

## CHALLENGES FOR THE USE OF INFORMATION TECHNOLOGY AND STANDARDS IN INTERNATIONAL DISASTER MANAGEMENT

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### Abstract

In this paper we will reflect on the regulatory framework for communication exchange in case of international disasters. In particular, we will consider the potential challenges of the existing regulatory measures and standards for information exchange and disaster relief in the EU. First responders' behaviour during the disaster relief is defined by standards and local measures regulating the domain of civil protection. Sovereign states adopt legislation that determine the set-ups of civil protection mechanisms, communication channels and other relevant measures related to disaster response. States also carry responsibility for adopting laws that would enable assistance from national or international resources. Often "international disasters" challenge domestic regulations with strong requirements on flexibility and ability to accommodate a number of local teams and supporting teams from either neighbouring administrations (e.g., counties, districts or municipalities) and/or international organisations (e.g., the EU or the United Nations) and/or Non-Governmental Organisations. However, even in the event of "international" disaster relief, which results in coordination of multi-level governance structures, local teams of first responders depend on their contingency and disaster management plans and on their ability to integrate and share information with the assisting teams.

Disaster response strongly depends on the efficiency of information exchange: rich and timely information can empower stakeholders and first responders with a good situational awareness and allow an optimal allocation of resources. In general, sharing and processing data, including personal data, during emergencies is subject to legal requirements. Often legal requirements set constraints for operational staff involved in relief actions. Yet, due to the need for prompt actions and the aim for providing help, responders in disaster relief may fall short on compliance with legal requirements.

Given such contrasting predicaments, it is timely to discuss whether there is a need for legislative and policy measures that would reduce uncertainties influencing the fieldwork of first responders. Legal framework affects the way how information exchange is enabled amongst various layers at different institutional stages, which may include sharing of operational pictures, updating availability of human and material resources and forwarding individual-related data. Therefore, in this paper we will set the scene for such a debate by considering the limitations of existing regulatory frameworks and standards. We will also consider how they could be integrated with new technologies and legal initiatives.

Keywords: crisis management, disaster relief, standards, communication, legal aspects and information exchange.

## 1 INTRODUCTION

The word “disaster” indicates an alarming situation and may be used to refer to emergencies, crisis, critical events, terrorist attacks, technical accidents and alike events having adverse impact. The EU has adopted a definition for a disaster, it “means any situation which has or may have a severe impact on people, the environment, or property, including cultural heritage.” [1] Yet there is a number of other definitions for the term “disaster”. It can be argued that to date the most elaborate definition has been proposed by the United Nations International Strategy for Disaster Reduction (UNISDR), which defines “a disaster” as “a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources.” This definition has been recognised by various first responders and by the International Federation of Red Cross and Red Crescent Societies (IFRC). The International Disaster Database EM-DAT takes a somewhat different approach and proposes specific criteria to qualify a situation as a disaster, for example, ten or more people reported killed, a hundred or more people reported affected.

Disasters can be categorised according to different dimensions, such as source (e.g., natural or human-made), scope (e.g., local or international) and impact (e.g., low and high). “International” disasters, on which we focus throughout this paper, refer to situations either where disasters occur in cross-border areas and require a combined action by neighbouring countries, or where the impact overwhelms the response capacity of the affected country. An important indicator for the term cross-border disaster management is that it exceeds the daily-routine procedures of emergency services and requires additional capabilities. The Council of Europe Convention on Transfrontier Co-operation between Territorial Communities or Authorities (no. 106) facilitates and encourages cross-border cooperation on civil protection and mutual aid in the event of disasters occurring in frontier areas on the basis of agreements between regions and local authorities. Therefore, at the moment the cross-border cooperation is subject to international (bilateral and multilateral), national and regional treaties and/or agreements.

When it comes to organising an effective disaster response, it is not the number of different disaster definitions that may have an impact on the field work but rather the lack of common standards for emergency communication. This is of a particular concern to the EU as a crisis manager and is a specific area of research of the EPISECC project. [2] The EPISECC project aims at developing a Pan-European information space for all actors providing disaster relief. [3] The Pan-European information space would be used to improve the collaboration in disaster management situations. Setting such a system implies an EU wide standardization activity, which will expand the EU market for organizations developing solutions and tools for crisis management.

