come into focus with the Communication 'European Energy Security Strategy (2014)[59] as a reaction to the events in Ukraine at the time and the potential for disruption to energy supplies. The Communication **'**A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy' (2015)[60] introduced the Energy Union package[61], with the stated goal of 'giv[ing] EU consumers - households and businesses - secure, sustainable, competitive and affordable energy', and an ambitious **climate policy** declared to be at its core. The strategy is built on five 'closely related and mutually reinforcing' dimensions: (1) energy security, solidarity and trust; (2) a fully integrated European energy market; (3) improved energy efficiency to moderate demand, reduce dependence on imports, lower emissions, and drive jobs and growth; (4) decarbonising the economy, and (5) research, innovation and competitiveness.

The Communication 'Critical Raw Materials Resilience: Charting a Path towards greater Security and Sustainability' (2020)[62] aims to 'ensur[e] resilience through a secure and sustainable supply of **critical raw materials'** and thus 'make a major contribution to the recovery and the long-term transformation of the economy. The Communication presents a plan for addressing 'challenges for a secure and sustainable supply of critical raw materials and actions to increase EU resilience and open strategic autonomy'.

In **mobility,** the Communication 'Sustainable and Smart Mobility Strategy – putting European transport on track for the future' (2020)[63] states: 'ensuring that our transport system is truly resilient against future crises must also be a key objective of the EU's transport policy going forward, and that in the context of the recovery from the severe crisis, 'public support should help mobility "build back better" and leap forward to a sustainable and smarter future'. The Action Plan annexed to the strategy includes preparing crisis contingency plan(s) for the transport sector, including health-safety and operational measures and setting out essential transport services, planned for 2021-2023.

[59] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0330&from=EN
[60] https://eur-lex.europa.eu/resource.html?uri=cellar:1bd46c90-bdd4-11e4-bbe1-01aa75ed71a1.0001.03/DOC_1&format=PDF
[61] https://ec.europa.eu/energy/topics/energy-strategy/energy-union_en
[62] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0474
[63] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0789

B. Relevant EU sources of knowledge and evidence

Vice-President Šefčovič is mandated to lead the effort to embed **strategic foresight** into European Commission work by ensuring that it 'makes full use of the knowledge, information, and research to future-proof our policies', as well as 'strengthen[ing] our culture of preparedness and evidence-based anticipatory policymaking'.[64] The European Commission's Secretariat-General and the Joint Research Centre (JRC) lead the implementation work (the latter drawing on its Competence Centre on Foresight).[65] The EC Strategic Foresight Network is a coordination forum between all European Commission departments. The European Strategy and Policy Analysis System (ESPAS)[66] is the main forum for collaboration on foresight with other EU institutions.

The first annual **Strategic Foresight Report**, 'Charting the Course towards a More Resilient Europe' (2020)[67] asserts that resilience has become 'a new compass for EU policies' in the aftermath of the COVID-19 crisis. Resilience is defined as 'the ability not only to withstand and cope with challenges but also to undergo transitions in a sustainable, fair, and democratic manner'. The report outlines how 'foresight will inform policies with a view to strengthening the EU's resilience in four interrelated dimensions: social and economic, geopolitical, green, and digital'. It identifies capacities, vulnerabilities and opportunities for each of the four dimensions. The next annual foresight report (2021) is to focus on **'open strategic autonomy'** as an aspect of geopolitical resilience.

As a follow-up to the foresight report, the European Commission (led by the JRC) is working on **'resilience dashboards'** for the above-mentioned four dimensions. The stated goal is to assess the EU's and the Member States' ability to progress in terms of the transformations needed. The plan includes the involvement of external experts and other institutions, in order to bring in cross-disciplinary advice. Discussions with the Member States are planned kicked off in April 2021. European Commission Vice-President Maroš Šefčovič has initiated an EU Foresight Network at a ministerial and sherpa level.

The JRC has done other significant work on resilience to inform policy:

- The report **'Building a Scientific Narrative: Towards a More Resilient EU Society. Part 1: a Conceptual Framework" (2017)**[68] has informed the 2020

[64] https://ec.europa.eu/info/strategy/priorities-2019-2024/new-push-european-democracy/strategic-foresight_en
[65] https://knowledge4policy.ec.europa.eu/foresight_en
[66] https://espas.secure.europarl.europa.eu/orbis/espas
[67] https://ec.europa.eu/info/strategy/priorities-2019-2024/new-push-european-democracy/strategic-foresight/2020-strategic-foresight-report_en
[68] Manca, Anna Rita; Benczur, Peter; Giovannini, Enrico, 'Building a Scientific Narrative Towards a More Resilient EU Society, Part 1: a Conceptual Framework', JRC Science for policy report, 2017;

Foresight Report. It traces the evolution of the concept of resilience in various disciplines and proposes a 'policy framework for societal resilience'.

