SECURITY AND ECONOMIC IMPLICATIONS OF CROSS-BORDER RISKS IN THE EU – NEW HORIZONS AND THE RISK PORTFOLIO

Miodrag Komarčević, PhD[1]
Mića Živojinović, PhD[2]
Veljko Samardžić[3]

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Abstract: In recent years, Europe has been facing increasingly complex national and cross-border risks, ranging from disasters generated by natural hazards and exacerbated by climate change, through industrial and technological accidents, hybrid threats, to a broad spectrum of threats originating in cyberspace. For these reasons, there is a growing need for a holistic, integrative, and scientific approach to understanding contemporary risks, particularly their transformed nature, including strategies for mitigating their consequences at both the national level and within the EU's subnational structures. Policymakers, the academic community, regulators, and practitioners have recognized the scale of emerging hazards and associated risks, given that they are evolving at an unprecedented pace, and are therefore striving to build proactive and collaborative responses grounded in scientific principles at all levels, with the aim of developing and enhancing the overall resilience of the EU and the achievement of its objectives. In the context of the current proliferation of new risks, cross-border risks in Europe have attracted significant attention. Judging by the growing body of scientific research, cross-border risks are becoming a highly attractive research cluster for both national and European institutions and their research resources. Following the contextualization of the general state of affairs, that is, the strategic environment that generates current and potential risks with a cross-border dimension, this paper seeks to examine the profoundly altered risk landscape and configuration, which, in addition to climate-related risks, encompasses environmental, health, technological, and military threats. This development places the process of

1 Faculty of Organizational Studies "EDUKA", Belgrade, Republic of Serbia, E-mail: miodrag.komarcevic@vos.edu.rs, https://orcid.org/0009-0004-3200-4994
2 College of Professional Studies for Security and Criminalistics, Nis, Republic of Serbia
3 Faculty of Organizational Studies "EDUKA", Belgrade, Republic of Serbia

risk management at the very top of existing EU security and strategic agendas.

Keywords*: European Union, risk portfolio, cross-border risks, climate risks, natural disasters, risk management*

Introduction

Institutions of the European Union, and in particular the European Commission, have for years developed a policy framework for researching complex risks arising from natural and industrial–technological disasters, while increasing attention has been directed toward the study and understanding of risks that, by their very nature, predominantly possess a cross-border dimension. Due to the growing frequency and severity of natural and technological disasters—largely driven by climate change—as well as the expansion of urban populations, economic crises, and geopolitical tensions, EU institutions, drawing on their research capacities, numerous policies, and development programmes, are making concerted efforts to operationalize the clearly articulated need for robust and coordinated risk management strategies addressing current and potential disasters and other forms of threats across the entire territory of the EU.

Given that these hazards, threats, and risks often transcend or cross national borders, the response must likewise be unified and oriented toward enhancing EU resilience through the strengthening of prevention, cooperation, preparedness, and the organization of operational capacities for consequence management. Risk management policy at the EU level was initiated in 2013 through the strengthening of the Union Civil Protection Mechanism and was further advanced in 2019 by EU Decision (420/2019) introducing mandatory joint reporting on national risk assessments. Four years later, in 2023, the European Commission adopted the EU Disaster Resilience Goals, encompassing common objectives (anticipate, prepare, alert, respond, ensure), with a particular emphasis on the qualitative improvement of risk assessment through the introduction and development of more sophisticated tools and methods for the accurate detection, analysis, and evaluation of potential hazards.

In addition, from 2013 to the present, at intervals of two to three years, the European Commission—through its expert bodies, that is, working groups, as well as specialized research institutions such as the EU Joint Research Centre (JRC)—has published the so-called Overview of Risks from Natural and Human-Induced Hazards, which provides detailed analyses of key risks across the EU. However, cross-border risks have not been the subject of in-depth analytical research, and this topic, despite its importance, has remained largely neglected, resulting in multiple—and at times far-reaching—consequences for the security and stability of the EU.

In order to partially address this gap, the Joint Research Centre of the European Commission (JRC) published in 2024 the Report on Cross-Border and Emerging Risks for the EU, which for the first time consolidated data on all cross-border risks and threats. The report offers an in-depth analysis and mapping of various risks, their probability levels, the exposure of regions, cities, communities, and systems to these hazards, and, finally, the vulnerability associated with such exposure and hazards

(Corbane et al., 2024). In domestic scientific and reference literature, only a limited number of authors have addressed this issue. Some authors emphasize that climate change is a reality and increasingly acts as a threat multiplier worldwide (Cvetković et al., 2019).

