Improving Damage assessments to Enhance cost-benefit Analyses

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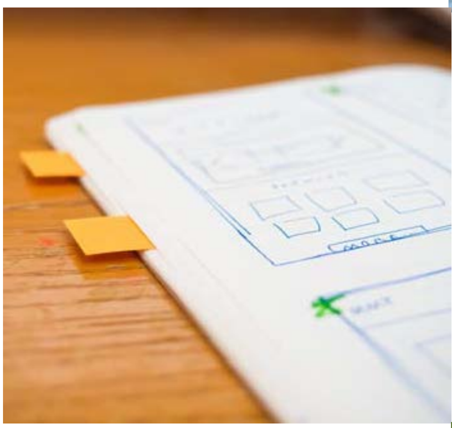
Improving Damage assessments to Enhance cost-benefit Analyses

Recommendations on Post disaster damage data collection and analysis



Layman's Report

February 2017

IDEA—ECHO-SUB-2014-694469

H2020 – Prevention and Preparedness in Civil Protection

The IDEA project

The IDEA project (Improving Damage assessments to Enhance cost-benefit Analysis) aimed at developing enhanced methods and tools for the collection, analysis and use of disaster loss data for multiple purposes. In an attempt to integrate the various needs for which disaster data are generated, maintained and used, the project grounded its efforts on existing practices and procedures followed by civil protection authorities involved in the project. Five partners from three European countries participated in the project: the CSIC (Agencia Estatal Consejo Superior de Investigaciones Científicas) Research Institute 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.

In order to be practical and achieve concrete results, four case studies were identified, namely: floods in the River Severn Basin in the UK in 2007, in the Umbria Region in 2012, 2013 and 2014, in the Vall d'Aran valley in Catalunya in 2013, and the Lorca earthquake in 2011. These case studies served as test areas for collecting and using the data and provided important insights for developing an IT system architecture to manage the data.

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 organised to share the results achieved at each stage of the project with a large audience of different stakeholders, pertaining also to the business sector.

Post disaster damage data collection and analysis: why has this topic been brought up for the risk governance agenda now?

The issue of the low or insufficient quality and quantity of data related to past events, in terms of specific aspects of the events that occurred, the affected communities and the disrupted built environment is not new. In fact, commentaries regarding the low reliability of data related to damage due to floods in the United States can be found published in a book as early as 1955[1]. Whenever researchers, practitioners or decision makers have wanted to present trends of losses and events in the last decades or in the last century they have been faced with the many limitations and the lack of reliability of existing data sources. This seems strange, as usually, a few days after a disaster, media are ready to provide aggregate numbers regarding victims and overall compensation needs. However, such numbers are rarely verified or verifiable, and long after the event damage estimations are still affected by large uncertainties. Furthermore, current practices in damage assessment for compensation purposes do not contribute to analysing the damage drivers. Damage assessment is usually carried out to get financial compensation, while little or no effort is put in on decision making regarding resilient reconstruction based on lessons learnt from the occurred event. This is the reason why in the last few years a large effort has been made by different levels of governments, and international and European institutions in order 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. The initiative led by DG-ECHO, and now taken over by the recently instituted Disaster Risk Management Knowledge Centre (DRMKC) led by the JRC, is one important example, the other being the Sendai Framework for Disaster Risk Reduction that requires "Understanding risk" as the first pillar of the new agenda for the next fifteen years. "Understanding risk", made explicit in the document signed on the occasion of the World Conference in Sendai in March 2015, also means

[1] W. Hoyt, W. Langbein, Floods, Princeton University Press, 1955.

essentially improving disaster data at all levels, starting from global and going down to national and local and the other way round.