- The report **'The resilience of EU Member States to the financial and economic crisis. What are the characteristics of resilient behaviour?' (2018)**[69] is based on the above framework and presents an empirical analysis of the resilience of European countries to the financial and economic crisis that started in 2007.
- The report **'How resilient are the European regions? Evidence from the societal response to the 2008 financial crisis' (2020)**[70] proposes 'a new approach for measuring regional resilience that goes beyond the assessment of traditional economic dimensions'.
- The report **'Time for transformative resilience: the COVID-19 emergency' (2020)**[71] also builds on the earlier conceptual work to recommend policy measures aimed at tackling the COVID-19 crisis.
- A forthcoming JRC technical report is to focus on individual resilience (i.e. how individual EU citizens cope in times of distress).[72]

The European Parliamentary Research Service (EPRS) has published two studies focusing on post-COVID-19 resilience, under the theme **'Towards a more resilient Europe post-coronavirus'**; 'An initial mapping of structural risks facing the EU'[73] and 'Capabilities and gaps in the EU's capacity to address structural risks'.[74]

The European Climate Adaptation Platform Climate-ADAPT[75] is a partnership between the European Commission and the European Environment Agency (EEA). It aims to support Europe in adapting to climate change by helping users to access and share data and information on expected climate change in Europe, current and future vulnerability of regions and sectors, adaptation strategies and actions, adaptation case studies and potential adaptation options, tools that support adaptation planning.

The **Disaster Risk Management Knowledge Centre (DRMKC)**,[76] which is a part of the JRC, works on 'integrat[ing] existing scientific multi-disciplinary knowledge and

https://publications.jrc.ec.europa.eu/repository/bitstream/JRC106265/jrc106265_100417_resilience_scienceforpolicyreport.pdf

[69] https://publications.jrc.ec.europa.eu/repository/bitstream/JRC111606/jrc111606_resilience_crisis_pilot_withidentifiers.pdf

[70] https://publications.jrc.ec.europa.eu/repository/bitstream/JRC121554/jrc121554_regional_working_paper_2020_registered.pdf

[71] https://publications.jrc.ec.europa.eu/repository/bitstream/JRC120489/resilience_coronavirus_final.pdf

[72] https://ec.europa.eu/jrc/sites/jrcsh/files/jrc-science-for-policy-brief_individual-resilience_0.pdf

[73] https://espas.secure.europarl.europa.eu/orbis/sites/default/files/generated/document/en/EPRS_STU%282020%29653208_EN%20%281%29.pdf

[74] https://espas.secure.europarl.europa.eu/orbis/sites/default/files/generated/document/en/EPRS_STU%282020%29652024_EN.pdf

[75] https://climate-adapt.eea.europa.eu/

[76] https://drmkc.jrc.ec.europa.eu/

co-develops innovative solutions for existing needs [in Disaster Risk Management, DRM] and offers a range of knowledge tools to that end' and defines its activities as 'support[ing] the translation of complex scientific data and analyses into usable information and provides science-based advice for DRM policies. Among the most recent relevant publications of DRMKC are 'Science for Disaster Risk Management 2020'[77] and 'Recommendations for National Risk Assessment for Disaster Risk Management in EU'.[78]

The Union Civil Protection Mechanism (UCPM) has its own **Union Civil Protection Knowledge Network**,[79] which aims to "[…] to aggregate, process and disseminate knowledge and information relevant to the Union Mechanism, following a multi-hazard approach and including relevant civil protection and disaster management actors […]; […] support coherence of planning and decision-making processes by facilitating continuous exchange of knowledge and information between all areas of activity under the Union Mechanism […]; […] strengthen cooperation on training and promote the sharing of knowledge and experience between the Union Civil Protection Knowledge Network and international organisations and third countries […]**[80]**" In addition, with its most recent revision the UCPM aims to work together with Member States to establish Union wide resilience goals and cross-sectoral disaster risk management planning for both natural and man-made disasters likely to have a transboundary effect. The goals are to allow a better a stronger evidence base to inform prevention and preparedness measures in the area of civil protection.