The Profile and Characterization of Cross-Border Risks

Numerous official EU documents unequivocally indicate that contemporary Europe is confronted with an increasingly complex, diverse, and sophisticated risk landscape, marked by ever more intense and numerous hazards resulting from a dramatic expansion of risk drivers and generators. These include climate change, urbanization, environmental degradation, a volatile security environment, geostrategic instability, and technological development, including the widespread application of disruptive technologies. Of particular importance is the fact that risks are becoming significantly more complex and increasingly cascading in nature, which substantially complicates their assessment as well as the formulation of strategies for their reduction and mitigation.

Recent reference literature encompasses several research-based and empirical studies that provide a highly illustrative overview of existing knowledge and understanding of the key risks Europe has faced in recent years. In its most recent study, the European Environment Agency published, for the first time, a report on the European Climate Risk Assessment, which effectively consolidates existing knowledge and research findings from international and regional organizations such as the Intergovernmental Panel on Climate Change, the Copernicus Climate Change Service, the Joint Research Centre, as well as other projects funded through EU programmes or encompassing national climate risk assessments. Unlike all previous research efforts, this study not only outlines and frames but also systematically delineates and quantifies 36 climate risks present across the EU, while identifying their current and potential impacts throughout the continent

In addition to extreme weather events such as heatwaves, floods, wildfires, storm winds, and similar phenomena, the assessment also addresses systemic challenges, including food and water security, energy security and stability, and public health risks. The study's key finding is unequivocal: Europe is not adequately prepared for emerging climate, energy, environmental, and military challenges and risks. Particular attention is devoted to the examination of climate risks that are largely shaped by the interaction between climate-related hazards, on the one hand, and non-climatic risk drivers, on the other. This multifaceted impact of climate change directly or indirectly exacerbates existing vulnerabilities through the development of cascading risks across different sectors, communities, and regions.

Earlier publications, such as Science for Disaster Risk Management (Vallès et al., 2020) and Recommendations for National Risk Assessment for Disaster Risk Management in the EU (Poljanšek et al., 2021), have likewise addressed the issue of cross-border risks through analyses of climate impacts on populations, economic

sectors, critical infrastructure, ecosystem services, and cultural heritage. A particular strength of these studies lies in the fact that, beyond identifying key risks, they also examine the impacts of risks on specific systems, structures, and values. This significantly facilitates policymakers' and practitioners' efforts to define preparedness and recovery measures aimed at prevention, mitigation, and readiness for future events, with a strong emphasis on the importance of foresight and the planning of risk management measures across different contexts.

As the complexity and criticality of the risk environment continue to increase, it is essential to continuously improve and adapt existing strategies, measures, mechanisms, tools, and instruments for risk management, while strengthening tailored approaches to cross-border risks, emerging risks, and related challenges.

Figure 1 – Overview of New Systemic Risks
Source: European Commission – Joint Research Centre (JRC), 2024.

Within the academic community, there is a broad consensus regarding the significance, relevance, and consequences of cross-border risks; nevertheless, intense debates and polemics persist concerning what constitutes a cross-border risk and how it should be defined. Owing to their complexity, dynamic nature, multidimensionality, and numerous interactions with other risks or their underlying drivers, cross-border risks are not easily defined in conceptual terms. Some authors (Menoni et al., 2023)

argue that the concept of cross-border risk may carry different meanings, given the complexity of interconnected systems and the various types of disruptions involved, as well as the multitude of direct physical and functional impacts associated with cross-border risks across different contexts.

Despite notable differences in the reference literature, descriptions of cross-border risk generally encompass three key dimensions:

1. political boundaries (horizontal and vertical);
2. functional crises manifested across different sectors;
3. temporal dimensions, insofar as certain risks or disasters transcend temporal boundaries, such as armed conflicts, terrorist attacks, or hybrid threats.

The term cross-border risks was introduced relatively late into official policy, environmental, and climate risk discourse. In addition to the concept of cross-border risks, reference literature, established publications, the media, and the policy sphere frequently employ a variety of related concepts and terms drawn from different disciplinary and semantic fields, as well as from distinct epistemological frameworks. These include transnational risk, risks without borders, international dimensions of change and impact, and global contexts for global impacts. In the official narratives of international and regional organizations, such as the Intergovernmental Panel on Climate Change (IPCC) and the International Risk Governance Council, terms such as secondary effects and international or cross-border spillovers are also commonly used (Roggero et al., 2019). In the Fourth and Fifth IPCC Assessment Reports, these risks or impacts are referred to as indirect, cross-border, and remote (Oppenheimer et al., 2014). Finally, in discussions on global risk, terms such as systemic risk, globally networked risks, and cascading effects are frequently employed (Galaz et al., 2014).

