



DARWIN RESILIENCE MANAGEMENT GUIDELINES (DRMG Book)

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Acknowledgements, ethical and license considerations

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Data has been gathered and stored according to appropriate data protection mechanisms, in accordance with the EU General Data Protection Regulation (GDPR). It has followed applicable ethical and security regulations ensuring anonymization and confidentiality.

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About the DARWIN project

In recent years crises and disasters (Eyjafjallajökull and Deepwater Horizon 2010, Fukushima Daiichi 2011) have made it obvious that a more resilient approach to preparing for and dealing with such events is needed. The DARWIN project aimed improve response to expected and unexpected crises affecting critical infrastructures and social structures. It addresses the management of both man-made events (e.g. cyber-attacks) and natural events (e.g. earthquakes).

The main objective and core result of the project is the development of DARWIN resilience management guidelines (DRMG). The DRMG improves the ability of stakeholders to anticipate, monitor, respond, adapt, learn and evolve, to operate efficiently in the face of crises. The DRMG are not prescriptive guidelines for crisis management per se, but enable organizations to give a critical view on their own crisis management processes and practices grounded in research and practice on resilience management inspired by the fields of Resilience Engineering and Community Resilience.

The DRMG cover most essential and important resilience concepts as identified from a worldwide survey and practitioners needs and requirements. These concepts are operationalized through resilience themes and associated resilience capabilities cards in the DRMG. It has been iteratively updated after and guidelines evaluation that involved 247 practitioners from 22 different countries.

The DARWIN resilience management guidelines (DRMG) are presented in diverse formats such the DRMG Book, the DARWIN Wiki and others for easy usage and maintenance to avoid them being dust-collectors on a shelf. To enable dynamic, user-friendly guidelines the project developed a DARWIN Wiki is now a knowledge management platform enabling organisations to adapt, adopt and further develop the guidelines to improve resilience. Other developments within the DARWIN project include serious games, simulation and tutorials to facilitate.

A multidisciplinary approach has been applied, involving experts in the field of resilience, crisis and risk management, and service providers in the Air Traffic Management and health care domains. To ensure transnational, cross-sector applicability, long-term relevance and uptake of project results, a Community of Crisis and Resilience Practitioners (DCoP) participated in an iterative evaluation process to provide feedback, co-create and evaluate guidelines. The target beneficiaries of DARWIN are crisis management actors and stakeholders responsible for public safety, such as critical infrastructures and service providers, which might be affected by a crisis.

Executive summary

The guidelines produced during the project DARWIN and provided in this document represent 13 topics belonging to 6 higher-level themes, captured in the table below. The topics, addressed through Capability Cards, capture a significant amount of information, structured around five main sections:

- **Purpose**, which highlights the overall objective and scope of the CC.
- **Implementation fields**, describing the interventions proposed, by phases of crisis management (across phases, before, during and after). They include “triggering questions” that capture essential resilience-oriented issues users should think of or try to address. The implementation fields represent the most essential content of the guidelines.
- **Background and context information**, to describe the objectives and rationale underlying the resilience management capability addressed, as well as associated benefits, challenges, relevant actors, illustrative examples, etc. Such content facilitates the understanding of the guidelines.
- **Relevant material**, describing selected strategies, practices, methods and tools from the implementation section, and providing references for further reading. Relevant material gives interested users the opportunity to explore further the ideas and presented in the guidelines.
- **Navigation fields**, providing ways to navigate the content of the guidelines through indicating relationship of topic with themes or categories (resilience abilities, functions of crisis management). Direct links between topics are also made in the content of the previous sections.

<i>DRMG Themes</i>	<i>DRMG Topics</i>
Supporting coordination and synchronisation of distributed operations	<ul style="list-style-type: none"> • Promoting common ground for cross-organisational collaboration in crisis management • Establishing networks for promoting inter-organisational collaboration in the management of crises • Sharing information about roles and responsibilities among organisations involved in the management of the crisis
Managing adaptive capacity	<ul style="list-style-type: none"> • Enhancing the capacity to adapt to both expected and unexpected events • Establishing conditions for adapting plans and procedures during crises and other events that challenge normal plans and procedures • Managing available resources effectively to handle changing demands
Assessing resilience	<ul style="list-style-type: none"> • Assessing community resilience to understand and develop its capacity to manage crises • Identifying sources of resilience: learning from what goes well • Noticing Brittleness
Developing and revising procedures and checklists	<ul style="list-style-type: none"> • Systematic management of policies involving policy-makers and operational personnel for dealing with emergencies and disruptions
Involving the public in Resilience Management	<ul style="list-style-type: none"> • Communication strategies for interacting with the public • Increasing the public's involvement in resilience management
Managing system failures	<ul style="list-style-type: none"> • Supporting development and maintenance of alternative working methods

The document ends with a comprehensive list of terms used throughout the guidelines.

CHAPTER 1

DRMG approach, principles and objectives

THE NATURE OF RESILIENCE IN CRISIS MANAGEMENT: OVERVIEW, FUNDAMENTALS

Recent crises, disasters, and accidents challenging established risk management strategies include 11 September 2001, the SARS and H1N1 pandemic outbreaks in 2003 and 2009, the Indian Ocean tsunami in 2004, Hurricane Katrina in 2005, the Eyjafjallajökull eruption (2010, total losses of approximately 1 billion euros), the Deepwater Horizon disaster (2010, 11 fatalities and environmental damage from the equivalent of almost 5 million barrels of oil) and the Fukushima Daiichi major accident (2011).

The use of the term Resilience has emerged during the last decades as an alternative concept for society to deal with many challenges. Based on agreement on, and a commonly increasing awareness of, the inherent shortcomings in the prevalent approach to risk and crisis management, the concept of resilience is however used differently in diverse areas and at different organisational and temporal scales. DARWIN focuses on a proactive approach for dealing with disturbances and the realisation that surprises are an inherent characteristic in these challenges. Reducing the consequences of complex vulnerabilities is therefore an important approach rather than reducing the probability for a specific risk to occur. Some trends that have influenced this call for an operationalised resilience approach are:

- The changing nature of societal risks and increased focus to address complex risks and interdependencies in society.
- The changing nature of today's and future crises in terms of their predictability of the occurrence and impacts, complexity of the consequences as well as interdependency of the countermeasures put in place.
- The awareness of the limitations in prevalent risk analytical approaches that has focused on the predictability of the occurrence and impacts of risks that has downplayed rare events, systemic risks, emerging risks and risk controversies.
- The insufficient ability and increasing demands to learn and evolve from experience from these types of crises and limitations of prevention and planning.
- The decreased tolerance to single crises and the need for the traditional *fly-fix-fly* manner of learning from crises to be supplemented with a

- more holistic and proactive systems view on prevention, anticipation and flexible responses.
- The changing regulatory and public view on safety to individuals no longer having the ability to manage the risks around them, where people are demanding greater responsibility from the regulator to secure oversight, from operators to learn from events, and to balance safety-risks, time-to-market, and budgetary pressures.
- The increase in real-time information flow to and from the public due to the complexity of the risks and crises as well as the accessibility of data through social media, thus changing the role of the population in responding to the event and their expectations from governing and response entities.
- The cascading effects which spread across geographical boundaries (nations, states or local authorities) and/or policy boundaries (between organizations, administration levels, different types of critical infrastructures), where a crisis can become trans-boundary and even develop into a global shock through non-linear processes due to increased mobility, globalisation, and interdependencies in production and operation.
- The complexity and risk of propagation of everyday performance variability and cascading to other systems, which could lead to trans-boundary crises. This coupling and complexity makes prevention, mitigation, and preparation very challenging.
- The complexity of modern crises that often require the involvement of many actors, above and beyond emergency services, thus demanding effective co-ordination for a successful outcome. There have been evolutions on risk management methods and strategies to adapt to these changes. Still, crises continue to evolve challenging the most recent risk management and robust systems.

In the context of these trends in modern-day crises and accidents, the DARWIN project bases its development of Resilience Management Guidelines on two major strands of research: The Resilience Engineering perspective, and the body of knowledge on Community Resilience. These two research strands are briefly outlined here, to provide an overview of what resilience is in the context of crisis management generally and the DARWIN project in particular.

RESILIENCE ENGINEERING

Resilience Engineering (RE) is the discipline that aims to provide design and development processes, strategies and capabilities to accomplish resilient performance in complex socio-technical systems. Resilience Engineering has been developed by researchers from the fields of Safety Science, Cognitive Systems Engineering, and Human Factors (Engineering) since the beginning of the 2000s. An early description of resilient and brittle (the opposite of resilient) performance of socio-technical systems was an analysis of the 2003 space shuttle Columbia accident. The first edited book on the subject was published after a meeting of safety scientists discussing new perspectives on safety and a number of RE symposia and books, have followed since. Notable drivers of Resilience Engineering are the need for extension of the explanatory power to understand complex accidents and incidents but also the need to understand successful outcomes (e.g., the aircraft ditching in the Hudson river).

Resilience Engineering aims to understand and cope with complexity. Complexity may be addressed in terms of coupling, interactions, tractability, and the potential for cascading effects. Coupling (loose/tight) refers to the time-dependency of a process, the flexibility of action sequences, the number of ways to achieve a goal, and the availability of slack in operational resources. Interactions are defined as the number of variables and causal relations in the system's processes and interconnected subsystems. Tractability refers to the extent to which the detailed functioning of a dynamic system can be described and understood. Cascading is the extent to which small variations (which are unpredicted and undetected) combine into hazardous situations.

COMMUNITY RESILIENCE

Also the Community Resilience, emergency and disaster management literature has acknowledged the importance of the concept of resilience for some time. For example, discussions of public organisations in risky dynamic environments emphasise these organisations' need for a balance between anticipation, meaning assessment of vulnerability and safety and (planning for) preventive action, and resilience, meaning (planning for) flexible response ('bouncing back') after a damaging event. In this view, resilience is the capacity to cope with unanticipated dangers after they have become manifest, learning to bounce back. This ability is distinguished from and needs to be balanced with the ability of anticipation (which here is

not part of resilience). Flexible mutual adaptation to changing conditions and the acknowledgement of a common goal are seen as critical characteristics of organisations that are effective in their joint response to a harmful event. Resilience has however been described as being more than flexibility and improvisation, and that it is displayed in the form of successful adaptation and accommodation. In other words, a flexible organisation is in this view not resilient until this organisation adapts and accommodates its social, organisational and technological systems to lessons learned from situations when improvising occurred.

One of the more recent definitions of resilience in the disaster management strand of research is: "Resilience is the capacity of a social system (e.g., an organization, city, or society) to proactively adapt to and recover from disturbances that are perceived from within the system to fall outside the range of normal and expected disturbances". The need for resilience is described in community and disaster resilience literature mainly as resulting from the limits of planning, the difficulties in multi-organization communication, challenges in management, increasing the need to enhance improvisation, coordination, flexibility, and endurance.

CRISIS MANAGEMENT: RISK AND RESILIENCE AS COMPLEMENTARY APPROACHES

At a European level, the disaster management cycle addresses prevention, preparedness, response and recovery. It has emphasis on a risk management approach addressing national risk assessment and mapping considering a multi-hazard and multi-risk approach. Risk management deals with the coordinated activities to direct and control an organisation with regards to risk. It includes different forms of actions including structural, organisation and community measures to avoid (prevention) or to limit (mitigation, preparedness and response to) adverse events.

Traditional risk management approaches focus on prediction, prevention and protection against expected events. Models and methods are used to assess risk associated with specific failures and to propose measures to avoid them. Methods widely used include fault tree analyses (FTA); common cause analyses (CCA); event tree analyses (ETA); a combination of ETA and FTA is represented by bow-tie analyses. A typical risk matrix is used to represent risk categories in terms of probability and severity, and risk acceptability. The focus on risk reduction measures identified by these

methods, e.g., the risk matrix, addresses risks with high likelihood and high consequences. These approaches cover known system disturbances as initiating events. Consequently, procedures, training, regulations, and methods for operation are put in place to protect from known disturbances and mitigate their consequences.

The nature of risks and crises has changed but the methods have not. Currently, the attention of the risk analyst is not on unexpected events. Risk methods to analyse interdependencies between critical infrastructures have been proposed in recent years. However, the balance of level of complexity and simplicity is challenging (Utne, Hokstad, & Vatn, 2011). Moreover, there is little experience on imaging scenarios that change assumptions and situations that can escalate off-the-scale (Topper & Lagadec, 2008). As a complement to traditional risk management, resilience engineering focuses on knowing what to expect in the sense of anticipating threats and opportunities such as potential changes, disruptions and their consequences. This capability provides inputs to the capabilities to monitor and respond.

While organisations need to maintain the capacity to deal with traditional crises using a risk management approach, innovations are required to deal with new type of crises. These innovations are not seen as a replacement but as a complement to existing capacities. Therefore, organisations need to deal with the trade-offs preparing to crisis through predefined plans and procedures to address expected situations as well as developing adaptable and flexible capabilities to prepare to unexpected situations.

Resilience management addresses the enhancement of the abilities of an organisation to sustain adaptability and continue operations as required to a changing context. It includes “everyday operation” as this information is essential to ensure that the organisation functions under expected and unexpected situations alike. This information includes how multiple activities work together to produce successful outcomes for different kinds of systems and organisations at different levels. It combines technical structures and social systems and interplay of different kind of systems and organisations at different levels, which traditional risk management approaches have difficulties to address.

At community level, the human component is central, because in the majority of disasters, resilience depends first on the actions of the people operating at a neighbourhood scale, but also on the actions of the different levels of organisations. To frame the difference of resilience from risk management, a brief treatment of the traditional view of the four stages of emergency and disaster response is presented below:

MITIGATION/PREVENTION often consists of systematic risk assessment, considering the conditions that generate risk. Interdependencies among environments are mapped, considering the physical (gives rise to destructive events), built (vulnerable to risk), and social (affected by severe events) environments. This has traditionally been organised in a distributed fashion where citizens, businesses and practitioners share the task of reducing risk. Mostly, a top-down prevention (from government, regulators/inspectorates, to operations) approach has been implemented of designing prevention mechanisms for known risks, regulation and inspection, detailed task lists and plans, and building on lessons from previous events.

PREPARATION is necessary because not all disasters can be prevented. Disasters as a result of the nature and characteristics of the physical environment cannot be prevented, and there are strong arguments that also in the complex socio-technical built environment accidents are “normal”, although most could theoretically be prevented. This stage takes the form of designing and establishing policies, organisational structures, and resources, making sure that responders are trained and facilities ready, based on careful and informed assessment of potential risks and interdependencies. A challenge is however that the nature of the next contingency is unknown, and therefore difficult to prepare for, which the concept of resilience aims to address.

RESPONSE operations have the purpose of averting or containing a threat, minimising damage, and/or preventing critical systems’ breakdown. Typical challenges are the ability to understand the immediacy of response strategies and communication that is likely to be hampered by time pressures and fundamental uncertainty, and the fact that coordination mechanisms, responsibilities and authorities often are unclear or not appropriate for the specifics of the response. The response capacity also depends on results, focus, and investment in mitigation/prevention and preparation to allocate resources and expertise in a timely manner.

RECOVERY strives for quick return to normalcy. In the aftermath the aim is to derive lessons to be learned, with may also involve accountability and political-administrative investigation that may take considerable time and effort. Another challenge is that the decisions to avoid recurrence may lead to unintended consequences due to the complexity and unpredictability of interactions between the physical, built, and social environments.

Contributions of resilience to risk management practices when dealing with crises are summarised below:

Risk management	Changes	Resilience management
Organisations have investment and implemented protective infrastructure	Changing in the nature of crises	Organisation invest in the ability to maintain operation and continuity of operations for different kinds of system, organisations at different levels
PREPAREDNESS PHASE		
Command and control: Appropriate institutional structures, clear mandates supported by policies	Management processes that can be adapted to situational demands	Preparation for flexible and agile management and organisational processes (e.g. through training and other efforts at establishing common ground)
Risk assessment based on historical events, identification and analysis of threats and hazards and vulnerabilities	Detecting emergent risk require significant efforts.	Forward looking analysis to complement risk assessment
Scenario based emergency planning, maintenance of equipment and supplies	Address trade-off between highly specialized expert centres or ensuring proximity of response services	Capability planning and network building to ensure various capabilities and capacities are mobilized
Training to test plans and procedures e.g. table-top exercises or large-scale exercises		Train in leadership and network coordination not to test understanding of plans but the ability to innovate in a stressful situation. Strategic crisis management training to be able to improvise and innovate and flexibility Strategic engagement from centres of agencies dealing with crises
RESPONSE PHASE		
Detection and crisis development monitoring: Early warning systems based on monitoring forecasting, warning messages to activate predefined plans (emergency or contingency)	Non-linear dynamics, hidden interdependencies and complexity of modern crises make difficult to detect	Strategic foresight: Sense making capabilities, capability to “think outside the box” and come with innovative scenarios that might occur, use of weak signals before and during crises using multidisciplinary expertise.
Command and control according to hierarchical break-down of tasks and responsibilities	Trade-off between emergency response at local level and centrally managed at national level. Role of civil society (e.g., NGOs) is growing.	Managing a response network. Crisis identification and monitoring role of expertise and polycentric governance. Policentricity emphasizes the co-existence of many decision centres with different level of autonomy. It uses local knowledge as well as common pool of resources. Flexible and agile management and organisational processes of the response, adaptive to organisational demands
Standard Operating Procedures (SOPs) designed and enforced	More flexibility according to situational demands	Flexible and multipurpose crises management teams and facilities
Strict lines of responsibilities	More flexibility according to situational demands, focus on common ground and cooperative crisis management	Common concepts across agencies to inform leadership with high adaptive capacities

Sectorial approaches	Need for a more holistic and broader view of risk and opportunities through a multi-threat approach	Similar tools and protocols that could be used for multi-crisis International cooperation Management of large-response networks
Crisis communication organized in a top-down manner from local/regional/national government agencies to the general public in a normative way to influence behaviour	Use of social media, focus on dialogue and a view of seeing the general public as a resource for aiding the response	Crisis communication on the basis of mutual dialogue and a strategic awareness of crises including a multitude of new media
RECOVERY PHASE		
Feedback to improve SOPs	Enhanced learning capabilities	Feedback. Using lessons learned to rearrange or re-structure the way the organisation works

GUIDELINES MANIFESTO

The DARWIN Resilience Management Guidelines (DRMGs) consist of guiding principles to **help or advise a certain organisation in the creation, assessment or improvement of its own guidelines**. Such principles should help the organisation in developing a **critical view on its own crisis management activities** (management of resources, procedures, training, etc.) based on resilience management concepts. The organisations we refer to in DARWIN can be either private or public companies, authorities or governmental agencies (either at international, national or local level) which are considered as a critical infrastructure or part of it or which are relevant for the functioning of a critical infrastructure. It is important to underline that the DRMGs could become **complementary to guidelines, procedures and practices** already present in a certain organisation, but they are not intended to replace them. The assumption is that the necessary knowledge and competences to establish organisation specific guidelines can only be available inside the organisation itself. On the other hand - as mentioned above - the adoption of the DRMGs by the relevant stakeholders in a certain organisation will guide the revision, improvement or even creation of new guidelines, but always as an initiative internal to the organisation. Consistently with this nature, the DRMGs are **mainly addressed to policy makers, decision makers and managers** at different levels in an organisation. **They can only indirectly affect the activities of front line operators or first responders** in crisis management, since these actors are users of those guidelines, procedures, practices that may have been redesigned or generated ex novo, after the adoption of the DRMGs by their organisation. As

mentioned above, the DRMGs are principles based on resilience management concepts, which indicate criteria to increase the resilience of an organisation. In this respect, they do not consist of step-by-step prescriptions. They need to be interpreted in the specific context of their application and to be adapted to the specific goals and characteristics of the organisation in which they are adopted.

HOW TO USE THE GUIDELINES

This section describes the basic structure and type of content available in the guidelines and their basic components, the Capability Cards.

Ultimately, the DRMG Map represents the overall picture of the resilience management capabilities addressed by the guidelines, organised by themes, and of how these elements relate to each other.

CCs propose interventions that can be implemented in order to reach the capabilities identified in crisis management practices and scientific literature. The guidelines build on the CCs by organizing and relating them. This aspect of the guidelines is a consequence of the fact that resilience management capabilities are not independent. For instance, the management of adaptive capacity requires that coordination is properly supported between operational units; these two types of resilience management capabilities are different, but interdependent. Each CC consists of a set of pieces of information that provide support to the understanding and implementation of the interventions proposed. The following elements of content are provided:

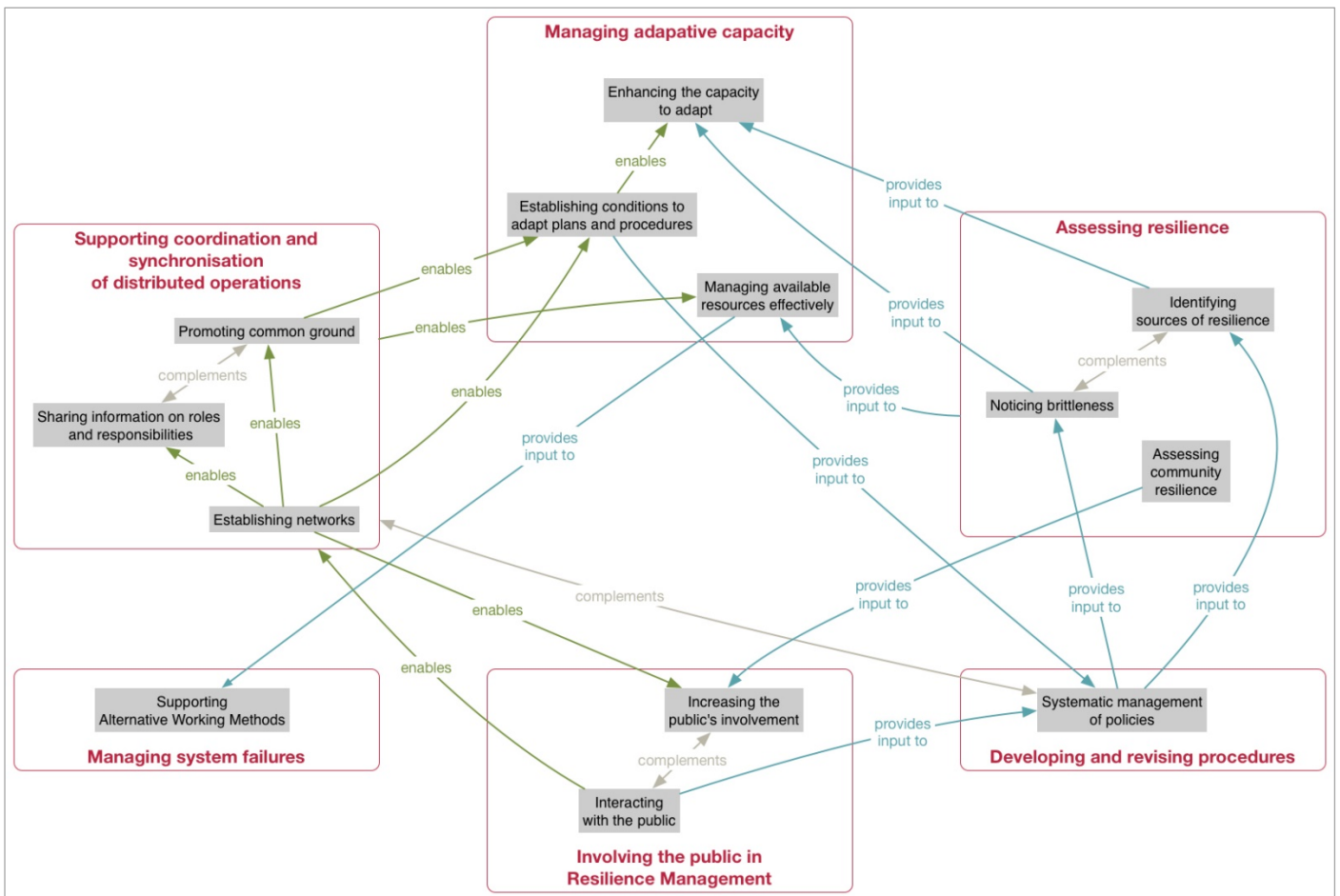
- *Background information* to describe the objectives and rationale underlying the resilience management capability addressed, as

well as associated benefits, challenges and actors of crisis management.

- *Descriptions of interventions*, organised by phases of crisis management (before, during and after). These description often include “triggering questions” that aim to capture essential issues users should think or try to address. These questions also aim to help users adopt a resilience-oriented perspective, which might differ from typical views on risk and safety. The interventions often refer to strategies, methods, tools and practices that are selected from literature or experience, and presented succinctly (main elements of implementation, relevance for the CC, and reference to external sources for additional information). When possible, CC rely on illustrative examples and hints to provide

additional guidance, estimate maturity in terms of technology readiness levels (TRL), and discuss cost of implementation.

- *Categorisation information* that associates the CC with high-level themes or categories, resilience abilities, functions of crisis management, and types of actors. Most of the time, CCs are associated with multiple items in each category, which as a result, serve as a tagging mechanism more than a hard classification. An important purpose of the categorisation information is to serve as a navigation mechanism and suggest associated content in order to facilitate the implementation of the CC in the general guidelines context. For the same purpose, relationships with other CCs are provided when relevant.



Darwin Resilience Management Guidelines Map

CHAPTER 2

Supporting coordination and synchronisation of distributed operations

ASSOCIATED CARDS

2.1. Promoting common ground for cross-organizational collaboration in crisis management

Promote periodic cross-organisational dissemination exercises to increase organisations mutual awareness of other motives, perspectives, terminologies and working practices. In turn, this can support improved collaboration at the time of crises, because first responders are more aware of the behaviour to expect from staff of other organisations.