The **Copernicus Emergency Management Service (CEMS)** provides information for emergency response in relation to different types of disasters, including meteorological and geophysical hazards, humanitarian disasters, as well as prevention, preparedness, response and recovery activities. The **Copernicus service for security applications** aims to improve crisis prevention, preparedness and response in border surveillance, maritime surveillance, and in support of EU external action.

The EU Galileo programme of **satellite navigation** is relied upon heavily in crisis and emergency response. In the field of **satellite communication**, a new EU space programme component is to start in 2021, to provide secure satellite communication for governmental actors, based on pooling and sharing of existing satellites (GOVSATCOM). The European Commission is now also investigating setting up an EU satellite constellation for secure connectivity.

[77] https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/science-disaster-risk-management-2020
[78] https://drmkc.jrc.ec.europa.eu/Knowledge/Science-for-DRM/NRA
[79] https://ec.europa.eu/echo/what/civil-protection/knowledge-network_en
[80] Article 13 of Regulation of the European Parliament and of the Council amending Decision No 1313/2013/EU on a Union Civil Protection Mechanism (to enter into force in May 2021).

ANNEX 3 – POLICY LANDSCAPE

1. Policy landscape

1.1. A complex policy landscape

Crisis management traditionally focused on large scale and exceptional events. The aim was to provide a range of expertise and intervention capacities to prevent as much as possible their occurrence, respond rapidly and effectively, recover and reconstruct, and ultimately return as fast as possible to pre-crisis conditions. Different arrangements exist for these challenging tasks, both at EU and Member State level. Specialised capacities are usually located in the Ministry of Interior and Defence. However very often a coordinating civil protection organisation exists close to the highest levels of government (Prime Minister, President, etc.). The proximity to the highest level of government makes it possible to deploy rapidly the needed financial and human resources and to coordinate among all ministries and governmental agencies to obtain specialized knowledge and resources depending on the specifics of crises. Besides, crisis management competences are distributed vertically across levels of government from local to regional, national and European on the basis of subsidiarity principle.

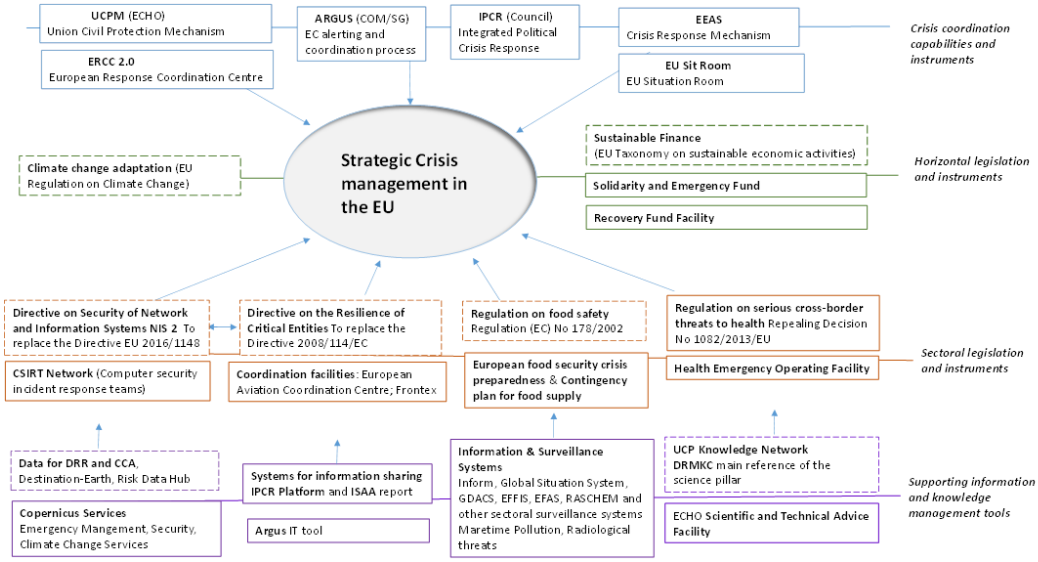

Figure 1. Main policy arrangements in the field of crisis management at the EU level

The EC was not originally intended to be a crisis manager, yet both its role and capacity in this area were increasingly enlarged, in particular for crises that can overwhelm capacities of individual Member States and for transboundary crises. Over time, legislations, mechanisms, and instruments have been added following lessons

learnt and crisis experience. It is challenging to produce an overview of existing policies as those have been dynamically changing, especially in the past two years[81].