More in-depth and nuanced analytical approaches to cross-border risks—taking into account their evolving nature and multiple interactions with other risks, particularly their drivers or multipliers—stem from the growing recognition, as noted by some authors (Benzei et al., 2023), that the territorial framework of risk assessment, and consequently of risk management, is increasingly being abandoned. This shift, alongside the need to adapt to turbulent and rapidly changing environments, implies a reframing toward regional or global approaches to understanding and managing cross-border risks.

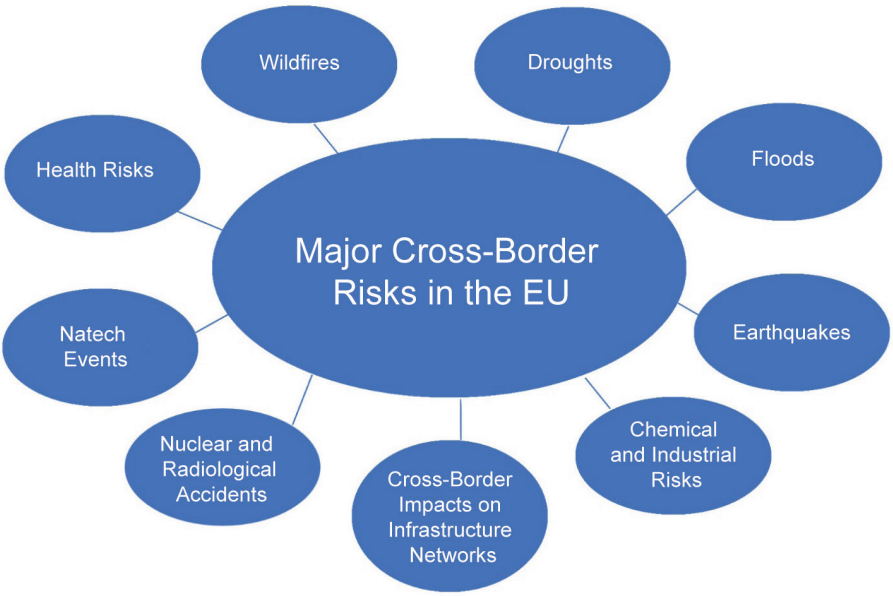

Figure 2 – Panorama of Cross-Border Risks in Europe
Source: European Commission – Joint Research Centre (JRC), 2024.

Moreover, the very definition of cross-border risk encompasses several meanings, some of which are linked to risk assessment, others to vulnerability assessment based on hazards, and, ultimately, to impacts and systemic vulnerability (Menoni et al., 2023). Definitions of cross-border risk that are hazard-based most commonly refer to hazards with a regional dimension, such as floods, wildfires, major industrial accidents, incidents at nuclear facilities, and extreme weather events. When conceptual frameworks focus on impacts, they relate to the potential for assets affected in one country to influence the same system or sector in neighboring countries, most often through disruptions and dysfunctions of critical infrastructure. In such cases, the loss of electricity, water supply, communication networks, or the interruption of transport in one country may constitute a serious problem or even a disaster in another.

The Portfolio of Major Cross-Border Risks in the EU

An analysis of past catastrophic events indicates that natural disasters and human-induced disasters most frequently constitute cross-border risks, primarily due to their geographical nature and the vectors that arise from it. Only a limited number of disasters exhibit a purely local or national character. According to official typologies and standards—most notably those of the European Commission's Directorate-General for Regional and Urban Policy and Eurostat—the EU has developed a classification system for statistical purposes known as NUTS (Nomenclature of Territorial

Units for Statistics). Under this nomenclature, NUTS 1 defines major socioeconomic regions (a total of 92), NUTS 2 delineates large regions (1,244 in total), and NUTS 3 refers to small regions (1,165 in total). Based on this classification, regions are categorized as either border regions or non-border regions, that is, regions that are not defined as border regions.

