COUNCIL OF EUROPE DEVELOPMENT BANK
BANQUE DE DEVELOPPEMENT DU CONSEIL DE L'EUROPE

TECHNICAL BRIEF

Managing Disaster Risks to Leave No One Behind

October 2023

ISSN 2707-5974 (print)
ISSN 2707-5982 (online)

Disclaimer

Acknowledgements

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Please cite this publication as:
Dell'Anna, S., Maslauskaite, K. and Rakcejeva, S. (2023). "Managing Disaster Risks to Leave No One Behind". Technical Brief Series. Council of Europe Development Bank, Paris.

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List of Acronyms

BCR	Benefit to Cost Ratio
Cat DDO	Catastrophe Deferred Drawdown Option
CBA	Cost-Benefit Analysis
CDP	*Cassa Depositi e Prestiti*
CEA	Cost-Effectiveness Analysis
CEB	Council of Europe Development Bank
CERC	Contingent Emergency Response Component
CRED	Centre for Research on the Epidemiology of Disasters
CRU	Climate Research Unit
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EM-DAT	Emergency Event Database
EU	European Union
EUSF	EU Solidarity Fund
GDP	Gross Domestic Product
GEM	Global Earthquake Model
GFDRR	Global Facility for Disaster Reduction and Recovery
HFA	Hyogo Framework for Action
IFI	International Financial Institution
IMF	International Monetary Fund
ISMEP	Istanbul Seismic Risk Mitigation and Earthquake Preparedness Project
MC	Member Country
NEX-GDDP	NASA Earth Exchange Global Daily Downscaled
OECD	Organisation for Economic Co-operation and Development
PFF	Public Finance Facility
RCP	Representative Concentration Pathway
PCVA	Participatory Capacity and Vulnerability Analysis
TRY	Turkish Lira
UN	United Nations
UNDRR	United Nations Office for Disaster Risk Reduction
UNHCR	United Nations High Commissioner for Refugees
USA	United States of America
WHO	World Health Organisation
WMO	World Meteorological Organisation

Executive summary

Disasters are exacting a high and growing socio-economic cost in all countries, including those in Europe. During the last four decades, natural disasters have impacted the lives of nearly 50 million people in the European Union (EU) alone, with the economic losses from such events estimated at over €480 billion (World Bank, 2021(a)). In 2023, climate-related catastrophes led to loss of life in Greece and Italy, while the earthquakes in Türkiye in February were among the biggest disasters in recent times, claiming more than 50 000 lives as well as an estimated immediate economic loss of US$104 billion, or 9% of the country's GDP (Government of Türkiye, 2023).

While natural events such as earthquakes cannot be prevented, their high costs and impacts can. Moreover, human activity can lie at the root of some disasters, such as flooding or wildfires. This Technical Brief provides an overview of best practices in disaster risk management (DRM) based on the CEB's experience, recent developments in the sector and a literature review. Since 2010, the CEB has financed 19 projects related to natural disasters in 13 member countries with loans amounting to more than €3 billion. As of 2023, 11 projects are active in eight countries, providing a total funding of more than €2 billion. Around half of this CEB funding is directed to reducing the risk of disaster, with the other half allocated to response and recovery.

Action in three key areas would help strengthen disaster risk management in Europe:

- **First, it is paramount to invest in disaster risk reduction which can greatly reduce the negative impact of disasters on people and our planet.** The effectiveness of investing in risk reduction, and not just responding when a disaster has struck, is recognised by the international community and enshrined in the UN-backed Sendai Framework for Disaster Risk Reduction.
- **Second, disaster risk management programmes should adopt a people-centred approach to address vulnerabilities and reduce their unequal impacts.** Vulnerable and economically disadvantaged people suffer the most from disasters. Disaster management should assess the needs of women, persons with disabilities, ethnic minorities and other socio-economically disadvantaged groups to reduce immediate and long-term impacts.
- **Third, a forward-looking financial strategy is crucial for meeting the needs of each step of the DRM cycle.** Ensuring the availability of timely and sufficient resources, including the creation of budget reserves, insurance and bonds specifically targeted at disaster-related activities, would help reduce disaster risks and manage their impact when and where they strike. Governments, citizens, international organisations and international financial institutions such as the CEB have a key role in ensuring that sufficient resources are available.

In addition to specific actions targeted at disaster risk management, it is crucial to build societies that are more socially cohesive and, as such, more resilient to crises, including natural disasters. For example, reducing regional and social inequalities and ensuring equal access to high-quality essential public services can contribute to the social, human and financial resilience of people and communities. In order to achieve these broad objectives, CEB supports actions across different social sectors, such as housing, education, urban development, health, microfinance, MSME financing, among others.

1. Introduction

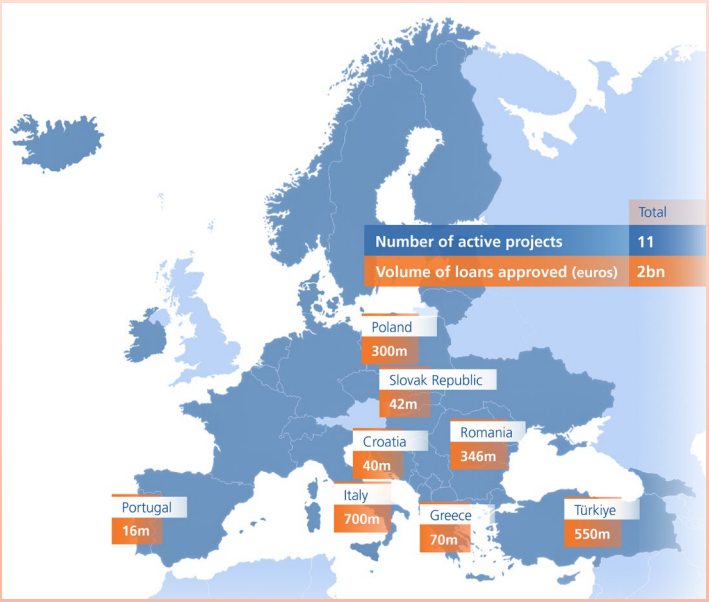
People in Europe and throughout the world have endured a succession of global and regional disasters and crises in recent years. From the COVID-19 pandemic to the catastrophic earthquakes in Türkiye, these events have exposed the lack of preparedness of European societies and economies in the face of shocks. We live in a world in which disaster risk is a growing concern for the vital systems and infrastructure upon which our societies and economies depend. Reducing such risk and improving preparedness and resilience, particularly among the most vulnerable, are therefore crucial for achieving sustainable development and promoting social cohesion.

Managing disaster risk has been one of the CEB's priorities since its creation in 1956. Indeed, disaster risk management is a building block that enables the Bank to fulfil its social mandate, while contributing to a wider sustainable development agenda behind. Today, in the CEB's Strategic Framework 2023-2027, addressing natural disasters constitutes one of the Bank's ten social sectors of activity with projects financed in a number of member states struck by different types of disasters in recent decades (see Box 1).

This Technical Brief consists of four main parts: the first one explains the key DRM concepts and presents data on the increasing and unequal impact of disasters; the second part discusses the importance of moving from disaster response to managing risks, highlighting the importance of disaster risk reduction and vulnerability analysis; the third part considers some financing options; and the fourth part outlines the conclusions and lessons learned based on CEB and international experience.

Box 1: The CEB's recent projects in disaster risk management (DRM)

Since 2010, the CEB has financed 19 projects related to natural disasters in 13 member states. Loans totalling more than €3 billion have been granted to prevent and manage the effects of flooding, earthquakes and wildfires. Of these 19 projects, 11 are currently active, with the CEB providing more than €2 billion in financing. The most prominent projects include reconstruction following the 2016-2017 earthquakes in Italy (two projects worth €700 million in CEB funding), the Istanbul Seismic Risk Mitigation and Earthquake Preparedness Project (ISMEP) in Türkiye (three projects, €600 million), flood prevention in the Odra and upper Vistula river basins in Poland (two projects, €505 million), flood risk prevention and response to the 2005 floods in Romania (two projects, €346 million), post-earthquake emergency health facility rehabilitation and reconstruction in Türkiye (€250 million) and a wildfire preparedness project in Türkiye (€200 million).



2. Disasters and their growing impact in Europe

2.1 Understanding disasters – key concepts

The definition of disasters has evolved over time. In the past, disasters were seen as singular, exogenous events, mostly resulting from natural hazards, but the importance of human activity as a cause of disasters and the extent of their impact is now increasingly recognised. A disaster, according to a UN definition, is a serious disruption in the functioning of a community due to a hazardous event, leading to losses and impacts across many dimensions, including human, material, economic and environmental aspects (UNDRR, n.d.(a)). In this context, disaster risk is a direct function of hazard, exposure and vulnerability, which we explain below (Figure 1).

Figure 1. Disaster risk equation

Hazard is a key element in the disaster risk equation above as it defines the type and likelihood of a disaster. Hazards can be understood as purely natural, such as volcanic eruptions, or man-made, such as wars, or they can be a combination of both, such as droughts caused by poorly managed aquafers or climate change, also known as anthropogenic or socio-natural disasters. Natural and socio-natural hazards are also often classified by their type, including geophysical (e.g. earthquakes), meteorological (e.g. tropical cyclones), hydrological (e.g. floods and droughts), and biological (e.g. those related to viruses or bacteria). Hazards can differ in their intensity, speed of onset and scale. This Technical Brief, in line with international policy frameworks, focuses on natural disaster risk, and socio-natural hazards where relevant.

The disaster risk equation shows that even when hazards are intense and large-scale, disaster risk depends on how exposed or vulnerable communities are to them. For example, an eruption in a small, remote, uninhabited volcanic island may only have limited effects on humans and the environment, and therefore not become a disaster as such.

Exposure relates to physical presence, and in particular the location of people, infrastructure and other tangible human assets within hazard-prone geographic zones (UNDRR, n.d.(b)). Removing critical infrastructure or human settlements from the areas where disasters may occur therefore reduces disaster risk.

Vulnerability refers to limitations in the characteristics and capabilities of a community, system or asset to withstand hazards and recover from them (UNDRR, 2009 in Chowdhooree, 2020). Some communities or individuals may be more sensitive to hazards: for example, children or people with disabilities may find it more difficult to evacuate a flood-prone area. However, their vulnerability can be reduced by increasing their adaptive capacity, such as having an emergency response plan and the means with which to implement it when the hazard occurs.

When hazards are combined with high levels of vulnerability and exposure, the risk and the impact of disasters are the greatest: high exposure increases the extent to which lives, communities and assets will be affected by an event, and vulnerability determines the differing degrees of damage or losses. Moreover, disaster risk can be further amplified by compounding and cascading hazards, as multiple disasters can happen at the same time or in close succession, and exhaust the capacity to respond (UNDRR, 2022(a); Liu & Huang, 2014; Pescaroli & Alexander, 2015).

2.2 Growing scale and cost of disasters

The frequency and impact of disasters are high and growing around the world, resulting in significant human, environmental and economic costs. On average, there were up to 100 annual reports of medium- and large-scale disasters[1] in the world between 1970 and 2000, a number that grew to 350–500 per year between 2001 and 2020 (UNDRR, 2022(b)).

Disasters have an increasingly heavy human cost. In the EU[2], disasters affected nearly 50 million people, or more than 10% of the population, between 1980 and 2020 (World Bank, 2021(a)). An estimated 3.7 million people globally and at least 200 000 in Europe have died as a direct consequence of disasters related to natural or socio-natural hazards since 1970 (UCLouvain & CRED, 2023). In Europe, heatwaves were the biggest killers, accounting for 75% of all recorded fatalities caused by natural disasters between 1970 and 2022 (Idem). In the CEB's non-EU member states,[3] nearly 86 000 people died as a result of disasters between 1970 and 2023, including the 50 000 deaths caused by the 2023 earthquake in Türkiye (UCLouvain & CRED, 2023; International Medical Corps, 2023).