It should be pointed out that improved damage data quality leads to improved risk mitigation measures. But, in what sense? First, with better knowledge of damage and losses we can improve program resources to cope with them and possibly to avoid them. Understanding better the causes of damage, including also the man-made causes arising from excessive exposure in hazardous areas and high levels of vulnerability, we can better address reconstruction decisions and also reveal lessons to help mitigating risks in areas similar to the ones that have been affected. Finally, improved damage data can be used for calibrating and verifying the models, testing damage forecast outputs against observed damage that has actually occurred in a given scenario, in the particular event that has occurred. Even though an individual instance cannot be used for "scientific" validation or verification, it can still be used to get greater insights into real events, understanding what aspects and elements of risk should be better known and analyzed in order to provide improved damage forecasts in the future and more reliable risk models.

In this regard, the IDEA project has conducted a number of verification tests using real events that have been investigated in depth 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.

Similarly to the DRMKC initiative already mentioned here, we wish to look at the results of the IDEA project through the same lenses suggested by DRMKC: ***knowledge, innovation,*** and ***partnership*** that are a thread of many current initiatives.

Knowledge that has been acquired during the project

The experience that has been gained by the partners of the IDEA project working together and sharing and exchanging ideas with other stakeholders either individually or in joint workshops permitted the reinforcement of some findings that had also been matured in a previous project (see e.g. the Know-4-drr project funded under the 7th FP by the EU Commission). We found that whilst all focus and attention is generally devoted to ***scientific knowledge***, ***regulatory*** and ***organizational knowledge*** are equally important for risk governance. As for the former, it is essential to know which laws, decrees, regulations and norms are pertinent to post disaster damage data collection campaigns; which agencies of the state or what private bodies are responsible for compensation and damage recovery, what are the conditions for being entitled to aid. Organisational knowledge is essential in order to know how complex organisations, such as public administrations or insurance companies, work. In order 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 and combine their interpretation and understanding of calamities and recovery needs. Different types of knowledge are "possessed" 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. The stress on the point that different types of knowledge held by different stakeholders need to be shared is important because the advancement in post disaster damage understanding and accounting capacity depends not only on the scientific identification of crucial data and information to be collected, but also on the development of improved and agreed-upon procedures to match the political need to respond as fast as possible to the pressures generated by a disaster and the requirement to get better insight on the affected assets.

Data collection practices and challenges

Regarding knowledge in the widest possible sense, we have certainly gained a much deeper and profound understanding of what the current practices in damage data collection are and the numerous challenges ahead.

An important challenge is the need to get, in the meantime, 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 also allows consideration of the interdependencies and interrelations among sectors leading to indirect damage, determined by ripple, cascading, and enchained effects.

Without comprehensively considering all sectors we cannot achieve an understanding of the overall damage a community has suffered as a result of an extreme event. How different sectors and their relative components can be damaged must be known if, for example, we wish to create a common and shared platform where data are stored and queried upon request.

There are two other important key aspects in any damage data collection and analysis that are often neglected: ***the time and the spatial scale.*** As for the former, we need to be aware that not all damage appears immediately after the event; some damage,especially indirect damage, due to ripple effects across systems may become manifest only some time later, even weeks or months later.

Sectors	Scale	Aspects	Type of damage	Tool/data
Event	local/regional	hazard		regional/CNR/ Tevere River Basin/other
People (victims, evacuated)	local	loss	direct and indirect	Regional Authority and interviews
Lifelines	regional	loss and functionality	direct and indirect	Authority, lifelines provideers
Public facilities	provincial/ regional	loss and functionality	direct and indirect	Regional, provincial and local authorities
Agricolture	regional/large scale	loss	direct	Regional/associations/others
Industrial plants	local	vulnerability and loss	direct and indirect	Local authorities, Regional authorities, direct surveys
Residential buildings	local	vulnerability and loss	direct and indirect	Local authorities, direct surveys
Cultural heritage	local	vulnerability and loss	direct and indirect	Local authorities, specific authorities
Natural environment	local/regional	loss	direct and indirect	Regional authorities, Parks, others