2.2. Establishing networks for promoting inter-organizational collaboration in the management of crises

Establishing pre-crisis relationships between the organizations that may be jointly involved in managing a crisis paves the way for more effective collaboration and communication during crisis and post crisis responses across organisations.

2.3. Sharing information on roles and responsibilities among different organizations

Stakeholders involved in resilience management need to have **clear idea of roles and responsibilities** who may be involved in the management of a potential crisis. Each organization should have an adequate knowledge not only of its own roles and responsibilities, but also of those of other organizations they may be required to collaborate with during a crisis. This is vital in order to identify gaps and cooperate before, during and after a crisis.



2.1. Promoting common ground for cross-organizational collaboration in crisis management

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IMPLEMENTATION

INTRODUCTION

What is needed to promote common ground:

To promote common ground and improved cooperation among the front-end staff of different first responders' organizations involved in crisis management, the managers of these organizations need to organize shared activities that allow the respective personnel to know each other. Differently from what advised by the CC 2.3. [Understanding roles and responsibilities](#), in this case such activities should necessarily involve front-end staff and should not be limited to the managerial levels, nor to people simply delegated by them. In fact, the common ground implies a deeper understanding of working practices, motives and values that cannot be limited to the explicit knowledge encompassed by formal procedures and policies, but should also consider the way knowledge is concretely put into practice.

A prerequisite for the application of the actions described in the card is the existence of a network of organizations already collaborating among them in crisis management activities. If each organization is mostly operating in isolation and no mutual relationships have been established beyond those mandated by the law, it is advised to first apply the principle of the CC 2.2 [Establishing networks](#). Depending on the specific phase (Before, During or After a crisis), the activities can be instantiated differently, as explained in the following sections.

Healthcare implementation – Introduction



In order to "Establish common grounds", involved actors need to plan and discuss this issue jointly prior to the event. The predetermined common grounds is then implemented during the event. After the event, it is important to analyse the work performed and examine what can be improved.

BEFORE A CRISIS

Promoting common ground among different organization before any type of recent crisis or accident has occurred is in principle the most favourable situation. The managers of the different organizations are not biased by the interpretation of the events occurred during a previous crisis and less concerned by the sharing of information that might be used to assign responsibilities regarding past events. On the other hand, the managers may face the problem of justifying their investments on common ground activities, in the absence of any recent event causing concerns in the organization (owners or shareholders) or in the public opinion (taxpayers or other users of the service). The managers should first identify potential gaps in the mutual understanding between their own organization and the other organization with whom there is a collaboration in place, and then they should be promoters of one or more of the following actions:

- **Organise information sharing workshops.** The main goal of these workshops is that of allowing the staff of your organization to gain useful insights into the mission, culture and

operating methods of other organisations involved in crisis management. Such workshops can be organised by inviting relevant staff members of other organisations: (a) to attend presentations about own organisational mission, resources, dependencies and expectations (from other organisations), working methods and practices; (b) to provide their presentations about their own organisational mission, resources, dependencies and expectations (from other organisations), working methods and practices. The workshops may also foster cross-fertilization of practices among different organizations.

- **Organise periodic visits of own staff to facilities of other organisations**, so as to provide an opportunity to own staff to learn about the resources and procedures of other relevant organisations. Host similar visits by other organisations.
- **Organise joint crisis preparation exercises** in order to address potential sources of joint activity breakdowns. These include, for instance, the use of inconsistent maps by different actors to refer to the same crisis area; the use of specialist terminologies that may be unclear or ambiguous to the teams of other organisations; conflicts in resource usage.

These conditions may slow down understanding between team members of different organisations, thus slowing down the crisis response process. Thus crisis preparation exercises—such as drills, review of emergency plans, review of past disasters—should be conducted jointly, i.e., at least one operational expert from each relevant organisation need to be involved in order to achieve an adequate representation of the organisation that may have to cooperate at the time of the crisis. Besides the identification of breakdowns, these exercises can be helpful for the identification of potential synergies in (for instance, the knowing about useful resources available by another partner may be helpful in case own resources are insufficient).

TRIGGERING QUESTIONS

Identification of gaps in mutual understanding

- What is our understanding of the mission, culture and operating methods of other organizations with whom we need to collaborate in crisis management?
- What is the level of understanding of our mission, culture and operating methods by

other organizations with whom we need to collaborate in crisis management?

Information-sharing workshops

- Are there opportunities for organizing workshops with one or more of the organizations collaborating with us in crisis management and for sharing presentations about our respective mission, culture and operating methods?
- If such workshops were already organized in the past, is there a need to repeat such experiences to take into account relevant changes in each organization and the turnover of our respective staff members?

Visit to other organizations

- Are there opportunities for organizing visits of our staff members to the facilities of other organizations collaborating with us in crisis management and vice-versa?
- If such visits were already organized in the past, is there a need to repeat such experiences to take into account relevant changes in each organization and the turnover of our respective staff members?

Joint drills and crisis preparation exercises

- Are there opportunities for organizing joint drills and crisis preparation exercises with other organizations collaborating with us in crisis management?
- Do we use specialist terminologies that may be unclear or ambiguous to the teams of other organisations and should be addressed in joint crisis preparation exercises?
- Can we think of possible sources of joint activity breakdowns that should be addressed in crisis preparation exercises?
- Can we envision the presence of conflicts in resource usage that should be addressed in joint crisis preparation exercises?
- Can we think of potential synergies between our organization and other organizations that should be addressed in joint crisis preparation exercises?

Healthcare implementation – Before



Establishing common ground could be implemented in the perspective by setting up a strategy for collaboration. A strategy would describe how the interaction should be done between different actors

before, during and after major incidents that require interaction between actors. The aim with the cooperation is that resources are used efficiently and responsibly. This could be implemented as a **regional committee**, including managers at strategic level from different actors, which meets regularly a couple of times a year. These could include:

- Health care
- County council
- Police
- Municipalities
- Fire brigade
- Civil protection
- Military forces

The regional committee is a strategic function that decides on issues that have an overall character in terms of long-term planning, such as establishing and/or revising strategies, plan regional joint exercises and initiate education opportunities.

Exemples from such implementations could be common education between different actors conducted regularly every year while exercises take place every four years. These **common activities (e.g. table-top exercises, real-life simulation or workshops) are focused on real events where the importance of actors' cooperation have been identified**, such as during; school shooting, fires, and CBRNE incidents.

Every two months, representatives from operational levels could gather for the purpose of disseminating information about ongoing and upcoming activities with each other with the intention of increase the potential for cooperation between them.

DURING A CRISIS

During the development of crisis requiring the collaboration among different organizations, the conditions to promote common ground can be very different, depending on the type of crisis. When the crisis takes the form of an emergency where time is a critical factor, the organization may only count on the common ground that was established before the crisis itself. On the other side, if the crisis has a longer timeframe (e.g. at least two days, up to several months), the promotion of common ground actions could be beneficial, provided that they do not interfere with the activities of the crisis units, operation centres or task forces already established to manage the crisis. Among those described for the Before Crisis phase, the following should be considered:

- Identify potential gaps in the mutual understanding

- Organise information sharing workshops.
- Organise visits of own staff to facilities of other organisations

For very long crises (e.g. those lasting more than a month), it may be beneficial to also organise **joint crisis management exercises** to simulate and test specific parts of the interventions required to solve the crisis. Example of situations in which these exercises are useful are those in which the crisis is very complex and requires coordinated interventions in areas that may be unfamiliar to the front-end staff and in which the personnel might be exposed to risks in case of misunderstandings among the different actors. In order to guide the process, a self-assessment based on answering the same triggering questions proposed for the Before Crisis phase is advised, in association with the respective thematic areas.

Healthcare implementation – During



The implementation of the capability card could have been implemented by developing an **operational collaborative group**.

- According to the group's developed strategy, an **operational collaborative group** (Point of Contact Designated Duty Officer) with predetermined functions could be initiated within different actors, in case of a threat or major accident. The group's task is to assess if the threat or major accident require coordination and cooperation. This group should have the mandate to initiate a structure for cooperation and on immediate actions.
- Rapid initiation of the group create conditions for proactive coordination through collaboration.

AFTER A CRISIS

The managers of organizations cooperating in crisis management activities will probably find easier to justify the investments on common ground actions, if at least part of these organizations have already experienced a real crisis. On the other hand, depending on the development of the crisis itself, the relationships among the organizations might be more or less difficult, especially if there is no shared view of the responsibilities for what happened and if there are investigations in course that make the sharing of information among the organizations more delicate than in no crisis periods.

Generally speaking, the same actions identified for the Before Crisis phase will also apply to this phase, except for the fact that the lessons learnt from the crisis will be very useful to guide both the **identification of gaps in mutual understanding**, as well as the **good coordination practices** emerged during the management of the crisis. However, the organizers of the common ground actions should make a particular attention to the risk of being excessively biased by the specific events occurred during the crisis which was just experiences.

Therefore the Information sharing workshops, the Visits of own staff to the facilities of other organisations, the Joint drills and crisis preparation exercises will have to consider both the specificities of that crisis and other alternative scenarios that may lead to different types of crisis.

In order to guide the process, a self-assessment based on answering the same triggering questions proposed for the Before Crisis phase is advised, in association with the respective thematic areas.

Healthcare implementation – After



The implementation of the Capability Card could involve joint after-action meetings regarding events where collaboration has been essential. During these meetings representatives from collaborating actors gather every two months, or so, with the purpose of identifying strengths and weaknesses in the co-operative management of the event. Identification of collaborative indicators can be used in the work of analyzing/ reviewing the management of the event to create a structure.

Example of collaborative indicators:

- Tetra radio interagency coordination channel assigned from dispatch
- Dispatch initiate radio check and provide current incident orientation according to ETHANE structure (ref ETHANE)
- Agency Incident commanders initiate coordination via Tetra radio coordination channel

Content: Preliminary rendezvous point, approach vector, decision on coordinated response strategy

- First unit from any agency provide initial situation report
- Establish interagency command site. (REF # Collaborative indicators: Instruktörsmanual

UNDERSTANDING THE CONTEXT

DETAILED OBJECTIVES

Rationale. In order to collaborate effectively at the time of a crisis, the people involved in crisis management, from different organizations and/or from different departments of the same organization need to have a sufficient understanding of their mutual goals, expectations, capabilities, and operational procedures (Kuziemyky and O’Sullivan, 2015; Collins et al., 2012; O’Sullivan et al., 2013). For example, the personnel of fire brigade, medical teams, police offices, civil protection departments, area control centers, etc. need to understand their mutual needs, in order to operate effectively and safely while minimizing losses. However, establishing such a common ground (Kuziemyky and O’Sullivan, 2015; Collins et al., 2012) is not necessary an easy goal to achieve. Division of work in large organizations tend to result in different units and subunits, each characterized by (i) its own situated perspective, (ii) specialist language, (iii) resources, (iv) temporal and productive pressures (O’Sullivan et al., 2013; Klein et al., 2005), so that, while personnel tend to see clearly their local objective, they may also fail to see opportunities for collaborating effectively with other units in order to work towards larger, shared goals (Hopkins, 2006; Hansen, 2009). This dynamic, which can be termed as the silo effect (Hopkins, 2006), is exacerbated when staff members that have to collaborate belong to different organizations. The existence of organizational barriers to the flow of knowledge, information and people, combined with the fact that different organizations have different missions, organizational cultures, resources and operating procedures, implies that it is not necessarily easy for staff members engaged in joint activity to establish a common set of mutual and shared knowledge, assumptions and belief that is functional to the management of the crisis.

Compared with card [Understanding roles and responsibilities](#) of other actors, the present card targets different organizational roles. This card is directed to the widest number of first response operators of different organizations. The former card involves, instead one or a few point of contact from each organizations that will participate in the shared activities, and then will disseminate internally

information about roles and responsibilities of other organizations.

TARGETED ACTORS

- The card implementing user include relevant back-end roles that are able to implement the actions mandated by the card. Arguably, these will be middle managers and/or relevant experts that maintain close ties with other organizations;
- Actors: different teams of front-end crisis response operators.

Healthcare – Actors



Involved actors should be identified and predetermined to participate in the rescue, regardless of the nature of the event. Analysis can then be made jointly by the actors with the purpose of identifying eventually additional actors that may be involved in the specific event. In Sweden, all actors mentioned below are involved in the response, regardless of event. However, in addition to these ones, more may be called depending on the type of event that occurred. Common Grounds - as a concept - should be discussed and practised at all levels, starting from front-line operators to management. This involves both inter- and intra-agency communication in all agencies, independently of the crisis scenario.

- The healthcare staff is responsible for the medical care.
- The police are responsible for the security on site and for the identification and registration of the victims. They also inform relatives in case of fatalities.
- The municipality is responsible for both acute and follow- up crisis/psychological support.
- The fire brigade and the municipality provide meeting halls for the care of mildly injured and for those who are in need of crisis support.
- Communication with the media takes place in collaboration where each actor pronounces information according to their area of responsibility.

The National board of health and welfare, Ministry of Social Affairs and the Government (on the national level) will gather an overall picture of the situation from different perspectives.

Air Traffic Management – Actors



The roles and responsibilities of involved actors change according to the type of crisis and the related environment of operations. The "Common Ground" must encompass most of the activities of the organization, at all levels starting from senior management to front line operators.

The actors involved are those listed below:

- Air Navigation Service Providers (both civil and military)
- Aircraft owners and operators
- Aircraft manufacturers
- Aviation regulatory authorities (National and International)
- ATFCM (Air Traffic Flow and Capacity Management)
- International aviation organizations (i.e. EUROCONTROL, ICAO, CANSO, etc)
- Investigative agencies
- Flying public
- Airport operator (if airports and/or ground operations are concerned by the crisis)
- Firefighters (if airports and/or ground operations are concerned by the crisis)
- Police (if airports and/or ground operations are concerned by the crisis)

EXPECTED BENEFITS

Improved cross-organizational joint activity in crisis management, i.e., promoting improved cooperation and collaboration among the front end staff of different first responders' organizations involved in crisis management.

RELATION TO RISK MANAGEMENT

The card promotes the consideration of human and organizational aspects involved in the response phase of the crisis. In particular it promotes the consideration of cross-organizational aspects that can improve joint activity in crisis management. Therefore, the present card is particularly relevant for the successful implementation of the outcome of the risk management process, the risk mitigation solutions which can be defined as a result of the risk management process (see for instance the ISO 31000 risk management standard - ISO, 2009).

ILLUSTRATION

Healthcare – Illustration



School shootings are examples that illustrate the importance of "Establishing common grounds". These events may involve several injured pupils and teachers and require for example effective interaction and collaboration among a number of different actors at the national, regional and local level. Lessons learned from school shootings concern the effective collaboration that can be quickly activated if the actors have "Established common grounds", prior to the event. This has shown to imply that the Emergency Medical Services gain access to patients and by that beginning a quicker life-saving treatment. Sometimes, depending on the type of scenario, the healthcare and police sector may be better balanced to maximize the benefit for the victims.

Air Traffic Management – Illustration



The following example points out the importance of creating common ground:

1. **Misunderstanding between fire fighters and controllers in the aftermath of ATR 72 runway excursion at Fiumicino airport.** The accident in question was the runway excursion of an ATR 72 passenger aircraft at Fiumicino airport, in February 2013 (ANSV). The accident occurred at 20:32 pm so the aircraft was not visible aircraft from the ground. The fire brigade was looking for it on the runway, but could not find it because the aircraft came to a halt next to the airport perimeter, not immediately visible to the firefighters because of the dark. Eventually, the information that the controller was giving to the fire brigade turned out to be ineffective, as both were using different maps and terminologies. Because of this miscommunication, the fire brigade wasted more than five minutes prior to identifying the aircraft.

This example shows the consequences of poor common grounds, in this case caused by miscommunications due to the use of special terminologies, not duly shared among operators involved in emergency management.

IMPLEMENTATION CONSIDERATIONS

Challenges

The joint initiatives mandated by this card presupposes the availability of:

- Sufficient commitment by the senior managers of the involved organisations;
- Sufficient mutual trust and existence of communication channels across organisations. At least these conditions need to be satisfied to organize the joint initiatives aimed at improving common ground which are recommended by this card (see next section). Note that in case of implementation in contexts in which the relevant organizations do not already collaborate, the successful implementation of this card may be favored by the card [Establishing networks](#).

Implementation cost

Healthcare – Implementation considerations



Associated Challenges

Implementation of "Establishing common grounds" on a policy level require, however, that legislation and guidelines support this type of collaboration. On the strategic level, opportunities for collaborative planning are required while, at the operational level, opportunities for training, in order to implement in normal procedures and in crisis situations.

Air Traffic Management – Implementation considerations



In ATM Standardisation of the terminology and acronyms/abbreviations/initialisms used to describe procedures, processes or conditions is essential in order to ensure that organisations and crews from abroad understand local procedures and conditions. [\[1\]](#)

In ATM, the concept of **Common Ground** is linked to the concept of **Interoperability**. ICAO in its **Circular 330-AN/189** on the "Civil/Military Cooperation in ATM" states something that is applicable at all levels and in all ATM context: *Global standards, uniform principles and agreements are needed to ensure the technical and operational interoperability of the ATM system. However, ATM system interoperability needs to be considered in the broader context of governance, not just technology and procedures, while bearing in mind the requirements users place on the system. After all, ATM aims to enable all airspace users, including the military, to operate their preferred flight/mission profiles, cost-efficiently and*

effectively, without compromising flight safety or national security. [...] At the strategic/political level, the concept of interoperability can be considered as an enabler for coalition building. It facilitates meaningful contributions by aviation coalition partners, both civil and military. At the highest level, interoperability of aviation issues centres on harmonizing global (e.g. ICAO) or regional (e.g. European Union) views, doctrines and, foremost, a regulatory framework. One main element at this level is the political willingness to cooperate and coordinate over the long term, to achieve and maintain shared interests in aviation safety, environment, efficiency and capacity. The price of strategic and/or political interoperability at national as well as international levels can be high and finding a common ground can be difficult to achieve. National considerations and culture are potential disablers of affordable interoperability. Nevertheless one can assume that the aviation chain is as strong as its weakest link and that it is therefore in everyone's interest to cooperate and invest in order to achieve the highest level of interoperability. [Ref. https://www.icao.int/APAC/Meetings/2012_CMC/CIR_330_en.pdf]

The **Airport** environment of operations is regulated by **Commission Regulation (EU) No 139/2014** laying down requirements and administrative procedures related to aerodromes states that **ADR.OPS.B.005 Aerodrome emergency planning** [...] The aerodrome operator shall have and implement an **aerodrome emergency plan** that: [...] b) provides for the coordination of appropriate organisations in response to an emergency occurring at an aerodrome or in its surroundings; and (c) contains procedures for periodic testing of the adequacy of the plan and for reviewing the results in order to improve its effectiveness. **ADR.OR.B.025 Demonstration of compliance** (a) The aerodrome operator shall: (1) perform and document all actions, inspections, tests, safety assessments or exercises necessary

Common ground is created mostly during the tests and exercises performed in the scope of the AEP that involve all airport stakeholders.

RELEVANT MATERIAL

RELEVANT PRACTICES, METHODS AND TOOLS

Practices

1. **Reviews of shared maps prior to the preparation of large scale events.** During the preparation of the World Youth Day in Kracov,

the relevant leaders/experts of the first responders' organizations meet in order to define a common map of the area of the event. Once the joint map of the event was defined it was communicated to front end operators. This was reported to ensure that these referred to the same reference points (e.g. sector X, emergency exit 1) in their communications (e.g., call by security guards to obtain medical assistance in a given area, provision of instruction to the direction of crowd flow, etc.).

Healthcare – Practices, methods and tools



In Sweden, several organizations have introduced good **practices** and **methods** with the aim to establish Common Grounds.

For example, in the Region Ostergötland in Sweden implementation of the concept Common grounds for cooperation and management is implemented throughout the crisis response system. This results in a consensus regarding terminology, approaches and working procedures among players important for the crisis management. This implementation generates conditions for more actor-wide activities in all phases e.g.:

- Before: Proactive development of strategies for how to manage a crisis by e.g. common workshops and/or educations
- During: Effective working procedures for actor-wide management of social disturbances with common approaches.
- After: Actor-based follow-up based on indicators for stakeholder cooperation.

Air Traffic Management – Practices, methods and tools



In the ATM context, several organizations have introduced good practices, methods and tools with the aim to establish Common Ground.

EUROCONTROL, the European Agency for the Safety of Air Navigation, promotes :

- the **use of Skybrary** (http://www.skybrary.aero/index.php/Main_Page) which is an electronic repository of safety knowledge related to flight operations, air traffic management (ATM) and aviation safety

in general. It is also a portal, a common entry point, that enables users to access the safety data made available on the websites of various aviation organisations - regulators, service providers, industry.

- the participation to **simulations sessions open to non-experts**. EUROCONTROL, organizes simulations training sessions in which non-controller staff can take part in realistic air traffic control simulations. Such sessions are effective in promoting the diffusion of knowledge about the air traffic control job across EUROCONTROL staff as well as the staff of other organizations (e.g. contractors, project partners, academics, regulators, etc.).

Both the practices above are relevant to show how knowledge of the working methods of a specific role can be disseminated across organizations. Note that although both best practices are mono directional, i.e., they promote the diffusion of knowledge about one operational role, they are however relevant as they could be repeated for all the relevant roles that have to cooperate jointly in emergency situations.

- the use of **Network Operations Portal (NOP)**. It is designed for ATM professionals. It provides real-time information on air traffic operations and a single entry point via a human-machine interface to ATM operations, bringing together various EUROCONTROL tools and services. It provides full transparency with regard to the current and expected European air traffic situation, thanks to constantly validated information and robust collaboration processes.

Journalists and the general public can also consult the portal for information on delays and the number of flights in real time. The NOP serves two main purposes:

- monitoring the real time status of traffic, airspace and air traffic flow and capacity management measures, and planning pan-European operations in a collaborative way from the strategic to the tactical phases, thus optimising the use of available ATM capacity.
- The NOP enables partners to anticipate or react to events more effectively. It provides a means for all actors, both civil and military, to increase their respective knowledge of the ATM situation from the strategic phase to real time operations. Its extensive reporting facilities are a solid foundation on which operations planning and the performance monitoring and

reporting functions of the Network Manager are built.

NATS, which is UK ANSP, is endorsing several activities (i.e. Events, Seminars, workshops, training, etc) in order to improve the management of Emergency situations: STAC is one of the most interesting.

- **STAC** (Scenario Training for Aircrew and Controllers) which is a forum for pilots and controllers offering the possibility to jointly explore the risks and hazards inherent in emergency situations, and to promote mutual awareness of the protocols and options to be observed or considered. The workshops use actual emergency scenarios to help promote increased awareness by all participants of the separate and often competing demands on attention and responses in unusual and emergency situations.

They are facilitated by NATS TRM Specialists and airline CRM instructors and will follow structured discussions relating to:

- Communication issues within the flight-deck and externally with ATC agencies
- Sharing situation awareness in an emergency scenario within and between the two groups
- Issues of overload and decision making for both parties
- Handover issues between controllers, and sharing the situation within and between the aircraft crews
- The use of SOPs, including emergency quick reference checklists by both groups

[2]


In the airport context, **Airport Collaborative Decision Making (Airport CDM)** is a concept that is applied in many airports. It aims at improving Air Traffic Flow and Capacity Management (ATFCM) at airports by reducing delays, improving the predictability of events and optimising the utilisation of resources. Implementation of Airport CDM allows each Airport CDM Partner to optimise their decisions in collaboration with other Airport CDM Partners, knowing their preferences and constraints and the actual and predicted situation. The Airport CDM manual which is available online [3] provides useful examples for the use of some elements/tools in different events, both planned and unplanned, that can disrupt the normal operation of an airport and reduce its

capacity to levels substantially below that of normal operations (e.g. adverse weather conditions, need for de-icing, construction and maintenance works, burst tyre aircraft which is blocking the runway, etc.)

Cross-fertilization workshops. ENAV, the Italian ANSP, organizes periodically internal cross-fertilization sessions during which the work of air traffic controllers is explained to non-controller staff of the organization. These workshops are effective to spread awareness about controllers' job and needs across the different organization departments besides operations. The workshops are organized yearly. Although restricted to ENAV staff, this kind of workshop can be organized to promote cross-fertilization also across organizations with which ENAV staff operates—e.g. airport, regulators, fire fighters, etc.

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Healthcare – References



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Samverkan Stockholm: [See page](#) 

Socialstyrelsens föreskrift 2013:22 [See document](#) 

Collaborative indicators: Instruktorsmanual Samverkan CBRN, Katastrofmedicinskt centrum.pdf

NAVIGATE IN THE DRMG

- **Parent theme:** Supporting coordination and synchronisation of distributed operations
- Resilience abilities
 - Contributes to: Respond and Adapt
 - Supported by:
- **Categories:** Collaboration, Communication, Situation understanding
- **Functions of crisis management:** BEFORE, Preparation, Cooperation and coordination

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2.2. Establishing networks for promoting inter-organizational collaboration in the management of crises

Establishing pre-crisis relationships between the organizations that may be jointly involved in managing a crisis, paves the way for more effective collaboration and communication; building trust and create professional relationship across organisations during and post crisis responses.

IMPLEMENTATION

INTRODUCTION

Identifying relevant stakeholder organizations prior to a crisis and cultivating positive relationships with these is extremely important for successful crisis response. Effective crisis response and management require coordinated actions among multiple organizations across many jurisdictions under conditions of urgent stress, heavy demand and tight time constraints. During crises, numerous interdependent organisations—government agencies, private companies, no profit organisations, etc.—are part a common network, as they have to work together towards a common goal.