In addition to the direct human costs, disasters can cause serious environmental damage, affecting biodiversity and ecosystems, as well as causing pollution and climate change. Extreme weather events can affect the ability of forests to absorb carbon dioxide, for instance: it has been estimated that the 2005 Gudrun storm in Sweden led to a decrease in the carbon sink of around 3 million tons in the first year following the storm, while the Lothar cyclone that swept through France, Belgium, Luxembourg and Germany in 1999, was associated with a carbon sink reduction of around 16 million tons or around 30% of the net European biome production (Lindroth et al., 2009). Past years have seen dramatic wildfires blazing throughout Europe, causing severe environmental damage. Moreover, recent historically hot summers have been characterised by desiccating soils with higher water stress for natural vegetation and crop production (Copernicus, 2022, 2023; Cammalleri, McCormick, & Toreti, 2022; Schumacher et al., 2022). Such environmental impacts raise the probability and scale of future disasters and will likely generate an underestimated economic and human impact in the form of land loss or degradation, negative effects on human health and food security, and the loss of homes and income (Birkmann et al., 2022).

The economic cost of disasters is also increasing. In terms of immediate yearly damage to property, crops and livestock, the global adjusted financial losses from disasters in the last three years are estimated at between US$200 and US$270 billion (UCLouvain & CRED, 2023). Figure 2 shows that these costs have risen in the past decades. In the EU, the average economic loss due to disasters was estimated at around €12 billion per year, totalling more than €480 billion between 1980 and 2020 (World Bank, 2021(a)). Storms, floods and earthquakes are among the costliest natural and socio-natural hazards in terms of economic loss. For instance, the August 2023 flooding in Slovenia caused at least US$550 million worth of damages, and according to the country's Prime Minister, was the "worst natural disaster" in the country's history (Mendonca, 2023). In non-EU CEB member states, the total adjusted economic loss from natural disasters reached more than US$77 billion between 1970 and 2023 (UCLouvain & CRED, 2023). This data does not include the economic impact caused by the 2023 earthquakes in Türkiye, which the Government has estimated at US$104 billion (Government of Türkiye, 2023).

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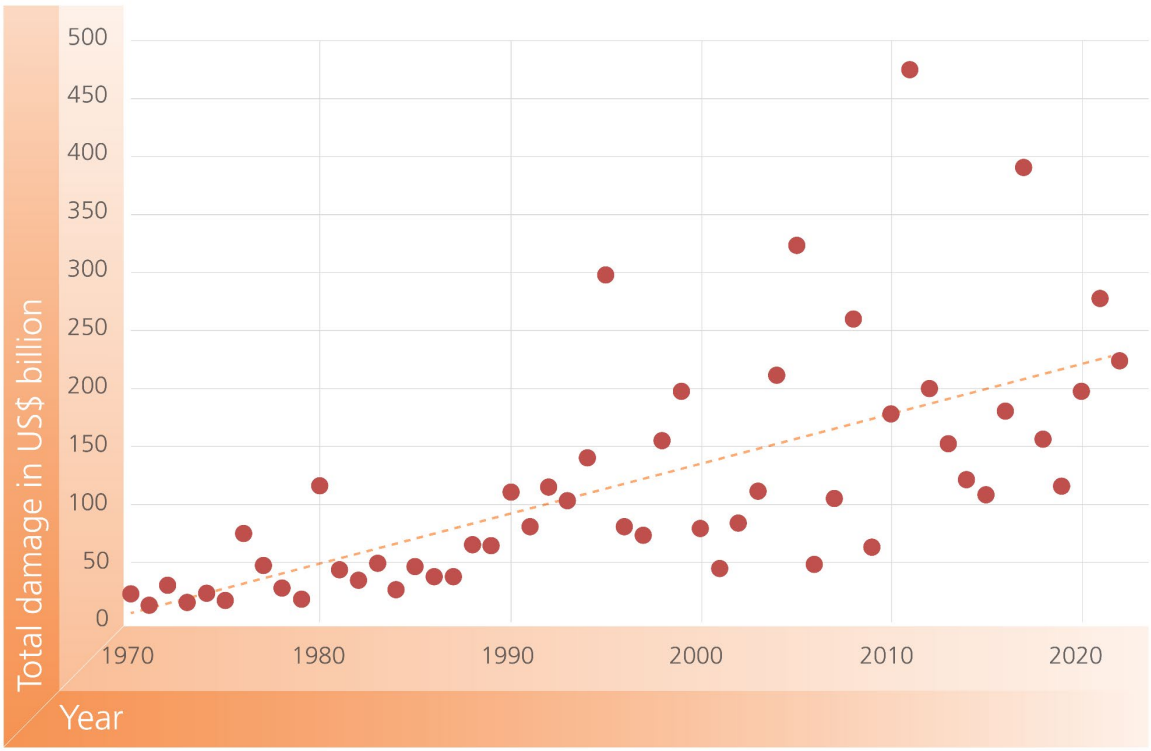
1 These include "geophysical disasters, such as earthquakes, tsunamis and volcanoes, climate- and weather-related disasters, and outbreaks of biological hazards, including crop pests and epidemics" (UNDRR, 2022(b)).

2 Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain and Sweden.

3 Albania, Bosnia and Herzegovina, Georgia, Iceland, Montenegro, North Macedonia, Norway, Republic of Moldova, Serbia, Switzerland, Türkiye and Ukraine. There is no separate data for Kosovo, Andorra, the Holy See, Liechtenstein and San Marino.

Figure 2. Rising costs of disasters: Total yearly adjusted damage globally, 1970-2023



Source: The authors' own visualisation of the EM-DAT dataset (UCLouvain & CRED, 2023)

Physical infrastructure in Europe is particularly vulnerable to disasters. A model developed by the OECD predicts that if a major flood were to happen in Paris, the infrastructure sector would bear 30% to 55% of the damage (Mullan et al., 2018). In addition, 35% to 85% of indirect business losses would be caused by infrastructure disruptions, such as in transportation and electricity, rather than directly by the flood itself. Some risk estimates suggest that in Europe, flooding alone could cause nearly €1 billion per year in road and railway damages (van Ginkel et al., 2020; Bubeck et al., 2019).

The negative long-term impact on the overall economy and society risks being higher still. Many costs are difficult to express in financial value, such as the loss of life, migration, long-term health impacts, general disruptions in economic activity and strain on public finances (Deryugina, 2022). The long-term economic effects are amplified by poorer health outcomes, population displacement and environmental degradation. Disasters generally also incur large opportunity costs in public spending as available resources are redirected to dealing with the crisis and away from planned investments, often in combination with a long-term deterioration in a country's fiscal position (Statista, 2022; World Bank, 2021(b)).

2.3 Why are disasters becoming more common and more severe?

Disaster risk and impact are increasing for two broad reasons. First, continuous urbanisation and population growth in cities expose more people and infrastructure to existing hazards, which is often accompanied by higher levels of vulnerability related to the lack of capacity to absorb higher population density. The second main driver of disaster risk and impact is climate change.

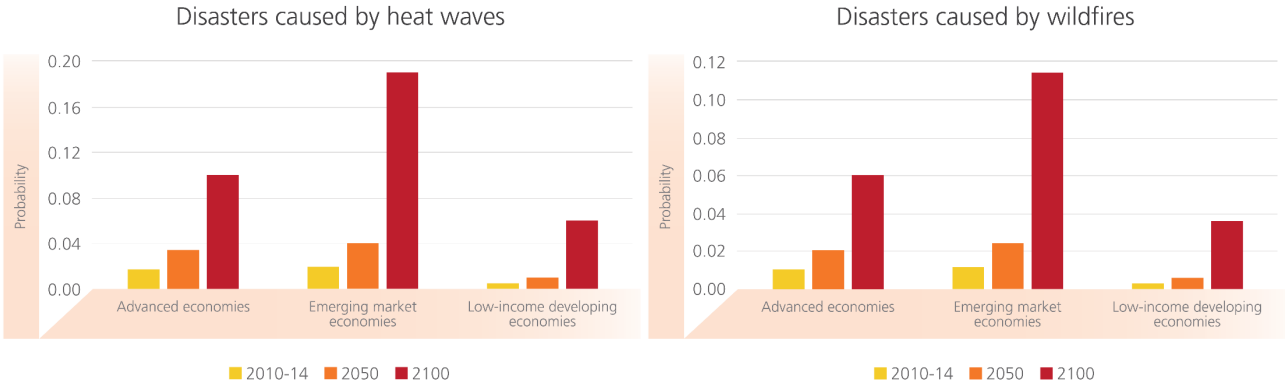
In Europe alone, the share of the population living in urban areas increased from 59% in 1960 to 75% in 2021 (World Bank, n.d.(a)), which has led to higher land use and deforestation (Quinney, 2020; Global Forest Watch, n.d.). As discussed in the CEB's previous Technical Brief "From Community Vulnerability to Resilience", European cities have become particularly vulnerable to natural and socio-natural hazards (Muzzini, Maslauskaite & O'Regan, 2022). As an example, urban growth in the past

decades has led to increasing soil sealing with almost half of Europe's urban area now having a low capacity to mitigate floods (Maes et al., 2019).

Certain specific features of European cities are directly linked to disaster impact. As an indication, the size of the built-up area in the EU is about 25 billion square meters, of which about 10 billion were built before the 1960s. Buildings dating to more than half a century ago often do not meet evolving needs or standards for resilience. For example, most buildings in the seismic-prone regions of Europe were designed without making provisions for earthquake resistance or following even moderate-level seismic codes (Tsionis et al., 2017).

The impact of climate change is driving increasing disaster risk across the continent and beyond. Higher weather temperatures amplify droughts, wildfires and heatwaves, whereas more intense precipitation results in floods, landslides and storms. As shown in Figure 3, it is estimated that, if greenhouse gas emissions continue to rise, the probability of disasters caused by heat waves and wildfires will increase dramatically in the coming decades, both in emerging and advanced economies, including Europe, where these hazards already have the highest impact (Acevedo & Novta, 2017).

Figure 3. The probability of natural disasters if greenhouse gas emissions continue to increase[4]



Source: The authors' recreation of Acevedo & Novta (2017)

2.4 Disasters impact vulnerable groups disproportionately

Widening social and regional inequalities can worsen the effects of disasters. Some individuals and communities can be disproportionally affected because they are more exposed to hazards, more vulnerable to them, or both. The determinants of unequal disaster impact are often based on the socio-economic status of individuals and communities, as well as gender, migrant background, health status, and so on.

Poverty remains a leading determinant of exposure and vulnerability to disasters. The economically disadvantaged are usually more exposed to hazards, more sensitive to them and have a lower adaptive capacity to deal with their consequences. At a global level, there is a correlation between the number of people affected by disasters and the proportion of people below the international poverty line in a given country (UNDRR, n.d. (c)). The income poor are typically more exposed to different types

[4] Sources: International Disaster Database (EM-DAT); Climate Research Unit (CRU); NASA Earth Exchange Global Daily Downscaled (NEX-GDDP); and IMF staff calculations. Note: Panels show the predicted monthly probability of a disaster in the years 2050 and 2100 based on climate change scenario RCP8.5. Most of the predicted probabilities for individual months are not statistically significant; the results should only be interpreted as indicative of the potential increase in the frequency of disasters with climate change. The county development level is based on the IMF classification (Acevedo & Novta, 2017; IMF, 2017).

of hazards as they live in less expensive and less safe areas. They can be more sensitive as they are more likely to depend on fragile infrastructure and housing, and they have a lower adaptive capacity due to their lack of access to financial savings, housing insurance and timely early warnings (Holzmann, Sherburne-Benz & Tesliuc, 2003; World Bank & GFDRR, 2021). Moreover, people experiencing poverty tend to depend on the environment, for example, by engaging in agricultural activities (Birkmann et al., 2022). This amplifies the disaster impact and makes it more long-term as people experiencing poverty often lose their livelihoods if the environment is affected by a disaster.