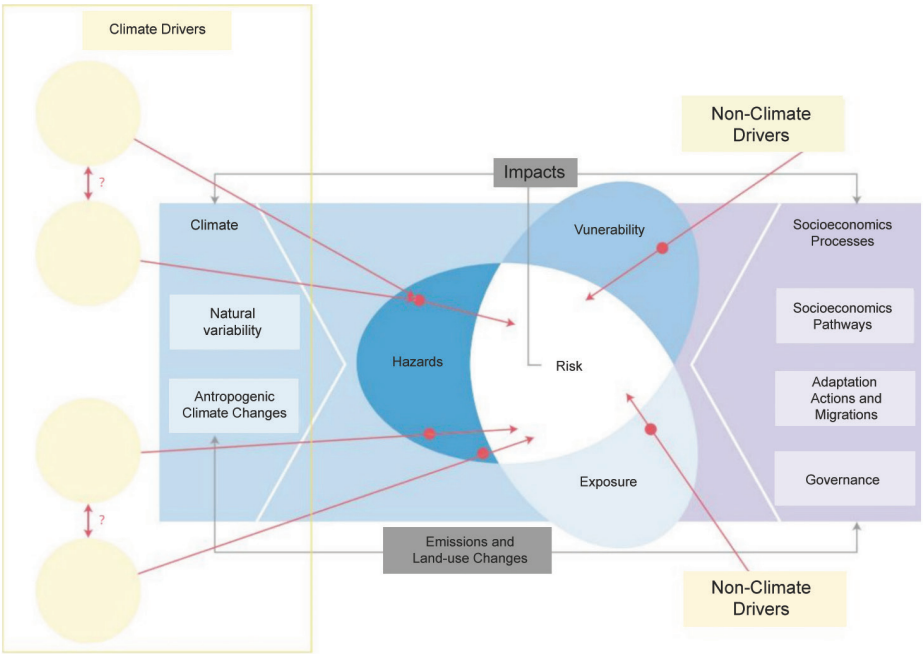

Figure 3 – Expanded Risk Framework
Source: Zscheischler, J., et al. (2018).

In recent reports of the European Commission and its expert services, key cross-border risks are examined, specifically nine major risk categories: floods, earthquakes, wildfires, droughts, chemical and industrial risks, nuclear and radiological accidents, Natech events, cross-border impacts on infrastructure networks, and health risks.

Floods

Floods represent the most frequent natural disaster within the EU. Their high occurrence is determined by the interaction of two key vectors: the increasing intensity of heavy precipitation across Europe and the large number of river basins, including 40 international river basins within the European territory. The interaction of these two

vectors has led to a rise in the number of river floods in Europe over the past three decades (Blöschl et al., 2020), resulting in substantial economic damage and losses in practice. According to statistical data and projections from the PESETA IV project, economic losses caused by floods are expected to increase further, potentially raising annual economic losses in the EU sixfold—from the current EUR 7.8 billion—while, in terms of affected populations, it is estimated that more than half a million people will be impacted by floods in the coming years (Feyen et al., 2020).

Although floods are associated with the lowest mortality rates among natural hazards in Europe, they remain the most frequent and economically costly disasters affecting the European territory each year, largely due to their cascading effects or domino impacts. Despite being identified as the most common risk in the assessments of EU Member States, the cross-border dimension of flood risk—although significant and widespread—has not received adequate attention. Over the past three years, an increase in both the intensity and the scale of damage caused by catastrophic floods has been recorded in certain regions, particularly in Northern and Central Europe.

Catastrophic floods pose the greatest threat to infrastructure and ecosystems, as flood waves—often prolonged in duration and spatially extensive—can disrupt the provision of critical infrastructure services, including communications, healthcare, water supply, and other essential services. At the same time, floods may, under certain conditions, especially when associated with high flood levels, trigger numerous cascading effects, such as marine contamination, incidents involving chemical or industrial waste, erosion, landslides, epidemics, pandemics, and related secondary impacts.

Earthquakes

In the geological sciences, seismic risk is defined as a combination of seismic hazard, the exposure of people and physical assets, and the vulnerability of the built environment. According to recent research, earthquakes may trigger secondary effects such as landslides, damage to critical infrastructure, ground failure, tsunamis, avalanches, debris flows, and ultimately fires, which often cause greater damage than the earthquake itself. Geological risk is most commonly addressed through national risk assessments conducted by EU Member States. However, earthquakes also possess a cross-border dimension, as they do not recognize state, political, or administrative boundaries, but rather propagate across such spaces.

Only 20 countries currently include seismic risk in their national risk assessments and, consequently, in their mitigation strategies. Moreover, the projected probability and impacts of earthquakes vary significantly from one country to another due to differing levels of risk exposure, including variations in structural vulnerability. According to seismic risk mapping, the most exposed countries include Portugal, Spain, Italy, Greece, and Bulgaria. Given the wide range of destructive consequences associated with earthquakes and their cross-border nature, most countries—at both the national and subnational levels—are investing substantial efforts in the development of new tools for seismic risk assessment and management.