If inter-organisational relations in the network are too weak, organisations may provide insufficient support, may withdraw it during a crisis, may fail to or may even intensify the threat. Thus, organisations should allocate effort to establishing adequate communication channels and alliances with other organisations during the pre-crisis phase.

Once it is established, a collaboration network will create opportunities for both promoting a common ground among different organizations (see [Card Promoting Common Ground](#)), and defining agreements for a periodic coordination and continuous crosschecking of the respective roles and responsibilities in the management of a crisis (see [Card Roles and Responsibilities](#)).

Healthcare – Introduction



In order to "Establish networks" one actor should be assigned with the responsibility of implement and maintain updated contact details for agencies and actors that potentially can be involved in incident coordination. This network should jointly meet and discuss important issues. This will enhance the managing of the crisis. The network thereafter analyse the work preformed and examine what can be improved.

BEFORE A CRISIS

Before any crisis has occurred, a five-step protocol is recommended to establish effective inter-organizational collaboration across the relevant organizations that may have to work together in the management of a crisis or emergency. The protocol is presented from the point of view of each individual organization. Depending on its size and relevance in a specific crisis management domain, the managerial levels of an organization should consider whether they prefer to play an active role in the establishment of the network or to respond to the initiatives of other organizations.

1. **Identify the organizations to include in the network.** Based on analyses of crisis/emergency scenarios resulting from internal risk assessment activities, identify the relevant organisations with whom collaboration may be necessary at the time of a crisis response. These may be located at

International, National, Regional, and local level(s). Looking at the different types of crises that the organization might experience one day, priority should be given to links with the organizations expected to be involved in the largest number of types. However, also the organizations potentially involved only in very specific types of crisis scenarios, who are considered very unlikely to occur, should be taken into consideration, having in mind that the strength of the links to be established can be variable.

2. **Specify the rationale for collaborating with an organization.** For each organization identified for a potential involvement in your network, specify the rationale for collaborating with it, depending on different types of crisis scenarios. As part of the exercise, clarify as a minimum what are the expectations with respect to the type of cooperation needed with the partner organization and the communication means to be used for establishing and/or maintaining the cooperation.
3. **Approach the organization to include in the network.** Approach the relevant organisations in order to establish a communication exchange and organize at least a meeting with representatives of the other organizations. Depending on the opportunities and status of relationships the meetings might be either bilateral or multilateral, i.e. involving more than one partner organization at the same time.
4. **Establish collaboration terms of reference.** Establish Terms of Reference of the collaboration to provide the basis for joint shared actions. Two possible options are envisaged:
 - 4a. *Define a Memorandum of Understanding.* Formalise a declaration of intent that clarifies the current rationale (why do we need to collaborate?), objectives (what do we want to achieve?) and mechanisms (how shall we collaborate?) for inter-organisational collaboration. The same declaration should also clarify the potential for future developments (how the scope of the present collaboration may increase in the future?).
 - 4b. *Define a stable framework for collaboration.* The framework defines the actual collaboration measures that have to be implemented, including details of resources to be committed, roles involved, type and frequency of meetings, either bilateral or multilateral involving also other organisations. The framework should consider at least one of

the mechanisms proposed in the parent CCs 2.1: [Promoting common ground](#) and 2.3 [Roles and Responsibilities](#). The first mechanism is particularly recommended if the collaboration has just started and the representatives of the organizations need to better know each other. While the second mechanism should be preferred when there is already a long lasting collaboration and it was possible to design some kind of shared procedure regulating how the organization should operate jointly in different types of crises/emergencies.

5. Maintain a record of the status of inter-organizational relationships. Create and periodically update a record about the status of the relationship with the other organizations.

TRIGGERING QUESTIONS

Identifying the organizations to include in the network

- When thinking of a specific type of crisis, are there organizations that may be involved together with us in the management of it. Among these organizations, are there any with whom we do not have any collaboration yet in place?
- If there is no collaboration yet in place, would it be worth establishing it?
- When thinking of new possible collaborations, are we considering all relevant levels, including the local, regional, national and international level?

Specifying the rationale for collaborating with an organization

- What type of collaboration do we expect to have with an organization we have decided to include in our network?
- What do we expect to achieve from the collaboration?
- Which communication modalities do we want to adopt in order to interact with such organizations?

Approaching the organizations to include in the network

- Do we know with which person/s should we get in touch in order to activate the collaboration?
- Do we know if there are interpersonal relationship already established in previous activities that may be exploited to facilitate this process?

Establish Memorandum of Understanding

- Have we clearly defined why we need to collaborate?
- Have we clarified what we expect to achieve from the collaboration?
- Have we defined the specific way we intend to collaborate?
- Have we discussed and agreed with the other organization about possible extensions of the scope of our collaboration in future?

Establish a Framework for Collaboration

- Have we defined how often we should get in touch with the other organization to review reciprocal roles and responsibilities in the management of crises?
- Have we defined shared activities to improve the common ground among us and the other organization in the management of crises (e.g. common training sessions)?
- Have we developed inside our organizations a documentation to record the status of our collaboration with the other organization?

Healthcare – Before



"Establishing networks" could be implemented in the perspective by setting up a strategy for collaboration. For example, a **strategy for stakeholder cooperation** could be developed in the pre- perspective.

The strategy would include establishing:

- **communication protocol** which initiate communication and following coordination among agencies during incidents that might require agency-coordination;
- **communication channels** for initiating coordination should also be established, as for example if Emergency Dispatch Centre should call to a coordination conference on Tetra radio, phone, email or video conference.
- **Points of Contacts, alarm protocols and general strategies** should be tested and drilled in order to maintain effective communications during incidents. This could be done during coordination exercises in a before-perspective.

Air Traffic Management – Before



When applying the card to the ATM context, it should be considered that this domain is strongly regulated. Since the regulation is shaping all the activities, there

might be cases in which the preparation to crisis management requires establishing a link with a new organization to respond to new regulation requirements. It is therefore advisable to add a triggering question such as "Is there any new regulation that requires to extend the existing network to other organizations?"

DURING A CRISIS

During the development of crisis requiring the collaboration among different organizations, the conditions to establish a new network of organizations or to reinforce an existing one can be very different, depending on the type of crisis. When the crisis takes the form of an emergency where time is a critical factor, the organization will mostly count on the collaboration network that was established before the crisis itself. On the other side, if the crisis has a longer timeframe (e.g. at least two days, up to several months), it may be necessary to either create an ad-hoc network of collaborations or to extend the existing one to accommodate for specific needs emerged during the development of the crisis. Therefore, limited to the crises with a longer timeframe, the first 4 steps of the protocol designed for the Before Crisis case could be considered:

1. **Identify the organizations to include in the network.** Based on analyses of the ongoing crisis/emergency scenarios, identify the relevant organizations with whom collaboration is necessary to make the crisis response more effective. These may be located at International, National, Regional, and local level(s).
2. **Specify the rationale for collaborating with an organization.** For each organization identified for a potential involvement in the network, specify the rationale for collaborating with it, depending on different types of crisis scenarios. As part of the exercise, clarify what are the expectations with respect to the type of cooperation needed with the partner organization and the communication means to be used for establishing and/or maintaining the cooperation.
3. **Approach the organization to include in the network.** Approach the relevant organizations in order to establish a communication exchange and organize at least a meeting with representatives of the other organizations. Depending on the opportunities and status of relationships the meetings might be either

bilateral or multilateral, i.e. involving more than one partner organization at the same time.

4. **Establish collaboration terms of reference.** Establish Terms of Reference of the collaboration to facilitate joint shared actions. In the During Crisis phase this can be limited to a short Memorandum of Understanding clarifying the current rationale (why do we need to collaborate?), objectives (what do we want to achieve?) and mechanisms (how shall we collaborate?) for inter-organizational collaboration. Once the crisis is terminated the managers of organizations which were engaged in a collaboration should consider whether to upgrade the memorandum of understanding to a stable framework for collaboration.

TRIGGERING QUESTIONS

Identifying the organizations to include in the network

- When considering the ongoing crisis, are there organizations that may be involved together with us in the management of it. Among these organizations, are there any with whom we do not have any collaboration yet in place?
- If there is no collaboration yet in place, would it be worth establishing it?
- When thinking of new possible collaborations, are we considering all relevant levels, including the local, regional, national and international level?

Specifying the rationale for collaborating with an organization

- What type of collaboration do we expect to have with an organization we have decided to include in our network?
- What do we expect to achieve from the collaboration?
- Which communication modalities do we want to adopt in order to interact with such organizations?

Approaching the organizations to include in the network

- Do we know with which person/s should we get in touch in order to activate the collaboration?
- Do we know if there are interpersonal relationship established in previous activities that may be exploited to facilitate this process?

Establish Memorandum of Understanding

- Have we clearly defined why we need to collaborate?

- Have we clarified what we expect to achieve from the collaboration?
- Have we defined the specific way we intend to collaborate?
- Have we discussed and agreed with the other organization about possible extensions of the scope of our collaboration in future?

Healthcare – During



An implementation of the Capability Card could be the setting up of an operative coordination staff.

In this group predefined roles (Point of Contact – Designated Duty Officer) should be established within each agency in the event of/or threat of crisis or major incident. The staff assesses the scenario if there is a demand for coordination. The agencies identified as key-actors are notified by emergency dispatch center to participate in a telephone conference initiating coordination. During the conference, the need of inviting additional agencies/actors important to manage the specific scenario is assessed. Emergency dispatch will carry out any of such requests

The actor (Emergency Dispatch Center) has the task to act as:

- a switchboard
- gather all agencies
- as prerequisite for swift initiation of the coordination staff.

This in turn creates necessary conditions for proactive inter-agency coordination.

AFTER A CRISIS

After a crisis has occurred, the managers of organizations that were collaborating in the response to it may consider whether there is a need to establish a stable framework of collaboration for future needs or to extend the network to new organizations. The following 5 stage process is proposed in order to extend the network of collaboration. The organizations which were already collaborating among them previously to the crisis may consider reinforcing their framework of collaboration by applying only the steps 4b and 5 and reflect on lesson learned about the process of establishing a new network.

1. **Identify new organizations to include in the network.** Based on analyses of the recently occurred crisis, identify the relevant organizations with whom collaboration is

necessary to make the crisis response more effective in future occasions. These may be located at International, National, Regional, and local level(s).

2. **Specify the rationale for collaborating with an organization.** For each new organization identified for a potential involvement in the network, specify the rationale for collaborating. As part of the exercise, clarify what are the expectations with respect to the type of cooperation need with the partner organization and the communication means to be used for establishing and/or maintaining the cooperation.
3. **Approach the new organization to include in the network.** Approach the relevant organizations in order to establish a communication exchange and organize at least a meeting with representatives of the other organizations. Depending on the opportunities and status of relationships the meetings might be either bilateral or multilateral, i.e. involving more than one partner organization at the same time.
4. **Establish collaboration terms of reference.** Establish Terms of Reference of the collaboration to facilitate joint shared actions in future occasions. Two possible options are envisaged:
 - 4a. Define a Memorandum of Understanding.** Formalize a declaration of intent that clarifies the current rationale (why do we need to collaborate?), objectives (what do we want to achieve?) and mechanisms (how shall we collaborate?) for inter-organisational collaboration. The same declaration should also clarify the potential for future developments (how the scope of the present collaboration may increase in the future?);
 - 4b. Define a stable framework for collaboration.** The framework defines the actual collaboration measures that have to be implemented, including details of resources to be committed, roles involved, type and frequency of meetings, either bilateral or multilateral involving also other organizations. The framework should consider at least one of the two mechanisms proposed in the parent CCs 2.1 [Promoting common ground](#) and 2.3 [Roles and Responsibilities](#). The first mechanism is particularly recommended if the collaboration has just started and the representatives of the organizations need to better know each other. While the second mechanism should be preferred when there is

already a long lasting collaboration and it was possible to design some kind of shared procedure regulating how the organization should operate jointly in different types of crises/emergencies.

5. **Maintain a record of the status of inter-organizational relationships.** Create and/or periodically update a record about the status of the relationship with the other organizations.

TRIGGERING QUESTIONS

Identifying the organizations to include in the network

- When thinking of a recently occurred crisis, are there organizations that may be involved together with us in the management of it. Among these organizations, are there any with whom we do not have any collaboration yet in place?
- If there is no collaboration yet in place, would it be worth establishing it?
- When thinking of new possible collaborations, are we considering all relevant levels, including the local, regional, national and international level?

Specifying the rationale for collaborating with an organization

- What type of collaboration do we expect to have with a new organization we have decided to include in our network?
- What do we expect to achieve from the collaboration?
- Which communication modalities do we want to adopt in order to interact with such organizations?

Approaching the organizations to include in the network

- Do we know with which person/s should we get in touch in order to activate the collaboration?
- Do we know if there are interpersonal relationship established after the crisis that may be exploited to facilitate this process?

Establish Memorandum of Understanding

- Have we clearly defined why we need to collaborate?
- Have we clarified what we expect to achieve from the collaboration?
- Have we defined the specific way we intend to collaborate?
- Have we discussed and agreed with the other organization about possible extensions of the scope of our collaboration in future?

Establish a Framework for Collaboration

- Have we defined how often we should get in touch with the other organization to review reciprocal roles and responsibilities in the management of crises?
- Have we defined shared activities to improve the common ground among us and the other organization in the management of crises (e.g. common training sessions)?
- Have we developed inside our organizations a documentation to record the status of our collaboration with the other organization?

Healthcare – After



The implementation of the Capability Card could be carried out by:

- Having an inter-agency after action review during meetings on coordination scheduled on monthly basis.
- Incidents that has demanded coordination would be subject for discussions. The purpose of these reviews would identify strengths and weaknesses in the joint management of the incidents. On these meetings, communication and points of contacts should be debated, whereby uncertainties are clarified and associated protocols revised.

UNDERSTANDING THE CONTEXT

DETAILED OBJECTIVES

Rationale. Identifying relevant stakeholder organisations prior to a crisis and cultivating positive relationships with these is extremely important for successful crisis response (Kapucu 2006). Effective crisis response and management require coordinated actions among multiple organizations across many jurisdictions under conditions of urgent stress, heavy demand and tight time constraints (Comfort and Kapucu 2006). During crises, numerous interdependent organisations—government agencies, private companies, no profit organisations, etc.—are part a common network, as they have to work together towards a common goal. The need to establish an effective pre-crisis network is also exacerbated by the large the scale of recent emergencies such as pandemics, cyber-attacks and prolonged critical infrastructure failure, which have large scale impact and accentuate the challenge that public and private organisations have

to jointly address (Ansell & c. 2010). If inter-organisational relations in the network are too weak, or there is insufficient reciprocal trust, organisations may provide insufficient support, may withdraw it during a crisis or may even intensify the threat (Ulmer 2001). Thus, organisations should allocate effort to establishing adequate communication channels and alliances with other organisations during the pre-crisis phase. Once it is established, a collaboration network will create opportunities for both establishing a common ground among different organizations (see CC 2.1 [Promoting Common Ground](#)) and defining agreements for a periodic coordination and continuous crosschecking of the respective roles and responsibilities in the management of a crisis (see CC 2.3 [Roles and Responsibilities](#)). Therefore, the present card has limited applicability to the situations in which a stable network of organization is already in place and in which the efficacy of the response to a crisis largely depends on the quality of the relationship and on the mutual understanding of respective roles and responsibility.

TARGETED ACTORS

The card is directed to top management roles involved in strategic decision making (e.g., executive management, policy makers), and indirectly this will affect operational levels.

Healthcare – Actors



Down below is example of actors that may be jointly involved in managing a crisis:

- health care
- police
- rescue services
- municipality
- county concil
- military
- refugee agency
- joint rescue coordination and airborne evacuation coordination

National level - **Policymakers - National Board of Health and Welfare:** responsible for policy and national coordination. E.g. supporting coordination among counties but primarily by requesting a situation report that is then relayed to the Ministry of Health and the Government. This level is also active in strategic decision making during a crisis.

Regional level - The **Regional medical major incident management**: manage resources in order to optimize response with respect to the situation. They have mandate to command all available resources within affected county according to the scenario. This level is also active in strategic decision making on the regional level during a crisis.

Local level - **First responders are prehospital command and control**: responsible to managing the incident scene regarding casualty treatment and coordination with other agencies at the scene.

These actors may be involved during mass-Casualty events such as fire, train crash, terrorist attacks, traffic accidents and ship accidents.

Air Traffic Management – Actors



In the ICAO Crisis Management Framework Document, several networks are identified at National (NN), Regional (RN) and beyond national and regional boundaries (Inter-Regional Network - IRN). They are listed hereafter (non-exhaustive lists):

Relevant stakeholder

- Aircraft operators (both commercial and non-commercial) including operators of State Aircraft (NN, RN)
- Air Navigation Service Providers at aerodromes, in the Terminal Areas and in the Area Control Centres (NN, RN),
- Airport operators (NN, RN),
- Military (NN, RN),
- Appropriate Ministries (NN),
- Civil Aviation Authority and/or appropriate National Supervisory Authorities (NN, RN)
- EACCC (RN),
- EASA (RN),
- EU Council of Ministers (RN),
- European Commission (RN),
- ICAO EUR/NAT Regional Office (RN),
- International organisations (RN), e.g. IATA, ACI, CANSO, etc.
- Main ATM Centre (MATMC) (RN),
- Network Manager (RN), etc
- FAA and NAV Canada in North America (IRN),
- ISAVIA in Iceland (IRN),
- adjacent ICAO Regional Offices (mainly ASIA/PAC, MID and AFI), ASECNA in Africa, etc.

Knowledge centres/Agencies

- EC Emergency Response Coordination Centre (ERCC) managed by DG ECHO with its expertise in management of events requirement humanitarian aid or involving civil protection activities (RN),
- Manufacturing industry (RN)
- Volcanic Ash Advisory Centres (VAAC) in London and Toulouse in the event of volcanic ash episodes (RN),
- Other United Nations Agencies (e.g. World Health Organisation, International Atomic Energy Agency, etc.) which have a responsibility to deal with crisis management, etc (RN).
- in USA: NOAA, NASA, etc. (IRN)
- Other United Nations Agencies (e.g. World Health Organisation, etc.) (IRN)

Crisis Focal Points

- A network of Aviation Crisis State Focal Points has been established in the framework of EACCC (RN)

States in the EUR region outside the EACCC context should consider establishing the appropriate liaison at the national level to serve as the focal point in aviation crisis management (RN).

EXPECTED BENEFITS

Improved ability to respond, adapt and learn from a crisis, thanks to a more effective inter-organizational collaboration and communication, both during and after the concerned crisis.

RELATION TO RISK MANAGEMENT

This card requires an internal risk management approach sensitive enough to detect crisis situations in which collaboration is needed. The card brings and added value in that it increases the likelihood of successful implementation of the measures that may be defined in a risk management framework, especially those measures that are shared with or are dependent on the resources of other organizations.

ILLUSTRATION

Healthcare – Illustration



Fire in buildings illustrates the importance of *Establishing networks*. In order to efficiently handle a fire in a building with many people, contacts and identified

responsibilities among different actors should be identified prior to the event. Actors managing the crisis have different responsibilities, skills and resources that affect their approach. It is of importance that these factors are examined before the event since it will facilitate the managing of the crisis.

Fire at a hotel or at a refugee housing results in many severe burn injuries. For example, in the Region Ostergötland in Sweden, Point of Contacts and communication protocols are communicated and implemented well in advance in order to ensure a rapid all-agencies coordination. Any agency should be able to request and initiate multi-agency coordination.

The case illustrates the need of establishing pre-crisis relationships among the organizations that may be jointly involved in managing a crisis (in this case Firebrigade/ Police/ EMS - Emergency Medical Services). Example of outcome of pre-crisis relationships could be predefined liaison channels and procedures for collaboration. When the involved actors have agreed on rules and structure for collaboration, they can focus on identifying operational goals and action plans for network.

In case of fire in a refugee housing, successful management involves relevant stakeholders in migration management, municipality Authorities, County Councils and first responders who take care of casualties and provide for the psychosocial support of the victims.

This is a prerequisite for effective collaboration and communication during crisis and post crisis responses across organisations.

Air Traffic Management – Illustration



2010 Icelandic Volcano Eruption. Following the eruption of Icelandic volcano Eyjafjallajökull on 14 April 2010, a cloud of ash quickly spread across Europe, helped by favourable winds, bringing an unprecedented level of disruption on the air transport industry (10). Most European civil aviation authorities closed their respective airspaces. On the 17th of April, the n. of actual flight x day in Europe was reduced to 5,335, from an average of 28,000. The national measures were based on the scientific advice provided by the Volcanic Ash Advisory Centre, London (VAAC) and EUROCONTROL. In reaction to the flying bans, all major airlines claimed that authorities had been overly cautious by overestimating the extent of the ash cloud and the hazard it represented for jet engines, in the

name of the precautionary principle. In particular, airlines considered inadequate the hazard model used by VAAC. On the other hand, the authorities claimed they acted consistently with ICAO guidelines. One week after the crisis began the situation did not improve, as the ash cloud did not move. Eventually, the EU and EUROCONTROL took over, and proposed the adoption of a coordinated EUROPEAN action in response to the crisis. Ultimately the crisis “demonstrated the vulnerability of the European aviation system in terms of pan-European coordination between States for emergency situations affecting safety.” (11). In more general terms, the event showed that a cross-organisational coordinated approach is crucial in minimizing the impact of the crisis, as it protect networks against the inefficiencies of fragmented response.

IMPLEMENTATION CONSIDERATIONS

Challenges

This card has two main prerequisites:

- The existence of internal risk management framework sensitive enough to identify scenarios in which inter-organisational crisis collaboration may be needed (see CC [Adaptation relative to events](#)).
- A continuous commitment of senior management over the practices mandated by this card.

Implementation cost

Healthcare – Implementation cost



Associated Challenges

The need for multiple actors from different sectors and jurisdictions to rapidly form a network to coordinate the response, stress the need of previously established structures for a successful management of crisis. The actors need to invest time and effort to establish these structures but will in turn save valuable time in critical stages in mobilizing a crisis response.

Further purposes Disaster medicine doctrines should rely on an **all-hazard approach** (see CC [Adaptation relative to events](#)) where there are the same designated point of contact at each agencies who is contacted regardless of incident scenario. Otherwise there is a risk that time is wasted on figuring out who should be contacted depending on the scenario.

Minimum viable solution

Expected benefit/ results To implement the concept "Establish network", all agencies' PoCs should attend a conference call when each PoC can inform about potential contributions that can be made to the joint response. For example, a fire with a large number of casualties and potential antagonistic aspects needs to be managed by several agencies. These agencies need well established communication protocols in order to act proactively in a joint effort. The communication protocols should support coordination relating to: - Scene safety - Fire management - Care for injured - Care of uninjured - Evacuation within and between counties/regions - Information management between agencies

Air Traffic Management – Implementation cost

In the European ATM context, the networks are already established, organizations like EUROCONTROL, CANSO, ICAO, etc join the different ATM actors in order to encourage collaboration and the exchange of information. Each organization appoints its representing member at international tables and working groups.

For example, EUROCONTROL proposes to its members several programmes and projects aiming at "building a pan-European single sky that delivers the highest air traffic management performance". Also, in the **airport context**, it is the mandatory regulation (**Reg. 139/2014 [4]**) that makes organizations (e.g. ANSP and aerodromes) creating a network. "ADR.AR.B.005 Management system (c) The Competent Authority shall establish procedures for **participation in a mutual exchange** of all necessary information and assistance of other competent authorities concerned".

On the **European Commission** website **International cooperation** is promoted: *Aviation safety is influenced by the inherently international nature of the aviation industry. International cooperation is thus essential to ensure network safety and development of globally agreed standards. The EU is actively engaged in strengthening aviation safety at the international level, notably through its work with the International Civil Aviation Organization (ICAO [5]), implementation of technical cooperation projects, and negotiation of aviation safety agreements with key partners in Europe and Beyond [6].*

ICAO in the Crisis Management Framework Document (EUR Doc 031) (see document [here](#)) states "**Building partnerships** with relevant stakeholders at national, regional and beyond national and regional boundaries is an

essential step in the preparation for an effective crisis management."

Moreover [...] *As crisis often spills over the boundaries of States or Regions, in addition to partnerships established at the national and regional level, it is essential to establish close cooperation with key stakeholders beyond the boundaries of the Region, in this particular case beyond ICAO EUR Region.*

RELEVANT MATERIAL

RELEVANT PRACTICES, METHODS AND TOOLS

Practices

- **Establishment of a European Aviation Crisis Coordination Cell.** Following the Icelandic volcano eruption in May 2010, the EU has established the European Aviation Crisis Coordination Cell (EACCC). The EACCC is in fact a network that includes representatives of EU, EUROCONTROL, EASA, airspace users, air navigation service providers, military and airport. The creation of the EACCC ensures both improved preparedness and coordination support at the time of the crisis. [https://www.skybrary.aero/index.php/Europe_an_Aviation_Crisis_Coordination_Cell_\(EACCC\)](https://www.skybrary.aero/index.php/Europe_an_Aviation_Crisis_Coordination_Cell_(EACCC))
- **Establishing collaboration terms of reference.** In a study of three Swedish municipalities (Nohrstedt 2013), the clarifications of terms of collaboration was identified as an important component of effective crisis management network: "The cases show that if the network participants collectively agree on rules and structures for collaboration, they can move on to identify operational goals and action plans for the network. But if the initial terms of collaboration remain undefined, the formulation of common goals will be difficult. Uncertainty may feed frustration and increase doubts among participants regarding the benefits of networking". The creation of effective network requires the clarification of collaborations terms of reference.

Healthcare – Practices, Methods and Tools

In the Healthcare domain, several organizations have implemented the Capability Cards "Establishing networks". The *Swedish Civil Contingencies Agency's Common Ground for Command and Coordination* is an example of an all-agency coordination doctrine. Such doctrines should guide actors how to establish networks by sharing common language, communication structures and common networking events.