Economically disadvantaged individuals and households also tend to lose a much greater proportion of their income and assets than wealthier populations when disaster strikes (UNDRR, 2022). In Romania, Greece, Croatia and Bulgaria, for example, the socio-economic resilience[5] of the poor is on average 30% lower than the national average (World Bank & GFDRR, 2021). In Albania and Türkiye, this disparity is even more pronounced, with the difference reaching nearly 50% and 40% respectively (Idem). Estimates for Italy suggest that decreasing the exposure of economically disadvantaged populations to disasters by only 5% could prevent US$1 500 million in well-being (or consumption) losses and US$380 million in asset losses and in Greece, respectively, the impact could be US$960 million and US$260 million (Hallegatte et al., 2017).

Furthermore, disasters themselves can increase poverty and economic vulnerability through the loss of jobs or other income sources and the destruction of housing and assets (World Bank & GFDRR, 2021). At the European level, estimates suggest that, in the event of an unlikely, but realistic earthquake,[6] an additional 15% of the population in Tbilisi (Georgia) and 14% of the population in Bucharest (Romania) could fall into poverty following the disaster (World Bank & GFDRR, 2021). Similarly, in the event of an unlikely, but realistic high flood scenario, an additional 7% of the population in Shkodër (Albania) and 5% of the population in Tbilisi could fall into poverty as a result of the disaster (Idem).

Gender also plays a significant role in the disaster risk equation with women having higher vulnerability to disasters due to their reduced access to economic resources and to their roles in work, family and public life (Neumayer & Plumper, 2007). In European and Central Asian countries, 49% of males, but only 40% of females, have the ability to come up with emergency funds, which indicates women's lower adaptive capacity to deal with a crisis (World Bank, 2021(c)). In addition, evidence suggests that women are more prone to mental distress and are more likely to suffer from gender-based violence such as rape and sexual abuse during or after a disaster (Rezaeian, 2013). For instance, reported domestic violence increased by almost a third (32%) in France during the first week of the COVID-19 lockdown and by 20% in the three-week lockdown in Lithuania (European Institute for Gender Equality, n.d.). Gender-differentiated impacts of disasters and the social responses to them can exacerbate pre-existing gender inequality, especially in terms of access to economic resources, leading to greater impoverishment and less resilience to future disasters.

Disasters affect people with disabilities disproportionately because of their medical condition and the fact that their socio-economic situation is more fragile than the population average (Arnold et al., 2018). It is estimated that 1.3 billion people globally have a significant disability (WHO, 2023). More than 70% of individuals with disabilities do not have an individual preparedness plan in case of a disaster, 13% of those with disabilities have no one to assist them in case of an evacuation, and only one-fifth of individuals with disabilities think that they can evacuate immediately in case of a natural disaster (UNDRR, 2013). For example, during the 2011 Great East Japan Earthquake, the death toll of

[5] Socioeconomic resilience represents the ability of a given economy/socioeconomic group (based on household data) to minimise the impact of asset losses on well-being and is defined as the ratio of expected asset losses to well-being (or consumption) losses (World Bank & GFDRR, 2021).

[6] The probability of the event happening is 1 in 200 in any given year.

individuals with disabilities was twice as high as the death toll of people without any disability (Disability Information Resources, 2012). Disasters can also have a disproportionate impact on the socio-economic status of those with disabilities: after the 2014 floods in the Balkans, people with disabilities could not return to their jobs and had difficulties accessing their workplaces due to the delay in recovery efforts (World Bank & GFDRR, 2021).

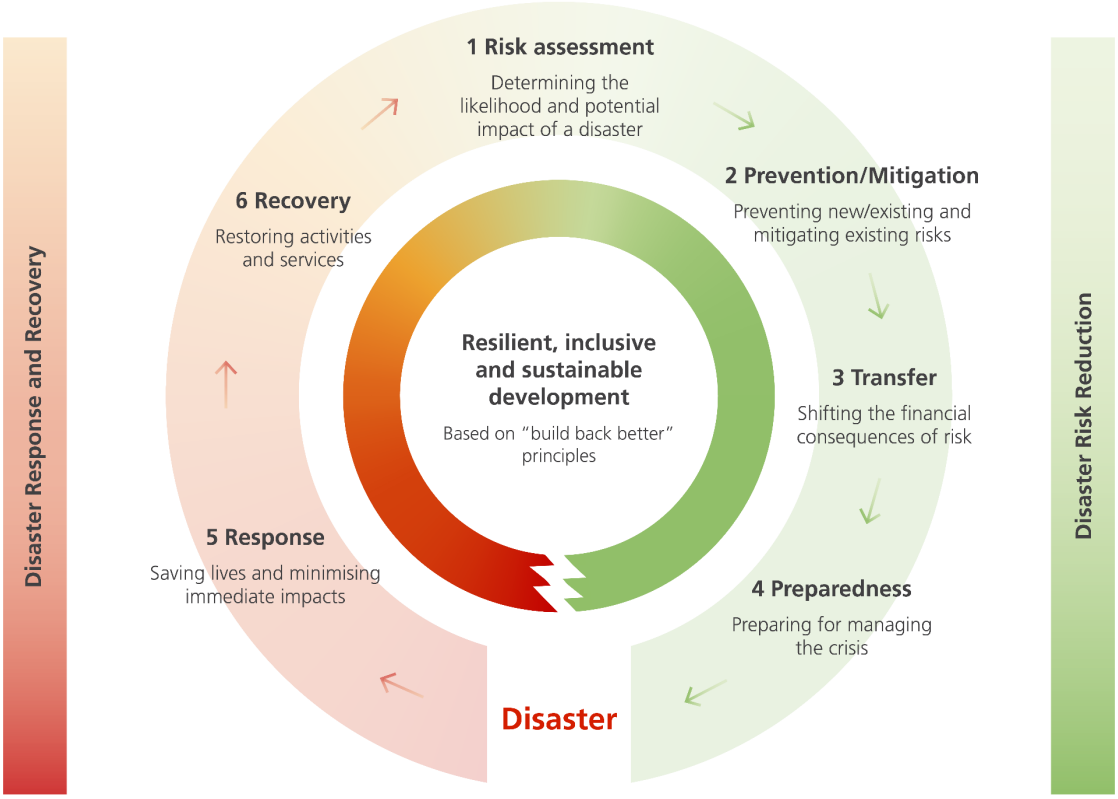
Ethnic minorities and migrants are often affected by disasters more than the general population. Their livelihoods may be more dependent on informal or seasonal employment, they may lack official documentation, and they tend to live in environments that are more exposed to disasters. For instance, following the 2014 floods in the Balkans, displaced Roma communities lost their informal and seasonal jobs such as street vending, and they could not access state help because of their lack of any legal documents and their pre-disaster social exclusion status (World Bank & GFDRR, 2021).

3. From responding to disaster impact to managing risks

3.1 Disaster risk management cycle

Disaster risk management is key for minimising the risk and the impact of disasters on humans and their environments. DRM can be presented as a cycle, which encompasses several interlinked phases before, during and after a hazardous event. These phases, as shown in Figure 4, are conceptually divided into two stages, pre-disaster, including risk reduction (right) and post-disaster, including response and recovery (left), with six steps: risk assessment, prevention/mitigation, risk transfer, preparedness, response, and recovery.

Figure 4. Disaster risk management cycle



Source: The authors' own interpretation of Le Cozannet et al. (2020)

In preparation for any possible disaster(s), risk assessment is a key step for establishing the risks and choosing different initiatives across the DRM cycle. It consists of analysing hazards, identifying exposure, assessing vulnerability, estimating impacts and evaluating the extent of risk. Once the risk estimation is established, risk reduction[7] measures are set up to minimise the impacts of future disasters by reducing exposure and vulnerability (UNDRR, n.d.(d)). They include prevention, mitigation, transfer and preparedness, as discussed in Section 3.2 below. Risk assessment is therefore a crucial first step for estimating the likelihood of different types of disasters happening within the selected geographical areas and communities. It also provides evidence for choosing actions in other stages of the disaster risk management cycle.

Post-disaster stages typically include response and recovery. Response measures are designed to save lives and minimise immediate impacts until more permanent and sustainable solutions are designed and implemented. Examples of response activities include providing targeted aid such as helping the affected population with transport, temporary shelter and nutrition, and performing initial repairs to damaged infrastructure. Recovery measures aim to restore economic and social activity. It is difficult to pinpoint when the response phase changes to recovery. Already during the recovery phase, there may be different types of opportunities to reduce vulnerability by integrating prevention and preparedness measures. Recovery programmes, designed based on the "build back better" principles, aim to smoothly transition to sustainable development that reduces vulnerabilities and ensures that populations become more resilient to disasters (Warfield, n.d.). Box 2 shows an example of a post-earthquake response and recovery programme in Italy financed by the CEB.

Box 2: A CEB response and recovery support project in Italy

Italy is one of the European countries with the greatest seismic risk, due to its geographical position between the African and Eurasian techtonic plates. Three earthquakes, in August 2016, October 2016 and January 2017, struck 138 municipalities in four regions: Abruzzo, Lazio, Marche and Umbria. More than 70% of the residential buildings in the municipalities affected by the earthquakes were built before 1974, the year in which the seismic building code was approved. As a result, these moderate earthquake events (5.5 to 6.5 magnitude on the Richter scale) inflicted catastrophic building damage and had a considerable impact, with 299 casualties, 40 000 people left homeless and more than 600 000 affected people in total.

The estimated reconstruction costs (damage plus the cost to "build back better") stand at €27.2 billion for both private and public infrastructure. *Cassa Depositi e Prestiti* (CDP), the Italian National Development Bank, has set up the "*Plafond Sisma Centro Italia*" (Central Italy Earthquake Fund), a facility for financial intermediaries in the affected regions, providing funds to final beneficiaries to cover reconstruction costs. The €350 million CEB Programme Loan, signed in 2018 and complemented by another €350 million in 2023, contributes to the CDP facility and thereby to the reconstruction efforts focusing on the private sector. The first CEB loan served to finance 3 028 private initiatives involving the reconstruction of dwellings and the recovery of private enterprise assets.

[7] Risk reduction can be defined as "the concept and practice of reducing disaster risk through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events" (Hugenbusch & Neumann, 2016).

A number of international frameworks and policies have been adopted by the international community and national governments in order to reduce the risks of disasters and their impacts. Following the devastating 2004 Southeast Asia Tsunami, the Hyogo Framework for Action (HFA) became one of the first critical milestones and a blueprint for DRM. At the end of its implementation in 2015, the HFA was replaced by the Sendai Framework for Disaster Risk Reduction with, as the name suggests, an increased focus on risk reduction (see Box 3). The Sendai framework is largely based on the DRM cycle and includes DRR policies and strategies to prevent new disaster risks, reduce existing disaster risks and manage residual risks, thus contributing to strengthening resilience and reducing disaster losses (UNDRR, n.d.(e)).

Box 3: Main international frameworks for disaster risk reduction

The Sendai Framework for Disaster Risk Reduction was adopted in 2015 during the World Conference on Disaster Reduction and endorsed by the UN General Assembly in June 2015, replacing the Hyogo Framework for Action (HFA), used from 2005 to 2015. The Sendai Framework focuses on the adoption of measures that address all dimensions of disaster risk – hazard, exposure, vulnerability and coping capacity – to prevent the creation of new risk, reduce existing risk and increase resilience. Four priorities were highlighted: (1) understanding disaster risk; (2) strengthening disaster risk governance to manage disaster risk; (3) investing in disaster risk reduction for resilience; and (4) enhancing disaster preparedness for effective response and to "build back better" in recovery, rehabilitation and reconstruction. Alongside the four priorities, there are seven targets. Each target and priority comprises a series of activities that are coordinated at local, national and international levels (UNDRR, n.d.(e)).