One tangible outcome of these efforts is the development of the European Seismic Hazard Model (ESHM20), which provides an assessment of seismic shaking across

the Euro-Mediterranean region. Its design is based on recently compiled datasets, including earthquake catalogs, instrumental records, active fault data, and related information and models.

Droughts

As a result of dynamic climate change, Europe has in recent years been increasingly affected by extreme weather events which, in addition to the frequency and intensity of heatwaves, storms, and heavy precipitation, also include droughts and their frequent companion—wildfires. In the scientific literature, droughts are treated as natural phenomena characterized by a slow onset and long duration, manifesting through various forms. Specifically, droughts may be meteorological, agricultural, hydrological, or socioeconomic in nature, occurring across different temporal scales and producing diverse impacts.

Within the EU context, drought is a recurring feature of the European climate and is not confined solely to Southern Europe or to more remote EU regions. Droughts generate numerous and severe consequences for populations and most economic sectors, particularly agriculture, forestry, energy, industry, inland navigation, and public water supply systems. According to the PESETA IV project report (Feyen et al., 2020), it is projected that with a temperature increase of 3°C, total annual losses from droughts will rise from the current EUR 9 billion to EUR 45 billion by 2100. At the same time, droughts are expected to significantly reduce the availability of water resources, with declines of up to 40% compared to current levels, while conditions in agriculture—especially in sectors requiring stable water supply—will become increasingly critical.

Drought risk is defined as the probability of the occurrence of impacts, damage, or economic losses during and after a drought period, depending on the interaction of hazards, exposure, and vulnerability within a given area. In order to improve the assessment and characterization of drought hazards, the Joint Research Centre (JRC) has recently developed an innovative event-based drought monitoring algorithm, together with a related European drought database, based on a spatiotemporal clustering approach (Cammalleri & Toreti, 2023). Following the adoption of the EU Strategy on Adaptation to Climate Change in 2021, the European Commission established the European Drought Observatory with the aim of enhancing drought resilience across the entire EU territory.

De facto, drought represents an extremely complex phenomenon that requires a multidisciplinary approach to holistic risk assessment, including potential cross-border effects, as well as impacts on other vulnerable regions.

Wildfires

In analyses of wildfires in Europe, climate change is identified as the key driving force. An increase in wildfires is projected, as higher temperatures and longer periods without precipitation are expected to facilitate fire ignition, intensification, and spatial spread. From a statistical perspective, wildfires are occurring with increasing regular-

ity and severity, given the substantial social, economic, and environmental damage they cause. Extreme wildfires, or so-called megafires, are also emerging in entirely new locations, including Northern Europe and even the Arctic.

With regard to causation, wildfires may arise as a result of natural phenomena—such as heatwaves, rising temperatures, and lightning—but they may also be triggered by human activity. The probability of wildfire ignition and spread primarily depends on vegetation type, terrain and topography, and prevailing meteorological conditions. According to recent assessments, as much as 90% of wildfires in Europe are directly or indirectly caused by human behavior, primarily through negligence, but also through deliberate ignition.

Over the past three years, numerous and highly destructive wildfires have been recorded across various parts of the continent, including some in atypical areas such as the Arctic, simultaneously causing significant human casualties and material damage. According to the European Forest Fire Information System (EFFIS), the year 2021 was the second-worst wildfire season on record compared to previous years, during which large-scale extreme fires affected Mediterranean countries, particularly within the Mediterranean basin.

Following the extreme wildfires of 2017 and the identification of numerous limitations in the Union Civil Protection Mechanism when responding to multiple and simultaneous emergencies, a dedicated reserve of resources was established. This reserve includes a fleet of firefighting aircraft and helicopters, as well as aerial assets for medical and emergency evacuation, along with stockpiles of medical equipment and field hospitals. In addition to the EU Solidarity Fund, which aims to mitigate the consequences of major disasters among Member States, a Global Fire Assimilation System and a Global Fire Information System have also been established to enhance monitoring, preparedness, and response capacities.

Chemical and Industrial Risks

A high level of industrialization of the economy—which, by its very nature, entails extensive use and consumption of various types of chemicals—inevitably results in significant exposure to the risk of chemical accidents. As the European Union seeks to maintain a high level of technological and industrial development, it possesses a highly developed chemical industry, along with a range of associated industries that also fall within high-risk categories. All of these industries utilize hazardous substances in large quantities that are toxic, flammable, or explosive, posing serious risks to human health and the environment.