This will lead to common understanding on terminology, work approaches and management. Implementation and operationalization of this program will create necessary conditions for more inter-agency activities in all phases (before, during, after).

- Before: Workshops, education programs, development of management strategies
- During: Effective inter-agency management with common grounds

After: Inter-agency after action review based on qualitative indicators for joint incident management.

Air Traffic Management – Practices, Methods and Tools

Practices

In most ATM international organizations websites (i.e. EASA, Eurocontrol, etc) there are specific sections dedicated to "Current and upcoming events". Usually some events are upon invitation only, but information is available upon request. These events offer opportunities to create networks.

Tools

In ATC domain, at the moment the most used tool in the context of "Establishing Networks" is the **mailing list** which is used to disseminate information, and possibly involve different actors in briefing and meeting related to the matter.

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Healthcare – References

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<http://www.samverkanstockholmsregionen.se/>

Socialstyrelsens föreskrift 2013:22 (National Board of Health and Welfare doctrine)

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NAVIGATE IN THE DRMG

- **Parent theme:** Supporting coordination and synchronisation of distributed operations
- **Resilience abilities**
 - Contributes to: Respond and Adapt
 - Supported by:
- **Categories:** Collaboration, Communication
- **Functions of crisis management:** BEFORE, Preparation, Cooperation and coordination

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2.3. Sharing information on roles and responsibilities among different organizations

Stakeholders involved in resilience management need to have **clear idea of roles and responsibilities** who may be involved in the management of a potential crisis. Each organization should have an adequate knowledge not only of its own roles and responsibilities, but also of those of other organizations they may be required to collaborate with during a crisis. This is vital in order to identify gaps and cooperate before, during and after a crisis.

IMPLEMENTATION

INTRODUCTION

If an organization needs to collaborate with other organizations, it is essential that the latter are sufficiently informed on the following aspects:

1. **Who needs to be contacted** during a crisis
2. Which are the **relevant roles** for the management of both generic and specific types of crises
3. Which are the **high level responsibilities of these roles**, so to have a correct expectation of how one should interact with them.

A prerequisite for the application of the actions described in this card is the existence of a network of organizations already collaborating among them. In addition, the actions are expected to be more effective if the organizations are already sharing some form of written policy or procedure, clarifying the way the organizations should collaborate. If the network is still under development or the organizations are only cooperating based on verbal agreements, it may be more productive to apply first other CCs related to the coordination and synchronization of distributed operations.

Air Traffic Management – Introduction



Airport Emergency Plan should contain a description of the sequence of actions to be performed before, during and after the emergency situation. Standard Operating Procedures (SOPs) and checklists have to be established for all phases (before, during and after) the emergency.

BEFORE A CRISIS

If a shared procedure among the different organizations **already exists**, the procedure should specify which are the involved organizations and which is the one expected to take initiative when a coordination with the other organizations is required. **If a shared procedure does not exist** yet, one or more organizations should take initiative to coordinate and decide together the group of relevant organizations to involve. For guidance on how to establish from scratch a new network of organizations, see the CC [Establishing networks](#). Actions needed before a crisis:

- **Identify organizations with shared responsibilities** in the management of a crisis.
- **Organize periodic coordination meetings among the organisations.** The frequency of meetings may vary, depending on needs, time and budget constraints (e.g. from twice a year, until once every two years). The meetings should address the following questions:

1. Which roles can be contacted within each organization to coordinate the management of both generic and specific types of crises
 2. Which are the high level responsibilities of these roles
 3. How these roles can be contacted
 4. What type of communication means should be preferred to coordinate with them (e.g. point-to-point communication tools, one-to-many communication tools, alarming systems, etc.).
 5. Which is the most updated terminology to indicate the roles and to describe their high level responsibilities
- Ensure that **at least one representative per organization** participate to the coordination meetings and that each organization designates a **point of contact (PoC)** to take care of such coordination.
 - Make sure that the designated PoCs will **arrange updating activities internally to their own organization**, following each coordination meeting (the internal updating activities can range from simple notifications to the interested personnel, to real training activities designed on purpose).
 - Make sure that **major changes affecting emergency procedures** in each organizations are assessed for their potential impact on the interaction with other organizations and communicated to them.
 - If possible, inside each organization, **design and develop a 'quick reference guide'** format of the procedure, simplified and adapted to the specific needs of the concerned organization. The quick reference format should help the first responders to easily identify the roles they have to interact with during a crisis, as opposed to the full list of roles discussed during the coordination meetings that may not be relevant for all the organizations. To note that the effort to design a quick reference guide may be worth only in more structured domains, in which roles and responsibilities tend to remain more stable over time, as opposed to less structured domains where there is a risk for the guide to quickly become outdated
- Does a shared procedure exist among different organizations required to manage jointly a specific type of crisis?
 - Is there a need to involve new organizations in the coordination activities about shared roles and responsibilities for the management of a crisis?
 - Is there a need to create a new network of organizations for the management of a specific type of crisis? (see CC [Establishing networks](#))

Coordination mechanism

- When a shared procedure among different organization exists, is there one organization clearly appointed to activate and arrange periodic coordination activities with other organizations?
- Within our organization, is a calendar of periodic coordination activities already established, to check roles and responsibilities with other organizations?

Impact on other organizations

- Did we recently experience within our organization changes of roles and responsibilities that could affect emergency procedures shared with other organizations?
- Are these changes sufficiently significant to require a communications to other involved organizations?

Internal dissemination of changes

- Are we providing adequate information and training on relevant changes of roles and responsibilities in other organizations to the personnel potentially involved in the management of crisis?
- Can we develop a 'quick reference guide' to help the personnel of our organization to promptly identify shared roles and responsibilities with other organizations during a crisis?
- If we already have a 'quick reference guide', do we need to update it to include recent changes of the procedure shared with other organizations?

TRIGGERING QUESTIONS

Involvement of organizations

Healthcare – Before



Example of situations of relevance to healthcare:
In case of **serious cross-border threats to health, public health organizations with shared**

responsibilities in the management of specific crises are identified according to national, European and international regulations and legal frameworks that support a coordinated action on monitoring, early warning and combating threats.

- At **international level**, each State Party appoints a **National Focal Point** and the authorities responsible within its respective jurisdiction for the implementation of health measures.
- In order to improve the coordination of the shared actions at **European level**, an **ad-hoc Committee** would be established to support the Member States in their efforts to prepare, tackle and mitigate health crises.
- Each Member State should regularly provide the Commission with an **update on the status of their preparedness and response planning at national level**, also including information that they are obliged to report according to the international regulation.
- At all levels, the public health organizations involved provide **contact details that need to be continuously updated and annually confirmed**.
- **All the levels** – international, European, national – need to be **interwoven and work on coordination by collecting and sharing data and information**.

See in addition Practice 1 in the Healthcare Practices, Methods and Tools section below.

concerning roles and responsibilities of other organizations involved in the management of the crisis.

- If available, use the **quick reference guide** version of the procedure shared with other organizations to easily identify the relevant roles and responsibilities.

Healthcare – During



Example of situations of relevance to healthcare:

- The **involvement of the actors** in the crisis management is **regulated by the classification of the critical event**, that is based on the magnitude of the event.
- During the crisis, **all the organizations involved** at the regional, national, European, international levels **operate according to the established legal frameworks and regulations in which roles and responsibilities are clearly described**.
- The **coordination of the organizations involved may shift according to the crisis scale** (e.g. whether the situation is classified or not as a national emergency) to guarantee an adequate level of access to the available resources and ensure a unified direction.

See in addition Practice 2 and Practice 4 in the Healthcare Practices, Methods and Tools section below.

Air Traffic Management – Before



In the context of Airport Emergency Plan, it is fundamental to organise **training, drills and exercises** to test if the people assigned to support the AEP are familiar with their roles and responsibilities

DURING A CRISIS

If the actions put in place before the crisis have been successful, during a crisis **the personnel** of each organization should be **ready to react in an efficient and effective manner**, reducing misunderstandings and misinterpretations about roles and responsibilities of other involved organizations.

Actions needed during a crisis:

- Operate taking into consideration **the information and/or the training received during internal updating activities**

Air Traffic Management – During



In the context of EACCC (European Aviation Crisis Coordination Cell), the steps that are taken in the event of a crisis are the following: [\[7\]](#)

- *the Network Manager contacts the relevant State Focal Points and those at risk at the beginning of any crisis, as well as relevant expert organisations, depending on the type of crisis (e.g. VAAC, ESA, etc.);*
- *the EACCC is convened via meetings or teleconferences;*
- *the remaining State Focal Points are contacted;*
- *a crisis mitigation policy is discussed, agreed and approved by the EACCC;*
- *the relevant State Focal Points provide a link with their internal structures nationally and, where appropriate, coordinate the response in line with their internal procedures;*

- *the remaining State Focal Points are contacted;*
- *a crisis-mitigation policy is discussed, agreed and approved by the EACCC.*

When the crisis is resolved, the EACCC is deactivated.

AFTER A CRISIS

The outcome of a crisis is obviously an opportunity to revise any kind of procedure shared among different organizations that were jointly involved in its management. Such review include the high-level definition of roles and responsibilities inside each organization. *Actions needed after a crisis:*

- **Organize extraordinary coordination activities** (beyond the one normally planned) to revise the common procedure and update the high-level definition of roles and responsibilities in each organization, as needed.
- **Consider whether new organizations should be included** in the shared procedure and periodic coordination mechanism (or if other organizations should be excluded from that, having lost their relevance in the shared procedure).

TRIGGERING QUESTIONS

Organizations involved

- Did the shared procedure and coordination mechanism involved all the organizations relevant for the management of the crisis?
- Considering what happened during the crisis: should new organizations be included in the shared procedure and coordination mechanism?

Coordination mechanism

- Was the experienced crisis severe enough to justify extraordinary coordination activities (beyond the one normally planned) to revise the common procedure and the definition of high-level roles and responsibilities in each organization?
- Is the frequency of periodic coordination activities sufficient at the light of the occurred crisis?

Impact on other organizations

- Does our organization have ill-defined roles and responsibilities in the shared procedure, which negatively affected the response to a

crisis managed in cooperation with other organizations?

Internal dissemination of changes

- Did the information and training provided previously to the crisis result to be effective for what concern relevant changes of roles and responsibilities in other organizations?
- If available, did the quick reference guide supported the identification of roles and responsibilities during the crisis?

Healthcare – Field



After a crisis, **the revision of common procedures is recommended at least after critical events with a large impact** (for instance an earthquake crisis). This review aims both at confirming roles and responsibilities, and **including new sub-clusters of actors and activities that have been set up for the first time in the field** to manage the crisis. When useful, in order to ensure the timely new coordination actions over the time, specific legal measures could be provided. See in addition Practice 3 in the Healthcare Practices, Methods and Tools section below.

Air Traffic Management – After



In the context of EACCC (European Aviation Crisis Coordination Cell), the steps that are taken after the crisis are the following [\[8\]](#):

- *A debriefing EACCC session is held after the crisis to address the lessons learned and to cover any remaining actions.*
- *The EACCC gathers, prepares and shares any relevant information with the entire aviation community, ensuring that consistent messages are issued.*
- *To achieve this, the EACCC prepares factual assessments of the situation for communications purposes. Using a nominated communications focal point, the EACCC ensures that consistent information, based on the factual assessment of the situation made by the EACCC, is transmitted to EC/EASA/EUROCONTROL as Network Manager, the civil and military authorities of affected States and corresponding NSAs/ANSPs, airlines and airports.*

UNDERSTANDING THE CONTEXT

DETAILED OBJECTIVES

Major crises and emergencies that require the joint intervention of more organizations are luckily quite rare to occur. A negative consequence of this is that when the crisis occurs, managers and first responders may have lost familiarity with the best way to cooperate with other organizations and in case they have never experienced such coordination, establishing new links may be even harder. In addition, since the story of each organization develops independently, there might be cases in which roles identified in the past do not exist anymore or cases in which the way to get in touch with them has changed. More than that, the same roles may have modified their function within the organization to an extent that changes the way cooperate with it or the terminology to identify them may have evolved in way that makes them difficult to recognize. Therefore, if more organizations are expected to cooperate in case of crisis, there is a need to ensure that each of them has an adequate level of knowledge of aspects such as:

- Which roles can be contacted within each organization to coordinate the management of both generic and specific types of crises
- Which are the high level responsibilities of these roles
- How these roles can be contacted
- What type of communication means should be preferred to coordinate with them (e.g. point-to-point communication tools, one-to-many communication tools, alarming systems, etc.).
- Which is the most updated terminology to indicate the roles and to describe their high level responsibilities

The actions proposed by this card focus around the idea that even in the case of well structured domains in which the relationships among different organizations are regulated by written procedures or policies, a stable coordination mechanism should be ensured. This mechanism consists of meetings among selected representatives of each organization, to be arranged at regular time intervals or after major events that have relevance for the way the cooperation should occur. Depending on budget and domain specific constraints, the meetings may also have a limited frequency (e.g. from twice a year, until once every two years), but it is very important that they are maintained over time and not triggered only by specific events or criticalities. It should be noted that

this mechanism can be complementary to the ones suggested by other coordination CCs, i.e. CC 2.1 [Promoting common ground](#) and CC 2.2 [Establishing networks](#). However, the three CCs should not be confused among them. Their mechanisms can be combined depending on specific needs and arrangements, but they are aiming at different goals.

TARGETED ACTORS

Policy, decision makers, resource managers, front-line operators in organizations, which have agreed to coordinate, exchange information and establish common procedures (even at a high level) with other organizations for the management of specific types of crisis.

Healthcare – Field



Several levels of actors need to be considered according to the healthcare system organization in each country. Especially policy and decision makers have to be identified with respect to the healthcare main macro area levels (i.e. international, European, national, regional/ local).

Air Traffic Management – Field



According to the provisions for Airport Emergency Plan of 'ICAO Annex 14 - Chapter 9. Emergency and other services' it is necessary to identify:

- **Agencies** involved in the plan
- **Responsibility and role** of each agency the director of the Emergency Operations Centre (EOC/COE) and Command Post (CP), for each type of emergency
- **coordinates of offices/people** to be contacted in case of emergency

The plan coordinates the response or participation of all existing agencies which, in the opinion of the appropriate authority, could be of assistance in responding to an emergency.

Examples of agencies are provided in the document concerning emergencies:

- **ON-aerodrome** : air traffic control unit, rescue and fire fighting services, aerodrome administration, medical and ambulance services, aircraft operators, security services, and police ;
- **OFF-aerodrome**: fire departments, police, health authorities (including medical,

ambulance, hospital and public health services), military, and harbour patrol or cost guard.

EXPECTED BENEFITS

Improved readiness to act in case of a crisis whose management requires joint and coordinated interventions of different organizations. Potential benefits associated to the improved readiness to act are:

1. A **more effective mitigation of the effects of the crisis**, such as a reduction of the number of deaths and a reduction of the severity of injuries;
2. A **quicker return to a stable state**, facilitating business continuity in the organizations affected by the crisis.

Relation to adaptive capacity

A **stronger and more effective coordination among different organizations** involved in the management of a crisis is expected to **improve the overall capability of such organizations (as a group) to adapt to unexpected events and quickly identify the most effective responses to them**. On the contrary, a loose and weak coordination between organization (e.g. lack of information on who should be contacted and wrong expectations on the roles of each actors) is likely to reduce adaptive capabilities and foster rigid and bureaucratic responses, which are inadequate to manage a crisis.

RELATION TO RISK MANAGEMENT

The existing risk assessment activities and the associated mitigation measures are made stronger by better knowledge of the safety issues concerning the interfacing between different organizations operating in the same domain.

ILLUSTRATION

A potential illustrative case is the use of the “Manuale Rosso” (Red Manual) adopted by different entities with shared responsibilities for the management of emergencies at the Fiumicino Airport (Rome-Italy) following major aircraft accidents in the aerodrome area on in the vicinity of it.

Healthcare – Illustration



An example of coordination and communication among actors - that is based on the mutual understanding of roles and responsibilities – concerns the **Psittacosis infection among the Fiumicino Airport staff and a cargo of live parrots**.

Several years ago, two members of the Fiumicino (FCO) airport staff – in Rome (Italy) - were diagnosed with Psittacosis in a nearby hospital. The information was relayed to the local health unit (LHU) and from there to the Lazio Region and to the Ministry of Health (MoH) - Communicable Disease (CD) Office as per the national surveillance system. The Department of Prevention of the LHU investigated the working environment of the patients and found that both had worked at the airport in enclosures dedicated to the care and inspection of live animals and had handled a cargo of live parrots that had since left the airport. The MoH - CD office informed the USMAF (Port, Airport and Ground Crossing Health Offices) Central Coordination Office and the MoH Veterinary services. The USMAF Central Coordination Office communicated with the USMAF FCO (Port, Airport and Ground Crossing Health Office situated in the Fiumicino Airport). The Human contact tracing and surveillance were performed by the Lazio Region in collaboration with the Local Health Units of Rome. Information on the air carrier and exporter/country of origin was collected by the Veterinary Office, according to the rules on the controls of live animals and animal products. The FCO Border Control Post was able to identify the suspected cargo and its final destination thanks to its dedicated database on products received and inspection/control procedures. The USMAF FCO also consulted its dedicated NSIS (New Sanitary Information System) USMAF database on products received and inspection/control procedures. All findings were communicated to the USMAF Central Coordination Office. After internal communication among the relevant offices in the MoH (Central level), the Region of destination of the parrots was contacted. The Region then alerted the local health unit of the concerned area. The LHU coordinated the inspection of the pet shop that had received the parrots both for aspects concerning animal and human health [1].

The example shows the **complexity of roles and responsibilities in multi-organizational crisis**. Several actors were involved and operated according to their internal procedures and regulations. **The fruitful collaboration among organizations were supported by a mutual awareness of their roles and responsibilities and by means of a central coordination** – performed by the USMAF Central

Coordination Office – that allowed the information collection and sharing among the actors involved.

Air Traffic Management – Illustration



Illustrative cases concerning the *Understanding of Roles and Responsibilities* may be found online among the material concerning **Airport Emergency Plans**:

- Some airport management companies publish online their AEP where all actors and their responsibilities are described in detail: e.g. Aeroporti di Roma [9] is one of them.
- some examples of Lessons Learned from **training, drills and exercises** are available online: e.g. the largest full-scale emergency exercise in Florida history has been organised at Orlando International Airport (MCO) [10]. The Exercise Scenario was about “*an Airbus A-320 carrying 93 passengers and 5 crewmembers crashes into a hotel one mile from the airport. In addition to including standard response elements such as patient triage & hazard identification, the off-site scenario also included the transfer of incident command to the jurisdiction of non-airport entity & area hospitals’ surge capabilities.*”

IMPLEMENTATION CONSIDERATIONS

Challenges

Different types of crisis are managed in different ways and may involve different organizations. The ideal cluster of organizations for the management of a certain crisis may not be applicable to or optimal for the management of another type of crisis. Therefore, the most challenging aspect is the identification of the right group of organizations for the establishment of a stable coordination. This may be particularly difficult in the case of very diverse and non-standardized domains in which the same activities (and therefore the potential crises affecting them) are managed in very different ways. In addition, the potential for effective cooperation among different organizations may be jeopardized by the lack of sufficient common ground for discussion on the most relevant aspects of crisis management. This may require specific actions to let the different organizations know better each other before establishing a stable coordination (see Card DR77 “Promoting common ground in cross-organizational collaboration in crisis management”).

Implementation cost

Costs may vary depending on different levels of implementation and different needs. They will be relatively limited when the intervention is mainly limited to the periodic coordination activities with the other involved organizations to update already existing shared procedures (minimum awareness level). They will considerably increase in complex organizations where a higher level of implementation will be required. E.g. large training programs as a consequence of updating common procedures with other organizations or major design/redesign of dedicated quick reference handbooks internal to specific organizations.

Healthcare – Implementation Considerations



Associated challenges

Some contextual conditions affect the implementation of the resilience principle described in this card:

- **Type of emergency.** The card is adequate to contexts characterised by repeatable, bounded emergency situations, where scenarios typologies are reasonably predictable, and where consequently it is possible to have stable emergency procedures, and identifiable actors. On the other hand, the approach may not work in non-structured situations, in which the intervention has to be prepared on ad-hoc basis.
- **Confidentiality.** Confidentiality may prevent some organisations to disclose internal information about roles, responsibilities’ and contact numbers.
- **Safety culture level.** Different actors from different organisations may have different levels of safety culture; therefore, not all of them may consider periodic meetings valuable to increase mutual awareness of relevant roles, responsibilities and contacts.
- **Competition among the actors.** The competition among the actors – rather than the collaboration - fostered by policies and strengthened by cultural, social and economic factors - do not enhance the resilience perspective.

Furthermore, in some countries healthcare actors' roles and responsibilities could not be easily identifiable because there is not always a direct correspondence between roles and responsibilities. During the emergencies, for instance, the lower hierarchical roles happen to endorse higher responsibilities but in an informal way and without an institutional acknowledgement due to power issues that are strictly related to the hierarchical structure of the healthcare system. This is a critical issue that severely compromises the possibility to recognize which are the effective and crucial healthcare roles.

Minimum viable solution

Implementation costs are scalable: they depend on the involved levels of the healthcare system (regional, national, European, international). The minimum viable solution to assure a common understanding of roles and responsibilities at regional and national levels, consists in clearly identifying, within each organization, contact persons, for shared procedures, who are in charge of arranging updating activities. One minimum activity should concern the regular information sharing by each organization regarding organizational aspects that could impact on the coordination activities for the crisis management (e.g. resources availability, changes in internal procedures and regulations). A mailing list or communication platform (see Tools in: Healthcare Practices, Methods and Tools section below) could be used for this purpose.

Air Traffic Management – Implementation Considerations

According to ICAO Annex 14 - Chapter 9. Emergency and other services

"An aerodrome emergency plan shall be established at an aerodrome, commensurate with the aircraft operations and other activities conducted at the aerodrome." "The aerodrome emergency plan sets forth the procedures for coordinating the response of different aerodrome agencies (or services) and of those agencies in the surrounding community that could be of assistance in responding to the emergency."

At European level [\[11\]](#): "In May 2010, the European Commission (EC) and EUROCONTROL jointly established the European Aviation Crisis Coordination Cell (EACCC) to coordinate the management of crisis responses **in the European ATM network**. In addition, the EC

included crisis management aspects in the NM implementing rule (NM IR), which lays down detailed rules for the implementation of ATM network functions." The main role of the EACCC is to coordinate the response to those network crisis situations which impact adversely on aviation, in close cooperation with corresponding structures in States. This includes proposing measures and taking initiatives and, in particular, acquiring and sharing information with the aviation community (decision makers, airspace users and service providers) in a timely manner. In accordance with the Network Manager Implementing Rule, the EACCC consists of a single representative of:

- the EU Member State holding the Presidency of the European Council;
- the European Commission;
- EASA;
- EUROCONTROL;
- the Network Manager;
- the military;
- the Air Navigation Service Providers;
- airports;
- airspace users.

The representatives of the Network Manager and the Commission co-chair the meetings of the EACCC. Experts may be seconded to the EACCC on a case-by-case basis, depending on the specific nature of the crisis. The EACCC coordinates with relevant State Focal Points from the early stages of the crisis onwards.

IATA in the "EMERGENCY RESPONSE PLAN - A template for Air Carriers - PUBLIC HEALTH EMERGENCY" proposes (for information purposes only) an outline of the roles and responsibilities of each member of the Emergency Response Team (ERT) and a checklist of actions to be taken in the event of a public health Emergency. [\[12\]](#)

RELEVANT MATERIAL

RELEVANT PRACTICES, METHODS AND TOOLS

Practices

Complex entities, composed of many interdependent subsystems, can improve their ability to recover from incidents through the better management of key interfaces (from the paper "Managing incidents in a complex system: a railway case study", Collis et al. 2016).

"Planning for incident response should include ensuring that interdependencies between organizations

and the contact details for each are maintained up to date, via agreed interface protocols, and that there are credible, robust, coordinated and practiced emergency plans" (ID 287-p183) (TRL9).

Organizations can become wiser by looking at incidents outside their own sector (from the Paper "Resilience Through Emergency Planning: Learnings from Cross-Sectoral Lessons", Chrichton et al, 2009).

"(...) a responding organization must retrieve control of the situation, and should have in place an effective emergency preparedness response plan and procedures. It is vital that the people involved in the response have received sufficient opportunity beforehand, in the planning stage, to form effective relationships with those people that the emergency will thrust together both intra- and inter-organizationally. These relationships also need to recognize the competencies, responsibilities, and constraints under which each organization and its people are working. People need to understand not just WHAT they must do, but HOW they can work most effectively together" (ID 1317-p13).

Healthcare – Practices, Methods and Tools



Practices

Practice 1. In Italy, in case of epidemic threats identified by a national surveillance system with impact at international level: Public Health organizations with shared responsibilities are identified according to national ministerial decree/ pandemic plan/ standard operating procedures, the European Decision No 1082/ 2013/ EU [3], and the International Health Regulation (IHR) [4].

- At **international level**, according to the IHR, each State Party establishes a National IHR Focal Point and the authorities responsible for the implementation of health measures. In the IHR, roles and responsibilities of the National IHR Focal Points are clearly described. States Parties provide WHO with contact details of their National IHR Focal Point and WHO provides States Parties with contact details of WHO IHR Contact Points.
- At **European level**, the Decision supports a coordinated Union action on monitoring, early warning and combating serious cross-border threats to health. An important role in the coordination of these actions is played by the

Health Security Committee composed of high-level representatives from Member States. In case of communicable diseases, the surveillance at Union level is carried out by the European Centre For Disease Prevention and Control (ECDC). In order to strengthen the preparedness and the response planning, Member States should regularly provide the Commission with an update on the status of their preparedness and response planning at national level, also including information that Member States are obliged to report to the WHO in the context of the IHR.