In Figure 1 a selection of instruments, mechanisms, and legislation relevant to strategic crisis management at the EU level are organised in four lines. In the first upper line, the blue contoured boxes represent generic instruments and mechanisms that are used to address various types of crises. The second line contoured in green refers to horizontal legislation and instruments that have an impact on several sectors and for different types of action and interventions across the crisis management cycle, from preparedness to response. In the third line, contoured in red are sectoral instruments and legislation. In the last line, contoured in violet data, information and knowledge management systems that are supporting the implementation of legislation, capacities and instruments are shown.

Legislation, mechanisms, and instruments that are aimed at prevention & preparedness of crises are represented in dotted boxes, whereas instruments & capacities applicable in the response phase are shown in plain boxes.

1.2. High level strategic and operational crisis management mechanisms

As stated by Collett and Le Coz (2018), crisis management requires high level political decision-making capacity to solve dilemmas and hard choices that have to be made to counteract the negative impacts on society.

The Union Civil Protection Mechanism (UCPM) was founded in 2001 after September 11 as member states became more aware of the increasing complexity and globalisation of crises. The UCPM has progressively moved from a pioneering initiative into a robust and well rooted framework reinforced by the new Regulation issued in May 2021 (Regulation (EU) 2021/836 of the European Parliament and the European Council), following a year of pandemic. The UCPM and the overall competence of Europe on emergency and crisis management is established in article 196 of the Lisbon Treaty and is rooted in Article 222 stating the solidarity clause. Now the UCPM is a mature framework designed to address emergencies that occur inside and/or outside the EU with the provision of aid to the affected countries who request assistance the ERCC. The ERCC is the 24/7 operational hub that monitors, inform and facilitates the coordination of the EU Member States and UCPM Participating States' response in case of disasters. It is well experienced in facilitating the delivery of assistance according to the needs. Aid takes the form of in-kind assistance, deployment of specially-equipped teams or experts including experts assessing and coordinating support right in the field.

Given the difficulties encountered by the EU Member States and the UCPM participating States to offer assistance to the several affected countries during the

[81] An Inventory of EU Crisis Management Capabilities has been prepared by the Crisis Management Unit of the Secretary General of the EC in June 2022 shared with relevant bodies at the EU and Member States levels.

2017 forest fire season, mainly due to the limited number of available forest fire airplanes, RescEU has been established and fully integrated in the May 2021 Regulation. RescEU is composed of a reserve of capacities fully financed by the EU, that can be deployed where needed without counting on voluntary aid that proved to be a limiting factor when several countries were affected at the same time. With the May 2021 Regulation, the ERCC has become a truly coordinating centre, functioning as main coordination hub of the EU response where demand of needed resources is met with response capacities offered by Member States or available within the European Civil Protection Pool or RescEU. The Emergency Response and Control Centre (ERCC) already existed as a situational room to facilitate the exchange of resources among Member States or donation to third countries. In the new May 2021 Regulation, it has become a truly coordinating centre, functioning as a focal hub where resource demands are met with response capacities offered by Member States or the RescEU. Following the Council Conclusions and based on COVID-19 Lessons Learnt, DG ECHO launched the ERCC 2.0 initiative to strengthen the ERCC capability to manage cross-sectoral crisis and develop foresight and strategic anticipation capacity.

ARGUS[82] is the Commission's general rapid alert system. It is a process supported by an homonymous IT application bringing together all relevant services and Cabinets to coordinate and to decide on measures in case of a transboundary crisis. ARGUS can be activated in two different phases: 'Phase I' is used for information-sharing on a sector-specific crisis or on a crisis of relatively limited impact on the EU; 'Phase II' is triggered by the President in a case of a major multi-sectoral crisis.

On 23 June 2013 the General Affairs Council (GAC) approved the EU Integrated Political Crisis Response arrangements (IPCR) replacing the previous Crisis Coordination Arrangements (CCA) created in 2005. The new arrangement was meant to overcome challenges and drawbacks of its predecessor (Beriain et al 2015) and provided Europe with a more flexible tool that could be triggered in two modes: information mode and full activation. The latter mode is obligatorily triggered when a Member State invokes the Solidarity Clause. In the IPCR, the role of the Permanent Representatives (COREPER) to the EU is reinforced with respect to the previous arrangement provided by the CCA. The IPCR provides Europe with a flexible tool to coordinate between Member States and EU bodies. The European Commission's Secretariat-General, Directorat-General (DG) ECHO, DG HOME and the European External Action Service (EEAS)[83] participate in the IPCR meetings. Other DGs and Agencies participate depending on the nature of the crisis. For example DGs SANTE, HERA, JUST, and CNECT and the European Centre for Disease Prevention and Control (ECDC) took part in IPCR meetings to coordinate during the COVID 19 pandemic. A common shared platform for information exchange and the Integrated Situational Awareness and Analysis (ISAA) report are important elements of the coordination.