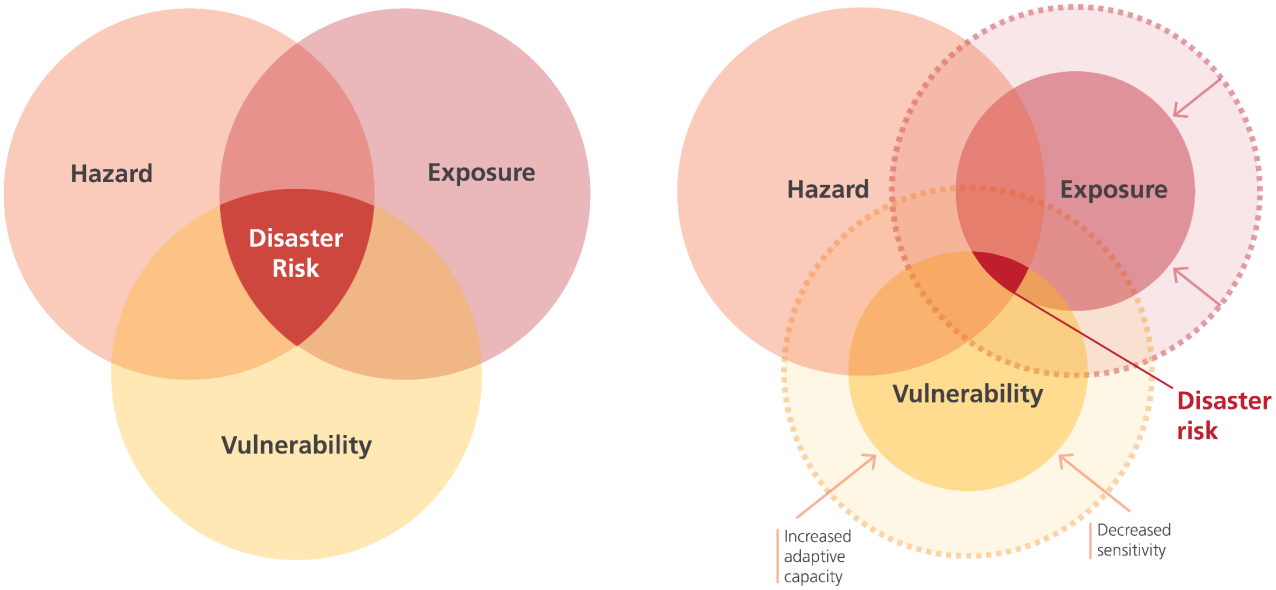
Just past the halfway point of the agreement's 15-year life, member states and their partners have made significant achievements in risk reduction since 2015. However, despite discernible progress, the world is off-track to reach the goals of the Sendai Framework by 2030. In Europe and Central Asia, significant progress has been made in achieving Priority 1 (understanding disaster risk) and Priority 2 (strengthening disaster risk governance to manage disaster risk), but the progress has been the slowest towards Priority 3 (investing in disaster risk reduction for resilience), and progress varied in Priority 4 (enhancing disaster preparedness for effective response and to "build back better" in recovery, rehabilitation and reconstruction) (UNDRR, 2023).

From 2015 to 2016, in addition to the Sendai Framework for Disaster Risk Reduction, three other related global agendas were adopted, namely (1) the Addis Ababa Action Agenda on financing for development (2) the 2030 Agenda for Sustainable Development; and (3) the Paris Agreement to combat climate change. The Sustainable Development Goals (SDGs) of the 2030 Agenda outline targets for a holistic plan of action for people, planet, prosperity, peace and partnerships to which the Paris Agreement and Sendai Framework pose specific drivers of change, as well as pressures that challenge the future achievement of these goals.

3.2 Critical role of disaster risk reduction

DRR can influence disaster impact or whether the disaster happens at all. As shown in Figure 5, the risk can be reduced through systematic efforts to assess, understand and manage the causal factors of disasters across two of the three variables of the disaster risk function, namely exposure and vulnerability. Exposure can be reduced by relocating communities and assets from hazard-prone locations. Lower levels of vulnerability can be achieved by ensuring that communities are less sensitive to hazards and/or have a higher adaptive capacity to deal with them. As for the third variable, the likelihood of socio-natural hazards is increasing, mostly due to climate change, as discussed above. However, it could be contained if societies manage to limit the impact of their activities on climate change.

Figure 5. Disaster risk reduction: lowering exposure and vulnerability decreases disaster risk (right) compared with business as usual (left)



Source: The authors' own interpretation based on Asian Disaster Preparedness Center (2005)

Within the DRM cycle, DRR measures are typically classified into prevention/mitigation, risk transfer and preparedness (Figure 4). *Prevention/Mitigation* measures aim to decrease exposure by minimising the likelihood of a hazard reaching the population (e.g. building physical infrastructure to prevent floods, installing irrigation systems to minimise droughts or land-use planning) or to mitigate the risk by reducing vulnerability to the potential hazards (e.g. undertaking seismic mitigation works on existing schools and hospitals to reduce their structural vulnerability to a potential earthquake). *Risk transfer* measures aim to transfer and share the financial risk (e.g. (re)insuring public and private property). *Preparedness* measures seek to decrease vulnerability or to reduce exposure by putting in place initiatives that minimise the impact of a disaster and raise awareness among citizens and institutions (e.g. establishing early warning systems, enforcing building codes, engaging in contingency planning, building shelter facilities, maintaining networks for emergency response, and providing information and education) (Hugenbusch & Neumann, 2016). Box 4 presents a DRR project in Türkiye financed by the CEB and other IFIs.

Box 4: Earthquake risk reduction in Türkiye

Türkiye is highly vulnerable to natural disasters, particularly earthquakes, as the tragic events of February 2023 in which thousands of lives were lost, showed. The Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP) was initiated in 2005 by the Turkish Government with the initial support of the World Bank in the wake of the 1999 earthquake in the Marmara region. The earthquake had a death toll of 17 000, with a direct economic impact estimated at some US$5 billion, or around 2.5% of GDP. Istanbul is among the most vulnerable metropolitan areas because of its seismic-prone location on the North Anatolian Fault and of its high population and industrial/commercial densities.

The probability that Istanbul will experience a seismic event of a magnitude in the 7.5 range on the Richter scale over the next twenty years is estimated at 60%. According to assessments carried out in 2002, an earthquake of 7.5 magnitude would result in up to 87 000 fatalities, 135 000 injuries and heavy damage to 350 000 public and private buildings. The CEB has supported the ISMEP project with three loans: two loans of €250 million in 2010 and 2014 and a loan of €100 million following an earquake of medium intensity that hit Istanbul in 2019. The CEB loans have specifically financed the seismic mitigation of schools, public buildings and health facilities (including public awareness initiatives). The first two CEB loans have contributed to the seismic mitigation of 226 public school buildings alongside other priority public buildings, such as student dormitories and public hospitals.

Every euro invested in DRR can potentially save from several to even tens of euros, depending on the context and the risks. Pioneering research in the USA found that, on average, every dollar spent on disaster risk reduction provides the US Government with about four dollars in future benefits (National Institute of Building Sciences funded by FEMA, 2005). Germany's Relief Coalition Institution reviewed 117 case studies of investments in DRR and found that, in approximately 90% of cases, DRR brought positive value for money (Hugenbusch & Neumann, 2016).[8] These investments included measures such as wildfire prevention or the strengthening of existing buildings in earthquake-prone areas in Europe, particularly for private buildings that tend to be less resilient. With regards to hydro-meteorological hazards, amongst the most common in Europe, research studies unanimously report positive value for money for disaster risk reduction, with an estimated benefit-to-cost ratio (BCR) of between three and six (Hugenbusch & Neumann, 2016). In the Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP) in Türkiye, co-financed by the CEB and presented in Box 4, it is estimated that the completed risk reduction measures would save €12.5 billion in the form of prevented injuries and casualties, avoided production loss and preserved building contents, among others, which is more than seven times greater than the investment cost. Some of the non-structural DRR measures, which are presented below, can save up to 36 euros per every euro invested (Hallegate, 2012).

DRR measures are often split into structural measures and non-structural activities. Structural measures are related to physical constructions, engineering techniques or technology to achieve hazard resistance and resilience in the built environment. Such measures could include dams, flood and wave barriers and earthquake-resistant buildings (see an example in Box 5). Non-structural initiatives relate to knowledge, practice or agreements to reduce disaster risks and impacts through policies and laws, public

[8] A widely-used tool to assess the effectiveness of DRR is cost-benefit analysis (CBA). The method compares the economic returns generated by an activity (benefits) with the amount spent for the activity (costs), and if the share of benefits to costs (BCR) is greater than one, then benefits outweigh the costs. In most of the methodologies, the benefit is defined as the 'avoided damage' thanks to the investment (hence the cost) in DRR. However, CBA does not give a complete picture as certain aspects that can be improved by DRR such as the human life and psychological well-being are difficult to quantify using a monetary value thus CBA calculations should not be the only aspect to consider when making financing decisions.

awareness raising, training and education. These can include building codes, land-use planning and regulations, risk assessment and public awareness campaigns (UNDRR, n.d.(f)).

Box 5: The CEB's role in flood prevention in Croatia

Croatia is exposed to hydrometeorological events, such as floods, landslides, and forest fires. A major flood event hit several areas of the country in 2014 and had a significant socio-economic impact, affecting more than 36 000 people. With a €40 million loan, the CEB supported the Government of Croatia in 2014 to reduce to the flood risks in selected areas of the Danube and Adriatic River Basins by rehabilitating and building flood protection infrastructure. The programme financed 31 flood mitigation infrastructure subprojects implemented by Croatian Water (Hrvatske Vode) and aimed at reducing flood risks for both populations and assets in mainly rural areas with populations of more than 90 000 people. By 2019, 5 100 people had been directly protected from floods, with an additional 75 800 indirect beneficiaries. Almost 2 000 units of dwellings and land, more than 37 000 km of infrastructure and 78 local administrative, economic and cultural buildings were protected by the programme.

Information campaigns, warning systems and other non-structural actions are particularly effective for Europe's most frequent disaster risks, such as those related to flooding, droughts and heatwaves (Hugenbusch & Neumann, 2016). For instance, every euro invested in weather and water-related information and early warning systems in Europe brings 4 to 36 euros in benefits and savings generated (Hallegate, 2012). Similarly, non-structural measures for extreme heat prevention, such as heatwave early warning systems show a high level of cost-effectiveness[9] that is from tens to hundreds of times higher than for structural measures (World Bank, 2021(a)). In terms of impact on human lives, countries with limited to moderate coverage of multi-hazard early warning systems had a mortality rate of 4.6 persons per 100 000 people in 2005-2021 compared to 0.6 persons per 100 000 people in countries with substantial to comprehensive coverage (UNDRR & WMO, 2022). In France, the early warning systems were upgraded after the 2003 heatwave that resulted in more than 15 000 deaths; thanks to these systems, and as a result of increased risk awareness by the population, the number of deaths was divided by three in the subsequent heatwave of 2006 (WMO, 2013).

Risk reduction measures often remain underfunded, despite international evidence of their effectiveness. Out of every US$10 of development assistance for natural disasters in 2005-2017, only 40 cents were allocated for disaster risk reduction (UNDRR, n.d.(g)), with the remainder funding disaster response and recovery (UNDRR, n.d.(g)). Several factors can explain this trend, observed in different countries and contexts. DRR expenditures do not generate immediately visible benefits and may not always yield as much public support as disaster response does (Vorhies, 2012). There is also an issue concerning the lack of comprehensive data and universally accepted methodologies for estimating economic benefits of DRR expenditures, which can make quantitative assessments and strategic planning difficult. The difficulty with strategic planning is further aggravated by the fact that the importance of DRR is recognised only after a disaster happens (World Bank, 2021(d)).