- At **national and regional levels**, in Italy, roles and responsibilities of organizations involved in the management of the epidemic disease are regulated by the Pandemic preparedness plan [5] provided by the Ministry of Health (MoH). Standard operational procedures (POS) are also released by the USMAF Central Coordination Office in charge for healthcare facilities and services at the Points of Entry (PoE) such as airports and ports (MoH).

Practice 2. In the **Italian National healthcare system**, numerous actors are involved in communicable disease detection and early warning and in outbreak/health emergency response. **Their involvement differs whether the situation is classified or not as a national emergency** [1]. All the organizations involved at the regional, national, European, international levels operate according to the legal frameworks mentioned in the before phase. **In case of a national emergency**, as foreseen in the Pandemic Preparedness Plan [4], the Council of Ministers activates the Department of Civil Protection that in turn activates governmental and non-governmental actors such as the Italian Red Cross, the operational network of the emergency health response (118) and the Police forces. **Coordination shifts from the Ministry of Health to the Civil Protection Department.** If the emergency is health related, the Minister of Health will be called to provide technical advice. As National IHR Focal Point (NFP), the MoH – Directorate General of Prevention is responsible for communicating timely both to WHO at international level, and to ECDC at Union level by means of the Early Warning and Response System (EWRS). This notification of alerts is required only where the scale and severity of the threat are significant and they affect more than one Member State and require a coordinated

response at the Union level. Deadline and procedures are regulated by the legal frameworks [3], [4].

Practice 3. An example of **revision of common procedures after a crisis** is provided by the case of the Abruzzo earthquake emergency occurred in Italy, in 2009. In order to strengthen the local capability to assure an adequate level of health rescue and assistance at local/ regional level in coordination with the National Civil Protection Department – Sanitary Unit, Regional Health Modules (RHM) were established during the emergency, and legal measures to include them in a common procedure were released in 2011, after the crisis. Legal measures take into account what happened in the field, among the already identified actors, during the crisis management. The aim is to describe and specify the general process to activate and manage RHMs that have to operate in the first 72 hours of the crisis, to minimize victims and the avoidable health consequences among the severely injured persons. The procedure details have to be specifically established between the Civil Protection Department and each Region [More information, in Italian, are available at: http://www.protezionecivile.gov.it/jcms/en/view_prov_wp?contentId=LEG28816]

Practice 4. An example of coordination mechanism among the Health Emergency Operations Facility (HEOF) established by the Directorate-General for Health and Food Safety (DG SANTE) of the European Commission. The HEOF is a Link/Contact structure for health crises established in Luxembourg. Its activity has been agreed at European Community level and formally endorsed, taking account of subsidiary principles. If required, the Health Event Managers will cooperate with competent authorities and services other than human public health, as specified in their national plans. The Health Emergency Operations Facility operates as the public health hub for linkage with the centralised national / European Community Crisis Management structures. All stakeholders are supposed to provide information to each other. In this way they can feed into their decisional process the information displayed on a secure website monitored by the Link/Contact Structure. The HEOF is a tool that can provide decision makers with:

- (i) fast and comprehensive international situation awareness and analysis;
- (ii) transmission of information about measures implemented in other Member States

- (iii) effective coordination of responses.

Methods

The Cluster Approach, is generally applied to improve the effectiveness of response capability of the humanitarian response in terms of sufficient global capacity, predictable leadership in the main sectors of response, partnership among actors involved, accountability of partners, strategic coordination and prioritization [5].

Tools

Communication platforms, are useful tools to share information, practices, and to support the coordination among actors with same objectives.

Examples are provided by:

- *AIRSAN communication platform* [6] that brings together national public health and civil aviation authorities, local public health authorities, airport management and airlines across EU Member States. It facilitates greater mutual understanding of the requirements, practicalities and impact of proposed measures in the management of public health threats in air transport. [More information are available at: <http://www.airsan.eu/Login/tabid/105/Default.aspx?returnurl=%2fAIRSANNetwork%2fCommunicationPlatform%2fSearch.aspx>]
- *EU SHIPSAN ACT Information System (SIS)* [7]. The EU SHIPSAN ACT is a European Joint Action dealing with the impact on maritime transport of health threats due to biological, chemical and radiological agents, including communicable diseases and supports the implementation of IHR [3]. The SIS is a Communication Network platform, an information system and a database.

Air Traffic Management – Practices, Methods and Tools



According to **ICAO ANNEX 14, VOL I Provisions for Airport Emergency Plan**, the AEP has to be subject to periodic testing & review results.

"The AEP shall be tested by conducting:

- *a full-scale aerodrome emergency exercise at intervals not exceeding two years. The purpose of a*

full-scale exercise is to ensure the adequacy of the plan to cope with different types of emergencies.

- **partial** emergency exercises in the intervening year to ensure that any deficiencies found during the fullscale aerodrome emergency exercise have been corrected. The purpose of a partial exercise is to ensure the adequacy of the response to individual participating agencies and components of the plan, such as the communications system.

The AEP shall be reviewed thereafter, or after an actual emergency, so as to correct any deficiency found during such exercises or actual emergency.”

Moreover there are different types of exercises, from a lower level to a higher level exercise, with each one building on the concepts of the previous exercise. FAA in its AC 150/5200-31, Airport Emergency Plan [13] refers to and provides details about:

1. **Orientation Seminars** to discuss the AEP and initial plans for upcoming drills and exercises, as well as to become familiar with the roles, procedures, responsibilities, and personalities of all those involved.
2. **Drills** to test, develop or maintain skills in a single emergency response procedure.
3. **Tabletop Exercise** to provide training and evaluate plans and procedures and to resolve questions of coordination and assignment of responsibilities in an informal, non-threatening format without concern for time constraints, stress levels, or actual simulations.
4. **Functional Exercise** to test or evaluate the specific capabilities of the participants for several functions under a stress-induced environment with time constraints and actual simulation of specified events. In other words, it can test within specified limits the internal airport and the external responses of off-airport emergency response agencies.
5. **Full-Scale Exercise** to evaluate the operational capability of the emergency management system in a stress environment with actual mobilization and deployment to demonstrate coordination and response capability. It uses all resources and requires reaction from equipment and personnel that would normally be available if the exercise were an actual emergency.

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Healthcare – Reference



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NAVIGATE IN THE DRMG

- **Parent theme:** Supporting coordination and synchronisation of distributed operations
- **Resilience abilities**

- Contributes to: Respond and Adapt, Learn and Evolve
- Supported by:
- **Categories:** Collaboration, Communication, Planning, Resources, Situation understanding, Training
- **Functions of crisis management:** BEFORE, Prevention, Build knowledge of crisis situations, Train, Plan for crisis, DURING, Damage control and containment, Command and control, Assess emergency and response

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CHAPTER 3

Managing adaptive capacity

ASSOCIATED CARDS

3.1. Enhancing the capacity to adapt to both expected and unexpected events

Emergency situations occur suddenly and without warning. Therefore, organizations must be prepared and adapt their functions to respond to emergency events as quickly as possible. Among those situations, some of the events are expected while others, could be unexpected with different nature. Roles, training, strategies, and procedures must be in place to provide such capacity, using an all-hazards approach which considers the common denominator of emergency situations in different areas, building a generic response plans that can be adapted to a specific event.

3.2. Establishing conditions for adapting plans and procedures during crises and other events that challenge normal plans and procedures

Often, crises challenge the plans and procedures in place. As a result, organisations need to support and maintain a clear and legitimate space of manoeuvre relative to normative plans and procedures. Such space is important for actors engaged in crisis response in order to adapt to unusual (unanticipated) circumstances. After training or real events, investigating why these adaptations occur can feed the processes of revision of checklists, procedures and policies.

3.3. Managing available resources effectively to handle unusual and changing demands

To better handle the unusual and changing demands of crisis situations and achieve critical objectives, organisations need to be able to use available resources effectively, sometimes creatively, and potentially to bring in additional resources. For the purposes of this card, *resources* refer to human resources, such as personnel in various roles and divisions of an organisation, as well as to material or immaterial resources, such as equipment and tools. In other words, to anything that is necessary or useful in order to accomplish the tasks at hand.



3.1. Enhancing the capacity to adapt to both expected and unexpected events

Emergency situations occur suddenly and without warning. Therefore, organizations must be prepared and adapt their functions to respond to emergency events as quickly as possible. Among those situations, some of the events are expected while others, could be unexpected with different nature. Roles, training, strategies, and procedures must be in place to provide such capacity, using an all-hazards approach which considers the common denominator of emergency situations in different areas, building a generic response plans that can be adapted to a specific event.

IMPLEMENTATION

INTRODUCTION

In order to enhance organizations' capacity to adapt to all events (both expected and unexpected), it is recommended that response plans have two main features – that they are based on everyday operations, and designed using the all-hazards approach.

- Everyday operations

While crisis situations differ from routine operational challenges and disruptions, the capacity to adapt in crisis stems from the same general capacity used in everyday operations. In addition, familiarity of personnel with known procedures and guidelines makes it easier to implement them and operate during emergencies.

- All-hazard Approach

It is important that organizations map and understand potential emergencies, recognizing mutual components of different threats. Thus, they can build a generic response plan for many types of unexpected events, while each threat has a specific extension to its relevant needs.

The next stage is to build a mechanism (strategies, procedures, and tools) that identify roles and responsibilities, missions and goals. Personnel must be trained to work within this mechanism, and its

effectiveness assessed. For further information regarding understanding roles and responsibility, please read the CC of [Understanding roles and Responsibilities](#).

Such mechanisms need to be rehearsed, with the understanding that actual events will likely be different from anticipated situations. Assessment means learning from both failure and success, and regularly reviewing and revising. A mechanisms that supports adaptation, means having invested resources in capturing/clarifying strategies, resources and constrains. Please see more information relating to [noticing brittleness](#) and [identifying sources of resilience](#). The implementation of this CC requires a shift in the organization's perception of emergency management. Sometime, organizations may seek assistance from resilience management experts in applying these approaches.

Healthcare – Introduction



Risk and incident managers are experts in generic management, not in specific issues related to incident scenarios.

BEFORE A CRISIS

Before crises occur, preparedness activities are critical for creating the conditions for maintaining contingency and adaptation in a crisis. During non-emergency

periods, organizations should first map their potential emergency situations based on experts' experience and knowledge and relevant professional literature. Following the mapping, they must identify mutual components of preparedness, including personnel behavior and checklists for action. Checklists must include required activities, and names with contact information of internal and external actors that have to be involved during those situations. The organization must analyze carefully each scenario (based on potential emergencies) in order to understand the uniqueness of each situation and to add adjusted components beyond the initial response plan. After classifying the structure of response plans (initial and adjusted components), we recommend building the plans around daily activities and operations. In this way, the organization uses known resources, and increases the familiarity of personnel with guidelines. This approach affects also on management and monitoring different type of buffers. After mapping the emergency scenarios, it is important to have appropriate equipment that in a time of a crisis will assist to create time or room for maneuvering. For more information about managing and monitor buffers, we recommend to read the CC of [managing available resources](#). It is important that it is clear whose role it is to in charge of crisis management. This role should be nominated during the pre-crisis period. His/her tasks include being able to monitor and assess the complete picture, and together with the organization's managers define the roles and responsibilities of involved actors. For a deeper understanding of the subject, please read the CC [Understanding roles and Responsibilities](#). Managers should be trained in assessing the situation against prepared-for specific situations and recognize when coordination with relevant partners outside of established channels is necessary to coordinate response. For this important issue, please read the CC of [Promoting Common Ground](#).

TRIGGERING QUESTIONS

Classify and analyze potential emergencies

- What variables/data are monitored to assess whether there is a crisis? What is the underlying rationale for the monitoring efforts and what limitations does this approach have? What crisis information is difficult to capture in variables/data?
- Could we classify emergencies according to their nature?
- Do we identify mutual component of different types of emergencies?

Build a mechanism for response plans

- Do we have an actor who will be in charge of, coordinate or synchronize crisis management planning and response?
- Do we design the response plans based on everyday manner? Do we use known resource to handle unexpected situations?
- Do we have appropriate equipment to the first stage of the emergency?
- How are such managers trained to recognize when unexpected events occur that challenge the current organisational structure and processes?
- How do we define potential relevant partners to coordinate with in case of expected and unexpected situations?
- Are lists of “good-to-have” contacts available in case unexpected situations occur that may require contacting actors outside of established communication channels?
- Do we (re-)develop response plans based on new experiences?
- Do we have response plans as well as training such as exercise and drills?
- Do we model protocols to promote a common approach?
- How do we create communication channels and networks between partners so that they can adaptively coordinate and cooperate when unexpected situations occur?
- Can the adaptive re-allocation and deployment of resources within and between organisations be supported by building in slack in appropriate places in the network to meet unexpected demands?

Healthcare – Before



Plans are generic to the furthest extent. Specific scenarios might be tested. All such results are compared to find common procedures that are then formed into generic guidelines for incident response. However, limitations in these generic guidelines must be made aware in order to adapt the response when needed.

Air Traffic Management – Before



- Actor(s) who will be in charge/facilitator of, coordinate or synchronize crisis management planning and response.

The number of actors who will be in charge/facilitate the event is derived from its size. For a small air traffic controller, it is possible to have one actor. But for larger events, Air Traffic Incident Coordination and Communication Cell (ATICCC in UK) bring people together to agree on strategies. The issue is having the right level of people that bring different knowledge available at different times (e.g. volcanic ash event require MET expertise).

- recognizing and monitoring unexpected events

For ATM as a network, there will be a number of local manager or larger involvement might be required. People train for different strategies, then being creating for situation that are not expected (e.g. volcanic ashes, run out of APRON space, snow with not deicing people is prepared for snow but not that amount) Important in ATM is people (ATCO, engineers, pilots, assistants) and time people is available. The operational community is time limited. Thus, it is required to know how many people is available to deal with the situation. Managing resources and stability of the system, time, delays, weather. Degrees of freedom related to the capacity for manoeuvre.

- Define potentially relevant partners to coordinate with in case of expected and unexpected situations

In ATM, there is a list for emergencies, in America they have a play book that gives a preprogrammed set of strategies. An important issue is: if the document list is kept updated on regular basis, specially strategies. Communication channels between partners are in foundation of ATC the issue is to extended to making the established the existing channels effective. Enhancing resilience response in uncertain episodes. This includes creating common approaches for certain type of events

- Response plans- development, re-examined and training .

This is a normal practice in ATM e.g. volcanic ash (things that go wrong and exceptional events). A reflecting review, talking to people of any situation volcanic ash but other situation e.g. handling an aircraft in an adequate manner (formal and informal mechanisms to collect tacit knowledge on situation people need to adapt to). Resilience capacity comes from the availability to reconfigure. There are contingency planning and facilities embedded in ATM. In ATM training is done to a limited extent, but there is a need to broader the people and roles involved as a network training (reflecting in different situations).

Orchestrate agile and resilient strategies to uncertain events.

There is a constant reorganization, and it imply challenges and sacrifices to understand implication of slack. That include re-allocation and deployment of resources within and between organizations.

DURING A CRISIS

During an emergency, organizations are called upon to handle challenging situations, balancing between needs and limited resources in an unknown atmosphere. Basing activities on known manners allows actors to function in familiar way, increasing their capacity and confidence. There is a need to scarify non-essential functions. During the first stage of the crisis, while the organization acts according to the basic response plans, it must also diagnose the specific emergency, and adjust organizational plans to relevant situation and needs. It must remember to balance between various needs in accordance with different organizational levels. Contact and work in coordination with external actors who may assist and deploy extra resources.

TRIGGERING QUESTIONS

Identifying the specific nature of the emergency situation

- Are plans available and applicable?
- How can or should elements of plans be combined to meet situational demands?
- How can missing or inappropriate plan elements be added or compensated for (through improvisation)?
- Are organisational plans applicable in this situation or do other mandates?
- What uncertainties are there in the situation?
- For which aspects of the situation are we less than well-prepared?
- Are facts, domain knowledge, and experiential knowledge that we need to assess and/or act on the situation available to us?

Contact and work in collaboration with relevant actors

- Do we need to contact with relevant actors?
- How can we communicate with other/new actors in order to understand the complete picture of the event?
- Are the actors familiar with the actions they should take?

Healthcare – During



Generic guidelines are applied and incident managers respond according to all hazard applicability as long as possible. This approach gives incident managers the ability to quickly initiate the response and focus on where specific adaptation is needed.

AFTER A CRISIS

In the aftermath of critical events, there is a need to implement review processes, and revise plans and procedures according to assessment results. From the perspective of the all-hazard approach, it is important to evaluate the structure of response plans, identifying common components for various emergencies and the uniqueness of each threat. From the perspective of links between everyday operations and actions during a crisis, the lesson learning may affect both daily activities as well as further emergencies.

TRIGGERING QUESTIONS

All-hazard approach aspects

- How did they solve unexpected or not-planned-for situations?
- Does the planning process generate relevant, applicable and useful plans?
- Could the structure of response plans be improved based on core elements and specific components ?

Everyday operation and regular activities

- Which aspects of the situation were the actors involved in the response familiar with?
- Which were new to them?
- Could the organization advance everyday operations according to the evaluation of activities during the emergency?

General

- Did the organisation as a whole recognize these unexpected situations when they occurred?
- How can organisational processes be improved to recognize and act upon the unexpected in a better way?
- Was there a proactive action to recognize unexpected circumstances?
- How can planning and training processes be improved?
- Does training have the desired effect?

Healthcare – After



All incidents are reviewed with the purpose to identify limitations in generic guidelines and standardise where possible.

UNDERSTANDING THE CONTEXT

DETAILED OBJECTIVES

Emergency response plans commonly guide a specific action in a specific event. The approach takes into account the common denominator of emergency situations in different areas and treats them as the thinking process proposed in this card prepares relevant actors with a framework for action rather than a blueprint for action. Monitoring and control activities are to be implemented with the purpose to check if roles, process and training support the adaptation of organizational structure in a flexible way to the changing demands of the operational environment. A “framework for action” needs to be periodically verified against the need for assessing when organizational processes, structures, strategies need to adapt to be flexible, and how to implement these changes and adaptations effectively.

TARGETED ACTORS

Actors directly concerned by this Capability Card are decision and policy makers, and crisis managers.

The guideline is relevant at all administrative and management levels, since adaptive capability also concerns front line operators, and roles who (re-)design response plans.

Healthcare – Actors



The actors, from the HC perspective, is the decisions and policy makers on regional and local level and the Ministry of health and welfare. These are for example regional and hospital disaster preparedness managers as well as Emergency Department Head Nurses and prehospital commanders.

Air Traffic Management – Actors



The roles and responsibilities of involved actors change according to the type of crisis and the related environment of operations. The "Adaptation relative to events" must encompass most of the activities of the organization, at all levels starting from senior management to front line operators.

The actors involved are those listed below:

- Air Navigation Service Providers (both civil and military)
- Aircraft owners and operators
- Aircraft manufacturers
- Aviation regulatory authorities (National and International)
- ATFCM (Air Traffic Flow and Capacity Management)
- International aviation organizations (i.e. EUROCONTROL, ICAO, CANSO, etc)
- Investigative agencies
- Flying public
- Airport operator (if airports and/or ground operations are concerned by the crisis)
- Firefighters (if airports and/or ground operations are concerned by the crisis)
- Police (if airports and/or ground operations are concerned by the crisis)

EXPECTED BENEFITS

This card facilitates the development of response plans as well as strategies, design and implementation of training based on routine operations addressing goal conflict, sacrifice decision making to both expected and unexpected events (all-hazard approach and everyday operations). This resilience approach address network interactions and is more likely to facilitate and enable responsible actors to deal with more complex incidents and emergencies potentially involving more than one type of hazard or opportunities, and combination of expected and unexpected circumstances. The actors involved in the operational response plans and acting will recognize the responsibilities and actions that should be taken or might be applicable.

RELATION TO ADAPTIVE CAPACITY

It promotes adaptive performance prior, during and after emergency situations through the adaptation of organizational processes and structures in response to situational demands. The fitness-for-purpose of plans are complemented with practices (formal and informal)

and organizational processes for adapting to circumstances with respect to expected and unexpected events, enhances the adaptive capacity for dealing with unknown and unforeseen situations. This will be achieved by a) flexibility in building and applying plans and practices; b) capability to interpret the situation and to work out interventions accordingly; and c) capability to adjust procedures in progress. These capabilities can be achieved through training and reflection on action.

RELATION TO RISK MANAGEMENT

Emergency response plans commonly guide a specific action in a specific event. In addition, resilience management promotes the development of plans and practices that provide the opportunity to identify likely threats as well as opportunities, think through their capabilities, identify key resources, explore contingencies and what for what kinds of events the organisation is well/less-prepared, and develop alternative action practices, strategies in a network of actors that are exercised to stretch adaptive capacity.

ILLUSTRATION

The need to strengthen the capacity of European Member States to coordinate the public health response to cross border threats, whether from biological, chemical, environmental events or events which have an unknown origin. (see relevant practices at the example of practices).

Healthcare – Illustration



The same emergency response procedure is applied to all incidents, regardless of incident scenario. For example a regional major incident medical command is formed by the same core staff in all incidents. This enables the management to be mobilised quickly and to accumulate experienced staff that are active in a wide variety of events. Further specific expertise is added to the management staff if needed in a later stage, and have the specific role as experts in the otherwise standard management team.

Air Traffic Management – Illustration



[Ref. <https://www.eurocontrol.int/articles/what-has-changed-aviation-dealing-volcanic-ash-2010>]

"There has been significant progress since 2010 on the volcanic ash and aviation front. Overall European approach in dealing with volcanic ash"

"While each individual state remains responsible for deciding whether or not to impose restrictions on flights in its airspace, there has been a move towards a more harmonised approach – one which recognises that decisions to perform flights in airborne contamination (such as ash or sand), should be made by airlines, based on the conclusions of their safety risk assessment."

"This approach significantly reduces the number of flights that would have to be cancelled in the event of another ash crisis."

Operational response in dealing with volcanic ash

"At the request of the European Union Transport Ministers, the European Commission and EUROCONTROL established the European Aviation Crisis Coordination Cell (EACCC) in May 2010. This cell, which will fall within the activities of the new Network Manager, is responsible for coordinating the response to any crisis affecting European Aviation, such as an ash cloud."

"The Crisis Coordination Cell will utilise existing communication tools such as EUROCONTROL's successful web-based Network Operations Portal. A new tool, the European Crisis Visualization Interactive Tool for ATFCM (EVITA), has also been developed to help airspace users evaluate the effect that an ash cloud will have on their operations."

Detecting and observing the ash

"Increased use of PIREPS (Pilot In Flight Reports) significantly contributes to determining where the ash is located, how high and concentrated it is. This information is essential for decision making during an ash crisis."

Volcanic Ash Crisis Exercises (VOLCEX)

"One year after the eruption of the Eyjafjallajökull volcano EUROCONTROL took part in a major crisis exercise to validate changes and improvements to the volcanic ash contingency plan and procedures." "The VOLCEX exercises are organised by ICAO, the International Civil Aviation Organisation and allow a full assessment of the impact of applying updated procedures."

"As part of the exercises, the European Aviation Crisis Coordination Cell is activated, and the EVITA is tested. The exercises are simulations only; they have no impact on real flights."

"The VOLCEX exercises are organized yearly. Each time, the exercise scenarios vary and simulate eruptions on the volcanoes in Iceland, the Açores and Italy. "

IMPLEMENTATION CONSIDERATIONS

Challenges

Classification of available procedures and practices, taking in account expected and unexpected events. The absence of shared or coordinated procedures among all levels and types of actors involved in the crisis management (for instance, to all actors layers involved in the management of the organs transplantation, i.e. national and regional transplantation centers, regional emergency agency, traffic corporation, etc.)

Implementation cost

Building response plans based on an all-hazard approach, reduces development costs. Since, the core part of these plans to different scenario is uniform. Establishing the response plans on everyday operations increases the employees' familiarity with the required actions in emergencies, Therefore there is less need for investing resources with the learning process.

Healthcare – Implementation considerations



All-hazard approach can be applied to all levels of management (national, regional, local, operative). The fundamental ideal is that regardless if you have a surge capacity challenge at the local Emergency Department, a pandemic, or a train crash, the majority of procedures would be the same. Thus, a generic response plan can be applied.

Air Traffic Management – Implementation considerations



Adaptation relative to events build flexibility and adaptation. It does not solely focus on a particular event but on the organisational capabilities to deal with events (expected and unexpected).

RELEVANT MATERIAL

RELEVANT PRACTICES, METHODS AND TOOLS

Practices

1. Real Time Risk Assessment (Lay, Branlat and Woods; 2015) This tool was developed in the context of industrial maintenance and aims at providing support to teams experiencing challenging (novel, complex, difficult) situations at maintenance sites. Within one hour, a geographically separated, diverse group in terms of knowledge, skills, function level, and roles, convenes via telephone conference to collaboratively analyse the problem and explore solutions. At the end of the meeting, project managers on site have various courses of actions vetted by remote experts, which can be implemented to improve the situation.
2. Anticipating resource crunches
3. Tactical reserves
4. "All hands" alarm.

Healthcare – Practices, Methods and Tools

Checklists for initial major medical incident response are applied to all incident types on regional, local and prehospital level. This for example include a common situation report (METHANE) and time set key process indicators such as first report from scene, first formulation of incident strategy and first inter-agency briefing.