[82] COM(2005) 662 final of 23.12.2005, "Commission provisions on "ARGUS" general rapid alert system".
[83] 2010/427/EU: Council Decision of 26 July 2010 establishing the organisation and functioning of the European External Action Service.

Depending on the crisis, the ISAA report is drafted by the most relevant DG (such as ECHO, HOME, SANTE).

Crises are increasingly cross border and as highlighted by Vila Maior and Camisão (2022) all recent large-scale crises that affected the EU originated from outside. The European External Action Service (EEAS) is a functionally autonomous body established by Council Decision 2010/427/EU dated 26 July 2010. Since its establishment it included crisis management capabilities. In 2019 a Common Security and Defence Policy was established under the mandate of the Deputy Secretary General for CSDP-CR who also oversees the Civilian planning and Conduct Capacity department. One of the most visible crisis responses, spearheaded by the coordination efforts offered by the EU Delegations has been with repatriations of European citizens caught in major emergencies abroad in the context of the COVID crisis (2020) or more recently the fall of Kabul (2021) and the Russian aggression war on Ukraine (2022). EU Delegations' role in consular crisis has been spelled out through the Council Consular Protection Directive (EU) 2015/637 of 20 April 2015. The ERCC and EEAS collaborate when consular support is requested under the UCPM. As part of its crisis response system, EEAS relies on a Situation Room created in 2010 and as defined in the EEAS website constitutes a "switchboard and embeds within situation reports or flash reports all crisis related information provided, among others, by EU Delegations, EU Member States, EU CSDP Operations and Missions, EUSR teams, and International Organisations". EEAS relies also on a Crisis Platform, a flexible arrangement aimed at bringing together the relevant EEAS departments as well as other EU Commission DGs (such as ECHO, HOME) depending on the type of crisis. On the 21st of March 2022, the Council approved the Strategic Compass, a plan providing guidance in the fields of security and defence for the European Union stressing the civilian component of crisis management even in case of war. Building on the lessons learnt from recent crises and the guidance set in the Strategic Compass, the EEAS is establishing a Crisis Response Centre, expected to be operational at the end of 2022. In parallel, the Consular Protection Directive is expected to be reviewed in the coming years.

The crisis management mechanisms developed in DG ECHO, EEAS and the IPCR are rather generic and transversal to any type of crises. Those mechanisms proved to function well in recent crises, yet there is room for improvement as spelled out by the Council Conclusions of 23 November 2021. The latter highlight that in the future, the EU must also be ready to face acute crises of a different nature, which could be multi-faceted, of a hybrid nature, have cascading effects or occur simultaneously. "This will require improved cross-sectoral and cross-border crisis management, including risk analysis and strategic foresight for better anticipatory action, prevention, preparedness and response, in an all-hazards approach, in order to inform longer-term action to build resilience to such challenges. Available EU mechanisms, including their interaction with global mechanisms, should be regularly reviewed by the Council in order to ensure they remain fit for purpose." "Inter-institutional cooperation and transparency should help to avoid a multiplication of fora and overlapping activity. In that respect, structured information sharing and

common situational awareness […]" (Council Conclusions 23/11/ 2021). Whilst the good achievements in the COVID-19 crisis are acknowledged, the Council Conclusions also stress that lessons learnt should lead to further improvement of the mechanisms to better tackle the nature of cross sectoral crises, avoiding undue overlapping and duplication of mechanisms and instruments. "A blueprint with flexible and adaptable guidelines and procedural rules to inform the reaction of the EU and its Member States in case of a crisis, while respecting the principle of subsidiarity and avoiding unnecessary administrative burden" (Council Conclusions 3/11/2021) needs to be established. Under the French Presidency Q1 2022 work was undertaken "to re-examine the Council's crisis response mechanism (IPCR), with an aim to strengthen it".

1.3. Horizontal Instruments and legislations impacting on multiple sectors

The so called "Climate Law", namely Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 points at adaptation as a key a key component of the long-term global response to climate change. In article 5(3) it is stated that "Union institutions and the Member States shall also ensure that policies on adaptation in the Union and in Member States are coherent, mutually supportive, provide co-benefits for sectoral policies, and work towards better integration of adaptation to climate change in a consistent manner in all policy areas, including relevant socioeconomic and environmental policies and actions, where appropriate, as well as in the Union's external action". In article 5(5) "By 30 July 2022, the Commission shall adopt guidelines setting out common principles and practices for the identification, classification and prudential management of material physical climate risks when planning, developing, executing and monitoring projects and programmes for projects".