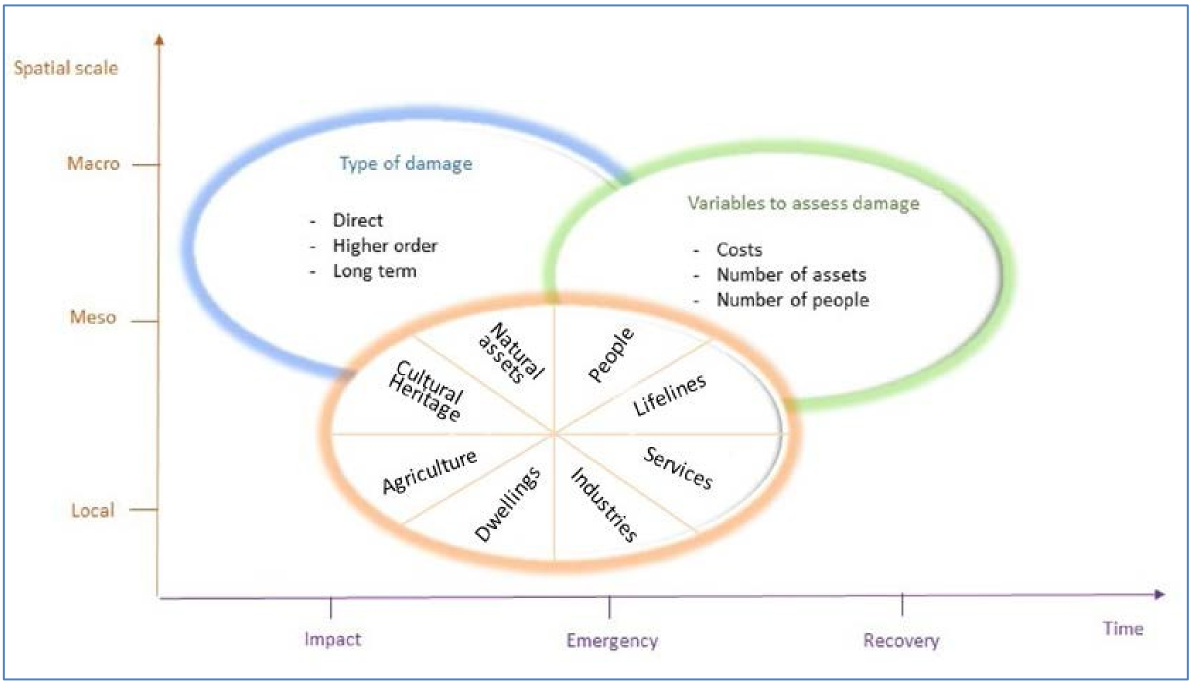
Table showing the sectors for which data should be collected

This means that on the one hand, a precise time-stamp must be attributed to damage data while on the other ***data collection is an iterative process*** that requires at least a couple of cycles to be accomplished in a satisfactory way. This is already implicitly done, but not in a systematic way and operators are not always aware of the need to distinguish between different phases of damage data collection. In our own experience we have decided to distinguish very clearly between “crisis data”, that is data produced during the emergency that provides a first picture of the situation, and more consolidated data, that are the result of survey campaigns or coming at the end of the damage collection cycles.

As for the spatial scale, it is important to identify the community that has been affected, whether it is a municipality, a region, a nation or a cross bordering region.
This permits the selection of the most appropriate level of analysis and overcoming inconsistencies related to the fact that a damage for one community may translate into a gain for another. It is also important to state that not all damages can be identified at the same scale. Physical damage to assets and buildings can be surveyed and analyzed at the local scale; systemic damage producing malfunction to critical infrastructures is often visible only at a larger scale. Consider for example damage to a transport network: the physical damage to a bridge is local, but the consequences may reach farther areas depending on the relevance of the network, on the cities and regions it connects, and on available redundancies.

Innovation on the way and for the future

Innovation is already on the way as far as damage data collection is concerned.