Air Traffic Management – Practices, Methods and Tools

The ATM sector has a long history of handling disruptions on a routine basis, or out of the ordinary. While not events are dealt with successfully, this domain has built are significant set of competences, processes and mechanisms to handle disruptions and crises. Such set can serve as inspiration for other operational domains and crisis management practices in general.

Clear goals and high-level adaptive strategies

Adaptation to disruptions relies on a shared understanding of some fundamentals:

- ATM has the primary goal of maintaining a flow and ensuring the safety of aircrafts
- ATM operations exist in a network of control centres and roles: solutions often involve nearby nodes (e.g., an adjacent centre offloads some traffic, a higher regional node replans traffic).
- ATM operations exist in collaboration with other organisations involved in air transportation, especially airports and airlines: disruptions are also solved in collaboration with those actors. For instance, airlines can accept some impact on traffic in order to address unmanageable situations for ATM.
- There is a limited number of typical strategies to maintain a capacity to adapt to disruptions:
 - Sectorisation allows to ... and, thereby, provide more capacity to handle traffic and adapt
 - Especially when sectorisation is not possible, air traffic flow and capacity management (ATFCM) aims at matching the traffic to the capacity. In order to reduce stress on an airport or air traffic center experiencing difficulties, ATM might: implement a *zero rate*, put aircrafts in holding pattern, divert traffic to a different airport, etc. (the specifics of ATFCM are very context-dependent).

Such goals and strategies are rehearsed in training, and are experienced during everyday operations (small disruptions occur routinely). They form the basis for the management of more challenging (e.g., unexpected) events and crises.

Roles supporting the management of adaptive capacity

Specific groups and roles exist in the ATM system to allow for the implementation of adaptive strategies:

- The Capacity and Flow Management Unit (CFMU) / Network Manager from Eurocontrol coordinates ATFCM, clearly establishing this process as a highly collaborative one (especially between ATM and airlines).
- Managers
- ATC Supervisors acknowledge the importance of their operators in managing disruptions
- ATCOs are highly engaged and competent individuals

Emergency plans and checklists

Emergency plans and checklists are constructed for all types of disruption events, and they serve different purposes. They enable adaptation by serving as action and memory support.

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NAVIGATE IN THE DRMG

- **Parent theme:** Managing adaptive capacity
- **Resilience abilities**
 - Contributes to: Respond and Adapt, Anticipate
 - Supported by: Learn and Evolve
- **Categories:** Planning, Procedures, Training, Governance, Learning lessons, Resources
- **Functions of crisis management:** BEFORE, Preparation: build knowledge; train; plan, DURING:, Command and control; execute and revise plan, AFTER, Learning: revise crisis management processes; assess performance

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3.2. Establishing conditions for adapting plans and procedures during crises and other events that challenge normal plans and procedures

Often, crises challenge the plans and procedures in place. As a result, organisations need to support and maintain a clear and legitimate space of manoeuvre relative to normative plans and procedures. Such space is important for actors engaged in crisis response in order to adapt to unusual (unanticipated) circumstances. After training or real events, investigating why these adaptations occur can feed the processes of revision of checklists, procedures and policies.

IMPLEMENTATION

INTRODUCTION

Resilience is positioned in complement to plans and procedures. Plans and procedures often are not fully useful and have to be used as guides to base actions on rather than as comprehensive and accurate descriptions of actions to execute. Flexibility and *improvisation* compensate for gaps in the procedures, providing solutions needed on the spot.

The management of *adaptive capacity* discussed here is that of the considered organisation and is limited by the corresponding organisational boundaries. However, crisis situations considered might involve multiple organisations. Adaptation relative to plans and procedures therefore needs to be thought in a cross-organisational context. The application of this guideline will therefore be facilitated by applying [Establishing common ground](#) and [Understanding roles and responsibilities](#) first. The management of adaptive capacity indeed requires that common ground and understanding of roles and responsibilities are in place within and across organisations. The interventions proposed here can also highlight deficiencies in capacity to coordinate.

The interventions described here aim to capture, understand and improve the use and potential limitations of plans and procedures in their organisational context.

What is needed to establish conditions for adapting plans and procedures:

- Clarify and rehearse plans and procedures
- Clarify lines of authority and the autonomy discretion
- Exercise situations that fall outside normal conditions and involve personnel across the organisation
- Document events and training sessions (e.g., establish and maintain logs, build narratives) to capture gaps or deviations in plans and procedures as well as innovative adaptations
- Reflect on gaps and deviations captured or on innovative adaptations
- Revise plans and procedure, authority and autonomy. Modify training when experiences appear generalisable
- Rely on members of the organisation familiar with resilience notions, such as resilience or safety managers, to conduct actions, lead and moderate discussions proposed here
- Involve external experts if such resilience or safety managers are not available

BEFORE A CRISIS

The foundation for trust is primarily laid down during this phase in terms of training and rehearsal on the rules of work and on different degrees of deviation according to need or severity of the situation.

Nature of Plans and Procedures

Document and rehearse relevant processes and procedures regularly. Regarding larger crises, organise lists indicating who needs to be contacted and when, including, e.g., for technical or political issues. For big crises, there should be specific infrastructure and facilities, and procedures flexible enough to be adapted to different kinds of situations and needs.

Authority Issues

Operators in direct contact with such challenges might, at a given moment, have the best knowledge of the situation and ability to act, while managers remote from the situations supervise operations and coordinate them across larger scales. It is important to clarify roles and authorities in advance and identify situations in which it might be difficult for the usual chain of command to make well-informed and fast decisions in the face of unanticipated challenges.

Capability Issues (skills, expertise)

Managers should develop a good understanding of the type of "adaptations of plans and procedures" that situations might require, as well as of the capabilities present in their organisation. Such capabilities include the ability to recognise early on that/when procedures or routines are insufficient. All levels in the organisation must understand the need to be prepared and to "release" themselves from planned activities when/if necessary. In order to do that, is possible to organise exercises regularly, as a major source of information on potential gaps, which should then be addressed through training programs. In training and preparation, address hypothetical situations that fall outside usual conditions addressed by plans and procedures. Either preplanned or random scenarios of escalation may be used. In such events, assess the adaptive capacity needed according to a scale ranging from only minor adjustments of procedure to abandoning procedure.

A baseline approach should be established in which:

- the situation and potential implications are assessed,
- the action alternatives are elaborated,
- a decision is enforced, and
- the implications of the decision (e.g., new areas of attention) are described.
- track and log mechanisms and actions used for expanding skills, expertise and resources within response team/organisation to problem-solving should be tracked and logged, including the strategies and heuristics for integrating them.
- consider situations in which plans and procedures are ambiguous or even missing,

and innovative ways of operating must be identified on the spot.

Learning Process (normal operations vs. crises)

Operators and management, should review training processes and outcomes: Comparing anticipated issues with actions required by the situations, and revising training programs, plans and procedures based on such assessment when necessary.

TRIGGERING QUESTIONS

Nature of Plans and Procedures

- Are plans and procedures in place for all operators?
- Are they rehearsed regularly?
- Is there flexibility for operators to adapt when situations are unexpected?

Authority Issues

- What roles will be in charge of abnormal situations?
- Will they be in a capacity to quickly make informed decisions if such a situation occurs?
- Would other roles be in a better position to make decisions?
- Do these roles have the authority to do so?

Capability Issues (skills, expertise)

- Are operators trained on unusual situations for which plans and procedures are limited?
- Does training include situations in which they need to solve problems or make trade-offs?
- Do they experience situations in which they need to show initiative, outside of the regular line of command, in order to act quickly?

Learning Process (normal operations vs. crises)

- How regularly are training programs reviewed and revised?

DURING A CRISIS

During a crisis, organisations are expected to execute and revise plans continuously. They should keep records of the plans and procedures used, as well as of the breaking points and brittleness that justified deviations from the initial plans and procedures. Many of the actions proposed below aim to capture such elements so that they can be used in the AFTER phase.

Nature of Plans and Procedures

Keep a log of procedures used and not used, and the causes for the latter case.

Authority Issues

Ensure especially availability of management support: Managers should provide relevant and timely mechanisms and interfaces for authorising specific courses of action, especially when the actions needed might exceed the defined space for manoeuvre.

Capability Issues (skills, expertise)

Is it important to track mechanisms and actions used for expanding skills, expertise and resources within response team/organisation to solve problems. Strategies and heuristics for integrating them to the response team should be documented for revision in the "after" phase.

Learning Process (normal operations vs. crises)

Use (simple) techniques to record precariousness, breaches and brittleness that trigger deviations from plans and procedures. For instance, indicate the level of deviation and its justification.

AFTER A CRISIS

As far as possible, revise crisis management processes, reconstruct adaptive capability process, assess performances, adjust or calibrate normative base, and describe prospects for future resilient performance.

Nature of Plans and Procedures

Revise procedures and plans if the actual experience (DURING) is generalisable (see [Systematic management of policies](#))

Authority Issues

Consider whether the defined space for manoeuvre was sufficient, and whether authority was conducted in a functional and proper way when decision support was needed, within or beyond the space for manoeuvre.

Capability Issues (skills, expertise)

If needed, assess training needs in order to close gaps in capabilities.

Learning Process (normal operations vs. crises)

After the crisis phase, it is important to learn lessons in order to match the procedures to the circumstances that emerged in the crisis itself. Reconstruct adaptive behaviour and capacity based on prior training records and notes from past events. To do so, build narratives that capture both coherence and disruptions. Describe deviations according to a useful scale, assess whether they were justifiable, and suggest, if needed, alternative pathways that are retrospectively coherent (but beware of the advantages of hindsight). If possible, define indicators of critical conditions, create lists of lessons

learned, or narratives that capture a number of critical issues in a coherent way.

TRIGGERING QUESTIONS

Nature of Plans and Procedures

- What were issues with plans and procedures in the situations experienced?
- Have these issues been identified before?
- Can the solutions found be used in other situations?

Authority Issues

- Were people in charge of decisions authorised to make them?
- Did people recognise that they had authority (e.g., when they didn't exert it)?
- Is there any indication of need to revise the space for manoeuvre?

Capability Issues (skills, expertise)

- Did people have the skills, expertise needed?
- Were they able to exert existing skills, expertise into combined action?

Learning Process (normal operations vs. crises)

- Do we have detailed accounts of the events?
- Can we identify deviations from plans and procedures?
- Can we make sense of such deviations?
- Could there have been better alternatives?

UNDERSTANDING THE CONTEXT

DETAILED OBJECTIVES

The guideline [Adaptation relative to events](#) describes the general need for managing adaptation. This guideline is more specific and focuses on the operationalisation of plans and procedures, and on their deviation. Resilience is positioned in complement to plans and procedures. Organisations have turned away from being checklist dependent, and have shown preference to having a broader knowledge in all personnel and increased teamwork. Plans and procedures often are not fully useful and have to be used as "skeletons" to base actions on rather than as comprehensive and accurate guides. Flexibility and improvisation compensate for gaps in the procedures, providing solutions needed on the spot. Hence, two modes of safety thinking, "compliance" vs "resilience" are mutually interwoven. This situation, in which resilience has to unfold in a more or less dominating context of compliance, is not only a matter of

practicality, but also a dominant expectation or "imperative" stemming from, e.g., laws, regulations, bureaucratic principles, institutional traditions and social preference.

Scope of the card The scope is twofold. "Downwards", it is about clarifying the reach and grasp of the normative base, and ensuring that adaptive actions do not deviate from plans and procedures in an unduly manner. "Upwards", it is about maintaining trust in the capacity to autonomously judge and decide when and where to deviate in order to ensure resilience according to situational needs. Both these aspects will benefit from a continuous and systematic reconciliation between the rules of work and the actual adaptive capacity (AC), in which both experienced and conceived/exercised AC is used to revise and improve the rules.

Nature of plans and procedures

Plans and procedures, and operators knowledge of them, constitute the base for operations. But procedures cannot be too prescriptive because the reality of crisis situations cannot be fully specified, and can even be surprising. Resilience implies behaving flexibly in the face of changing situations where procedures do not support action adequately (not specific enough or not relevant to unanticipated situation).

Authority issues

Supporting flexibility beyond the normal bases for operations (represented by plans and procedures) supposes that managers give authority and legitimacy to operators to deviate from the normal (normative) base when situations require to. Ideally, a legitimate space for manoeuvre therefore needs to be created, communicated and maintained. Organisations need to be able to calibrate and justify the degree of non-compliance and alternative action, thereby also building trust that allows them to go even further when the situation calls for it.

Capability Issues (skills, expertise)

The ability to adjust behaviour beyond procedures is a typical trait of resilience in the situations for which there is no clear existing guide to action. Such ability requires skills to appropriately assess the situation at hand, as well as solve problems and implement innovative actions. Such skills need to exist at the individual and collective level, given the distributed nature of crisis management operations. Hence, the adaptive capacity addressed here also depends on other skills and expertise related to, e.g., anticipation.

Learning Process (normal operations vs. crises)

Exercises and real operations represent opportunities for organisations to understand their capacity to adapt

beyond plans and procedures. Following the aspects above, they need to facilitate the capture and preserve of experiences of adaptation to develop and improve the corresponding abilities. This learning process serves as direct input to the revision of plans, procedures, training material and organisational mechanisms of decision. This guideline therefore provides input for [Systematic management of policies](#).

TARGETED ACTORS

Managers are the primary target of this CC; they expected to implement the interventions in different ways:

- setting up the proposed activities regularly to enable discussions about adaptation in the context of the rules of work,
- discussing the rationale behind the rules and the boundaries for deviations in order to ensure accountability (needed to avoid after the fact blame-games);
- involving actors at all levels of the organisation. In particular:
 - team leaders and other operational personnel who are engaged in crisis management activities;
 - and higher-level managers who act as policy level and are relevant observers of the processes of adaptation relative to rules.

Members of the organisation familiar with resilience notions (e.g., resilience or safety managers), play a key role in conducting events (possibly with the help of external experts) leading and moderating discussions about brittleness.

Healthcare implementation – Actors



Ministry of Health, Regulatory Bodies and Scientific-Technical Institutions. Within each of them: Site Director or Manager (could be Director General), Quality Manager, Safety Manager, Regulatory Manager, Human Resources Manager. Then, according to the area -: the Head of the Department (or Service), and the Head of the specific Unit (or, other specific Units according to the specific mission of the institution). Each of these actors have financial and signature authority, according to the legal frame of the body.



The roles and responsibilities of involved actors change according to the type of crisis and the related environment of operations. The "Adaptation relative to procedures" must encompass most of the activities of the organization, at all levels starting from senior management to front line operators.

The actors involved are those listed below:

- Air Navigation Service Providers (both civil and military)
- Aircraft owners and operators
- Aircraft manufacturers
- Aviation regulatory authorities (National and International)
- ATFCM (Air Traffic Flow and Capacity Management)
- International aviation organizations (i.e. EUROCONTROL, ICAO, CANSO, etc)
- Investigative agencies
- Flying public
- Airport operator (if airports and/or ground operations are concerned by the crisis)
- Firefighters (if airports and/or ground operations are concerned by the crisis)
- Police (if airports and/or ground operations are concerned by the crisis)

EXPECTED BENEFITS

- Improves understanding of adaptive capacity when exercised in the context of normative base and expectations of compliance.
- Supports justification and legitimacy of resilient operation as deviation from normative preparations and plans.
- Provides a basis for accountability, thereby facilitating authority and trust to enforce resilient operation according to needs (as perceived by Resilience Management), while deviating from the normative base
- Contributes to a higher degree of predictability of which actors may be involved and when, as well as what they may do and how. In turn, it also contributes indirectly to an increased mutual understanding and calibrated mutual expectations among the actors.

RELATION TO ADAPTIVE CAPACITY

The concept puts issues of Adaptive Capacity in organizational/institutional contexts in which there is a

normative expectation/preoccupation towards checklists, plans and procedures, separating between

1. Issues related to the nature of plans and procedures in the organization and how much flexibility they provide by design (e.g., how specific they are, what is their grasp and reach).
2. Issues of authority and legitimacy of deviation in the face of existing plans and procedures (normative base) organizations expect operators to comply to.
3. Issues of skills and expertise at the individual, team or organization levels, related to the capability to accurately assess the situation, and act in it, when plans and procedures are not obviously available to support operations.
4. Issues of organizational learning when adaptations performed highlight the gaps and limitations related to the two previous aspects.

RELATION TO RISK MANAGEMENT

The narratives of adaptive capacity, and the defining moments that trigger the need alternative (non-normative) action, should be revised with an eye on the key underlying assumptions of existing risk assessments. If these "breaking points" actually are inconsistent with the underlying assumptions, a revised risk assessment is justified-

To the extent that an adaptive capacity (AC) is trusted, its presence can also be considered as a mitigating factor in a risk assessment owned by the stakeholders

ILLUSTRATION

In a world characterized by complex interdependence, crises that originate in one country have the potential to rapidly diffuse across borders and have profound regional and even global impacts. The eruption of the Icelandic volcano Eyjafjallajkull in April 2010 demonstrates how rapidly a natural disaster can morph from a local crisis with local effects to a cascading crisis with international effects across multiple sectors. In this case, the relevant authorities did exhibit institutional resilience and came up with creative solutions in just a few days, in the form of new operating thresholds that distinguished between three degrees of ash contamination. This new methodology was incorporated in the guidelines SRA (Safety Risk Assessment) common criteria for airline operators. This may be seen as an example of active reconciliation between the normative base and the AC.

Healthcare implementation – Illustration



For many Regions, de novo development of guidelines is very hard because of evidence base, lack of time, expertise, resources. so they make use of high-quality already existing generic guidelines: this weakens the efficacy and efficiency of the intervention. To avoid the enlisted issues, we outline a systematic, participatory approach for evaluating and adapting available guidelines to a local context of use. Whether evidence comes from a case study/report, informed consent, clinical practice guidelines, end-users must consider if or how the generic guidelines could be adapted to the local context. Care of ulcers of the leg, the task force collectively assessed the quality of individual guidelines and their recommendations. They developed a protocol that was feasible to implement locally and that was endorsed by stakeholders. The guideline was condensed to a one-page algorithm to enhance use by the clinicians, and documentation forms were created for collection of clinical data. For example, to streamline the process of assessment and facilitate application of evidence-based care, documentation forms were created to collect information about the cause of the ulcer, with venous symptoms and history on one side of the page and arterial symptoms on the other.(Howard M. Kimmel, DPM, MBA, FACFAS; and Angela L. Robin, DPM)

IMPLEMENTATION CONSIDERATIONS

Challenges

Nature of plans and procedures

The combination of resilience and compliance to rules may encompass a number of variations, spanning from slight adjustment of or facilitation for procedures, to abandoning procedures completely. The actual design of rules will have an impact on the possible range of variation.

Authority issues

Resilience as a concept is associated with the idea of safety as an emergent property. This is ultimately contradictory to the underlying idea of a normative repertoire; that safety is an instrumental result from a priori anticipation and routinization. Hence, the managerial challenge of "resilience in the context of its opposite" (namely compliance), is also a managerial challenge of combining two different organizational approaches to safety.

Capability Issues (skills, expertise)

Providing the relevant actors broad knowledge and information that direct them to identify the situation and the optimal response, are important prerequisites for achieving an adaptive capacity as described here.

Learning Process (normal operations vs. crises)

A learning process of reconciliation between the adaptive capacity and the normative base/context should be supported by and provide input to the policy level (see DR-85)

Implementation cost

TORC training requires a quite substantial amount of basic preparation (see SINTEF report A27931), while the actual training with the board game and the review processes are very cost effective.

Healthcare – Implementation considerations



Using the best evidence is a fundamental aspect of quality health care. Valid guidelines for clinical practice are fundamental to inform evidence-based practices. To assess the uptake and adherence to guideline-based care, auditing sessions are implemented in Healthcare. However, often through the evaluation of these functions, an exhaustive and global conformity of practices is still far from expectations. This demonstrates that high-quality guidelines and its dissemination are not sufficient to ensure evidence-based decision-making. This requires a substantive, proactive effort to encourage use at the point of decision-making.(Harrison, M., Legarè, F) The gap between valid guidelines and delivery of evidence-based care is often hampered. For instance, clinicians may not have the required skills to implement a recommended action (e.g., being unfamiliar with implementation of a novel therapy, or the hospital lacking of recommended equipment or the necessary time to deliver a guideline's recommendation).

RELEVANT MATERIAL

RELEVANT PRACTICES, METHODS AND TOOLS

Practices

- *Narratives* (cases description in newsletters – see Beth Lay references)

- *Flexible procedures for unanticipated crises.* Regarding larger crises, organisations have lists indicating who needs to be contacted and when, including, e.g., for technical or political issues. For big crisis, there is specific infrastructure and facilities, and procedures flexible enough to be adapted to different kind of situations. (ANSP3; SafetyMgt)

Two references were found in the SLR

1. Logistics management processes and practices in disaster management provide healthcare leaders. (ID 1054) TRL- Not applicable.
2. It describes how the relevant authorities exhibited institutional resilience and came up with creative solutions in just a few days, in the form of new operating thresholds that distinguished between three degrees of ash contamination. This new methodology was incorporated in the guidelines SRA (Safety Risk Assessment) common criteria for airline operators. This allowed flights to resume and successfully avoided accidents. (ID 82) TRL- 3.

Methods

The [Training for Operational Resilience Capability \(TORC\)](#) combines operational and managerial under a common "resilience in the context of compliance" scheme", and by the use of a board game that also provides the necessary logging capabilities to support the implementation described above. TORC is associated with a TRL level 7-8 on "normal operation" and has also been piloted in the ATC domain related to emergency/crisis training

Tools

Safety Management Systems: Learning goes mainly through deviation reports through the SMS. Sometimes hard to connect all events to SMS, but there are organizational ways to handle other types of feedback than deviation reports: Meetings, logbooks, different ways to give feedback, and debriefings after every shift (ANSP4;OpsMgr)

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NAVIGATE IN THE DRMG

- **Parent theme:** Managing adaptive capacity
- **Resilience abilities**
 - Contributes to: Respond and Adapt
 - Supported by: Anticipate
- **Categories:** Procedures, Planning, Resources, Learning lessons, Situation understanding

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3.3. Managing available resources effectively to handle unusual and changing demands

To better handle the unusual and changing demands of crisis situations and achieve critical objectives, organisations need to be able to use available resources effectively, sometimes creatively, and potentially to bring in additional resources. For the purposes of this card, *resources* refer to human resources, such as personnel in various roles and divisions of an organisation, as well as to material or immaterial resources, such as equipment and tools. In other words, to anything that is necessary or useful in order to accomplish the tasks at hand.

IMPLEMENTATION

INTRODUCTION

What is needed to manage resources

Crises will typically require additional resources to be handled in time, before they degrade further and lead to worse outcomes. Taking the example of personnel as type of resources, "additional resources" might mean more of the same type of actors as those operating in usual circumstances, or types of competences that are different from the ones usually available (or both). The general belief is that, in emergency situations, if additional resources are requested at the moment they are needed, it might already be too late. Conditions must therefore be created in advance for providing and enabling the necessary increased resources. In addition, while many efforts need to be put before crises occur in order to facilitate the effective use of resources during operations, what constitutes such effective use needs to be specified in the situation because it depends on context. Supporting the effective management of resources includes three main types of interventions:

- **Identifying the required resources:** their types and amount necessary to respond to a given crisis, and where they exist, within or beyond the regular team, department and organisation

- **Establishing conditions to use resources** in order to request, include or reallocate these resources
- **Assigning resources to objectives**

The interventions proposed in each phase of crisis describe more specific activities for each type.

BEFORE A CRISIS

Identifying the required resources

- Build understanding of the resources required in challenging situations, especially based on the results from resilience assessment (see [Noticing brittleness](#) and [Assessing community resilience](#))
- Locate where adequate resources might exist, which might be identified based on past situations in the results from [Identifying sources of resilience](#)
- Build lists of available resources, such as a roster of personnel, that includes their location(s)
 - For personnel, listed skills might include technical as well as non-technical skills
 - Such lists can be used to match resources with operational needs

Establishing conditions to use resources

- Manage competences, skills, knowledge, capabilities
- Establish conditions to share resources across departments, organisations: conduct joint training, develop letters of agreement
- Leverage networks created through [Establishing networks](#)
- Identify and implement in the organisation methods and strategies to bring in additional resources (see for instance the *Front Line Anomaly Response* in the Methods section)

Assigning resources to objectives

- Anticipate authority issues in crisis events over national vs. regional vs. local control of resources
- Ensure plans and procedures address how to prioritise activities, scale up situations and request and handle extra resources
- Anticipate difficulties to add extra resources to existing operations, for instance related to coordination within and between teams (ensure the cards [Establishing common ground](#) and [Understanding roles and responsibilities](#) have been implemented)

TRIGGERING QUESTIONS

Establishing conditions to use resources

- Are we aware of human resources that can potentially be shared with other organisations or departments of our organisation?
- Can we distinguish between human resources that can be shared with other organisations and human resources who cannot be shared in any circumstance?
- Do we know who should be consulted to receive authorisation to take advantage of the human resources of another organisation or department?
- To take advantage of the human resources of another organisation or department are we sufficiently aware of their level of training, skills and competences?

DURING A CRISIS

Establishing conditions to use resources

- Clarify who controls resources, based on what information
 - Ensure local actors have some discretion for using resources due to their knowledge of local context

- Ensure regional/national actors can monitor use of resources across larger scale

Assigning resources to objectives

- Manage reallocation of personnel: tasks, location
- Create and maintain buffers
 - Free up resources: changing priorities
 - Deploy resources
 - Avoid situations in which everybody is busy

TRIGGERING QUESTIONS

Identifying the resources required

- Are all our resources currently committed?
- What would be needed if the situation degraded?

