Improving the assessments of real costs of disasters

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Economic losses caused by natural disasters are increasing worldwide

Although natural hazards do not necessarily have to become natural disasters, the economic losses caused by natural disasters are increasing worldwide no matter whether these are caused by geophysical, meteorological, hydrological or climatological hazards. Natural hazards become disasters when lives are lost, when buildings and infrastructures are damaged, and when the financial and social costs of dealing with reconstruction and complete recovery, lasting years or even decades, can hardly be afforded.

The estimates of the comprehensive costs of disasters are necessary to analyse the benefits of past and future risk management policies. This information is helpful to inform decision making and to develop cost effective strategies and measures to prevent or reduce the negative impacts of disasters and threats.

By creating and building resilience[1], natural disasters can be avoided, if not completely at least in part, by mitigating their effects and allowing to recover more quickly.

During the United Nations 2015 World Conference, States reiterated their commitment to address disaster risk reduction and the building of resilience to disasters, and the Sendai Framework for Disaster Risk Reduction, SFDRR, 2015-2030 (UN, 2015)[2] was adopted. The SFDRR aims to achieve the substantial reduction of disaster risk and losses by 2030 setting seven global targets and four priority areas for action.

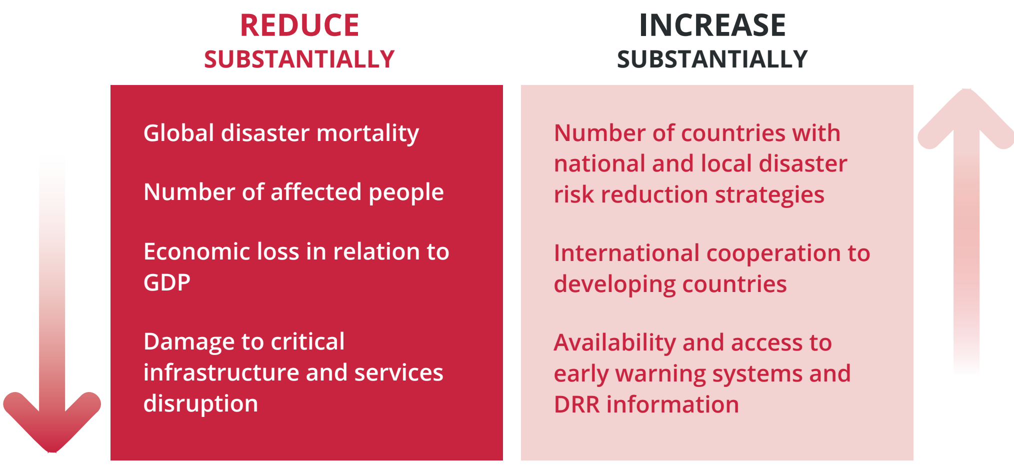


Figure 1. UN Sendai Framework seven global targets to be achieved by 2030.

(1) Resilience is defined as the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of essential basic structures and functions through risk management (UNISDR, 2017).
(2) UNISDR, 2015, *Sendai Framework for Disaster Risk Reduction 2015-2030*, UN Report UNISDR/GE/015, Geneva, Switzerland.

PRIORITIES FOR ACTION

1 Understanding disaster risk

2 Strengthening disaster risk governance to manage disaster risk

3 Investing in disaster risk reduction for resilience

4 Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction

Figure 2. SFDRR priorities areas for action.

Disaster Risk Reduction and Climate Change Adaptation are as well integrated in key European Union policies and strategies. Among them, the EU Action Plan on SFDRR 2015-2030 (EC, 2016)[3] recognizes the Sendai framework as an opportunity to advance the DRM agenda in Europe and to reinforce resilience. As part of its implementation, the European Commission aims to build disaster risk knowledge across all EU policies with the aim of providing a better understanding of disaster risks and to contribute to a disaster informed approach to EU emergency management and other relevant policies.