Economic and financial impacts are a very evident and fearful consequence of crises, especially of large-scale crises that may trigger important ripple effects across economic sectors and impact on the overall GDP of a country or a region. The EU Taxonomy for Sustainable Activities, according to Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 established four criteria upon which economic activities can be considered sustainable, one of which relates to the contribution to the achievement of objectives as set in Article 9. Climate change adaptation is listed in the latter and further expanded in article 11 that explicitly defines substantial contribution to climate change adaptation. The latter is brought by an activity that either "includes adaptation solutions that either substantially reduce the risk of the adverse impact of the current climate and the expected future climate on that economic activity or substantially reduce that adverse impact" or "provides adaptation solutions that, in addition to satisfying the conditions set out in Article 16, contribute substantially to preventing or reducing the risk of the adverse impact of the current climate and the expected future climate on people, nature or assets". In both cases "without increasing the risk of an adverse impact on people, nature or assets".

The EU has also developed specific financial instruments to deal with crisis, such as the Solidarity and Emergency Aid Reserve that provides immediate aid for Member States that have been affected by a large disaster. To counteract the negative impacts on economy of the pandemic, the EU has established the Recovery and Resilience Facility as a key temporary instrument.

1.4. Main sectoral instruments and legislation

More specific sectoral provisions relate to a number of legislative and policy initiatives that have developed all in the last two or three years.

1.4.1. Health

In the field of Health, the creation of DG HERA and the Regulation on Serious Cross Border threats (COM2020 727 Final, 11/11/2020). The Health Emergencies preparedness and Response Authority (HERA) established by a European Commission Decision on the 16th of September 2021 will complement ECDC and EMA in both preparedness and crisis times, thus becoming a crucial pillar of the European Health Union with an anticipatory and response-focused dimension in terms of threat assessments and foresight. The Regulation on Serious Cross Border Threat, that obtained a provisional agreement on the 23rd of June 2022, establishes rules and tools for the management of pandemic and other serious threats to health, such as antimicrobial resistance, biotoxin and other harmful biological agents, threats of chemical origin. It envisages the development of a Union plan for pandemic including all aspects of preparedness and response, training programs in coordination with Member States, joint procurement of medical countermeasures. It also sets a platform for early warning and monitoring to be managed by the ECDC and sets the floor for a joint preparedness and response among European Commission and relevant Agencies.

1.4.2. Food safety and security

Regulation (EC) 178/2002 of the European Parliament and o the Council, of 28 January 2002 lays down principles and requirements of general food law, establishes procedures in matters of food safety and the European Food Safety Authority (EFSA). Articles 55 to 57 require development of a plan for crisis management and a crisis unit at community level including EFSA. Furthermore, this General Food Law Regulation lays down the main procedures for the management of emergencies and crises, including the Rapid Alert System for Food and Feed (RASFF), designed to enable a swift reaction when risks to public health are detected in the food chain. The type of crises and incidents considered in the regulation are mainly focused on threats to human health.

Although Food Safety is fundamental in EU regulatory system, large scale, transboundary crises such as the Russian invasion of Ukraine may trigger also security concerns along the food supply chains. Disruption in the latter is threatening the access to food along the overall commitment to fight with hunger e.g. ensuring

access to safe, nutritious and sufficient food for all people all year round (SDG 2, see also FAO 2020).

As reported by the Council Conclusions November 2021, on 11 November 2021 the Commission adopted the Communication COM(2021) 689 final outlining the Contingency plan for ensuring food supply and food security in times of crisis. An important pillar is the constitution of the European Food Security Crisis preparedness and response Mechanism by DG AGRI relying on a group of experts to be convened on a regular basis for preparedness and whenever a crisis occurs.

The Communication from the Commission to the European Parliament, the European Council, the European Economic and Social Committee and the Committee of the Regions on "Safeguarding food security and reinforcing the resilience of food systems" COM(2022) 133 final, issued on 23/3/2022 indicates the pillars of increased resilience for the food system, considering the vulnerabilities of disadvantaged population in Europe and the tools that may be used to alleviate them. It also identifies the additional initiatives to tackle the food global crisis triggered by the war in Ukraine and the consequent further increase in energy prices.