AFTER A CRISIS

Assigning resources to objectives

- Reflect on resources used for managing crisis: were they the right kind? the right amount? (use results from [Identifying sources of resilience](#) and [Noticing brittleness](#))

TRIGGERING QUESTIONS

Identifying the resources required

- Could other resources have been deployed?
- Where would have they come from?

Assigning resources to objectives

- How were additional resources integrated to operations?

UNDERSTANDING THE CONTEXT

DETAILED OBJECTIVES

In crisis situations, situations that fall outside of the norm, resources which organisations rely on daily are limited. These resources do not solely provide sufficient capacity to adapt to unusual demands and challenges (see for instance Woods and Branlat, 2011):

- a crisis might require to address a difficulty in emergency, i.e. within a shorter time than

usual, hence benefiting from additional resources

- a crisis may confront personnel with a problem for which they lack expertise and knowledge, hence benefiting from the involvement of outside experts
- a situation might degrade or evolve

CI organisations and emergency response agencies need to have mechanisms to address these different types of situations and handle a crisis. For instance, they need to be able to seize opportunities to bring in additional resources to handle a crisis situation. Seizing such opportunities requires that they create the conditions to do so, e.g., by planning for reinforcement and anticipating the needs for coordination. When mechanisms are not already in place or are not sufficient, strategies are needed to use available resources in creative ways, for instance by relaxing some goals in favour of more critical ones (as described in Cook and Nemeth, 2006). Resources exist within a team or organisation, but are not limited to those that were supposed to act. They can for instance be expanded through collaboration within departments of an organisation or between organisations or other agencies.

TARGETED ACTORS

- Actors who have the responsibility to decide on the allocation of resources within CI organisations and agencies, such as operational managers and commanders who manage resources in their regular activity, as well as high-level managers who can authorise reallocation of resources.
- Actors who can contribute resources to support crisis response.

EXPECTED BENEFITS

Through implementing interventions proposed here, the organisation will develop plans and strategies to better use its resources and leverage external ones in crises.

RELATION TO ADAPTIVE CAPACITY

Woods and Branlat (2011) have discussed how failures to adapt successfully to adverse events can occur and identified three basic patterns of adaptive failure: (1) failure of adaptive responses to match the tempo of the disruptions faced (before events cascade and situations get out of control); (2) failure to maintain sufficient coordination while implementing adaptive responses;

and (3) failure to recognise the novel character of the situation faced and devise new forms of adaptive behaviour. To handle adverse events, new forms of behaviour often require additional resources (amount, kind) and/or different uses of existing resources. The management of resources to provide such adaptive capabilities and avoid the traps described above (patterns 1 and 3 especially in the context of this card) are key to resilience.

ILLUSTRATION

The following case describes the use of a method for the rapid assessment of a challenging situation involving remote experts (see more in the description of the Front Line Anomaly Response method and in Lay and Branlat, 2013).

Context: maintenance of power plant turbines

Turbine maintenance involves the disassembling, inspecting, repairing, reassembling and re-starting of the turbine-generator system. Such maintenance is planned on a regular basis and involves the deployment of a field team at the plant location for several weeks. Turbine maintenance is a highly planned operation, but field teams regularly encounter situations that challenge the implementation of the plan. Challenging situations can arise from adverse events (e.g., incidents with power tools) or from unanticipated conditions (e.g., weather, particular site characteristics). Tight schedules allow operations to bring the power plant back to service as soon as possible because of the high cost from lost generation of a shut off power plant.

Vignette: Surprising conditions during maintenance operations

A field team is deployed on a maintenance site. Upon disassembling the turbine in order to conduct scheduled maintenance operations, they discover that the blades show an unusually high amount of oxidation. Fearing that it might impair their capacity to perform maintenance or might be an indicator of a more serious problem (compromised integrity), the project manager decides to conduct an assessment of the situation with the help of remote experts and contacts risk managers at the company's headquarters. Risk managers rapidly identify and convene several people in various locations nationwide, who could provide technical or managerial expertise. Within a couple hours, documents about the situation are exchanged and a one-hour conference call between the field project managers and remote experts is initiated. During the call, risk managers facilitate the exploration of issues

related to the diagnosis of the severity of the oxidation, to its impact on maintenance operations (e.g., cleaning process), to potential approaches and associated risks, and to impact on schedule. At the end of the conference call, the site manager decides how to move forward (e.g., find accredited contractors for specific cleaning process) and how to reorganise the maintenance operations, and has identified contacts for follow-up calls should the conditions change or an iterative solution be needed.

Analysis of the case

Maintaining control on the schedule of operations in the face of anomalies is a complex task for project managers: operations involve numerous tasks that are highly synchronised and interdependent, and anomalies represent multi-faceted problems often requiring specific technical expertise. Successfully and efficiently managing unexpected situations that arise is critical to the success of turbine maintenance operations and to the company's larger business objectives. The assessment process described in the vignette above represents an organisation's answer to the problem of responding to risky anomalies for which remote expertise might add significant value to the front line operations. This generic problem, experienced in a variety of work domains (e.g., healthcare, disaster response), relates to resource allocation trade-offs for organisations that spread operations across space. Anomalous situations in this domain typically represent complex problems for which no clear-cut path exists: affected sites often present specific characteristics, anomalies can be of novel nature, and different dimensions of the situations need to be considered. Often, the assessment process, rather than solving the problem at hand, serves as a means to expose and discuss the relevant aspects of problem and solutions. The process represents a form of distributed anomaly response that leverages external expertise and diversity of perspectives to handle the complexity of the problem and responses. The process represents a mechanism to implement appropriate adaptations to unanticipated situations, and managing interactions across the system due to interdependencies between tasks. The rapid conduction of the conference call supports the avoidance of a fast degradation of conditions into an even bigger problem.

For its conduction, the organisation's pool of experts represents the critical resources. However, participants are conflicted between being temporarily deployed for anomaly response or tending to their own, urgent work (since they are valuable resources, they are highly solicited). The assessment process requires that they are in a capacity to sacrifice other professional (or personal)

activities, and that the organisation is willing to support the corresponding shifts in priorities. Organisational measures include creating the conditions for the involvement of the highly experienced members of the organisation, as well as of the divisions they belong to.

Healthcare – Illustration



Response to bus bombing in Israel

Cook and Nemeth (2006) describe how the Israeli health system manages the high and unexpected demands of mass casualty events. Events such as suicide bombings in public places present a high potential for cascading into unmanageable situations: casualties are typically severe and high, requiring injured people to be transported and treated quickly; already busy hospital units face heavy disruptions in planned patient care and other tasks; families and friends search for potential victims, seek information and require psychological support; news media require the latest elements of information; etc. However, the Israeli health system has evolved into a system capable of very resilient management of such events. The system's performance relies on the system's capacity to rapidly mobilise large amounts of resources (from ambulances to social workers), on a general tendency to delegate authority at all levels rather than to centralise decisions (e.g., for the dispatch of ambulances to the scene), and on the successful reprioritisation of tasks to handle the emergency before returning to normal.

IMPLEMENTATION CONSIDERATIONS

Challenges

- Link to needs to coordination, handover
- How were "unusual" resources integrated to operations? Link to "Roles and responsibilities", "Common ground"

RELEVANT MATERIAL

RELEVANT PRACTICES, METHODS AND TOOLS

Practices

The following practices all come the domain of urban firefighting. They illustrate different aspects about the

management of resources in a domain for which this aspect is crucial to performance and safety - these practices can, however, serve as insight for other domains.

1. Tactical reserves - extra personnel mobilised and present on the scene, ready to operate as soon as it is needed (Klaene and Sanders, 2008, p.127). If additional resources are requested at the moment they are needed, they might be operational too late by the time they arrive on the scene (even if it only takes a few minutes).
2. "All hands" signal to dispatch - the signal is used by the Incident Commander to indicate all personnel on the scene is busy. This is a precarious situation, because if anything happens that complicates the situation (e.g., incident, or fire expanding), everybody is already committed and cannot easily take on new tasks without jeopardising the operations. The signal is used by the dispatcher to immediately send additional units on the scene.
3. Fire company dynamic relocation - in urban firefighting, fire houses are positioned to ensure coverage of the area, i.e. to minimise the time necessary to reach an event location. However, coverage is challenged when an event occurs, because the units in fire houses nearby are committed to its location. To readjust and improve area coverage while some units are operating, other units will redeploy momentarily to the vacant fire houses.

Methods

1. Front Line Anomaly Response (industrial maintenance) - TRL 9 - Lay and Branlat (2013). Mechanism to quickly bring in additional, remote experts in a conference call to support problem solving when operations on a site face unusual and challenging circumstances.
2. Resilience Analysis Grid (RAG) - TRL 6 - Hollnagel (2010). "To be able to respond it is necessary either to have prepared responses and resources at the ready, or to be flexible enough to reconfigure the existing configuration so that the necessary resources become available." The method includes a set of questions to assess this ability.

Healthcare – Practices, Methods and Tools

1. Health Care Coalitions (HCCs): staff- and resource-sharing (survey paper 168)
2. Temporary dropping off non-critical tasks in hospital management of surge in demand (Cook and Nemeth, 2006)
3. HESF database - record of personnel data with information on expertise, availability etc. for augmenting hospital surge capabilities through the reallocation of internal human resources. Includes employees' skill sets, credentials, certifications, licenses and current job description. This information can be critical to have during the occurrence of a disaster in which medical help is needed. (Paturas et al., 2010)

Air Traffic Management – Practices, Methods and Tools

1. Use of a roster-based system (i.e. predefined lists of names, contact details and responsibilities of involved personnel) to manage resources during contingency situations.
2. Decrease of airspace capacity (as part of flow management) is the standard solution if necessary in case of resource constraints: capacity goals are temporarily relaxed to allow for personnel to regain control on a challenging situation

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Healthcare – References



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NAVIGATE IN THE DRMG

- **Parent theme:** Managing adaptive capacity
- **Resilience abilities**
 - Contributes to: Respond and Adapt
 - Supported by: Anticipate, Monitor
- **Categories:** Collaboration, Planning, Resources, Training

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CHAPTER 4

Assessing resilience

Assessing and comparing are needed in order to, for instance, estimate baseline resilience and measure progress toward resilience. Comparing different entities could be a motivator and one could follow the progress over time. Best practices could be highlighted and serve as guiding examples. Outside of moments of crisis, the assessment of resilience is also useful in order to capture the essence of resilience, and to examine the factors that contribute to (or undermine) resilience. The identification of such factors is important in order to identify the most effective measures to actually enhance resilience and reduce brittleness. It also provides effective markers in order to monitor and assess resilience during the management of crises.

ASSOCIATED CARDS

4.1. Assessing community resilience to understand and develop its capacity to manage crises

The assessment and monitoring of community resilience prior to, during and after the occurrence of crises allows policy makers to establish interventions and plans in collaboration with community leaders and members, in order to ensure communities will be better able to manage and recover from future events.

4.2. Identifying sources of resilience: learning from what goes well

One of the aims of Resilience Engineering is to learn from the everyday performance and from successful operations, rather than by only through lessons learned after failures. In line with this, identifying **Sources of Resilience** means investigating the mechanisms by which organizations successfully handle expected and unexpected conditions. Such mechanisms (e.g., strategies, processes, tools) allow the organization to adapt, perform and deliver required services in spite of the variability and complexity they experience in their operations. This *adaptive capacity* can be recognized by looking at the **work-as-done**, both in daily operations and unusual or exceptional scenarios, in order to identify sources of resilience and to **learn from what goes well**.

4.3. Noticing brittleness

The interventions proposed here aim to support organisations to identify sources of *brittleness* in order to invest in their correction.

Brittleness is experienced in situations of goal conflicts and trade-offs, or when there is a competition for resources and a need to establish priorities under time pressure. Other difficulties emerge when an organisation struggles to manage *functional interdependencies* between different parts of the same organisation, or when there is insufficient *buffer capacity* to provide additional resources. Noticing brittleness also means observing *operational variability* and comparing *work-as-done* with *work-as-imagined*, so to reveal how the system might be operating riskier than expected.

In addition, brittleness manifests itself when the organisation is unable to learn from past events, such as near misses and accidents.



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IMPLEMENTATION

INTRODUCTION

The use of a community resilience assessment process allows policy makers to establish planning to strengthen communities. When the process can be used at different times, it allows for an understanding of how a community can better prepare, is impacted by crises, and recovers from them. The Community resilience assessment process is based on data collection. Thus, could be done by several methods, including community members' survey (recommended), analyzing formal databases or questioning of key informants. The assessment should be managed by experts, but the process of assessment may involve volunteers and un-professional workers.

What is needed to assess community resilience

- Identify a tool/ method and process for community resilience assessment
- Conduct assessments at different points in time
- Identify how assessment results can be turned into interventions in the communities
- Identify how assessments prior to crises allow for anticipating impact and recovery
- Anticipate challenges to conduct assessments, especially during crises, and establish alternative methods (e.g., less demanding)
- Understand limitations and assessments conducted

BEFORE A CRISIS

Prior to crisis events, decision makers and policy makers use resilience assessment to identify the weaknesses and strengths of the communities under their responsibility. Based on the resilience scores obtained, intervention plans should be made in order to reduce the weaknesses and reinforce the strengths, thus improving the community resilience. Once intervention plans have been implemented, it is useful to perform new assessments in order to identify the impact of the intervention plans on the community. The basic action is to identify a valid method for assessing community resilience. It is essential to use a multi-dimensional method that relates to different aspects of the community, such as leadership, social components, preparedness and infrastructure. There is no a gold standard to assess community resilience, but it is important to choose a validated method to maximise study reliability (for example the CCRAM in the Relevant methods section).

TRIGGERING QUESTIONS

CR assessment tool

- Is there an accepted tool for measuring community resilience?

CR assessment process

- Is the study population representing all population strata, including vulnerable population with special needs?

- What is the aim of the assessment? To create a baseline? To measure the impact of intervention plan?

CR assessment results

- How do we translate the study results to intervention plans?
- How could the organisation (from the whole business/CI sector) be involved in strengthening the community resilience in accordance with the assessment's results?

DURING A CRISIS

Measuring the impact of the emergency on the community members during the short period; analyzing trends and gaps between assessment points; Planning intervention plans or applying adapted plans prepared in the past and stored for these situations. Measuring community resilience during emergency is a complicated issue. It is of utmost importance to understand the impact of the emergency situation on the community members, but it is difficult to seek the information and to analyze it.

TRIGGERING QUESTIONS

CR assessment process

- Can we measure community resilience during the emergency situation?

CR assessment results

- What are the factors (independent variables) that are associated with an increase of community resilience score?
- Does the organisation (from the whole business / CI sector) have a special capabilities and resources to enhance the community resilience?

AFTER A CRISIS

Measure the impact of the emergency situation on the community members in the long term; assessing the rehabilitation after the emergency. Assessing community resilience after the emergency situation enables to understand the long term impact of the emergency, as well as the rehabilitation process. In case the CR assessment was conducted in several time points (before and during the emergency), it is important that assessment reports refer to results of these assessment.

TRIGGERING QUESTIONS

CR assessment results

- Can we understand the impact of the emergency situation on the community?
- Can we build an intervention plan based on the results of measurements?
- Does the organisation (from the whole business / CI sector) have special capabilities or resources to enhance the resiliency of the community?

UNDERSTANDING THE CONTEXT

DETAILED OBJECTIVES

The resilience of a community during emergency situations has become a core element in the emergency preparedness and response arena, since the local community has a significant role in providing assistance during crises. The term 'community resilience' describes a complex construct that encompasses physical dimensions, such as infrastructure, services and protection, along with social aspects, such as leadership, collective efficacy, social cohesion and place attachment. Despite the importance of community resilience, integrating these aspects to an organisational resilient management is innovative. From this perspective, the organisation is perceived as part of "a bigger picture", taking in account the associations between organisations and the local community. The important role of organisations in the community resilience paradigm could be expressed in a wide range of aspects, including functional continuity, providing services and particular assistance, and economic significance. Increasing the involvement of organisations and communities during routine time may strengthen the relationships and cooperation between them, enabling to maximise the potential for action when needed. To deepen this subject, please read the CC dealing with [Increasing the public's involvement in resilience management](#). The assessment of community resilience aims to identify weaknesses and strengths that are relevant for better coping with crisis situations. This process provides comprehensive information for decision makers regarding the way they should strengthen their community. Among communities, the rationale for integrating resilience assessment results and mapping the needs is to focus on addressing the public's key needs, especially those of vulnerable groups. It is important to mention that although measuring community resilience is mainly aimed to assist in a time of an emergency, it further enriches the community life during the routine times.

TARGETED ACTORS

The actors that are directly concerned by this Capability Card are:

- decision and policy makers,
- formal and informal community leaders.

The cornerstone of community leadership in an emergency situation is the local authority. The results of resilience assessment should be provided to decision makers in the local authority. Based on these results they would be able to build (preparedness) and implement interventions and response plans.

The capability card applies to management levels as well as operational level during implementation phases.

EXPECTED BENEFITS

Monitoring readiness and measuring the resilience prior to, during and after an emergency situation, reflects the internal resources of the community. Thus, it enables enhancing the community's ability to cope with extreme situations, and reducing the impact of crises and disasters. In mass events, the community members often serve as first responders. Therefore, it is important to strengthen the community as a functioning system. Currently, the resilience of the community is considered as one of the core elements to cope with those situations.

RELATION TO ADAPTIVE CAPACITY

Community resilience assessment includes understanding the community's capacity to adapt to crisis events. It is part of the information gathered in order to strengthen a community's resilience, therefore its adaptive capacity.

RELATION TO RISK MANAGEMENT

Measuring CR during routine time in the pre-emergency period enables to create a "baseline score" which is presumed to be useful as a reference point for comparison during a crisis period. The magnitude of change and the direction of the change trend can serve as a predictor of a community's ability to sustain crisis events and recover.

ILLUSTRATION

Despite the perceived importance of community resilience, there is a lack of empirical evidence

regarding it. In a longitudinal study conducted among poor rural communities in Honduras before and after Hurricane Mitch (1994–2002). Results indicated that residents were highly vulnerable to the hurricane—due in part to previous development assistance—and that the poorest households were the hardest hit. Surprisingly, however, the disaster led the community well to cope with comparable flooding occurring 10 y later. The study provides compelling evidence that communities can seize the window of opportunity created by climate-induced shocks to generate sustained social-ecological improvement, and suggests that future interventions should foster local capacities for endogenous institutional change to enhance community resilience to climate shocks (McSweeney & Coomes 2011)

IMPLEMENTATION CONSIDERATIONS

Challenges

Although the importance of community resilience assessment was established in the professional and scientific literature, it is difficult to implement it due to three main reasons: first, the complexity of the resilience concept requires a validated research tool. The second reason lies in the relationships between the organization and the community. These relations have to be promoted during the pre-emergency periods, taking into account the formal and informal leadership aspects together with investments of resources. The third reason relates to cultural diversity among communities and between communities and organizations.

Implementation cost

There are several approaches to measure resilience. Data collection may be a costly matter. However, preexisting tools and electronic assessment may reduce this cost. It is sometimes possible to measure objective indicators at a lesser cost, however the benefits and introspection following such an assessment cannot be compared with the potential contribution of the understanding gained by using community resilience assessment scores as described above.

RELEVANT MATERIAL

RELEVANT PRACTICES, METHODS AND TOOLS

Methods

It is important that the community resilience assessment has practical interpretations, giving to decision makers the possibility to build an intervention plans comprehensively. For example: community resilience assessment conducted by the CCRAM score found that elders have a significant rise in community resilience scores in the age groups of 61–75 years as compared with younger age bands, suggesting that older people in good health may contribute positively to building community resilience for crisis (Cohen et al., 2016a). Studies conducted in the European project 'DRIVER' used the CART toolkit's framework for assessing community resilience among a broad range of rural and urban communities (Davis et al., 2016). They reported that as a result, members of communities became more aware of their own vulnerabilities and capabilities, both at the individual and collective levels, encouraging action as to increase their resilience.

Three methods were described assessment of community resilience in more than one publication.

1. Communities Advancing Resilience Toolkit (CART- Pfefferbaum et al., 2013)- The Communities Advancing Resilience Toolkit (CART) is a publicly available theory-based and evidence-informed community intervention designed to enhance community resilience by bringing stakeholders together to address community issues in a process that includes assessment, feedback, planning, and action. Tools include a field-tested community resilience survey and other assessment and analytical instruments. The CART process encourages public engagement in problem solving and the development and use of local assets to address community needs.
2. Conjoint Community Resilience Assessment assessment (CCRAM – Leykin et al., 2013)- The CCRAM has demonstrated its' potential role in establishing a baseline score of community resilience and its' constructs. The CCRAM has two versions: 28 items and 10 items. We recommend to use the short version of the CCRAM during a crisis, a 10 items questionnaire that provides a valid information regarding the CR factors. see at: <http://in.bgu.ac.il/en/PREPARED/Pages/ccram.aspx>
3. Climate Disaster Resilience Index (CDRI- Yoon et al., 2016)- A method with five dimensions (economic, institutional, natural, physical, and social), and 25 parameters reflect the abilities of

people and institution and communities to respond to potential climate-related disasters.

There are two main methodological approaches to measure community resilience: a “bottom up” VS “top down”. CCRAM and CART correspond to a “bottom up” assessment , which presents the voice of individuals, focusing on the capacities of the community to cope with emergencies. Conducting research by such method provides the decision makers with reliable information regarding the attitudes and feelings of their community members.

Tools

Some of the methods have a version of technical tools designated to assess community resilience. There is a lack of information regarding the experience in using in these tools.

- CART (Pfefferbaum et al., 2013)-
- RRI- Rural Resilience Index (Cox & Hamlen, 2014)
- Community Resilience System Tools and Resources (White et al., 2014)
- The Sahana mapping software (Eisenman et al, 2014)

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NAVIGATE IN THE DRMG

- **Parent theme:** Assessing resilience
- **Resilience abilities**
 - Contributes to: Anticipate, Learn and Evolve
 - Supported by: Monitor
- **Categories:** Evaluation, Learning lessons, Situation understanding, Planning
- **Functions of crisis management:** BEFORE, Prevention, Preparation, Build knowledge of crisis situations, Anticipate threats in environment, DURING, Damage control and containment, Short-term recovery, Assess emergency and response, AFTER, Long-term recovery, Assess needs and progress, Learning, Revise knowledge of crisis situations

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4.2. Identifying sources of resilience: learning from what goes well

One of the aims of Resilience Engineering is to learn from the everyday performance and from successful operations, rather than by only through lessons learned after failures. In line with this, identifying **Sources of Resilience** means investigating the mechanisms by which organizations successfully handle expected and unexpected conditions. Such mechanisms (e.g., strategies, processes, tools) allow the organization to adapt, perform and deliver required services in spite of the variability and complexity they experience in their operations. This *adaptive capacity* can be recognized by looking at the **work-as-done**, both in daily operations and unusual or exceptional scenarios, in order to identify sources of resilience and to **learn from what goes well**.

IMPLEMENTATION

INTRODUCTION

Organizations need to invest in the understanding of everyday operations in order to better be prepared for crisis situations. Resources for building up and maintaining this understanding need to be allocated, an investment with the purpose of retaining, enhancing or amplifying the organization's (or, organizations') resilient capabilities. This means, among other resources, that time needs to be available from experts to share their views on the functioning of the system, as well as facilitators or analysts (possibly experts on resilience management) that are able to compile this knowledge so that the organization may learn from it in a methodological manner.

To identify sources of resilience:

- Build the necessary **skills to understand and identify sources of resilience** at different levels of the organization.
- Select **methods for the identification of possible sources of resilience** with the involvement of roles and actors at different levels in the organization, making sure to account for an adequate diversity of perspectives. In order to achieve such diversity,

combine individual interviews and workshop-based techniques, taking into account time constraints and availability of resources.

- Plan the methods around **triggering questions** to be used as guide for defining and describing *margins* and *couplings* in daily operations (*triggering questions before*) or looking back at past events to identify successful skills, strategies, and procedures (*triggering questions after*).
- Use the outcome of your analysis to **revise your internal guidelines**, training or to create ad-hoc ones.

BEFORE A CRISIS

The following triggering questions can be used to guide a discussion aimed to understand **work-as-done**, both in daily operations and in situations of crisis.

This can be done in a number of activities, such as dedicated workshops, through interviews, group interviews, observational studies informing analyses, and over-the-shoulder observations, etc. The analyses as such can be part of other safety, security, and change management activities, audits, safety assessments, concept design sessions, etc. The discussion should be intended as a way to improve the capability of the organization to react to a situation of crisis, by revising internal guidelines and procedures

in light of the **existing practices that have shown to work well.**

TRIGGERING QUESTIONS

Adaptive capacity:

- Which strategies (e.g. working methods or contingency procedures) can be used to handle a sudden loss of capacity and/or increase in demands?
- For which events is there a response ready?
- How and when can existing roles and tasks be reorganized in response to such events?
- Is the personnel exposed to unusual situations as part of the training?

Operational Margins:

- Which margins are available in everyday operational situations that can be used to handle suddenly increased demands?
- Which margins have been defined and anticipated beforehand?
- How is it possible to increase existing margins?
- When is it necessary to negotiate this increase with other actors? With which actors?
- Are there criteria to establish when it is possible to revert to the original margins?

Resources:

- How and when can additional resources (human, technical, material) be allocated/called in to integrate existing ones?
- What back-up (incl. legacy) resources and working methods are available? Is personnel (still) familiar with these in order to readily use them?
- What kind of coordination with other actors needs to be established for additional resources?
- Are there criteria to establish when it is possible to revert to the original set of resources?

Monitoring:

- Which roles in the organization can monitor the margins/resources available, both during and after an unexpected increase in demands?
- How are margins/resources monitored?
- Which monitoring mechanisms are put in place by the organization to anticipate and assess possible threats that may occur in the future?