In the following sections of our paper we will reflect on the current EU approach to disaster relief that includes both regulatory measures developed by the EU and its Member States and standards developed for various purposes at different levels. The main objective of our paper is to consider whether the existing standards and procedures solve practical problems on the disaster scene or whether they clash with national laws on information management in disaster relief. The second section will discuss the EU regulatory framework for disaster management. The third section will point out some limitations of the EU Civil Protection Mechanism. The fourth section will underline challenges for available tools in disaster management. The fifth section will map and analyse the current landscape of available standards used in disaster management. The subsequent sections will analyse the impact of operational, cultural standards and good practices on disaster management. The final section of the paper will summarise the discussion and propose actions for the future.

## 2 THE EU APPROACH TO DISASTER MANAGEMENT

At the moment, the EU disaster management framework is highly fragmented. The civil protection field is typically subject to domestic laws and regulations. Sovereign states determine the set-up of their civil protection mechanisms, communication channels and other relevant measures related to

disaster response. Practice has shown and first responders point out clear limitations of the current approach, which often give rise to technological, sociological, and organizational challenges. [4]

The EU has recognized the need for improved and more coordinated cooperation within the Union between national civil protection services in disaster response in Communication “The EU Internal Security Strategy in Action: Five steps towards a more secure Europe”. [2] The Communication points out a need for “improvements to long-standing crisis and disaster management practices in terms of efficiency and coherence [...] solidarity in response, and responsibility in prevention and preparedness with an emphasis on better risk assessment and risk management at EU level of all potential hazards.”[2]

At the same time, EU citizens are also in favor of a more coordinated disaster management approach. A recent Eurobarometer study shows that majority of EU citizens deem that a coordinated EU action in dealing with disasters could be more effective than actions by individual countries. [4] Moreover, a large number of EU citizens consider pooling civil protection resources in the EU to be more cost-effective than each country managing their own resources. [5]

### 3 THE SCOPE OF THE EU CIVIL PROTECTION MECHANISM

The EU Civil Protection Mechanism (CPM) was launched in fall 2001, just shortly after the terrorist attacks in the USA. Some argue that the EU CPM was built on old ideas but provided new tools. [7] Indeed, several EU initiatives related to the Member State cooperation in the civil protection area, in particular in the field of environmental protection, date back to the 80's. The novelty of the EU CPM was that it provided an integrated coordination in the field of disaster response.

The EU CPM allows swift relocation of needed resources. For the mechanism to be triggered, a country hit by a disaster has to submit a request for assistance to the European Commission. Although only European countries are parties to the mechanism, the mechanism can be activated to tackle disasters outside the EU. The mechanism was used 186 times between 2007 and 2013.

The setup and advancement of the civil protection mechanism reflect the institutional and competence changes within the EU. The Lisbon Treaty (2009) has provided the EU with a new legal basis to encourage Member States' cooperation in the civil protection matters. According to Article 196 of the Treaty on the Functioning of the European Union (TFEU), the EU can support and complement Member States actions undertaken on national, regional and local levels related to the field of civil protection [8]. The EU can also “promote swift, effective operational cooperation within the Union between national civil-protection services” and “promote consistency in international civil-protection work” [8]. Article 196 of the TFEU should be read together with the solidarity clause. The solidarity clause provides that in case of natural or man-made disasters Member States “shall act jointly in a spirit of solidarity” [8]. The wording of this article is somewhat vague and it does not set any limits as to the implementation of the provision under different circumstances. However, it underlines the existing limitations of the current approach. The mechanism is based on voluntary participation and can be triggered only in a response to “request for assistance under the Union Mechanism in the event of an imminent disaster, or during or after a disaster, to address its immediate adverse consequences”. [1] Noteworthy, it does not cover disasters of a smaller scale or occurring in cross border situations.

### 4 REMAINING CHALLENGES FOR DISASTER MANAGEMENT

Coping with disasters, in particular, the ones overwhelming the capacity of a country, requires coordination of multiple actors and multi-level governance structures. Disaster management across border includes stakeholders from various countries or international organisations, governmental bodies and agencies and heterogeneous legal personalities. [9] Typically, cross-border disasters demand cooperation between governmental decision-makers and disaster relief services of affected countries, response units of assisting countries and/or relief personnel of international organisations deployed to assist in disaster management. Many illustrative examples show the struggle to set up