Key in the strategy is ***to move from disaster management to disaster risk management*** in order to reduce and prevent new disaster risks. Under the SFDRR first objective ***"Understanding Disaster Risks"***, the Sendai framework addresses ***data, risk and vulnerability assessment, and the sharing of good practices***. Risk informed policies are based on the undertaking of risk assessments, a better collection of loss and damage disaster data, and a strengthen engagement with the scientific community.

The Sendai Framework highlights the importance of collecting data regarding damages and losses occasioned by disasters. The **need for damages and loss data collection** contributes both to the effectiveness of DRR policies and strategies, as well as to the improvement of risk assessment models.

Need for damages and loss data collection

Disaster loss data recording is the result of a systematic, consistent, coordinated process to collect human, physical, and economic losses as well as social and environmental consequences immediately following an emergency or a disaster. Although this practice has been mostly associated to compensation schemes, it results in crucial and unique evidence regarding risk trends, exposure, vulnerability, coping capacity, mitigation and response to the disaster and at the same time is essential for improving risk models.

At EU level, responding to the wide number of policies using and depending on loss data — disaster loss accounting and compensation, disaster forensics, and feeding risk modelling — **is challenging**. A harmonized collection of disaster and damage loss data analysis is recognized as key to improve Disaster Risk Management and to increase resilience to disasters across the territory of the EU.

The current practice in disaster loss data recording and collection across the EU collection is very heterogeneous among member states, with available loss databases varying in their level of completeness and detail, and IT systems varying in their purpose, complexity and openness. The lack of standards for damage and loss data collection and recoding represents a challenge for sharing or comparing data within EU.

(3) EC, 2016, Commission staff working document — Action Plan on the Sendai Framework for Disaster Risk Reduction 2015-2030: A disaster risk-informed approach for all EU policies, COM (2016) 739 final.

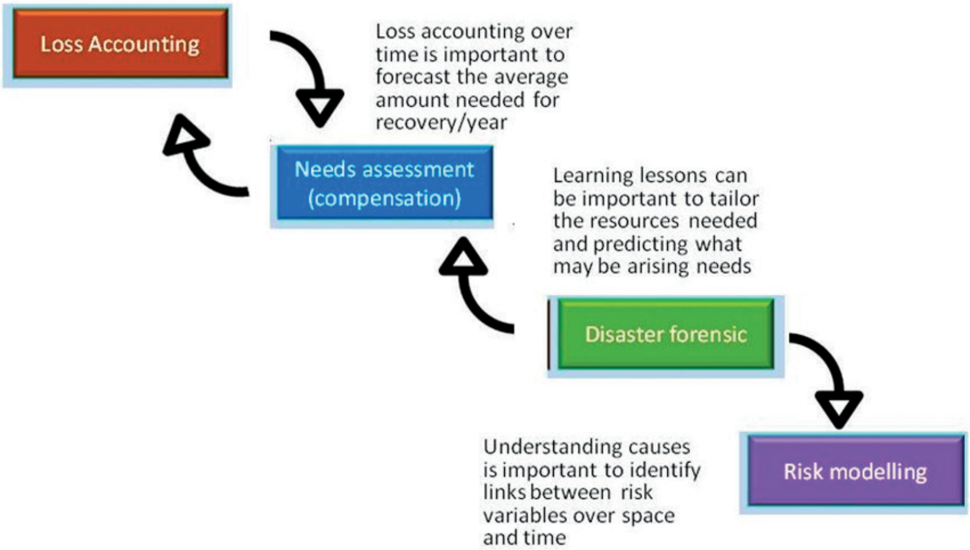


Figure 3. Four main application areas of disaster loss databases.

In a recent communication, the European Commission[4] calls Member States to promote more systematic collection and dissemination of loss data to enhance the collection of loss data and to make use of loss data for optimised prevention and climate adaptation planning.

Disaster damage and loss data are collected by many countries, but information is not always centralized in one national database. Different institutions, from national to municipal level, are active in the collection of data of disasters. There is also a need for sharing data collected by non-governmental agencies such as data on insured losses which are often more comprehensive and systematically recorded and which can provide a basis for estimating overall economic losses. **The estimates of the comprehensive costs of disasters are necessary to analyse the benefits of past and future risk management policies.** This information is helpful to inform decision making and to develop cost effective strategies and measures to prevent or reduce the negative impacts of disasters and threats.