Cross-border industrial accidents do not occur solely within production facilities but may also arise at other locations where hazardous materials are stored. The majority of chemical accidents in the EU, as well as globally, take place at fixed sites, particularly at facilities housing hazardous substance storage, with such areas commonly designated as hazardous or high-risk locations. According to the EU Seveso Directives, which establish requirements for controlling major accident hazards in industrial installations, this category primarily includes sectors related to chemical, oil, and

gas facilities, refineries, storage sites, power plants, the metal and mining industries, waste management facilities, and related sectors.

From a statistical perspective, more than 30 chemical accidents at Seveso sites occur annually on average across the EU. Due to the high number of Seveso establishments, cross-border risks from chemical accidents are present in almost all EU Member States, which further complicates not only national risk assessments but also the development of effective protection and response mechanisms. As long as industrial sectors within the EU remain highly developed and economically significant, Europe will continue to be exposed to the risk of potential cross-border incidents.

The implementation of effective protective measures—including population evacuation—often renders the specific location of an accident less decisive, given the cross-border impacts associated with the release of hazardous agents into the atmosphere. Industrial incidents or accidents, and the hazardous substances involved, can rapidly and easily cross administrative boundaries, while the scale and extent of contamination depend on the type and quantity of substances released, terrain characteristics, and prevailing meteorological conditions. These factors are of critical importance for the development of cross-border accident scenarios. However, available data indicate that only a limited number of EU countries have developed comprehensive scenarios and prepared operational plans for responding to such catastrophic events.

Nuclear and Radiological Accidents

Nuclear accidents occur when radioactive material is released into the atmosphere or water, potentially resulting in the contamination of people, food, water resources, or ecosystems as a whole. The primary pathways of exposure include inhalation and the deposition of radioactive material within the human body, which constitutes a significant health risk that must be anticipated in order to implement appropriate protective measures and countermeasures aimed at reducing both the likelihood of occurrence and the consequences of such events.

Shifts in European policy, particularly the adoption of the “green agenda,” which prioritizes renewable energy sources and the gradual phasing out of fossil fuels as dominant energy sources, have significantly reduced interest in the development of nuclear power plants in Europe. According to Eurostat data, a total of 106 nuclear reactors are currently operational within the EU, with the majority located in France (56 reactors). Germany, as a leading proponent of the green agenda and related policies, is the only country that has, several years ago, decommissioned a number of its nuclear power plants.

From the perspective of nuclear safety, a substantial risk to the EU also arises from neighboring non-EU countries that operate nuclear facilities, such as Russia with 38 reactors, Ukraine with 15, and Switzerland with four operational reactors. The Joint Research Centre (JRC), in cooperation with other partners, is actively engaged in accident modeling and the assessment of radiological consequences, employing state-of-the-art software simulation tools and applying specialized methodologies for hazard forecasting and diagnosis in nuclear emergency situations. In addition, plans

are underway to establish a database of source terms in order to assess the scope of all relevant models within the EU and neighboring countries. In a subsequent phase, the development of a conditional probability map of radiological risk is envisaged for all nuclear power plant locations in the EU, covering a wide range of safety- and security-related scenarios.

Natech Events

Natech accidents fall within the category of cascading events and occur when technological systems affected by natural hazards trigger a chain of subsequent technological accidents. Risk management of Natech events encompasses the processes of risk identification and assessment, the definition of objectives, and the design of measures and systems for their control (Necci & Krausmann, 2022). The key components of Natech risk assessment include the following elements:

1. identification and characterization of natural hazards;
2. identification of critical equipment;
3. damage to critical equipment caused by natural hazards;
4. accident-contributing factors;
5. Natech hazard identification;
6. Natech consequence analysis;
7. probability assessment of Natech accidents;
8. overall Natech risk assessment (Necci & Krausmann, 2018b).

Some authors classify Natech risk as a form of technological risk, given that it typically involves a clearly identifiable risk owner responsible for its management. Despite substantial progress achieved in the field of risk management, practice continues to reveal numerous weaknesses and shortcomings that require broader, more robust, and more frequent action—particularly by public authorities, industry stakeholders, and the academic community. The existing legal framework at the EU level has proven to be considerably more effective in managing Natech risks than arrangements at the local level.

In this regard, industrial facilities cannot be viewed in isolation from their surrounding environment. Some experts emphasize that addressing Natech risk requires a territorial approach to risk management, which, among other elements, includes the analysis of physical and socioeconomic factors (Suárez et al., 2020). Preparatory activities are currently underway to improve Natech methodologies and risk analysis tools, particularly with respect to enhanced equipment damage functions related to natural hazards and the integration of relevant economic and environmental factors into the analysis.