well functioning disaster relief structures. As stated by Walle and Turoff, the distribution of responsibilities is an important issue in disaster management. [10] Responsibilities at different levels are depending on the extent of the event and the available capabilities to cope with. In cross-border disasters the resilience of an affected community – measured by its ability to recover by its own capacities – is challenged by principles of solidarity, subsidiarity and sovereignty. Coordination efforts include information sharing for the purpose of resource management (e.g. resource allocation), situational awareness (e.g. sharing geographic information) and command and control activities (e.g. deploy relief units). Sagun et al. distinguish between four channels of information flow during the Disaster Management, namely communication within an organisation, between organisations, from the public to organisations and vice versa. [11] In order to obtain a common picture of the situation by merging information, which is spreading across several stakeholders, harmonised procedures are obligatory. At each level of the command and control structure (strategic, tactical and operational) different kinds of information are available. According to specific information requirements, at the operational or field level, mainly information about available human and material resources as well as important geo-locations like hospitals will be shared. While information gathering at the tactical level focuses on collecting battlefield information, aggregating and re-providing information about domestic capabilities, standard operating procedures and maps in use for further use, at the strategic stage the so-called “big picture” is generated. Here, all activities in the course of the disaster relief process are monitored based on the information obtained from the levels below. This is the place where an overall strategy for disaster relief is developed. [12] Moreover, with the ability to overlook, the provision of additional resources, units, capacity etc. that might be requested is a major business. Therefore, most sustainable efforts to harmonise conflicting approaches in sharing information for the purpose of cross-border disaster management can be undertaken at the strategic level. Strategic actors such as legislators or policymakers have the power to initiate or pass laws favouring a common disaster management. Thus maximise the effectiveness of actions in fighting against disasters by establishing a common framework for tactical-operational stakeholders such as incident commanders and member of crisis units.

Apart from legal requirements, information exchange in disaster management is often challenged by practical problems such as language barriers, which are located at a low level. Challenges to interoperability might be due to a lack of common practice, outstanding experience, heterogeneous taxonomy, incompatibility of applied systems. Additionally, it has been observed that first responders are often challenged to comply with competing regulatory regimes while providing disaster relief. For example, in Austria, alike in the other EU Member States, information exchange (processing) that includes personal details is subject to legal rules. Obtaining information about a single person depends on the role and remits of an organisation or institutional unit, which are defined by its mandate to become active during disasters and/or emergencies. In certain cases organisations are constrained to forward personal information. For example, Austrian ambulance services are authorised to process data about missing persons to the law enforcement authorities.

Problems in coordinating disaster relief or exchanging information across different organisations become obvious at the fieldwork level, but there is some evidence that interoperability problems arose at a higher level of organisation. The holistic view on the event can be located at the strategic level, where long-term strategies, definitions of relevant terms and an appropriate framework (e.g. laws and policies), as well as risk monitoring activities and communication with the public are important tasks. For disaster relief actions the strategic level provides the framework for allocating various resources and coordinated actions. Especially in cross border events, transnational agreements concluded on the strategic level emphasize the role of actors on the strategic level. Measures of the tactical level are dedicated to ensure that the actions taken by the operational level are coordinated, coherent and integrated in order to achieve maximum effectiveness and efficiency. [13] At the tactical level, commanders of disaster relief units have to deal with difficulties of allocating resources in a coordinated way. In order to perform relief efforts in an efficient way, the harmonization of emergency operations is considered as a challenge for the operational level. Because operational forces are the staff at the field, they have best prerequisites to assess the impact and inform the tactical level about the situation needs.

## 5 COMMUNICATION EXCHANGE STANDARDS IN DISASTER MANAGEMENT

Standards constitute a significant part of regulatory frameworks and they may be understood in a number of ways. In a broad sense, various instruments, such as legislative measures, directives, and regulations introducing certain requirements, may result in a standard. In a narrow sense, standards can be understood as technical specifications. Therefore, often a standard is considered to be “a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that materials, products, processes and services are fit for their purpose”. [14]

At the same time, standards may be grouped according to different criteria. For example, standards may be formal or informal, based on good practice or a mandate given to a particular working group. Standards in their application can be global/international, regional (e.g., European) or domestic (e.g., limited to a country).

In the following sub-subsections we analyse available standards for communication in/for disaster management. In particular we will consider several examples of standards reflecting technical, operational and cultural interoperability layers. We will reflect on the use and practical implications of these standards to a disaster response.

### 5.1 Interoperability layers

Interoperability is defined as “the ability of two or more systems or components to exchange information and to use the information that has been exchanged”. [14] In disaster management interoperability can be seen as the primary need at all levels for taking decisions and managing operations.

To improve the understanding of the organisational processes in emergency situations, the ESENET project adopted a structure based on the concept of “Interoperability Layers” (fig. 1). [15] The resulting “Interoperability Stack” shows how the crucial challenge of ensuring interoperability and communication in disaster management requires the implementation of several levels of interoperability, which range from the basic physical interoperability of devices to the agreement of political objectives of the organisations. The organization of the sections is bottom-up (i.e. from the Technical Layers up to the Organisational ones) and the central layer (“knowledge/awareness”) is where both technical and organisational strands tend to: it represents the ultimate goal of the whole concept of interoperability in emergency management.