In addition to risk prevention, preparedness and mitigation measures, risk transfer plays an important role in DRR, **especially for events that have low frequency and high severity.** Risk transfer mechanisms make it possible to minimise disaster costs by transforming the high total cost of a disaster into smaller annual payments (premiums) (Meenan, Ward & Muir-Wood, 2019). The "Financing disaster risk management" section explores the different financial instruments for risk transfer.

[9] As defined in the reference, the cost-effectiveness analysis (CEA) is used to identify options with the lowest cost to meet a specific, predefined target or policy objective. As the project costs are the variable of consideration, the CEA does not require the quantification of benefits and can therefore also be applied with intangible or more qualitative benefits.

3.3 Social vulnerability at the heart of disaster risk reduction

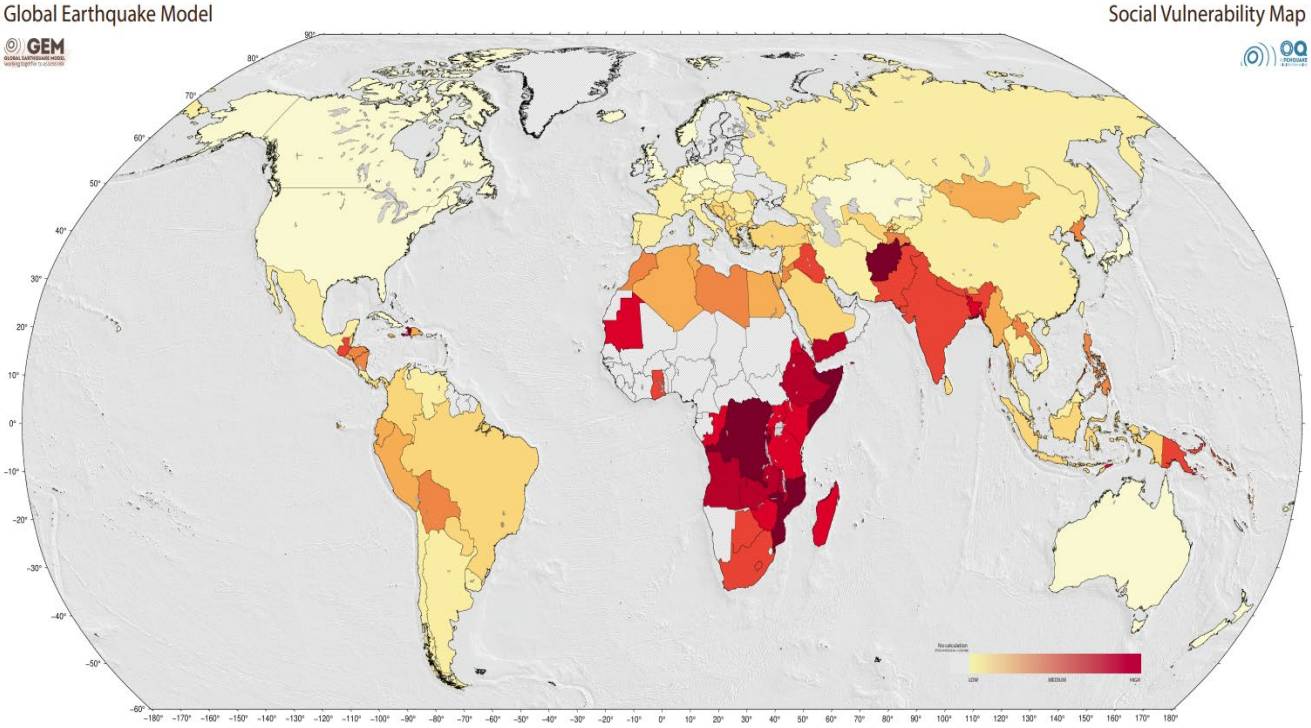
A vulnerability analysis can help better design DRR measures to address the needs of particularly vulnerable individuals and populations due to the unequal impact of disasters. Such analysis provides a mapping of specific groups of people who are likely to be the most harmed when a hazard happens. Instead of – or in addition to – analysing the vulnerability of a physical structure in terms of its sensitivity to certain types of damage and its adaptive capacity to withstand them, a people-centred approach focuses on a social vulnerability analysis in order to understand the effects on individuals and their livelihoods as a result of physical damage. For example, if people rely on a physical structure's ability to survive a hazard, then part of their vulnerability is incorporated in the potential for damage to that physical structure. Damage is then measured not only in terms of capital loss of the structure (as is the norm), but also as the loss of the flow of income to those who rely on the structure in order to live (Cannon, 2022).

Different indices have been developed to measure social vulnerability related to disaster risk combining different socio-economic and geographic indicators. For example, the Inter-American Development Bank's Prevalent Vulnerability Index combines indicators on exposure in disaster-prone areas (such as population growth, density and extreme poverty alongside other economic indicators), socio-economic fragility (such as unemployment rate, inequality and food price inflation, among others) and lack of social resilience (measured by indicators such as the Human Development Index, Gender-related Development Index, social spending, Governance Index and Environmental Sustainability Index) (OECD, 2012). The United States Centre for Disease Control has also developed a social vulnerability index to understand and visualise different combinations of social factors that can increase a community's social vulnerability risk over the entire course of a hazardous event. The index includes data on socioeconomic status, household composition and disability status, minority status, and access to housing and transportation (Flanagan et al., 2011).

A social vulnerability assessment can also be done at a community level to better understand the specific needs of groups and individuals, based on their living environment, institutional context, culture and other intangible aspects that are difficult to evaluate with hard data. A widely-used community-level method in a disaster context is the participatory capacity and vulnerability analysis (PCVA), which considers community knowledge alongside scientific data to understand local risks and inform local disaster action plans. The process involves collecting secondary data, generating contextual information, analysing the data, prioritising risks, designing action plans and moving towards implementation by engaging in community and stakeholder consultations and using participatory methods. It is important to note that the goal of the PCVA is not to extract information from communities but rather to facilitate community action for communities to design their own disaster action plans (Ahmed, Fuenfgeld & McEvoy, 2012).

Social vulnerability is often identified in relation to a specific hazard. For instance, the Global Earthquake Social Vulnerability Map (Figure 6) is based on a composite social vulnerability index that consists of 78 indicators, including the shares of age-dependent, homeless, disabled, under-educated and foreign migrant populations alongside indicators on population density, slum populations, and international tourists (Burton & Toquica, 2020). The objective is to measure the characteristics or qualities of social systems that create the potential for loss by looking at the social capacities and demographic attributes of each country. According to this index, among CEB member states, Türkiye, the Republic of Moldova, Greece, Croatia and the Western Balkans have the highest level of social vulnerability to earthquakes.

Figure 6. Global earthquake social vulnerability map: from low (light yellow) to high (dark red)



Source: Burton & Toquica (2020)

More complete analyses look at how multiple hazards affect social vulnerability. When multiple hazards occur within a short time span, or as a result of one another, understanding the evolving sensitivity and adaptive capacity becomes key for addressing the needs of the most vulnerable populations. The existing literature suggests that demographic characteristics, socioeconomic status and land tenure are important drivers of multi-hazard social vulnerability (Drakes & Tate, 2022). However, such analyses remain underutilised in DRM science and policy because they are difficult to carry out as the compound or cascading impacts of different hazards are difficult to predict.

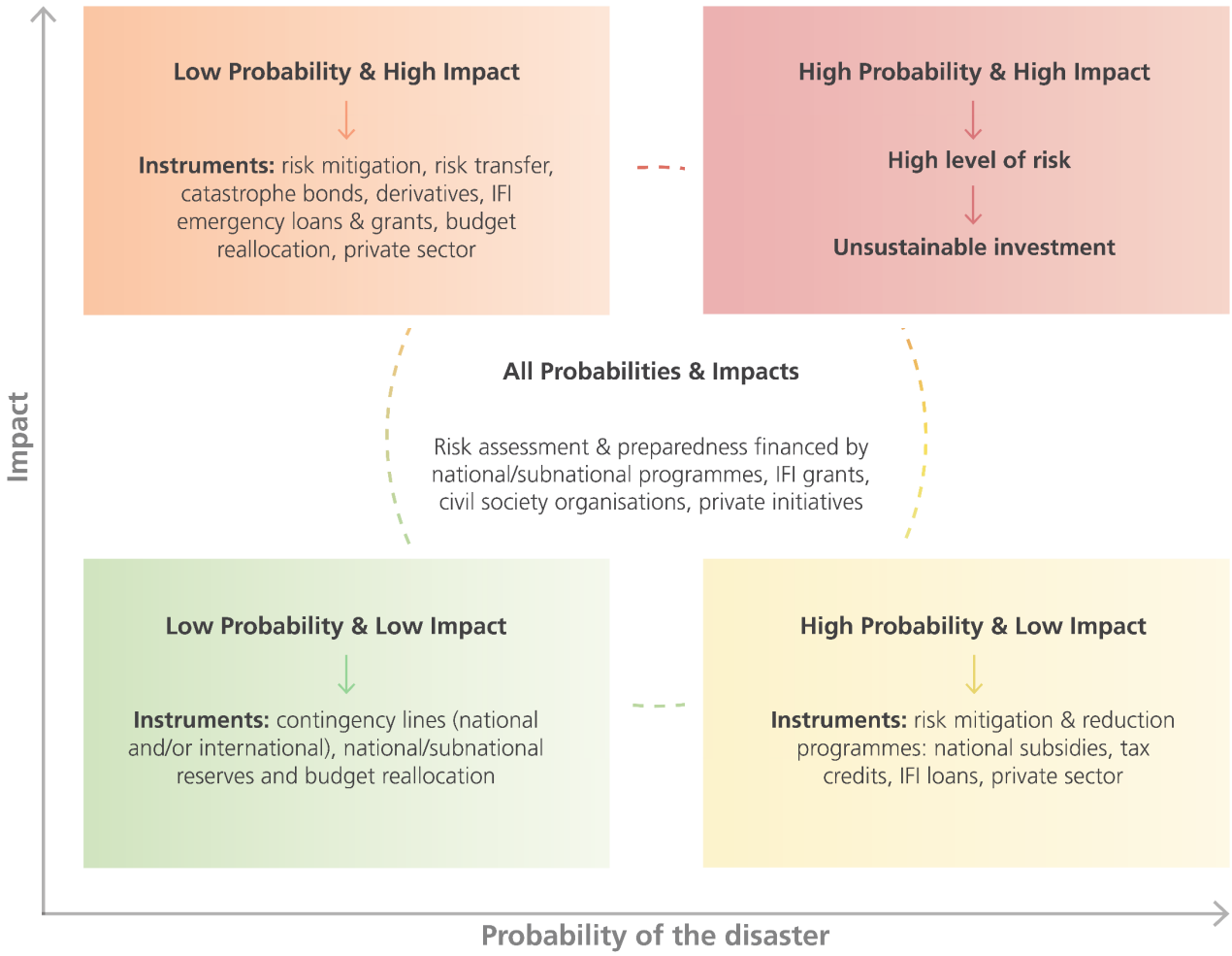
The CEB looks at social vulnerabilities when financing its projects in ten different sectors of activity, including natural disasters. The vulnerability approach presented in the Bank's Strategic Framework 2023-2027 focuses on disadvantaged individuals and groups of people, the well-being of whom is key for ensuring social cohesion for communities and societies as a whole. By identifying the specific sources of vulnerability that each project aims to address, the CEB's vulnerability framework can help design better solutions, adapted to the needs of the targeted beneficiaries. It can also be instrumental to understanding how vulnerability factors may generate risks or constraints to the achievement of a project's objectives, so that project design and implementation can be tailored to overcome such obstacles.

4. Financing disaster risk management

Designing a financing strategy is crucial for meeting the needs of each step across the DRM cycle. Damage to public and private physical assets and economic losses are usually financed by the national government and the affected populations with their own resources. Options for designing a financing plan for DRM are based on a risk assessment, which outlines the expected disaster impact and the probability of the risk. A matrix with a combination of low/high impact vs. low/high probability of the

disaster is shown in Figure 7. In areas with a high disaster probability with a high impact (upper right corner), the high level of risk makes the investment unsustainable as high damages would be incurred too frequently. For example, it would be financially untenable to re-build a house located in a frequently flooded area, rather than moving the asset and reducing exposure.