Framework showing the need to assess damage at multiple spatial and temporal scales for different sectors

There are guidelines provided by international organsiations, such as the Guidelines to conduct flood damage assessment issued by the World Meteorological Organisation in 2007[2] and the Post Disaster Needs Assessment developed as a joint initiative of the European Commission, the UN and the World Bank. At national level, several countries have issued rules and recommendations regarding how to produce reports and forms to apply for compensation. Databases of damage and loss data have been designed and implemented in some countries, such as in Slovenia (all hazards) and in Spain (floods).
A number of unresolved issues still require further innovation efforts. We deem it is important to invest in two types of ***innovation: in processes*** and ***in technologies*** or in the use of technologies.
As for the former, the whole procedure of damage data collection requires some innovation, not disrupting current procedures, but rationalizing them and producing a more advanced result in terms of quality and reliability of collected and managed data, while at the same time overall simplifying the workflow and the work load for each entity and person in charge of damage data. An important innovation that has already been recommended in the Report issued by the EU Technical Group (2015) as Guidance for the European Member States, refers to the coordination of data across sectors i.e. between private and public organisations and within public administrations between different levels of government and different offices and departments of the same governmental organization. Without such coordination it will be impossible to actually collect and organize the different damage data in a satisfactory way. There is the need for a person or a small group to be in charge of this task. Coordination certainly requires the willingness of those involved to collaborate towards the common goal. This is a point that will be further discussed under "Partnership".

As for technological innovation, it is rather banal to say that modern IT permits a much better and faster data management. However, as evidenced by the work conducted in the IDEA project it is clear that without knowledge on why and how different stakeholders collect data and for what purposes and how such data will be later used for a variety of purposes it is virtually impossible to design a system that will be useful and usable. Many tools are actually already offered in the market and more are currently being developed in research projects. However, without the required level of interaction with stakeholders (again partnership) and 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. Available tools can be effectively used for a very limited range of operations, data are too often lost, and a comprehensive picture needed for a number of applications including responding to international obligations such as Sendai is at present unachievable. In the IDEA project we have proposed an IT architecture that has at its core the damage, intended as physical direct effect of the event, as systemic consequence, and as economic loss. This is the result of a quite complex understanding of the need to reconcile different interpretations and understanding of damage. Relevant indicators for each sector and subsector have to be sufficiently interpreted to provide a satisfactory damage representation, useful for those who input the data and for those that will query it at a subsequent stage. This is in order to use data in multiple ways ranging from producing reports to different levels of government or to the EU, to providing researchers with information to help them improve risk assessment models, and to analysing damage causes and drivers.
Innovation is required also to improve cost benefit analyses, grounding them more on the knowledge of damage drivers and causes, and on the most