The role of knowledge and data in supporting disaster risk reduction

Evidence-based, effective and efficient disaster risk reduction (DRR) and climate change adaptation (CCA) assessments, policies and strategies require knowledge and data.

Although it is usually the case that few days after a disaster the media are ready to provide aggregate numbers regarding victims and overall compensation needs, such numbers are rarely verified or verifiable, and long after the event damage estimations are still affected by large uncertainties. Current practices in damage assessment for compensation do not contribute to analysing the damage drivers and very little or no effort is put in on decision making in what regards resilience as based on lessons learnt from the occurred event. For this reason, a large effort has been made by different levels of governance, and international and European institutions to improve the situation and provide a more solid basis for any evaluation of trends, accounting or assessment of damage over time and across different geographic areas.

(4) Communication from the Commission to the European Parliament, the Council and the Committee of the Regions, 'Strengthening EU disaster management: rescEU — solidarity with responsibility', COM (2017) 773 final, Brussels, 23.11.2017.

SFDRR Priority 1, "Understanding risk", implies improving disaster data at all levels, starting from global and going down to national and local and back the other way round.

Within the EU, the JRC[5] instituted the Disaster Risk Management Knowledge centre (DRMKC) in 2015, to help enhance EU and Member States resilience to disasters and their capacity to prevent, prepare and respond to emergencies through a strengthened interface between science and policy. The Disaster Risk Management Knowledge Centre pursues three main pillars: **knowledge, innovation, and partnership**.

Improving damage data quality leads to improved risk mitigation measures in three aspects. First, better knowledge of damage losses can improve program resources to cope with risk and if possible to avoid it. By understanding better the causes of damage — including also man-made arising from excessive exposure in hazardous areas and high levels of vulnerability — better addressing reconstruction decisions can be taken, and lessons to help to mitigate risks in similar areas are revealed. Finally, by calibrating and verifying the models and testing damage scenarios, forecast outputs based on improved damage data against observed damage.

Two DG-ECHO projects aiming at improving management of knowledge and data on damage and losses caused by natural and man-made hazards as an input for disaster risk reduction policies and strategies are IDEA (2015-2016) and LODE (ongoing at present). Both projects have involved case studies in Spain in which the CSIC group has participated in close cooperation with stakeholders such as CCS[6] who has provide invaluable loss and damage data at different development stages in both projects.

The IDEA Project (Improving Damage assessments to Enhance cost-benefit Analysis)

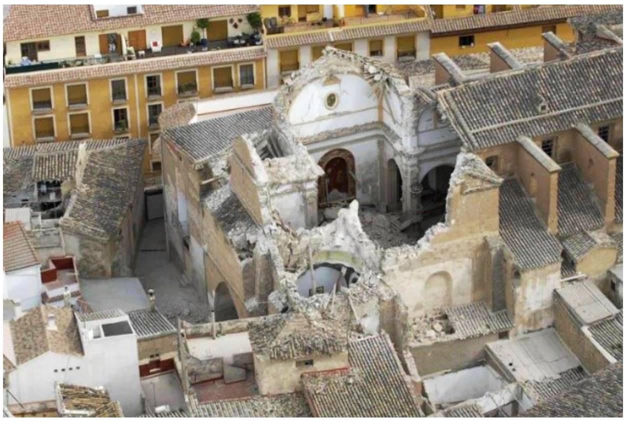
The IDEA project aimed[7] at developing **enhanced methods and tools for the collection, analysis and use of disaster loss data for multiple purposes.** Five partners from three European countries participated in the project: the MNCN[8]/CSIC[9] (Agencia Estatal Consejo Superior de Investigaciones Científicas) and the Catalunya Civil Protection in Spain, the Oxford Brooks University in the UK, the Umbria Region Civil Protection and the coordinating Politecnico di Milano in Italy. Four case studies were identified: floods in the River Severn Basin in the UK in 2007, in the Umbria Region (Italy) in 2012, 2013 and 2014, and in the Vall d'Aran valley in Catalunya (Spain) in 2013, and the Lorca (Spain) earthquake in 2011.