Figure 7. Disaster risk management financing options



Source: The authors' own visualisation

In places where hazardous events happen regularly, governments may choose to create budget reserves and contingencies that can be used specifically for financing disaster-related activities pre and post-disaster. Such reserves typically represent 2-5% of the annual government budget (Meenan, Ward & Muir-Wood, 2019). The cost of the instrument is one to two times greater than the expected pay-out,[10] which makes it one of the lowest-cost disaster financing instruments (Ghesquiere & Mahul, 2010).[11] The main disadvantage of this approach is the opportunity cost of unused funds if the disaster does not materialise. The reserves are usually complemented by budget reallocations, which involve using funds from other planned government programmes to finance disaster-related expenditures.

[10] "The cost multiplier represents the estimated cost of resources as a multiple of the average expected loss it finances" (Ghesquiere & Mahul, 2010: 10).

[11] "Reserves are generally held in short-term assets; their cost is the difference between the returns on long term investments and on short-term investments" (Idem).

Contingent financing instruments provide an alternative ex-ante mechanism to finance post-disaster emergencies for low-probability and low-impact events. They typically consist of pre-approved credits that provide liquidity immediately after a disaster strikes. For instance, the World Bank contingent financing options include the Contingent Emergency Response Component (CERC) and a Catastrophe Deferred Drawdown Option (Cat DDO) (see Box 6). These credit lines are often conditional, incentivising governments to design and implement prevention and preparedness activities (such as updating risk assessment, improving policies for reducing risks, raising risk awareness, integrating risks in land use planning, etc.) and allowing a rapid post-disaster response. Similarly to budget reserves, the cost of contingent debt facility is about one to two times greater than the expected pay-out (Ghesquiere & Mahul, 2010).

Box 6: The World Bank's CERC and Cat DDO

The Contingency Emergency Response Component (CERC) is an ex-ante emergency component that is embedded upstream in standard programmes and projects in countries prone to disasters. The component is designed at project appraisal, therefore approved before an emergency happens and, in the case of a disaster, the component rapidly finances pre-approved post-disaster expenditures such as goods, works and consultant services. There are three design possibilities for the CERC: it can be fully funded, represent a contingent window or involve a combination of both options. A contingent window component receives a small or no allocation at the project approval stage. If a disaster hits, funds can be re-allocated to it from other components (World Bank, 2009).

The Catastrophe Deferred Drawdown Option (Cat DDO) is a contingent loan that provides immediate ex-post disaster financing: funds are approved before an emergency, but are disbursed only after the drawdown trigger (usually the country's declaration of state of emergency) is activated. For the loan to be approved, the country must have or be preparing a satisfactory DRM framework and have an adequate macroeconomic policy framework. Usually, the country loan limit is the lesser of either US$500 million or 0.25% of GDP (World Bank, 2021(e)).

When the probability of a disaster happening is low, but with a potentially severe impact, market-based risk transfer mechanisms, in particular insurance, provide alternative financing solutions. Given the high contribution of residential building to overall damage due to earthquakes and floods in Europe, household catastrophe insurance can be very effective in disaster risk reduction. Damage to residential housing constitutes at least 50% of all losses in many European countries in the event of an earthquake, and range from 65% in Italy, Spain and Portugal to 35% in Poland and Lithuania in the event of a flood. It has been estimated that the uptake of private insurance in the EU could reduce government liabilities[12] by 50% (from €100 billion to €50 billion) for extreme events and decrease them by almost 70% (from €30 billion to €10 billion) for smaller disasters (World Bank, 2021(b)).

However, insurance products remain underutilised at both household and government level due to their high cost. Only a third of all the losses related to natural hazards in the EU were insured between 1980 and 2017 (Tavares Da Costa & Krausmann, 2021). Typically, the cost of insurance is twice

[12] Government liabilities are defined as the public assets such as administrative buildings, public hospitals and schools, roads, bridges, as well as the emergency response costs and residential losses covered by the government, minus insurance coverage for these assets; in some cases, the government is expected to reconstruct damaged housing of all uninsured households.

that of the expected pay-out (Ghesquiere & Mahul, 2010).[13] Microinsurance can provide a lower-cost alternative for individuals to cover parts of the disaster losses for those who cannot afford traditional insurance, but it remains underdeveloped in many European countries. At government level, the costs can be reduced by establishing sovereign risk pools whereby administrative units can purchase a shared insurance policy, benefiting from economies of scale and a more diversified risk profile (Meenan, Ward & Muir-Wood, 2019). One of the most notable examples of a sovereign risk pool is the Caribbean Catastrophe Risk Insurance Facility that was set up in 2007 with the help of the World Bank and includes small Caribbean islands and a few Latin American countries. The members pay a premium, the size of which depends on the required pay-out after a disaster. As of 2022, the facility has made 58 pay-outs worth a total of US$260 million, which have benefitted more than 3.5 million people (The Caribbean Catastrophe Risk Insurance Facility, 2022).

Financial derivatives and catastrophe bonds are market-based products that can be used alongside insurance to transfer the risk for low-frequency and high-impact disasters. For instance, if a country wishes to hedge a weather-related risk, it can purchase a weather derivative contract by paying a premium, and the seller of the derivative accepts the risk of a disaster happening. The buying country receives a payment if the index, which reflects losses or liquidity needs after a weather-related, adverse event crosses a pre-determined limit during the contract period. The advantage of weather derivatives over standard insurance is the fact that no assessment of the incurred loss is needed, which allows for rapid disbursement (World Bank, n.d.(b)). Like the weather derivative, the Cat bond, allows countries to transfer some of their natural disaster risk to the capital markets and provides an alternative to standard insurance coverage. If a disaster hits during the bond's life, the bond principal finances post-disaster response and reconstruction in the sponsoring country. The advantage of Cat bonds over standard insurance is that they provide countries with coverage for several years at a fixed cost over a bond's life, thus ensuring stability compared to the volatility of annual insurance premiums (World Bank, n.d.(c)).

For immediate post-disaster response, which is usually unplanned, the main financing options are emergency loans or grants from IFIs and donors. Emergency loans constitute one of the lowest-cost instruments (only behind grants), with the cost of the instrument being around one to two times greater than the expected pay-out (Ghesquiere & Mahul, 2010).[14] At the CEB, projects approved in favour of populations heavily affected by natural disasters benefit from accelerated, fast-track procedures for appraisal and approval. Fast-tracked emergency projects may benefit from higher funding ratios in relation to the total cost of the project and a larger amount for the first tranche, while eligibility criteria for certain categories of expenditure can be extended to allow for their rapid redeployment as emergency support. Moreover, IFIs as well as bilateral partners can offer grants blended with loans. In the case of Türkiye, for instance, in April 2023 the CEB quickly supported the Turkish Government's earthquake response with a €250 million loan recover critical health services (see Box 7), while at the same time establishing a Disaster Prevention and Recovery Fund to assist Türkiye and other member states to prepare and respond to natural disasters.

[13] The high cost of insurance is due to the fact that the risks of a natural disaster affect many policyholders at the same time, as a result of which the risks are not easily diversifiable. This necessitates insurers to maintain risk capital provisions, which incurs a high cost that is passed on to the policyholder (Ghesquiere & Mahul, 2010).

[14] The cost of emergency loans is represented by their interest rate (Ghesquiere & Mahul, 2010).

Box 7: The CEB's Türkiye post-earthquake loan

Türkiye's healthcare sector was considerably affected by the devastating earthquake in February 2023. Out of the 136 assessed hospitals in the affected areas, 94 were slightly damaged and 42 were moderately or heavily damaged. Only 20 hospital buildings did not suffer any damage. Like the hospitals, healthcare facilities were also impacted. Of the 1 620 assessed primary healthcare facilities, 712 were slightly damaged, 131 were moderately damaged, 105 were heavily damaged and 672 did not suffer any damage. The estimated total financial needs for the recovery and reconstruction of the healthcare sector have been estimated at approximately TRY126.3 billion (€6.2 billion).

Given this context, the CEB quickly supported the Turkish Government's response in the field of healthcare with a €250 million loan approved by an extraordinary Administrative Council meeting on 24 April 2023 (about two months after the earthquake). The loan finances short-term recovery measures and the reconstruction of health infrastructure. It will strengthen the operational efficiency of Türkiye's healthcare system in the long term.

In the design and implementation of the financed rehabilitation and reconstruction, particular attention will be paid to modern, seismic-proof engineering technology to build infrastructure that can withstand earthquakes and is able to operate during and after a disaster. Moreover, the CEB loan will finance the operational staff and technology costs (such as a health management information system) to ensure the long-term operational efficiency of the healthcare system.

At the European level, IFI emergency loans and grants can be complemented by financing from the EU Solidarity Fund (EUSF). Since its creation in 2002, following the catastrophic floods in Central Europe, it has been used for recovery after more than 100 natural disasters such as floods, forest fires, earthquakes, storms and droughts, as well as for 20 interventions in public health emergencies. To date, 28 European countries have received support amounting to more than €8 billion. For instance, Croatia received €1.03 billion from the Fund following the 2020 Zagreb and Petrinja earthquakes to finance the restoration of infrastructure, rescue operations and temporary accommodation, activities to protect cultural heritage, and the cleaning of disaster-hit areas alongside the prevention of soil erosion (Prepubic of Croatia - Ministry of Physical Planning, Construction and State Assets, 2023). A maximum total of €500 million (in 2011 prices) can be mobilised per year as well as the unspent funds from previous years. Since the aid can only be given to a country after an application and budgetary procedures that sometimes take several months, this financing option cannot be used for a rapid post-disaster response. Moreover, the funds can only be used for non-insurable damage and cannot pay for private losses (European Commission, n.d.).

In general, international financial institutions and donors play a key role in ex-ante and ex-post disaster financing. Before a disaster strikes, they can finance risk assessment and risk reduction programmes with loans, grants and blended instruments. Moreover, they can set up pre-approved credit lines such as the World Bank's Cat DDO that can be quickly disbursed if a disaster hits. For low-frequency and high-impact disasters, IFIs can help governments set up market-based risk transfer instruments such as insurance, catastrophe bonds and derivatives. IFI support is equally critical for post-disaster response as they can offer their standard financial instruments mentioned above with an accelerated approval process. For heavily-indebted countries, IFIs can also provide debt relief to increase the amount of funding available to governments for disaster-related activities. All these instruments can be combined into a comprehensive natural disasters' toolkit, such as the one announced by the World Bank at the Summit for a New Global Financing Pact in June 2023. Lastly, IFIs and donors are important actors in creating and disseminating DRM knowledge.

5. Conclusions

Natural disasters affect people around the world, including the CEB's 43 member states: from earthquakes in Türkiye and wildfires in Greece to floods across Europe. Hazards are striking more often and with higher intensity, and they turn into disasters due to a high level of exposure and vulnerability of individuals, communities and infrastructure. The frequency and severity of disasters grows every year, partly due to increasing urbanisation, but also as a result of climate change and environmental degradation caused by human activity. As a consequence, increasing numbers of people are affected by disasters: some lose their lives, homes and/or livelihoods, while others suffer from poor health and deteriorated living conditions. Natural disasters also have long-term socio-economic costs and often damage the surrounding environment and result in significant biodiversity loss. All these effects make human and environmental systems more likely to suffer from future disasters and yet less resilient to deal with them.

Managing disaster risk – from risk assessment to risk reduction to response and recovery in the aftermath of a severe event – is crucial for reducing the negative impact on people and the environment. In line with its historic mandate, the CEB, together with other international financial institutions, has invested in DRM in its member states. Since 2010, the CEB has financed 19 projects related to natural disasters in 13 member states with loans amounting to more than €3 billion. As of 2023, the CEB finances 11 projects with an active portfolio of more than €2 billion. Around half of the CEB funding is directed to disaster risk reduction and the remaining half to response and recovery, mainly to prevent and manage the effects of flooding, earthquakes and wildfires.