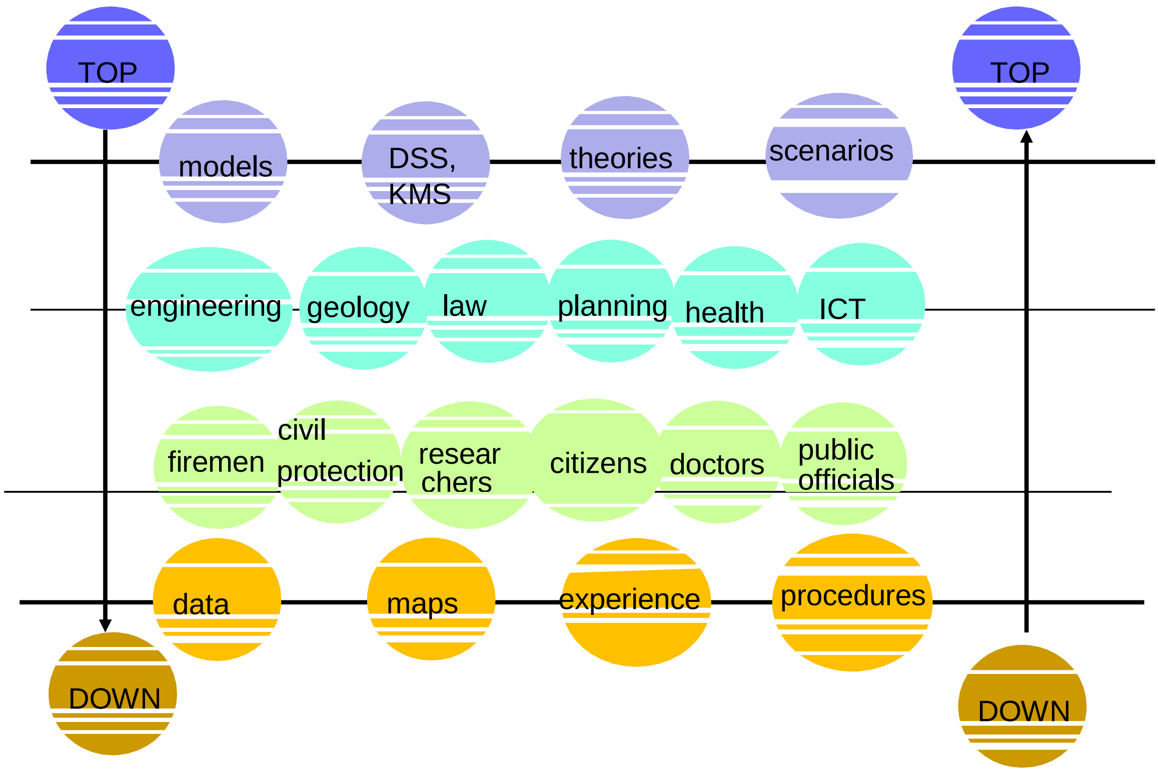
[2] World Meteorological Organisation (WMO): Conducting flood loss assessment. A tool for integrated flood management, APFM Technical Document n.7, Flood Management Tools Series, WMO, 2007

appropriate risk mitigation measures and their relative costs. Also, it is key to evaluating cost and benefits of mitigation measures that are feasible and actually useful in terms or risk reduction.
In addition, the benefits of avoiding damage for non-renewable goods and assets fundamental for activities such as tourism or with an unquantifiable economic value, such as branding, should be considered. Highlighting the benefits of saving such non-renewable goods and assets rather than pointing at the costs associated to damage may be a way to change the current perception of mitigation costs. The latter are perceived as immediate, whilst benefits are seen as something in the longer term with no immediate tangible results, unless differently presented and perceived.

Partnership

In the DRMKC website, under "partnership" it is written that what is sought is "to exploit and translate complex science into useful policy and applications in Disaster Risk Management". As discussed in the previous section on "knowledge", we believe that 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 acknowledges in several environmental and societal domains is certainly extremely important to avoid the chimera of easy solutions that might imply a risk of producing worse side effects than the problems they try to solve. In the meantime, organizational and legislative knowledge may inform scientists on what can be qualified as useful knowledge. Regarding damage data collection and consequent multipurpose use, we may say that stakeholders pertaining to different sectors have relevant knowledge that would be extremely important to share in order to understand: i. what are specific ***needs in terms of data collection and analysis***; ii. whether or not enhanced capacity to develop ***comprehensive damage scenarios*** can constitute an advantage for each stakeholder in performing its task. Also in the IDEA project, as was the case in former research, we found that some stakeholders are very open in sharing their data while others are still reluctant to do so. Changes can be perceived though, particularly in the insurance sector with the relevant examples of the initiatives taken in Norway and France where insurers have substantially contributed to create a public space where their data, deprived of sensitive components, have been made available to gain insight into the damage provoked by natural hazards in the last decade or so. Insurance companies may work with civil protection authorities to revise hazard zoning when the latter is found to be erroneous; including exposure and vulnerability considerations that may permit the adjustment of the level of premiums to the actual risk level instead of spreading it across all insured.
In our own experience, we found that there are still obstacles for lifeline managing companies, particularly for some, more for power than for water companies, more for telecommunication rather than transportation systems. This has to do with the ownership of the network (public versus private) but also with secrecy requirements that are justified by security. Sometimes it is simply due to a culture of the enterprise that has been traditionally protective of data for a long time and it is therefore difficult to change.
We can conclude that such partnership is the result of a process that we have initiated with the stakeholders involved in the IDEA project and that can be considered the beginning of a different way of approaching actors across public and private organisations.
Certainly partnership between the research sphere and organisations pertaining to both private and public sectors that we have considered essential for a comprehensive interpretation of damage should be encouraged in any possible way. This can be done by showing the opportunities and benefits that such sharing and enhanced understanding of the causes and drivers of damage may open, leading in the longer term to more resilient sectors, be it lifelines, critical infrastructures or businesses. Even though this was not the focus of the IDEA project,