In the context of the project, several meetings and interviews with stakeholders from different private organisations, in particular insurance and lifeline companies, and public administrations were carried out. Also, two international workshops were organized to share the results achieved at each stage of the project with a large audience of different stakeholders, pertaining also to the business sector.

IDEA conducted a number of verification tests investigating in depth real events to compare with the ex-ante estimations that could have been done or that were done based on the information available at the time on existing hazards, exposure levels and vulnerability conditions.

(5) Joint Research Center.
(6) CCS: Consorcio Compensación Seguros.
(7) IDEA project funded by the European Commission – DG ECHO – Directorate General for European Civil protection and Humanitarian Aid Operations under the Program: Union Civil Protection Mechanism Prevention and Preparedness 2016-2018. http://www.ideaproject.polimi.it/
(8) MNCN Museo Nacional Ciencias Naturales.
(9) CSIC Consejo Superior Investigaciones Científicas.

Floods in Vall d'Aran in Catalunya in 2013.



Earthquake in Lorca, Murcia, in 2011.

Figure 4: IDEA Case studies in Spain.

The results of IDEA have contributed to the three pillars pursued by the DRKMC, i.e. **knowledge, innovation, and partnership** as detailed in what follows.

While all focus and attention is generally devoted to **scientific knowledge, regulatory and organizational knowledge are equally important for risk governance**. To substantially improve the way post disaster data are collected and managed, it is essential that the three types of knowledge mentioned above are integrated combining their interpretation and understanding of disasters and recovery needs. Different types of knowledge are "owned" primarily, but not exclusively, by different stakeholders: researchers are more prominent in scientific knowledge, public officers and insurers are more knowledgeable about legislative and organizational knowledge. Sharing of the information held by different stakeholders is key to the advancement in post disaster damage understanding and accounting capacity.

An important challenge regarding data collection **is to obtain a systemic perspective on the damage** to multiple sectors that may be differently affected in different events, given the specific conditions of exposure, vulnerability and the exact event scenario that has occurred. In fact, a flood or an earthquake may affect a very large rural area or an industrial zone with very different consequences in terms of lost machinery, type of products, revenue sources, etc. The systemic approach to damage allows to consider the interdependencies and interrelations among sectors leading to indirect damage, determined by ripple, cascading, and enchained effects. Two other important key aspects in any damage data collection and analysis that are often overlooked are **the time and the spatial scale**. Not all damage appears immediately after the event. Part of damage, especially that indirect, due to ripple effects across systems may become manifest only some time later, even weeks or months after the event. **Data collection should be an iterative process** that requires at least a couple of cycles to be accomplished in a satisfactory way. The spatial scale is very relevant in the selection of the most appropriate geographical/territorial level of analysis. While physical damage to assets or buildings can be surveyed and assessed at the local scale, systemic damage producing malfunction to critical infrastructures is often only visible at a larger scale.