Based on the CEB's experience on the ground and an overview of the existing literature, this Technical Brief offers three main conclusions related to investments in DRM.

First, DRR is the most cost-efficient stage in the DRM cycle. DRR measures, which aim to reduce people's exposure and vulnerability to potential disasters, help prevent or mitigate the severe impacts of disasters while reducing the scope of the emergency response. The effectiveness of investing in risk reduction has been proven and recognised by the international community, both in academia and among policymakers: depending on the context and the risks, every euro invested in DRR can save from several to even tens of euros with non-structural measures being more cost-effective than structural ones. Despite the clear evidence, reduction measures are significantly underfunded compared to response measures as they do not generate immediate, visible benefits and may not always yield as much public support as disaster response does. In fact, out of every US$10 of development assistance for natural disasters in 2005-2017, only 40 cents were allocated for disaster risk reduction, with the remainder funding disaster response and recovery (UNDRR, n.d.(g)). This Technical Brief argues and recommends for more investments in DRR, with support from international financial institutions such as the CEB.

Second, the unequal social impact of disasters should drive DRM actions. Economically vulnerable individuals tend to lose a much greater proportion of their income and assets than the average population when a disaster strikes. For instance, it is estimated that decreasing the exposure to disasters of economically disadvantaged populations by only 5% could prevent US$1 500 million in well-being (or consumption) losses and US$380 million in asset losses in Italy and respectively US$960 million and US$260 million in Greece (Hallegatte et al., 2017). Moreover, disasters themselves can increase poverty and economic vulnerability. For example, in the event of an unlikely, but realistic earthquake,[15] an additional 15.4% of the population in Tbilisi (Georgia) and 14.3% of the population in Bucharest (Romania) could fall into poverty following the disaster (World Bank & GFDRR, 2021). Women, persons

[15] The probability of the event happening is 1 in 200 in any given year.

with disabilities, ethnic minorities and other socio-economically disadvantaged groups also tend to suffer more from disasters, which can further aggravate their disadvantaged socio-economic position within society. Therefore, DRM initiatives should be designed by assessing the socio-economic vulnerabilities in a given context and implemented through a people-centred approach.

Finally, managing risks includes devising a comprehensive financial strategy to finance DRR and unexpected disaster impacts. Proper risk financing management requires assessing the critical economic exposures to disaster and identifying the financing options for risk reduction and response activities. The goal should be to reduce the economic impact on both the private and public sectors at macro and micro-economic level, and, in case of a disaster, to maximise the speed and effectiveness of the relevant ex-post financing options. IFIs and international donors play a key role in ex-ante and ex-post disaster financing through funding risk assessment and risk reduction programmes, approving contingent and fast-tracked credit lines alongside grants, helping governments to set up market-based risk transfer instruments and providing debt relief for heavily-indebted countries.

More generally, since disaster impacts are highest for the most vulnerable populations, supporting social cohesion can contribute to building societies that are more resilient to natural disasters and other crises. Investments aimed at lowering interpersonal and interterritorial inequalities and providing equal access to high-quality, essential public services can help increase the social, human and financial capital of people and communities, thus making them less vulnerable to future uncertainties. With its unique social mandate, the CEB strives to promote social cohesion through all its social infrastructure projects. The DRM cycle is an essential building block of the wider sustainable development agenda, with the objective of leaving no one and no place behind.

References

Acevedo, S. & Novta, N. (2017). *Climate Change Will Bring More Frequent Natural Disasters & Weigh on Economic Growth*. Retrieved on 24 April, 2023 from IMF Blog: https://www.imf.org/en/Blogs/Articles/2017/11/16/climate-change-will-bring-more-frequent-natural-disasters-weigh-on-economic-growth

Ahmed, I., Fuenfgeld, H. & McEvoy, D. (2012). *Integrated Disaster Risk Reduction and Climate Change. Participatory Capacity and Vulnerability Analysis (PCVA) Toolkit.* Carlton: Oxfam Australia. Retrieved on 24 April, 2023 from: https://unfccc.int/files/adaptation/cancun_adaptation_framework/adaptation_committee/application/pdf/pcva_toolkit_oxfam_australia.pdf

Arnold, M., McClain-Nhlapo, C., Raja, D. S. & Piccio, L. (2018). *Five actions for disability-inclusive disaster risk management*. Retrieved on 26 April, 2023 from: https://blogs.worldbank.org/sustainablecities/five-actions-disability-inclusive-disaster-risk-management

Asian Disaster Preparedness Center. (2005). *Total disaster risk management: Good practices.* Retrieved on 24 April, 2023 from: http://lib.riskreductionafrica.org/bitstream/handle/123456789/526/4675.Total%20Disaster%20RIsk%20Management.%20Good%20Practices.pdf?sequence=1

Birkmann, J., Liwenga, E., Pandey, R., Boyd, E., Djalante, R., Gemenne, F., Leal Filho,W., Pinho, P.F., Stronger, L., Wrathall, D. (2022). Poverty, Livelihoods and Sustainable Development. In H. O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.), *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 1171-1274). Cambridge, UK: Cambridge University Press

Bubeck, P., Dillenardt, L., Alifieri, L., Feyen, L., Thieken, A. H. & Kellermann, P. (2019). Global warming to increase flood risk on European railways. *Climatic Change, 155*, 19-36

Burton, C. & Toquica, M. (2020). *Global Earthquake Model (GEM) Social Vulnerability Map*. Retrieved on April 26, 2023 from: https://maps.openquake.org/map/sv-global-human-vulnerability/#3/9.15/-1.71

Cammalleri, C., McCormick, N. & Toreti, A. (2022). Analysis of the relationship between yield in cereals and remotely sensed FAPAR in the framework of monitoring drought impacts in Europe. *Natural Hazards and Earth System Sciences, 22*, 3737-3750

Cannon, T. (2022). What must be done to rescue the concept of vulnerability? In G. Bankoff, & D. Hilhorst, *Why Vulnerability Still Matters. The Politics of Disaster Risk Creation.* New York: Routledge

Chowdhooree, I. (2020). External Interventions for Enhancing Community Resilience: An Overview of Planning Paradigms. In I. Chowdhooree, & S. Ghani, *External Interventions for Disaster Risk Reduction* (pp. 3-21). Springer Singapore

Copernicus. (2022). *European State of the Climate 2022*. Retrieved on 24 April, 2023 from: https://climate.copernicus.eu/esotc/2022

Copernicus. (2023). S*ummer 2023: the hottest on record*. Retrieved on 5 September, 2023 from: https://climate.copernicus.eu/summer-2023-hottest-record

Council of Europe (2010). New Strategy and Council of Europe Action Plan for Social Cohesion.

Deryugina, T. (2022). Economic Effects of Natural Disasters. *IZA World of Labor, 493*

Disability Information Resources. (2012). *The Great East Japan Earthquake and Disabled Persons*. Retrieved on 26 April, 2023 from: https://www.dinf.ne.jp/doc/english/resource/JDF/un_expert_group_meeting_120420_fujii_en.html

Drakes, O. & Tate, E. (2022). Social vulnerability in a multi-hazard context: a systematic review. *Environmental Research Letters, 17*(3)

European Commission. (n.d.). *EU Solidarity Fund*. Retrieved on 27 April, 2023 from: https://ec.europa.eu/regional_policy/funding/solidarity-fund_en

European Institute for Gender Equality. (n.d.). *Gender-based violence*. Retrieved on 26 April, 2023 from: https://eige.europa.eu/topics/health/covid-19-and-gender-equality/gender-based-violence

Flanagan, B. E., Gregory, E. W., Hallisey, E. J., Heitgerd, J. L. & Lewis, B. (2011). A Social Vulnerability Index for Disaster Management. *Journal of Homeland Security and Emergency Management, 8*(1)

Ghesquiere, F. & Mahul, O. (2010). *Financial protection of the state against natural disasters : a primer.* The World Bank. Retrieved on 26 April, 2023 from: https://documents1.worldbank.org/curated/en/227011468175734792/pdf/WPS5429.pdf

Global Forest Watch. (n.d.). *Global. Summary*. Retrieved on 24 April, 2023 from: https://www.globalforestwatch.org/dashboards/global/?category=summary&dashboardPrompts=eyJzaG93UHJvbXB0cyI6dHJ1ZSwicHJvbXB0c1ZpZXdlZCI6W10sInNldHRpbmdzIjp7Im9wZW4iOmZhbHNlLCJzdGVwSW5kZXgiOjAsInN0ZXBzS2V5IjoiIn0sIm9wZW4iOnRydWUsInN0ZXBzS2V5IjoiZG93bmxvYWRE

Government of Türkiye. (2023). Türkiye *earthquakes recovery and reconstruction assessment.* Retrieved on 2 May, 2023 from: https://www.sbb.gov.tr/wp-content/uploads/2023/03/Turkiye-Recovery-and-Reconstruction-Assessment.pdf

Hallegate, S. (2012). *Perspective Paper - Natural Disasters.* Retrieved on 25 April, 2023 from Copenhagen Consensus 2012: https://www.copenhagenconsensus.com/sites/default/files/naturaldisasters_perspectivepaper1.pdf

Hallegatte, S., Vogt-Schilb, A., Bangalore, M. & Rozenberg, J. (2017). *Unbreakable. Building the Resilience of the Poor in the Face of Natural Disasters.* Washington DC: International Bank for Reconstruction and Development / The World Bank. Retrieved on 28 April, 2023 from: https://documents1.worldbank.org/curated/en/512241480487839624/pdf/110618-PUB-Box396333B-PUBLIC-PUBDATE-11-24-16-UNIT-ITSKI.pdf

Holzmann, R., Sherburne-Benz, L., & Tesliuc, E. (2003). *Social Risk Management. The World Bank's Approach to Social Protection in a Globalizing World.* Washington DC: The World Bank. Retrieved on 28 April, 2023 from: https://documents1.worldbank.org/curated/en/494981468762925392/pdf/302560SRMWB0ApproachtoSP01public1.pdf

Hugenbusch, D., & Neumann, T. (2016). *Cost-Benefit analysis of disaster risk reduction. A synthesis for informed decision making.* Retrieved on 20 April, 2023 from: https://www.aktion-deutschland-hilft.de/fileadmin/fm-dam/pdf/publikationen/aktion-deutschland-hilft-studie-zur-katastrophenvorsorge-englische-version-english-version.pdf

International Medical Corps. (2023). *Syria/Turkey Earthquakes Situation Report #7, March 8, 2023*. Retrieved on 26 June, 2023 from: https://reliefweb.int/report/syrian-arab-republic/syriaturkey-earthquakes-situation-report-7-march-8-2023

Le Cozannet, G., Kervyn, M., Russo, S., Speranza, C. I., Ferrier, P., Foumelis, M., Lopez, T., Modaressi, H. (2020). Space-Based Earth Observations for Disaster Risk Management. *Surveys in Geophysics, 41*(3), 1209-1235

Lindroth, A., Lagergren, F., Grelle, A., Klemedtsson, L., Langvall, O., Weslien, P. & Tuulik, J. (2009). Storms can cause Europe-wide reduction in forest carbon sink. *Global Change Biology, 15*(2), 346-355

Liu, M., & Huang, M. C. (2014). *Compound Disasters and Compounding Processes.* UNDRR. Retrieved on 29 April, 2023 from: https://www.preventionweb.net/publication/compound-disasters-and-compounding-processes-implications-disaster-risk-management

Maes, J., Zulian, G., Guenther, S., Thijssen, M. & Raynal, J. (2019). *Enhancing Resilience Of Urban Ecosystems through Green Infrastructure (EnRoute).* Luxembourg: Publications Office of the European Union

Mendonca, D. (2023). *Slovenia floods kill at least six in 'worst natural disaster to ever hit' the country, says PM*. Retrieved on 12 September, 2023 from: https://edition.cnn.com/2023/08/07/europe/slovenia-floods-intl/index.html

Meenan, C., Ward, J. & Muir-Wood, R. (2019). *Disaster Risk Finance - a Toolkit.* GIZ. Retrieved on 4 May, 2023 from: https://indexinsuranceforum.org/sites/default/files/Publikationen03_DRF_ACRI_DINA4_WEB_190617.pdf

Mullan , M., Danielson, L., Lasfargues, B. & Morgado, N. C. (2018). *Climate-resilient Infrastructure.* Paris : OECD. Retreived on 24 April, 2023 from: https://www.oecd.org/environment/cc/policy-perspectives-climate-resilient-infrastructure.pdf

Muzzini, E., Maslauskaite, K., & O'Regan, K. (2022). *From Community Vulnerability to Resilience. The Experience of European Cities.* Paris: Council of Europe Development Bank.