Cross-Border Impacts on Infrastructure Networks

As a result of the effects of various natural hazards, cross-border implications or impacts arise across numerous infrastructure sectors in the form of potential failures, service interruptions, disruptions, shocks, and similar disturbances. Within the academic community, key networks and services are commonly defined through the

functioning of critical infrastructures. Some authors refer to these networks as lifeline systems, as they primarily encompass essential physical assets, technological networks, and infrastructure systems of particular importance for public welfare. Other scholars use this term to denote critical infrastructures such as transport systems, telecommunications, electricity supply, and similar sectors, as they provide essential services to modern society (Cedergren et al., 2018). A third group of authors argues that essential networks do not exist in isolation but are embedded within the territories they serve, a characteristic referred to in the literature as the spatiality of infrastructure (Arvidsson et al., 2018).

This characteristic of infrastructure is crucial for two main reasons. First, certain features of networks, including their vulnerabilities, only emerge at larger scales as a result of interconnectivity. More specifically, the vulnerability of essential services or networks arises from their location within hazard-prone areas, their exposure to one or multiple hazards, and their interactive relationships with other functions present in urban environments. In other words, the vulnerability and exposure of critical infrastructures are not primarily the result of their intrinsic characteristics, but rather of the built environment with which they interact (Menoni et al., 2023).

When considering networks that provide essential services, it is first necessary to clearly define what constitutes a cross-border impact. This concept goes far beyond incidents occurring at borders or the physical disruption of infrastructure connecting two or more countries. In particular, it requires consideration of the potential for functional cascading effects, the nature of spatial interdependencies between countries and regions, and the fact that disruptions in one infrastructure sector within a single country may not only be transmitted across borders but may also be amplified in neighboring states. Moreover, the interdependence of infrastructure sectors—especially due to critical and networked services such as transport, information systems, and telecommunications—facilitates the upward transmission of disturbances and the cascading propagation of impacts from one system to another (Thacker et al., 2019).

Cross-border impacts encompass all effects, whether direct or indirect, that cross boundaries between administrative jurisdictions, particularly between states. According to Walia et al. (2020), spatial and temporal thresholds are highly relevant in discussions of impacts that can easily escalate from local to regional, national, or higher levels. Temporal thresholds, in particular, may generate significant damage and losses that persist for many years or even decades.

The cross-border implications of potential failures in networks providing essential and vital services triggered by natural hazards have prompted legislative initiatives at the EU level, resulting in the adoption of several key legal instruments. These include the Directive on the Resilience of Critical Entities (EU, 2022/2557), the Communication on the EU Disaster Resilience Goals (EU, 2023/68), and related policy acts.

In parallel, a clear conclusion emerges: the perspective on managing cross-border impacts must be significantly enhanced, improved, and increasingly standardized, particularly given the fragmentation and large number of actors involved in the provision of essential and supporting services, which represent an additional challenge for effective governance and coordination.

Health Risks

The COVID-19 pandemic exposed numerous weaknesses and shortcomings in the EU's preparedness capacities for managing health crises. At the very onset of the pandemic, limited competences of both Member States and EU institutions became evident, along with a lack of solidarity. However, the most critical deficiency was the absence of operational preparedness and response plans at both the national and pan-European levels. Despite opposition from certain Member States, EU institutions launched a series of initiatives, including steps toward the establishment of a European Health Union and profound institutional and regulatory reforms in the fields of health governance and crisis response (Renda et al., 2024).

During the pandemic, particularly in the domains of public health and emergency medical assistance, EU institutions revised existing policies and adopted new legislative frameworks that more clearly define cross-border health threats. In this context, a range of measures was introduced to prevent and mitigate the most significant risks, including pathogens with high pandemic potential, chemical, biological, radiological, nuclear, and explosive (CBRNE) threats, as well as antimicrobial resistance. Drawing on the lessons learned from the COVID-19 pandemic, the new framework strengthens the EU architecture for the prevention, preparedness, and response to serious cross-border threats to health through Regulation (EU) 2022/2371. It also expands the roles of key EU agencies by granting new mandates to the European Centre for Disease Prevention and Control (ECDC) and the European Medicines Agency (EMA).

In addition, a new institutional structure has been established. The Health Emergency Preparedness and Response Authority (HERA) was created to enhance preparedness and response to serious cross-border threats in the medical domain. The aforementioned regulation establishes the structure and procedures for the development of an EU Health Crisis and Pandemic Plan, which integrates national plans in order to ensure an effective and coordinated operational response. Beyond governance arrangements, the plan defines the necessary resources, capacities, forces, and supporting assets required for crisis management.