1.4.3. Critical infrastructures

The Directive on the Resilience of Critical Entities (CER) and the new Network and Information Security Directive (the NIS2) have to be considered. The Council and the Parliament reached an agreement on the text of CER on the 28th of June 2022 that is going to substitute the prior Directive 2008/114/CE on the Protection of Critical Infrastructures. It provides clearer criteria for defining critical infrastructures and requires a liaison officer with the European Commission, that is certainly a key aspect of crisis management especially as the latter escalates beyond a state boundary. It also calls for national risk assessments to be conducted for critical entities. The new naming of the directive is mainly addressing the issue of liabilities and responsibilities for resilience management that are on the shoulders of operators, shifting the focus from the protection assets to the efforts towards business and service continuity in a more collaborative environment.

The text of the NIS 2 Directive has been agreed upon by the Council and the Parliament on 13 May 2022 and will replace the current NIS 2 Directive EU 2016/1148. NIS 2 is aimed at increasing "the level of cyber-resilience of a comprehensive set of businesses operating in the European Union across all relevant sectors". The NIS 2 Directive should reduce "inconsistencies in resilience across the internal market in the sectors already covered by the directive, by further aligning inter alia the security and incident reporting requirements and the capabilities of the Member States' relevant competent authorities". Overall, it aims at improving "the level of joint situational awareness and the collective capability to prepare and respond, by i) taking measures to increase the level of trust between competent authorities; ii) by sharing more information; and iii) setting rules and procedures in the event of a large-scale incident or crisis." NIS2 also covers the protection of assets

that permit the functioning of the information system, among which datacentres are defined for the first time.

Necessary interlinkages between the two Directives are indicated in both.

Related to both Directives, in May 2022 a provisional agreement has been reached on the Digital Operational Resilience Act (DORA), aiming at guaranteeing that the financial sector in Europe is able to maintain resilient operations through a severe operational disruption.

As reported by the Council Conclusions November 2021, on 11 November 2021 the Commission adopted the Communication COM(2021) 689 final outlining the Contingency plan for ensuring food supply and food security in times of crisis. An important pillar is the constitution of the European Food Security Crisis preparedness and response Mechanism by DG AGRI relying on a group of experts to be convened on a regular basis for preparedness and whenever a crisis occurs.

As asked for in the same Conclusions, on 23 May 2022 the Commission adopted the Communication COM(2022) 211 final on a Contingency plan for transport. The plan relies on a 10 principles toolbox among which the following are very relevant to the opinion: i. Making EU transport laws fit for crisis situations, ii. Ensuring adequate support for the transport sector (increasing the resilience of the system also through the Recovery Plan), iii. Ensuring free movement of goods, services and people, iv. Managing refugee flows and repatriating stranded passengers and transport workers, vi. Sharing transport information, viii. Strengthen cybersecurity, and ix. Testing transport contingency.

Specifically for the banking sector, a proposal for a 'Digital Operational Resilience Act' (DORA) was made, aiming at guaranteeing that the financial sector in Europe can maintain operations through severe operational disruption.

1.5. Knowledge, data and information sharing and building for strategic crisis management in the EU

The JRC established in 2015 the Disaster Risk Management Knowledge Centre, the first knowledge centre established in the Commission. The aim of the DRKMC is to bring together researchers, projects funded by the EU, international experts together to share and co-develop knowledge in the field of disaster management at large. The DRMKC leads the scientific pillar of the Civil Protection Knowledge Network that has been launched in November 2021 according to the Commission Implementing Decision 2021/1956. Science is one of the two pillars of the Civil Protection Knowledge Network, being the second the Capacity Development pillar. The Civil Protection Knowledge Network is aimed at growing and becoming referential for civil protection communities at large, including practitioners, officers of Member States, researchers, associations and organisations from the public and the private sectors. The Civil Protection Knowledge Network is developing an online platform providing access to various resources, including to information on trainings, exercises, some of which online some in presence or hybrid.