we have devoted some attention to the common knowledge of citizens, of the so called “civil society” that is increasingly active and present in the phase of signaling damage, outages, and malfunctions during and after emergencies. There is a new fud of information and data that is virtually open to anyone as people interact through the web to share videos, texts, photos of the disaster they are experiencing. Taking on board citizens in the effort to improve damage data collection is part of our reflection and of some of our suggestions at the end of the IDEA project. In this respect, we are at the starting point. It requires innovation, not so much in the technology which already exists, but in the capacity to manage it in a mature way, engaging the public, raising awareness on the importance of accurate damage data collection and analysis in order to improve the way disasters are managed and with the final aim of reducing their impact.



Mapping stakeholders activity between theoretical and applied work

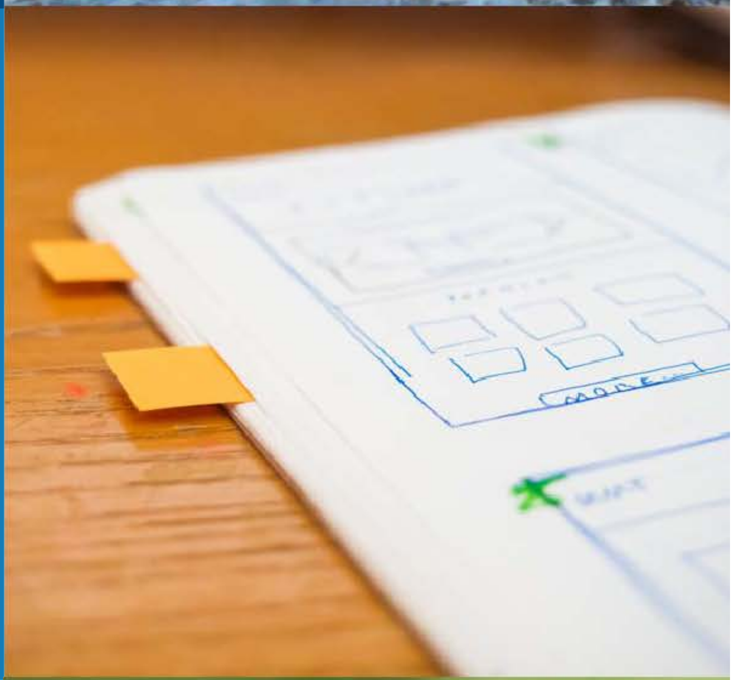
Post disaster damage data collection and analysis

Enable the knowledge to meet

Scientific, regulatory and organizational knowledge are equally relevant as far as damage data collection and analysis is concerned.

They permit to understand:
1) what are specific needs in terms of data collection and analysis
2) whether or not enhanced capacity to develop comprehensive damage scenario can constitute an advantage for each stakeholder in performing its task.

Innovate in processes



The innovation in procedures of damage data collection would
1) not disrupt current procedures but rationalize them and produce a more advanced result in terms of quality and reliability of collected and managed data
2) simplify the workflow and the work load for each entity and person in charge of damage data.

Create systemic knowledge

1) Adopt a systemic perspective on the damage to multiple sectors permits to consider the interdependencies and interrelations among sectors
2) Consider damage data collection is an iterative process that requires at least a couple of cycles to be accomplished in a satisfactory way

3) Attribute a precise time-stamp to damage data to explicit the time of damage 'appearance'
3) Define the spatial scale to describe what is the community that has been affected.