National Institute of Building Sciences funded by FEMA. (2005). *Natural Hazard Mitigation Saves: An indipendent Study to Assess the Future Savings from Mitigation Activities.* Washington. Retreived on 29 April, 2023 from: https://www.nibs.org/files/pdfs/hms_vol1.pdf.

Neumayer, E. & Plumper, T. (2007). The Gendered Nature of Natural Disasters: The Impact of Catastrophic Events on the Gender Gap in Life Expectancy, 1981–2002. *Annals of the Association of American Geographers, 97*(3), 551-566

OECD. (2012). *Disaster Risk Assessment and Risk Financing. A G20/OECD Methodological Framework.* Retrieved on 5 May, 2023 from: https://www.oecd.org/gov/risk/G20disasterriskmanagement.pdf

Pescaroli, G. & Alexander, D. (2015). A definition of cascading disasters and cascading effects: Going beyond the "toppling dominos" metaphor. *GRF Davos Planet@Risk, 3*(1), 58-67. Retrieved on 15 May, 2023 from: https://www.preventionweb.net/publication/definition-cascading-disasters-and-cascading-effects-going-beyond-toppling-dominos

Quinney, M. (2020). *The COVID-19 recovery must focus on nature*. Retrieved on 24 April, 2023 from: https://www.weforum.org/agenda/2020/04/covid-19-nature-deforestation-recovery/

Republic of Croatia - Ministry of Physical Planning, Construction and State Assets. (2023). *Croatia has used all funds from the EU Solidarity Fund for the post-earthquake reconstruction*. Retrieved on 12 September, 2023 from: https://mpgi.gov.hr/news/croatia-has-used-all-funds-from-the-eu-solidarity-fund-for-the-post-earthquake-reconstruction/15526

Rezaeian, M. (2013). The association between natural disasters and violence: A systematic review of the literature and a call for more epidemiological studies. *J Res Med Sci, 18*(12), 1103-1107

Schumacher, D. L., Zachariah, M., Otto, F., Barnes, C., Philip, S., Kew, S., Vahlberg, M., Singh , R., Heinrich, D., Arrighi , J., van Aalst , M., Thalheimer, L., Raju, E., Hauser, M., Hirschi , M., Gudmundsson, L., Beaudoing, H.K., Rodell, M., Li, S., Yang, W., Vecchi, G.A., Vautard , R., Harrington, L.J., Senevirante, S. I. (2022). *High temperatures exacerbated by climate change made 2022 Northern Hemisphere soil moisture more likely.* Retrieved on 5 May, 2023 from: https://www.worldweatherattribution.org/wp-content/uploads/WCE-NH-drought-scientific-report.pdf

Statista. (2022). *Cost of natural disaster losses worldwide from 2000 to 2022, by type of loss*. Retrieved on 24 April, 2023 from: https://www.statista.com/statistics/612561/natural-disaster-losses-cost-worldwide-by-type-of-loss/

Tavares Da Costa , R. & Krausmann, E. (2021). *Impacts of Natural Hazards and Climate Change on EU Security and Defence.* Retrieved on 25 April, 2023 from: https://publications.jrc.ec.europa.eu/repository/handle/JRC126315

The Caribbean Catastrophe Risk Insurance Facility. (2022). *2021-2022 Annual Report.* Grand Cayman: The Caribbean Catastrophe Risk Insurance Facility. Retrieved on 5 May, 2023 from: https://www.ccrif.org/sites/default/files/publications/annualreports/CCRIFSPC_Annual_Report_2021_22.pdf

Tsionis, G., Sousa, M. L., Palermo, V. & Maio, R. (2017). *Framework for resilience analysis of EU buildings.* Luxembourg: Publications Office of the European Union

UCLouvain & CRED. (2023). *EM-DAT, the International Disaster Database.* Retrieved on 9 April, 2023, from: https://public.emdat.be/

UNDRR. (2009). *2009 UNISDR terminology on disaster risk reduction.* Retrieved on 15 April, 2023 from: https://www.undrr.org/publication/2009-unisdr-terminology-disaster-risk-reduction

UNDRR. (2013). *UN 2013 global survey explains why so many people living with disabilities die in disasters*. Retrieved on 26 April, 2023 from: https://www.undrr.org/news/un-2013-global-survey-explains-why-so-many-people-living-disabilities-die-disasters

UNDRR. (2022(a)). *Compound, consecutive, and cascading events: Challenges for risk assessment and management*. Retrieved on 2 May, 2023 from: https://www.preventionweb.net/news/compound-consecutive-and-cascading-events-challenges-risk-assessment-and-management

UNDRR. (2022(b)). *Global Assessment Report on Disaster Risk Reduction. Our World at Risk: Transforming Governance for a Resilient Future.* Retrieved on 4 April, 2023 from: https://www.undrr.org/media/79595/download

UNDRR. (2023). The Report of the Midterm Review of the Implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030. Retreived on 2 June, 2023 from: https://sendaiframework-mtr.undrr.org/publication/report-midterm-review-implementation-sendai-framework-disaster-risk-reduction-2015-2030

UNDRR. (n.d (a)). *Sendai Framework Terminology on Disaster Risk Reduction. Disaster*. Retrieved on 24 April, 2023 from: https://www.undrr.org/terminology/disaster#:~:text=A%20serious%20disruption%20of%20the,and%20environmental%20losses%20and%20impacts

UNDRR. (n.d.(b)). *Sendai Framework Terminology on Disaster Risk Reduction. Exposure*. Retrieved on 24 April, 2023 from: https://www.undrr.org/terminology/exposure

UNDRR. (n.d.(c)). *Poverty and Inequality*. Retrieved on 26 April, 2023 from: https://www.preventionweb.net/understanding-disaster-risk/risk-drivers/poverty-inequality#:~:text=Inequality%20is%20linked%20to%20other,and%20the%20overconsumption%20of%20resources

UNDRR. (n.d. (d)). *Sendai Framework Terminology on Disaster Risk Reduction. Disaster Risk Reduction*. Retrieved on 24 April, 2023 from: https://www.undrr.org/terminology/disaster-risk-reduction

UNDRR. (n.d. (e)). *Implementing the Sendai Framework*. Retrieved on 24 April, 2023 from: https://www.undrr.org/implementing-sendai-framework/what-sendai-framework

UNDRR. (n.d.(f)). *Sendai Framework Terminology on Disaster Risk Reduction. Structural and non-structural measures*. Retrieved on 26 April, 2023 from: https://www.undrr.org/terminology/structural-and-non-structural-measures

UNDRR. (n.d.(g)). *Financing Prevention*. Retrieved on 26 April, 2023 from: https://www.undrr.org/financing-prevention

UNDRR & WMO. (2022). *Global status of multi-hazard early warning systems: Target G.* United Nations Office for Disaster Risk Reduction. Retrieved on 26 April, 2023 from: https://www.undrr.org/publication/global-status-multi-hazard-early-warning-systems-target-g

Van Ginkel, K., Dottori, F., Alfieri, L., Feyen, L. & Koks, E. (2020). Direct flood risk assessment of the European road network: an object-based approach. *Natural Hazards and Earth System Sciences*, 21(3), 1011-1027

Vorhies, F. (2012). *The economics of investing in disaster risk reduction.* Retrieved on 5 May, 2023 from: https://www.preventionweb.net/posthfa/documents/drreconomicsworkingpaperfinal.pdf

Warfield, C. (n.d.). *The Disaster Management Cycle*. Retrieved on 25 April, 2023 from: https://www.gdrc.org/uem/disasters/1-dm_cycle.html

WHO. (2023). *Disability*. Retrieved on 26 April, 2023 from: https://www.who.int/news-room/fact-sheets/detail/disability-and-health

WMO. (2013). *A WMO Factsheet. Early warning systems save millions of lives.* World Meteorological Organization. Retrieved on 26 April, 2023 from: https://library.wmo.int/index.php?lvl=notice_display&id=14824#.ZEjjEc5Bxyw

World Bank. (2009). *Including Contingent Emergency Response Components in Standard Investment Projects.* Retrieved on 27 April, 2023 from: https://documents1.worldbank.org/curated/en/857351468325152844/pdf/659980WP00PUBL0ycontingencyresponse.pdf

World Bank. (2021(a)). *Investment in Disaster Risk Management in Europe Makes Economic Sense.* Washington DC: International Bank for Reconstruction and Development / The World Bank.

World Bank. (2021(b)). *Financial Risk and Opportunities to Build Resilience in Europe.* Retrieved on 24 April, 2023 from: https://openknowledge.worldbank.org/entities/publication/e4c30ee9-594f-54ff-9122-05c4a8ee32fb

World Bank. (2021(c)). *Data Bank. Global Financial Inclusion*. Retrieved on 2 May, 2023 from: https://databank.worldbank.org/source/global-financial-inclusion

World Bank. (2021(d)). *Understanding the Needs of Civil Protection Agencies and Opportunities for Scaling up Disaster Risk Management Investments.* Washington DC: International Bank for Reconstruction and Development / The World Bank. Retrieved on 26 Apri, 2023 from: https://reliefweb.int/report/world/understanding-needs-civil-protection-agencies-and-opportunities-scaling-disaster-risk-0

World Bank. (2021(e)). *IBRD Catastrophe Deferred Drawdown Option.* Retrieved on 27 April, 2023 from: https://thedocs.worldbank.org/en/doc/1820b53ad5cba038ff885cc3758ba59f-0340012021/original/Cat-DDO-IBRD-Product-Note.pdf

World Bank (2023). *World Bank Group Announces Comprehensive Toolkit to Support Countries After Natural Disasters*. Retrieved on June 22, 2023 from: https://www.worldbank.org/en/news/factsheet/2023/06/22/comprehensive-toolkit-to-support-countries-after-natural-disasters

World Bank. (n.d.(a)). *Urban population (% of total population) - European Union*. Retrieved on 24 April 2023, from: https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=EU

World Bank. (n.d.(b)). *Index-based weather derivative product note.* Retrieved on 26 April, 2023 from: https://thedocs.worldbank.org/en/doc/414271507314973952-0340022017/original/productnoteindexbasedweatherderivative2015.pdf

World Bank. (n.d.(c)). *MultiCat Program Product Note.* Retrieved on 28 April, 2023 from: https://thedocs.worldbank.org/en/doc/438301507314977367-0340022017/original/productnotemulticatprogramcatbond2015.pdf

World Bank & GFDRR. (2021). *Overlooked: Examining the impact of disasters and climate shocks on poverty in the Europe and Central Asia region.* Washington DC: The International Bank for Reconstruction and Development/ The World Bank. Retrieved on 27 April, 2023 from: https://documents1.worldbank.org/curated/en/493181607687673440/pdf/Overlooked-Examining-the-Impact-of-Disasters-and-Climate-Shocks-on-Poverty-in-the-Europe-and-Central-Asia-Region.pdf

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