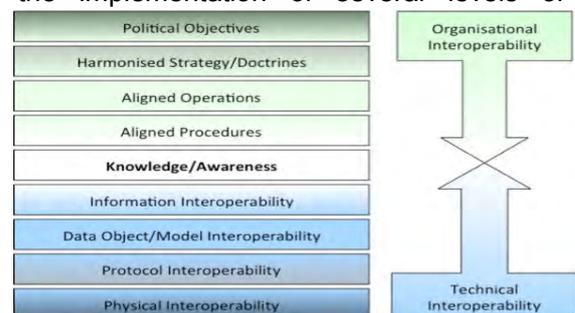


Fig. 1 - Layers of Interoperability (ESENET project)

For the purposes of this paper, we shall divide the above listed nine layers into three groups: Technical, Operational and Cultural.

### 5.2 Technical standards

Many Standardisation Organisations (SO) exist, combining different geographical relevance (e.g. global or regional), covered technical area (e.g. telecommunications, electronics, Internet) and application domain (e.g. engineering, emergency, transport). It is well beyond the scope of this paper to survey all the existing technical standards that are applied or are relevant for disaster management. Yet it is worth mentioning, the main SO and an important initiative from the European Commission for supporting the European Union policy on security: the Mandate 487.

The two main SO at global level are the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO), whose standards span from agriculture and from electronics to packaging. Besides a large number of standards commonly used in emergency

management, the activities of the ISO Technical Committee (TC) 223 (Societal Security) are of particular relevance for disaster management. ISO/TC 223 is structured in six Working Groups (WG), covering Emergency Management, Resilience and Continuity, Communication and Mass Evacuation. Concerning data exchange, it is particularly relevant the Technical Report ISO/TR 22351 "Message structure for exchange of information" approved and ready for publication (at the date of the writing of this paper). [16]

The three main European SO are the European Committee for Standardization (CEN), the European Committee for Electrotechnical Standardization (CENELEC) and the European Telecommunications Standards Institute (ETSI). Additionally, ETSI has created a dedicated project named EMTEL (Emergency TELEcommunications) to work on areas of great interest for disaster management. Besides other, the Technical standards TS 102 181 (Requirements for communication between authorities/organizations during emergencies), TS 102 182 (Requirements for communications from authorities/organizations to individuals, groups or the general public during emergencies) and TS 102 410 (Basis of requirements for communications between individuals and between individuals and authorities whilst emergencies are in progress) are relevant for this paper.

CEN and CENELEC have consolidated a close collaboration and they are now commonly referred as CEN-CENELEC. CEN/TC391 "Societal and Citizen Security" is particularly relevant for disaster management and was the leading group of the efforts carried out under the Mandate 487. More precisely, the Mandate 487 concerned the development of a work programme for the definition of European Standards and other standardisation deliverables in the area of security. It was aimed at analysing needs and possible activities for defining interoperability standards (technical, syntax, semantic and operational) and expected performances. The activities performed by CEN-CENELEC and ETSI under the mandate 487 have produced a final report "Proposed standardization work programmes and road maps".

In addition to these official SO, it is worth mentioning other initiatives aimed at defining de facto standard, such as the OASIS (Advancing Open Standards for the Information Society), a non-profit consortium that develops and promotes open standards for the global information society. Another non-profit organization relevant for emergency management is the Internet Society (ISOC), whose Internet Engineering Task Force (IETF) works on standards in emergency management through its Working Group "Emergency Context Resolution with Internet Technologies" (ECRIT).

It should be noted that when systems for disaster management are implemented, also national standards and proprietary implementation come into play, somehow contrasting the global interoperability targeted by all the mentioned standards.

## 5.2 Operational standards

To date, only limited literature is available on good practices that are used by organisations providing disaster response. Sharing of information across border varies from one country to another and is determined by the nature of the relationship between nations. There are no overarching standard procedures which serve as a common approach how to respond to a disaster in the best way.