1.6. Data and information management

Among tools that are supporting crisis management activities, data and information management systems are of primary importance. Data management is referred to in several of the previously mentioned policies. For example, in the Climate Regulation article 8 the type of data the Commission should use to assess Union's and Member States' adaptation measures are specified. "European and global statistics and data, including statistics and data from the European Earth Observation Programme Copernicus, data on reported and projected losses from adverse climate impacts and estimates on the costs of inaction or delayed action, where available". In the CER, article 4(4), "each Member State shall provide the Commission with data on the types of risks identified and the outcomes of the risk assessments, per sector and sub-sector", in various articles information sharing from critical entities to state authorities is an essential part of the new policy brought by the Directive. Data and information management are clearly supporting crisis management in many ways, at different spatial levels and phases of crises. The Copernicus Earth Observation Program is a pillar of a vast array of services that are of relevance for crisis management. Particularly relevant for this opinion the Emergency Management service started in 2012 that provides besides monitoring also early damage assessment mapping for the use of rescue services; the Security Service providing mapping relevant for border surveillance and support the External Action service the Climate Change Service initiated in 2018. Different systems are currently under development within the Commission. For example, Global Situation System (JRC) that combines, in a unique platform, different tools that had been developed separately insofar including access to services provided by the Copernicus Program such as EFFIS (European Forest Fire Information System) and EFFAS (European Flood Awareness System). The Global Situation System reports and monitor events worldwide thus permitting to identify those hazardous events occurring outside EU borders but with the potential of impacting Europe as well. The products that are delivered through those services are for example Flash Reports, maps.

Other initiatives are aiming at providing analytical tools for risk assessment and management. For example, the Inform Platform, recently updated provides worldwide indicators on hazards, exposure and vulnerabilities. Data that are used come from internationally available statistics therefore allowing for a certain degree of comparability. Other initiatives are Destination Earth (DG CNECT) and the Risk Data Hub (JRC). The former is aimed at producing a "digital twin" of the Earth based on the more advanced technologies, thus constituting a very ambitious program for monitoring and virtual laboratories for sustainability, mitigation and adaptation to climate change. The Risk Data Hub is mainly focusing on producing risk analyses and assessment from natural hazards, creating a space in which countries could upload their own informational layers to use models and methods that are embedded in the system. The Risk Data Hub is constituted by two main components, one aimed at assessing hazards, exposure and vulnerabilities, the second providing datasets on past events damage and losses as well as an interface for future events.

ANNEX 4 – LIST OF EXPERTS AND STAKEHOLDERS CONSULTED

External Experts

Dandoulaki	Miranda	Industrial Systems Institute, Japan
De Marchi	Bruna	University of Bergen, Norway
Fuggini	Clemente	RINA, Italy
Furlong	Nigel	UK Atomic Energy Authority, UK
Galbusera	Luca	EU Commission JRC, Ispra
Grøtan	Olav	Sintef, Norway
Kondouri	Phoebe	Athens University of Economics and Business, Greece
Latini	Clara	Sustainable Development Solutions Network – Youth
Linkov	Igor	US Army Corps of Engineers (USACE), USA
Hochrainer	Stefan	Stigler, IIASA
Klaver	Marieke	TNO, The Netherlands
Matilla	Paivi	Laurea University of Applied Sciences, Finland
Mechler	Reinhard	IIASA
Melzi	Carmela	Regional Government of Lombardy, Italy
Meesters	Kenny	Tilburg University, Germany
Moulinos	Konstantinos	ENISA
Noy	Ilan	Victoria University of Wellington, New Zealand
Parker	Miles	European Central Bank
Pesaro	Giulia	University of Insubria, Italy
Pursiainen	Christer	Arctic University of Norway (UiT), Norway
Schwarze	Reimund	Helmholtz Centre for Environmental Research, Germany
Wilson	Thomas	University of Canterbury, New Zealand
	Stakeholders	
Santamaria	Nestor Alfonzo	OECD
Radisch	Jack	OECD
Giacoma	Carlo	EIFEC
Michelle	Charles	EIFEC

Sapountzaki	Kalliopi	Society for Risk Analysis – Europe (SRA-E)
Dengler	Solene	World Bank
Ridanovic	Farah Soraya	World Bank
Portugal	Pablo	AFME
Marchetti	Laura	Mental Health Europe
Pozzi	Emma	Center for European Volunteering (CEV)

Officers from the European Commission, the EEAS and the Agencies

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The world experiences crises that increasingly involve multiple systems across large areas, and extend globally. These include the 2008 financial crisis, the COVID-19 pandemic, the crises engendered by the war in Ukraine and the crises caused by climate change. The common characteristics of those threats and their impact on societies include the presence of multi-risk factors likely to provoke cascading impacts across increasingly interconnected sectors. The speed of change and the complexity of crises are increasing, and consequent processes are more often irreversible.

Focusing on the systemic approach required by the complex nature of threats and their impacts on society, this scientific opinion provides policy recommendations on how the EU can improve its strategic crisis management and could better prepare for, respond to and recover from crises.

This scientific opinion informed by the SAPEA Evidence Review Report is co-issued with a Statement Values in times of crisis: Strategic crisis management in the EU by The European Group on Ethics in Science and New Technologies (EGE)

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