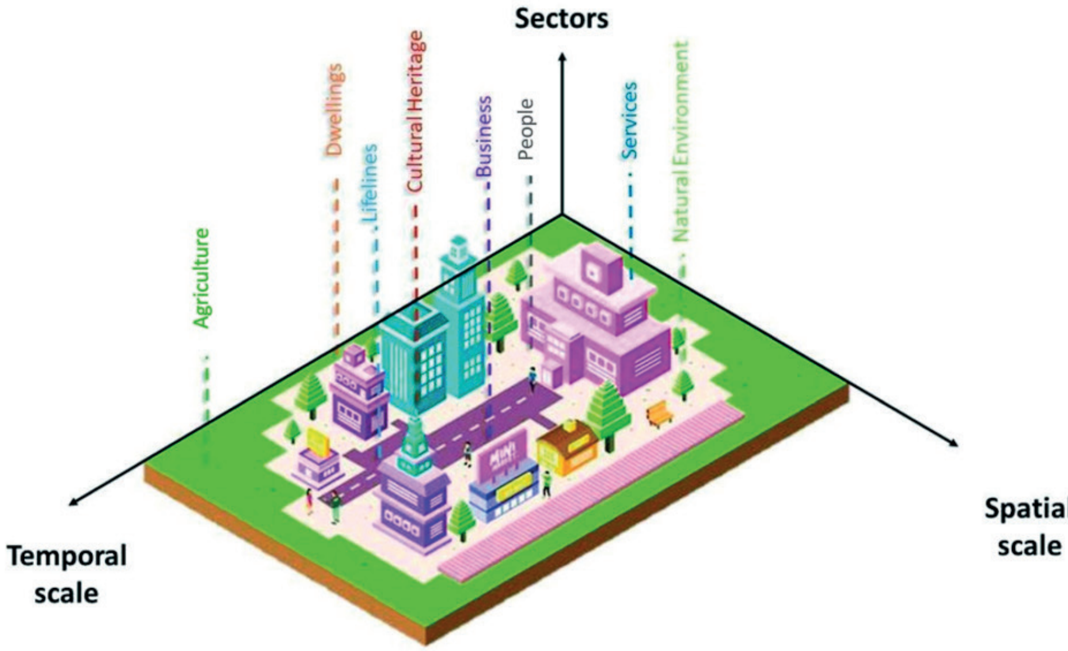


Figure 5. Sectors for which disaster data should be collected.

Innovation on damage data collection is already on the way although a number of issues require further efforts in two aspects: **processes and the use of technologies**. Procedures in data collection and management require improvements in terms of quality and reliability. A **key aspect is the coordination of data across stakeholders**, i.e. between private and public organizations, and within public administrations between different levels of government and different offices and departments of the same governmental organization.

Although modern IT systems allow for a much better and faster data management, **without knowledge on why and how** different **stakeholders collect data** and for what purposes and how such data will be used later for a variety of purposes, **it is virtually impossible to design a system that will be useful and usable**. This was clearly evidenced by the work conducted within IDEA. Equally important is the required level of interaction. Without an adequate level of understanding of the purposes, the assumptions, and the real context in which crisis and therefore damage data are collected, there will be no advancement with respect to the highly fragmented present situation. As a result of the **quite complex understanding of the need for reconciling different interpretations and understanding of damage, IDEA has proposed an IT architecture** with the damage at its core, intended as physical direct effect of the event, as systemic consequence, and as economic loss.

The third pillar DRMKC pursues is partnership, so that complex science can be exploited and translated into useful policy and applications for DRR. As mentioned above, partnership among different stakeholders needs to start from the recognition of the relevance of different types of knowledge that stakeholders may possess in a more or less prominent way. The level of complexity that current research in environmental and societal domains acknowledges can avoid taking risky easy solutions, which might imply worsening the situation through unexpected side effects. It is as well equally important that scientists are informed on what can be qualified as useful and usable knowledge according to the existing organizational and legislative frameworks. **Key relevant knowledge** to share among different stakeholders is that related to a) **specific needs in terms of data collection and analysis**, b) **whether or not enhanced capacity to develop comprehensive damage scenarios can constitute an advantage** for each stakeholder in their work practices.

From the experience gained in IDEA, but also in former research projects, some stakeholders are very open in sharing their data while others are still quite reluctant to do so. Changes can be perceived particularly in the insurance sector by making available their data, deprived of sensitive components, contributing substantially to gain insight into the damage caused by natural hazards. Obstacles still exist in lifeline managing companies on sharing their data most probably related to the ownership of the network (public versus private) and the requirements for security. In some cases, deeply rooted traditionally data protective culture in enterprises might be another reason for not sharing data.

Within IDEA, fruitful partnership was established between MNCN/CSIC and CCS regarding Lorca 2011 earthquake case study by exchanging and sharing information on damage and losses. This allowed to identifying the distribution of insured losses provided by CCS and non-insured losses collected by CSIC among the different sectors. Based on 2016 data, the CCS compensations contributed to around 44 % of the total costs of losses, 76 % of which corresponds to private housing, 57 % to business and industry sectors, and 9 % to cultural heritage sector.