Several post-pandemic research studies have demonstrated that individuals infected with COVID-19 may experience symptoms of long COVID with diverse clinical manifestations. More than four years after the outbreak of the pandemic, scientists continue to document the long-term effects of the virus on human health. The overall conclusion is sobering, as the virus increases the risk of developing other diseases and health complications. This is most clearly illustrated by the findings of two studies. First, a French national study, published in the leading medical journal BMC Medicine, confirms that the effects of the virus may manifest long after the initial infection. Second, another study focusing on risk factors identifies three clinical subtypes of long COVID, depending on whether symptoms are predominantly neurological, musculoskeletal, or respiratory in nature (Kogevitas et al., 2025).

Conclusion

Since 2023, following the revision of the NUTS typology, Europe comprises 1,165 cross-border regions, of which 384 are land border regions, meaning that approximately one third of all regions within the EU carry a cross-border designation. This circumstance, combined with processes of global and regional integration in which Europe exhibits a high degree of interconnectedness with the rest of the world—across production, international trade and supply chains, financial flows, military alliances, and related domains—significantly contributes to the heightened sensitivity and vulnerability of the European space to changes in the global environment, particularly to external impacts originating beyond its borders.

Despite its critical importance for the EU, the issue of cross-border risks has not yet been extensively addressed, and even less so systematically researched. The number, intensity, frequency, temporal and spatial dynamics, as well as the ultimate consequences of cross-border risks and their impacts, continue to increase, while the pace of their monitoring, analysis, and risk management lags substantially behind. Consequently, there is a pronounced need—and a political imperative—for EU institutions to urgently intensify efforts toward the development of a unified methodology for assessing cross-border risks, the establishment of coherent mechanisms for managing such risks, and the elaboration of a common operational response to cross-border threats.

Collectively, these efforts shape the pathways and objectives for achieving EU resilience, which represents a critical intermediate step toward ensuring the Union's security and stability in relation to the current and potential horizon of hazards, threats, and risks emanating from the strategic and operational environment.

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S u m m a r y

During a long period, the prevailing belief among policymakers, the scientific and professional community, and professional circles closely involved in risk and security management, was that the European Union was not exposed to risk, or rather had a high degree of resilience to natural disasters caused by climate change or anthropogenic vectors, compared to other geographical regions. However, over the last 8 years, after extensive empirical, research, and analytical studies, it has been shown that this perception regarding the presence, intensity, and scope of risk events that currently or potentially affect the European space stands in stark contrast to new research findings and irrefutable evidence. Namely, cross-border risks have until recently been considered within the framework of national risk assessments in EU member states. The above approach has mostly not taken into account the transboundary impacts of new climate change, i.e. the risks where the initial risk created in one region or country can be transferred across national and administrative borders to other areas and geographical areas hundreds or thousands of kilometres away from the initial source. In order to correct this weakness in the development of assessments, the European Commission, supported by the Joint Research Centre as its expert service and the specialised agency – the Disaster Risk Management Knowledge Centre (DRMC) and the Union Civil Protection Knowledge Network (UCPN), have launched a wide-ranging activity to assess and map transboundary disaster risks in order to develop new and more appropriate disaster risk management (DRM)

strategies. A holistic approach to risk assessment, including horizon scanning, the development of numerous scenarios, the development of risk metrics, as well as new methodological tools and methods, represents the European Union's response to the dynamic development of the risk landscape in the current strategic and operational environment, and this overall activity is generated by the urgent need to adapt and improve existing risk reduction strategies, especially since previous strategies, tactics, operational responses, and security procedures have not demonstrated the necessary effectiveness in practice. The latest report by the European Environment Agency clearly elaborates and classifies transboundary risks, a total of 36 risks divided into 6 categories. Therefore, newer risk reduction strategies, assessment methodologies, not only of risks but also of vulnerability and resilience assessments, of communities, urban environments, infrastructure, etc., are designed to assess the impact of the type, character, intensity, and scope of transboundary risks in addition to national or local risks.

The seriousness and real concern about the occurrence of increasingly frequent disasters in the European Union is most vividly illustrated by the Dutch scientist Marlin C. de Ruyter from the Institute for Ecological Studies at the University of Amsterdam. In her works, in extremely in-depth analyses and projections, she suggests that the weakest link in the development and implementation of risk reduction is precisely the insufficient understanding and quantification of two types of risks: multiple risks and cross-border risks that are not sufficiently represented or established in current security agendas, global, regional or national assessments, and even less so in planning and operational documents.