Currently the European Commission is coordinating the development of a Community of Users on disaster risk and crisis management. On one hand multiple bodies of the European Commission are responsible for different policy aspects of crisis management, on the other a large multitude of European as well as national research projects is performed in different domains being relevant for crisis management. So far, systematic links between the policy makers at European level as well as other type of users and the European research activities providing operational features being relevant for crisis management are missing or, if existing at all, are only available in a fragmented way. A major challenge in European Disaster Management is therefore a "mapping" of operational features arising from the different research domains such as preparedness, prevention and response, detection and surveillance or protection and recovery with the requirements of users such as the above mentioned policy makers operating at the level of the European Commission. The Community of Users includes also other actors such as operational units, the general public or the industry. Main domains of crisis

management are the mastering of CBRN-E events, man-made as well as natural disasters. In all three cases interoperability between stakeholders being active on strategic, tactical or operative level is an imperative pre-requirement for successful accomplishment of such events. Interoperability encompasses multiple aspects such as use of common taxonomies, application of systems being interoperable to each other or the provision and sustenance of a common information space.

Trans-regional cooperation was established in regions with a common threat and culture, e.g. regional cooperation of the Baltic area, South-Eastern Europe and the Mediterranean. Similar to Austria, a lot of European countries have established Cooperation Agreements on mutual help in protection measures beyond borders. [19] The majority of countries covered by the ANVIL Report signed bilateral agreements on emergency and/or disaster assistance with nearly all of their neighbours and are frequently well embedded in multilateral agreements. Best practices of natural disaster prevention have been stimulated by INTERREG initiatives, launched by the Committee of the Regions and promote the establishment of protocols for cross-border cooperation. This should facilitate a rapid data exchange, united forecasting capabilities and coordinated mutual help in the case of emergencies.

Experiences of the Austrian Red Cross showed that communication challenges can be overcome by consulting sister organisations in the respective country. The reason why non-governmental organisations such as the International Federation of Red Cross and Red Crescent Societies (IFRC, 2007) have established Standard Operating Procedures (SOPs) lies in the fact, that legal framework is often missing. [19] Current asymmetries in the state of knowledge impede coordination processes amongst different relief organisations, which are related to heterogeneity of data pools about country-specific vulnerabilities to disasters. In cases where central data would be needed, e.g. data of federal agencies, access rights for non-governmental relief organisations are limited due to the principle of subsidiarity. In general, sharing personal data even during emergencies is subject to the data protection law, which restricts the forwarding of personal data. Flexibilities exist in the case of infectious diseases, where a special law can overrule general law.

## 6 CONCLUDING REMARKS

Our contribution has shown that a number of technical, operational and cultural standards have been developed to improve communication exchanged in disaster response. This somewhat leads to standard pluralism, where several standards can be invoked at once. At the same time, a desk research has shown that currently standards serve as an extension of domestic laws. Yet the use and integration of standards into national regulatory frameworks raise some questions. How to measure which standard is more worthwhile to consider? How to effectively integrate standards into domestic laws? What is the political mandate of groups that have developed a standard? Who would have a capacity to provide such a mandate? Is better to follow bottom up rather than top-down approach? Who is responsible for the implementation and enforcement of the standard? How to ensure that standards aim at enhancing interoperability of the systems rather than leading to fragmentation? What procedures should be put in place that would allow continuously upgrade the standard?

Regardless, where problems occur, a lack of interoperability in crisis and disasters might influence the performance of agencies concerned with managing disasters on strategic, tactical and operative levels. Harmonisation of procedures at higher levels that are affecting the work of practitioners in the field level seems to be needed. Especially, if national law is derogating from international law concerning the deployment of relief workers or in the case, if international procedures and domestic practices of managing disasters are not interlocking at all. This might be the case, if the structure of a state's administration does not fit with Standard Operating Procedures (SOPs) of international organisations, which provide relief personnel. Restrictions in exchanging information across organisational and/or national borders between different types of stakeholders were considered as serious hindrances for an efficient coordination of disaster management. Frequently a lack of legal and/or political provisions evoke, that Standard Operating Procedures were conceived as missing link between the legal/organisational framework of affected states and the deployment of international assistance. Indeed, peculiarities in managing disasters and the necessity of coordinated procedures to meet the requirements of international or cross-border disaster management need to find a joint

basis for collaboration across borders. A common understanding of coordination structures and decision making processes could be seen as a further step towards a comprehensive inter-agency and cross-border collaboration. Thereby national and/or organisational boundaries, which influence the efficiency of mutual assistance in disaster management procedures, should be taken into account. Efforts focusing on the improvement of planning activities as well as the field-level collaboration need to consider the whole range of multiple actors with its legal mandate, functions and the scope of their actions in disaster management. As a big challenge it should be taken into account, that framework conditions should be designed in a way to enable, and not to be a hindrance for practising solidarity in terms of mutual help and subsidiarity in terms of self-protection capacities.

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