LODE project: (Loss data Enhancement for DRR and CCA management)

The ongoing LODE project builds on IDEA and prior experience of all partners in collecting, organizing, and using disaster damage and loss data. Ten partners are committed to the project from seven countries, including Italy, Spain, Portugal, France, Greece, Finland, and Serbia and they represent both scientific research centres and universities as well as public administrations that are active in different fields of risk management and mitigation.

The project practical goal is to develop damage and loss data information system (IS) for DRR and CCA to enhance our understanding of disaster impacts to multiple societal sectors at relevant spatial and temporal scales.

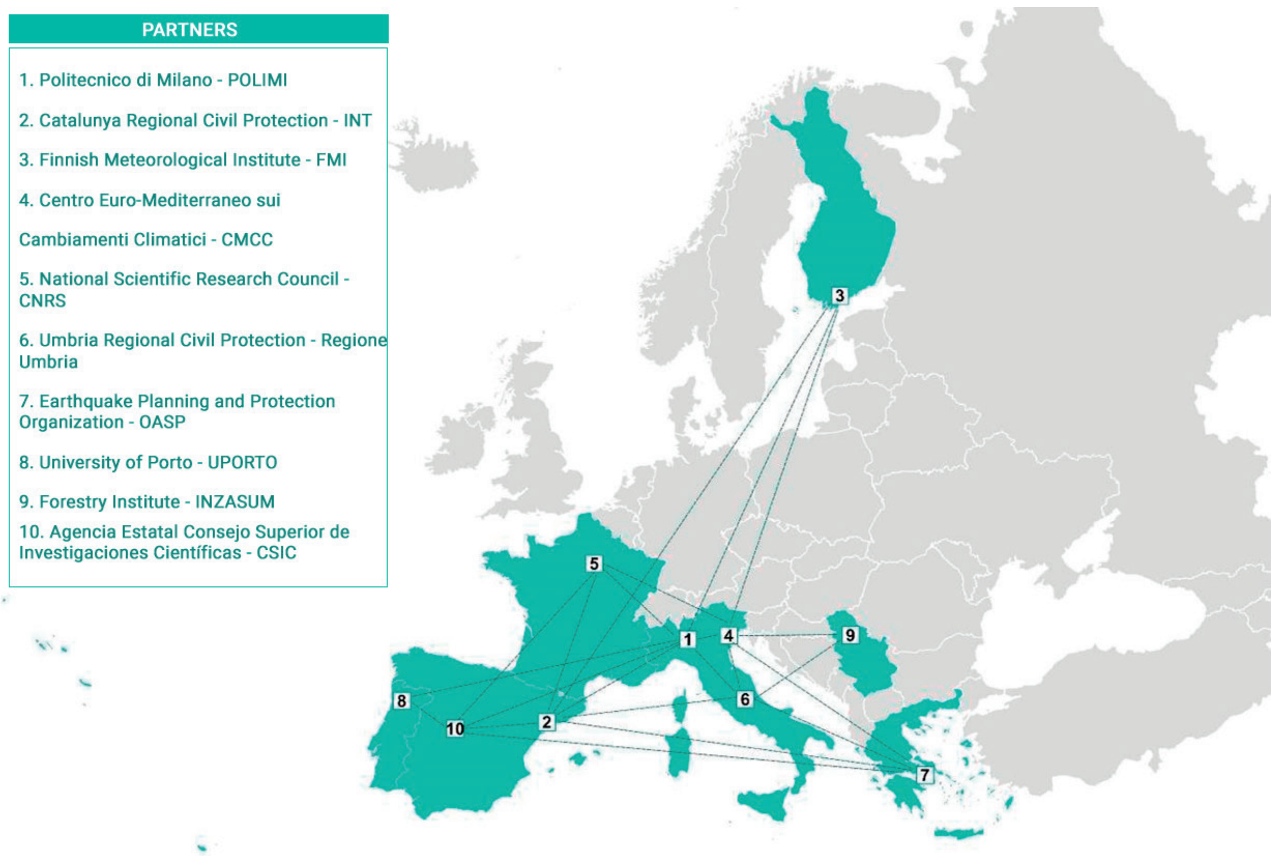


Figure 6. LODE project partners.

The baseline of LODE is a set of ten showcases in all countries of the project's partners where damage data collection, storage and analysis are carried out following the methodology and the approach which is been developed. In each case, one or two types of applications will be carried out in order to show in practice the added value of enhanced damage and loss data and the utilities provided by the information system proposed.

An important aspect in LODE is the network of stakeholders with a twofold role. Stakeholders are contributing in identifying best practice examples and are raising awareness of relevant policy and stakeholder organizations responsible for DRR and CCA in need of better coordinated efforts to develop a multisector and comprehensive picture of damage due to natural hazards.

The showcases range from local to national scale examples of different hazards where relevant impacts were recorded and for which data is available even though not already organised and structured. Some of the showcases will be focusing on one or two sectors that are the object of full IS implementation. The showcases are characterized by the fact that they cover different scales, different hazard types, and different typologies of affected sectors and territories in the countries participating in the action as can be seen in the tables below.

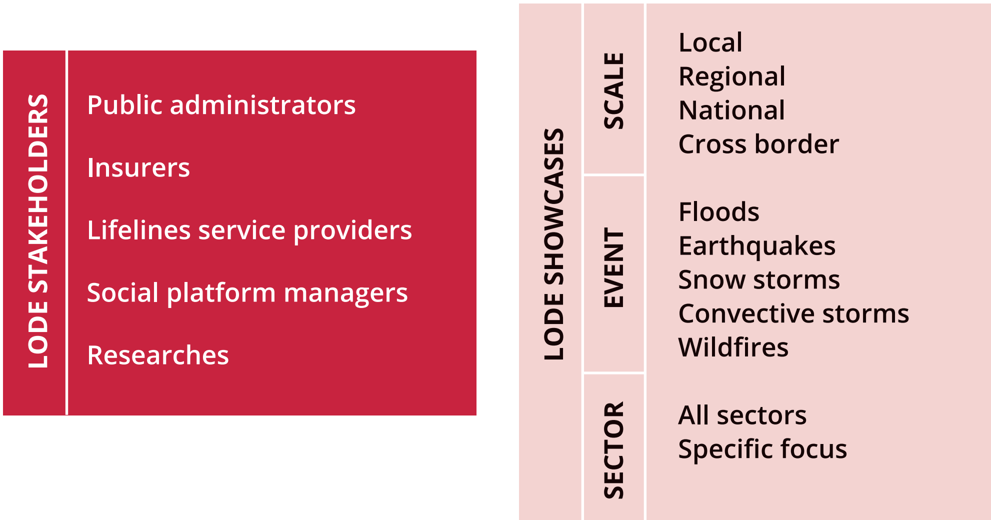


Figure 7. LODE stakeholders and LODE Showcases.

LODE will provide a conceptual and operational information infrastructure and a practical guideline not only to collect but also to manage and use the data for a variety of purposes — centralizing the data — so that various reports and analyses will consistently use the same set of data. The guidelines and the infrastructure system will need to be tested in future events and connected to already existing databases and/or populated with historic data if deemed relevant.

The LODE IT tools will be usable and open to stakeholders. Even though procedural needs will be defined to a certain extent during the project, the latter will need to be translated into operational protocol and regulations by involved stakeholders to enable its use in routine established actions in future events and for structuring also available data related to past events.

The way ahead

Still, the assessments of the costs of disasters, both by measuring the socio-economic impacts and in terms of understanding the cost of reducing or avoiding them, need to be improved. More precise expenditure evaluations in managing the consequences of disasters will allow decision-makers and stakeholders to evaluate the benefits of allocating resources and investments.

A key aspect still ahead is the need for closer cooperation between government agencies, non-governmental, and private stakeholders to improve the existing evidence base on damages and losses of disasters.