Goal trade-offs:

- During the management of everyday operations or crises, are there different goals that may come in conflict (e.g. ensuring

adequate safety margins vs. minimizing economic losses)?

- How do operators succeed in meeting conflicting goals and finding appropriate balance among them?

Dependencies and interactions:

- What strategies (could) foster a smooth coordination among actors and minimize constraints and bottlenecks?
- Where do more efforts need to be spent to understand the potential for small variations in conditions and performance outcomes to combine, propagate, and amplify across organizations (so-called “cascading”, “butterfly” or “snowball” effects)?
- What do operators (need to) know about the other parts of the system that they are interacting with?
- How are formal and informal networks nurtured that are useful in handling crises?

Healthcare – Before



Monitoring and mapping the ordinary professional practices (for instance in a Emergency Department) during peacetime is highly recommended to learn how people (e.g. front-line staff) navigate the complexity of the healthcare system and adjust their practices to provide safe and high quality care. *Organizational Ethnography* is a recommended methodological approach to know and understand everyday professional practices within the context where and when things happen (see *Method 2* in the Healthcare Practices, Methods and Tools section).

Learning from the ordinary offers opportunities to realign work-as-imagined from decision makers and safety managers (e.g. Nurse coordinators), and the “work-as-done” by the operational personnel and frontline employees, providing useful insights also to manage critical events (Fraser & Greenhalgh, 2001; Hollnagel, Braithwaite, & Wears, 2013).

The main question, guiding this learning process, concerns:

- *How do people usually navigate and adjust to the complexity of their professional practices to provide safe and high quality care?* (Braithwaite, 2015)

The switch between “normal operations” and “serious emergency situations” often occurs in the healthcare domain. Therefore, the responsible actor in charge of taking decisions in everyday operations is in the best

position to do this during a crisis situation (See *Practice 1* in the Healthcare Practices, Methods and Tools section below).

As an example of margins, the following comment from a DARWIN DCoP workshop illustrates this point: "the more I can do before [an event/earlier] the better margins I get after, with the moving of people for example", i.e. sometimes margins are provided through for example resources or time by other activities, for example doing an activity earlier "buys one time" or provides other (safety) margins later on.

Air Traffic Management – Before



Examples of an analysis of margins in Air Traffic Management (ATM) (Woltjer et al., 2015, p. 124) include fuel margins for aircraft operations, airspace margins for not vectoring too close to sector boundaries, time margins in sequencing and spacing, and aircraft separation margins.

These are some of the margins that are built into the ATM system (for example how the airspace is designed), into the technical systems that controllers work with (for example how timings in interfaces are designed), into procedures (for example minimum take-off time separations) or into the way of working of the air traffic controllers (for example ways of controlling traffic according to "defensive controlling" principles). These margins help controllers and Air Traffic Service units generally to handle the various expected and unexpected conditions and variations in circumstances, independently of their causes. For example, no matter why a level bust happens, margins in separation between aircraft at different flight levels enable the air traffic system to maintain safety.

If these margins are analysed and described explicitly as part of safety assessment and change management activities, Air Navigation Service Providers build up and maintain an understanding of what margins are being used to handle unexpected events, so that these conditions are not lost in changes to the functional system of people, procedures, and equipment.

On back-up systems, many operations in critical infrastructure have legacy systems, working methods, and resources in place in case of emergency. However, it cannot be taken for granted that all personnel is (still) current with these legacy resources, as they also need to be trained regularly. Paper and pencil and regular phone lines, as a simple example, are available in many domains in case computerized systems fail, but if

exercises and training do not prepare personnel for technical failures and use of such other resources, using these may provide difficult. As another example, in Air Traffic Management older technical systems are often available as backup, as well as "procedural control" (controlling aircraft based on a mental traffic picture only, with greater margins than with the radar screen) but regular training of these methods is necessary in order to keep these methods and resource use current to be used in emergencies. This may obviously be especially difficult for personnel who have not worked with legacy systems and methods on a daily basis.

DURING A CRISIS

Observe and document application of procedures, methods etc. and their outcome, i.e. not only when they fail, but also when they succeed. Take a step back and reflect on whether conflicting goals are balanced appropriately, where more adaptive capacity is needed, and whether complexity is handled appropriately.

TRIGGERING QUESTIONS

Probe where things are going well by asking:

- Where do we never experience (this problem/good operation)? Why is that?
- Is the organization flexible, adaptable? To what extent and in what way can the organization change to adapt to demands?
- Do we support colleagues in case of overload?
- Do we have people available with different competences that can take different roles if required?

Healthcare implementation – During



The **observation and documentation of the application of procedures, methods etc. and their outcome (both when they fail and succeed)** should concern both specifically the healthcare sector and the healthcare in collaboration with other actors according to a *common ground* perspective (see *Practice 3* in the Healthcare Practices, Methods and Tools section below).

Air Traffic Management – during



The activities concerning this phase are relevant for air traffic management. The issue is "HOW" and "BY

WHOM" they can be accomplished since, during a crisis, it is difficult to find someone that is capable and available to observe and collect the information.

AFTER A CRISIS

The following triggering questions can be used after the occurrence of an actual crisis which was successfully managed, in order to understand which of the **existing practices have shown to work well**. This can be done in a number of activities, such as dedicated workshops, debriefing sessions, after-action reviews, exercise analyses, interviews, group interviews, incident investigations, lessons learned analyses, etc. Example activities that can be done during these activities using the triggering questions are:

1. Analyzing the differences between the intended use of procedures and their actual use during the crisis (Understanding which surprises were experienced and which strategies or working methods came out to be successful).
2. Sharing of case studies between organizations (Explaining what happened, from the point of view of those involved, and ask to the participants how they would have reacted to the same situation).
3. Proposing changes and/or adaptation to existing plans, resource allocations, guidelines, and procedures, based on what was learnt from the crisis.

TRIGGERING QUESTIONS

Adaptive capacity:

- Which strategies (e.g. working methods or contingency procedures) were used to handle sudden losses of capacity and/or increases in demands?
- Were the exiting roles reorganized in response to such events?
- Was the allocation of tasks among different actors modified?
- Were the situations experienced in the context of training activities useful to handle the situation?

Operational Margins:

- Which margins were actually available to handle sudden losses of capacity and/or increases in demands?
- Which of these margins were defined and anticipated beforehand?

- As the crisis developed, was an adjustment of the margins required?
- Was it necessary to negotiate margin adjustments with other actors?
- If the available margins were changed during the crisis, when was it possible to revert to the original margins?

Resources:

- Was it necessary to allocate/call in additional resources (human, technical, material) as the crisis developed?
- Was a coordination with other actors needed in order to allocate/call in such additional resources?
- If additional resources were called in from other organizations or from other departments, when was it possible to release them back?

Monitoring:

- Which roles in the organization monitored the margins/resources available?
- How were margins/resources actually monitored?
- Were the threats experienced during the crisis somehow anticipated by the available monitoring mechanisms?
- In which way did the available monitoring mechanisms help to anticipate the threats?

Goal trade-offs:

- During the management of the crisis, did we experience situations of conflicting goals that affected our way of managing it?
- How did the operators succeed in meeting conflicting goals and finding the appropriate balance between them (e.g. ensuring adequate safety margins vs. minimizing economic losses)?

Dependencies and interactions:

- Which strategies worked better to minimize constraints and bottlenecks when coordinating among different actors?
- How did the knowledge of other parts of the organization contribute to facilitate the handling of sudden losses of capacity and/or increases in demands?
- Which strategies worked to minimize the cascading-effects of the crisis?
- How can we improve existing training by taking into account successful synergies with different organizations or departments experienced during the handling of the crisis?

Healthcare – After



Once the differences between intended use of procedures, methods as work-as-intended (WAI) and actual work-as-done (WAD) have been analyzed after a specific case, broader data may be collected to understand as to how work-as-done is performed for everyday operations (across many cases), for example through observations, interviews, or questionnaires. These broader investigations into work-as-done may be analyzed and included into the reporting after the specific crisis in order to understand how the specific case relates to everyday work on a broader scale. I.e. the specific case may be an example or wide-spread everyday practices, and not be unique to the case at hand, which is important to understand and relate to in reporting after the specific event. Changing goal trade-offs as a source of resilience can be found in health care, which is important to understand in the After phase of an analysis understanding a past event. When patient safety is at stake in a certain particularly pressing situation of life-and-death, certain goals such as privacy may need to be sacrificed in order to not lose time for an urgent treatment and save the patient's life. Thus, goal trade-offs need to be dynamically adjusted and goals may need to be sacrificed depending on the situation, which is a source of resilience.

Air Traffic Management – After



An example of changing goal trade-offs as a source of resilience can be found in the Air Traffic Management domain, which is important to understand in the After phase of an analysis understanding a past event: "Performance goals change depending upon the situation. For example, in the case that an [air traffic service unit] loses the display that shows where the aircraft are situated [due to technical problems], the primary goal [of the air traffic controller] will shift from providing both efficient and safe flow of traffic towards solely providing separation between aircraft using all means to achieve this [safety]." (Woltjer, et al., 2015, p. 120). Commonly, also, cockpit procedures will prescribe the intended use of checklists in various situations, often with the "disclaimer" that pilots may divert from these instructions if flight safety requires that the situation is dealt with in another way. In these circumstances, safety becomes the primary goal to be prioritized. Thus, goal trade-offs need to be dynamically adjusted and goals may need to be

sacrificed depending on the situation, which is a source of resilience.

UNDERSTANDING THE CONTEXT

DETAILED OBJECTIVES

One of the aims of Resilience Engineering is providing a deepened understanding of everyday performance, in order to learn, not only from failures, but also from successful operations. Resilience management should not only be based on analysis of risk and "["brittleness"](#)" illustrated through failures during incidents and crises, but on an understanding of all outcomes of everyday operations, including the positive ones. Learning from what goes well during normal operations in safety critical work as well as when incidents and crises occur, can support better preparedness and learning, thus increasing resilience. The study of everyday operations can reveal how the organisation are managing normal conditions through the [adaption to occurring events](#), but also how and when [procedures are adapted](#).

TARGETED ACTORS

Actors that may benefit from this topic include actors involved in safety, security, and change management activities, audits, safety assessments, concept development sessions, debriefing sessions, after-action reviews, exercise analyses, and incident investigations. This may include policy makers, middle and line management, operational management, and a variety of operational roles.

Healthcare – Actors



Actors should be identified in the following areas:

- Policy makers and regulatory bodies at different levels: International Organizations (WHO, ECDC), Ministry of Health; Regions/Counties, NGOs.
- Operational institutions that operate on the territory (hospitals, local health units, etc.).
- Patients (as class and as individuals).

Air Traffic Management – Actors



The roles and responsibilities of involved actors change according to the type of crisis and the related environment of operations. The "Identification of sources of resilience" must encompass most of the activities of the organization, at all levels, starting from senior management to front line operators.

The actors involved are those listed below:

- Air Navigation Service Providers (both civil and military)
- Aircraft owners and operators
- Aircraft manufacturers
- Aviation regulatory authorities (National and International)
- ATFCM (Air Traffic Flow and Capacity Management)
- International aviation organizations (i.e. EUROCONTROL, ICAO, CANSO, etc.)
- Investigative agencies
- Flying public
- Airport operators (if airports and/or ground operations are concerned by the crisis)
- Firefighters (if airports and/or ground operations are concerned by the crisis)
- Police (if airports and/or ground operations are concerned by the crisis)

EXPECTED BENEFITS

Enhanced understanding of everyday situations focusing on essential functions that makes a critical infrastructure work. The organization can use this understanding to retain, enhance or amplify the organization's (or, organizations') resilient capabilities, thereby ensuring that everyday processes go well as much as possible.

RELATION TO ADAPTIVE CAPACITY

This capability card is in essence an elaboration on how to identify and increase adaptive capacity.

RELATION TO RISK MANAGEMENT

Support investments in the ability to maintain operation and continuity of operations for different kinds of systems and organizations at different levels.

ILLUSTRATION

High Workload at the Maternity Ward

A remarkably large number of births one evening led to chaos at the maternity ward. The ward was understaffed and no beds were available for more patients arriving. Also, patients from the emergency room with gynaecological needs were being directed to the maternity ward as the emergency room was overloaded. To cope with the situation one of the doctors started to free resources by sending all fathers of the new-born babies home. Although not a popular decision among the patients this re-organization freed up beds, allowing the staff to increase their capacity and successfully manage all the patients and births. After this incident an analysis of the situation was performed that resulted in a new procedure for "extreme load at maternity hospital.

The system demonstrated several important abilities contributing to system resilience as it uses its adaptive capacity to respond to and learn from the event"(Rankin et al, 2013).

Healthcare – Illustration



Translating tensions into safe practices through dynamic trade-offs: the secret second handover - A specific threat to patient safety is when the ambulances are queuing in the Emergency Department, losing their ability to respond. In England, to improve this, ad hoc target times were specified. To achieve these target times, the process to receive handover was redesigned. *Work-as-imagined* was done in form of protocols and procedures. During field work such variations of the application of the dedicated handover (*Work-as-done*) were verified (Wears, 2015). This example demonstrates that it is possible to optimize the performance of the daily ambulances services by adjusting time-slots and avoiding waste of time.

Air Traffic Management – Illustration



An interesting illustrative case from the air traffic management context is represented by **Competence assessment of air traffic controllers**. In many professions, a regular check of competence is required. This is applicable for air traffic controllers, pilots, and airline maintenance, where international regulations have issued guidelines and requirements for competence. This includes:

1. Continuous assessment by making observations of air traffic controllers (ATCO) during "normal" operational duties.
2. Dedicated practical assessment on annual basis.
3. Oral and/or written examinations. In other domains this is not the case." (Hollnagel, 2017)

This provide examples of observations as a source of understanding everyday work and sources of resilience.

A noteworthy illustrative case is represented by the activities that have been established after the eruption of the Icelandic Volcano: in fact EUROCONTROL has introduced several tools (i.e. EVITA) and groups (EACCC):

- **European crisis Visualisation Interactive Tool for ATFCM (EVITA)**

EVITA is a collaborative online tool which allows users to visualise the impact of a crisis on air traffic and on the available air traffic network capacity in Europe. It supports decision making in times of crisis and is the principal communications channel for airlines. It is one of the Network Operations Portal's (NOP's) features and should be used for information purposes only. During major crisis situations, it supports the sharing of information between airlines, state regulators and air navigation service providers operating in Europe, in particular thanks to the functionality that allows airlines to identify precisely which of their flights may be impacted by ash. In fact, the tool, originally created to monitor ash concentration levels, could be used for other crises such as nuclear emergency, pandemics or security risks.

- *In May 2010, the European Commission (EC) and EUROCONTROL jointly established the **European Aviation Crisis Coordination Cell (EACCC)** to coordinate the management of crisis responses in the European ATM network. In addition to the EACCC members, EACCC Chair may decide to invite State focal points and, depending on the nature of the crisis, experts from relevant fields of expertise.*

In the **SESAR project 16.1.2 the i4D/CTA concept** that is under development was analysed from a newly developed resilience engineering-based methodology using many of the concepts recommended for use here (see Woltjer et al, 2015, p. 127-128, from which examples are taken below): "The i4D/CTA concept aims to optimize the arrival traffic to the airport by using more accurate and reliable trajectory planning, defined, and agreed between airborne and ground sides in four dimensions: latitude, longitude, altitude and time

(hence,4D)" ... through the use of a Controlled Time of Arrival (CTA).

- Work-as-done will change with the introduction of i4D/CTA: "From a controller perspective the use of i4D/CTA ... entails that the main task is monitoring of traffic, as the responsibility for maintaining separation is still with the controller. However, the ... activity of actively maintaining separation continuously throughout en-route and TMA ... will change." In addition: "Currently the use of the arrival manager (AMAN) is flexible, as it is mostly a recommendation to controllers ... The i4D/CTA concept implies a stronger commitment, an agreement between air traffic controllers and aircraft crew on a Controlled Time of Arrival (CTA), ... suggested by the AMAN software.
- A "significant trade-off triggered by i4D/CTA is between flexibility for controllers (e.g. to influence sequence and use vacant capacity) and predictability for airlines and airport services. This trade-off affects task complexity and demands on controllers". In turn, this trade-off affects the flexibility in the air traffic system as a whole, which is part of the sources of resilience.
- Another source of resilience, margins, may also change with this new concept: "Generally, more optimization to use the runway comes with decreased tolerance and margin. E.g., a tight sequence with set CTAs leaves little margin to manage weather changes or aircraft with an emergency and avoid a knock-on effect of changed CTAs."

As an example of complexity and the potential for cascading effects: "There will be a change in working strategies in areas with complicated geography, complicated sector boundaries and use of temporarily restricted areas, that may lead to quicker transfers between sectors. ... In situations such as diversions, bad weather and quicker transfer between sectors, the time available and feasibility to predict their impact on traffic and adjust to the circumstances [may] decrease, and there [may] be increased possibility of these effects cascading to other aircraft, sectors, and air traffic control units."

IMPLEMENTATION CONSIDERATIONS

Challenges

Initial familiarisation with resilience concepts, in particular the understanding of everyday work when nothing goes wrong.

Implementation cost

Implementation can vary based on the number of dedicated workshops. Typically focus groups engage 4-8 experts and 2 facilitators for a about a day, but the number of focus groups or workshops (and experts) is dependent on the scope of the analysis. For example, for small systems/organizations a single workshop or focus group may be sufficient, but with larger systems/organizations natural boundaries between subparts may be defined for which a number of workshops are run. Note that the integration and interactions between subparts deserve explicit and dedicated attention.

It is also possible to complement existing practices in the organization, for instance by including the proposed triggering questions while planning or reviewing operations, or during audits.

Pre-workshop and follow-up analysis and fact checking may also be expected according to standard workshop, focus group, or interview methodologies.

Healthcare – Implementation considerations



Associated Challenges

The background and context information in healthcare is one of the most complex. The mismatch between *work-as-imagined* and *work-as-done* constitutes the basis of this complexity (AIHI seminar), as explained below (Braithwaite, 2015):

Work-as-imagined (WAI), carried out by workers (blunt end) who:

- Experience health care indirectly by interpreting and filtering information (indicators, statistics).
- Receive delay in feedback.
- Represent ideas about practice, (outcomes are the access information easily assessable).

Work-as-done (WAD), carried out by workers (sharp end) who:

- Experience health care delivery first-hand.
- Receive feedback with little or no delay.
- Work in constantly changing and unpredictable conditions.

For applications of resilience and the gap between Work-as-Imagined (WAI) and Work-as-Done (WAD), see for example Hollnagel, Braithwaite, & Wears, (2015); Hollnagel, Braithwaite, & Wears (2013); or Wears, Hollnagel, & Braithwaite (2015).

Minimum Viable Solution

One of the first actions to carry out are the implementation of *Problem Based Learning* (PBL - see *Method 1* in the Healthcare Practices, Methods and Tools section). This includes at least a two day face to face course with at least two representatives of the stakeholders involved.

Air Traffic Management – Implementation considerations



This concept refers to one of the most interesting topics that are arising in the last decade in Air Traffic Management, the so-called “**Safety II**” that is “*move from ensuring that ‘as few things as possible go wrong’ to ensuring that ‘as many things as possible go right’*” [14] The “positive” approach is getting more and more interest to complement the “negative” approach which is the one that is commonly used in the Safety Methodologies (i.e. study the system in advance and identify possible points of failure).

RELEVANT MATERIAL

RELEVANT PRACTICES, METHODS AND TOOLS

Practices

Understanding the difference between how work is assumed or expected to be done (Work-as-Imagined) and how it is actually done (Work-as-Done) (see Herrera, et al, 2017):

- Teach value of, and how to ask, open-ended questions. (Schein, 2013)
- Implement “Learning Teams” in your query where Work-as-Imagined and Work-as-Done

are investigated (Hollnagel, 2017; Conklin, 2012).

- Patient safety senior executive walk-arounds to understand how the work gets done on the frontlines.
- Prepare to shift people for the “unexpected” such as environmental disasters or threats such as chemical spills or earthquakes, riots, terrorist attacks, and epidemics.
- Overcapacity protocols to manage overcrowding in emergency departments. *Development of “rapid assessment zones” to reduce overcrowding in emergency departments.
- Do simulations involving surprises as part of a certification program.
- Share case studies between plants that tell story, from point of view of those involved, to just before revealing what happened, ask: “What would you do? How could this play out? What would you do to avoid/support...?”

Methods

Resilience Analysis Grid (RAG) with questions related to the resilience potentials to anticipate, monitor, respond and learn (Hollnagel, 2017 latest version of RAG).

Critical incident investigation work that uses a framework based on resilience perspectives (Health care Canada).

Healthcare – Practices, methods and tools



Practices

Practice 1. In Sweden in the healthcare sector there are switches between “normal operations” and “serious emergency situations”. Other type of actors (no healthcare) stay as much as they can in normal operations according to standard allocation of decision rights. It means that the responsible actor to take decisions in everyday operations is in the best position to do it during a crisis situation.

Practice 2. The following real-life example shows how ED [Emergency Department] staff members employed multiple strategies that increased the resilience of their operations. Recently, at the start of the evening shift (15:00), the ED was boarding 43 patients; 28 of these patients filled the unit reserved for boarders; the remaining 15 were split among the acute care areas and the hallway. The use of the hallway as

additional treatment space is an example of resilient adaptation at the departmental, as opposed to the individual, level. This procedure was first used several years earlier. By now, it had become part of normal operations, representing an organizational reconfiguration to establish a new equilibrium (Nemeth, Wears, Woods, Hollnagel, & Cook, 2008).

Practice 3. In the Swedish healthcare domain, several organizations have introduced good practices and methods aimed to establish *Common Grounds*. In the Region Östergötland the implementation of *Common Grounds* for cooperation and management is made by means of the crisis response system (MSB, 2014). This implementation includes actor-wide activities in all-phases:

- Before: Proactive development of strategies for how to manage a crisis by e.g. common workshops and/or educations.
- During: Effective working procedures for actor-wide management of social disturbances with common approaches.
- After: Actor-based follow-up based on indicators for stakeholder cooperation.

Practice 4. A fieldwork (see *Method 2* below) was carried out in an Emergency Department (ED) to investigate its properties of resilience and adaptive capacity in the face of uncertainty and limited resources. In particular, the focus of the analysis was on the shift from a routine day, in which the system (ED) operates under usual condition (described by practitioners as “run of the mill”), to a situation in which a key person recognized system degradation (i.e. load and demands increase) and initiates adaptive tactics (i.e. recruiting and reorganizing multiple resources) in order to manage and maintain performance (Anders, Woods, Wears, & Perry, 2006).

Methods

Method 1. Problem Based Learning (PBL). The ability to adapt to change and continuously improve performance - capability - is enhanced through feedback on performance, the challenge of unfamiliar contexts, and the use of non-linear methods such as story telling and small group, and in particular the methodology called Problem Based Learning (PBL) that does not focus on problem solving with a defined solution, but it allows for the development of other desirable skills and attributes as knowledge acquisition and increased group collaboration and communication. This methodology was developed for medical education. PBL has been implemented within numerous undergraduate health curricula but less so in workforce training. Public health practice requires

many of the skills that PBL aims to develop and would benefit from some exposure to this type of learning and highlights some of the practical issues (Trevena, 2007).

Method 2. Organizational Ethnography is a qualitative research approach looking at the social interaction of people in a given organizational environment (e.g. a hospital's emergency department). It provides in-depth and up-close understandings of how the everydayness of work is organized and how work organizes people in everyday organizational life. The focus is on practices, communications, shared artefacts/tools, and physical spaces used in working teams. Ethnography includes the participation of the researcher in the organizational context (fieldwork), the observation of everyday activities, fieldnotes, interviews, video recordings, photography, and artefact analysis such as devices that a person uses throughout the day. The length of the studies can vary depending on the research objectives and the organizational availability to host the researcher (see *Practice 4* above).

Air Traffic Management – Practices, methods and tools



Practices

At ENAV, which is the Italian Air Navigation Service Provider, the practice is that critical events are studied and analysed. In some particular cases, **training and educational meetings** have been organized accordingly in order to present them to Air Traffic Controllers and managers. Also a special issue of the Company's internal magazine has been dedicated to present all the points of view of the particular event.

Methods

The guidance material that SESAR 16.1.2 and 16.6.1b has developed provides a method using workshops and various analytical techniques generating qualitative descriptions of Resilience Engineering principles applied to ATM services as done currently or as envisioned after introduction of a new technology or way of working. The guidance material has been integrated as part of the safety assessment methodology of SESAR (Single European Sky ATM Research), and as stand-alone guidance for ATM concept design processes.

ICAO “Doc 9995 AN/497 Manual of Evidence-based Training” highlights some methods concerning Competency-based training, in particular it lists several used methods/techniques together with their pros and cons. [15]

Tools

Teleconferences - During crises, the European Aviation Crisis Coordination Cell (EACCC) is normally convened via teleconferences.

“EUROCONTROL’s Network Manager provides the best assistance it can to help mitigate the impact of major network disruptions or crisis situations. It also provides tools and services which enable users to anticipate or react to events more effectively, based on the best available knowledge of the ATM situation.” [Source: <https://www.eurocontrol.int/articles/tools-available-times-disruptions-and-crises>]

On **Skybrary**, there is section dedicated to “Controller Training Methods and Tools” that provides a general description of training design and structure, simulator training, training techniques, computer based training. [16]

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NAVIGATE IN THE DRMG

- **Parent theme:** Assessing resilience
- **Parent card:** Assessing resilience (card old)
- **Resilience abilities**
 - Contributes to: Learn and Evolve, Anticipate, Respond and Adapt
 - Supported by: Monitor

- **Categories:** Evaluation, Situation understanding, Learning lessons, Planning, Training, Governance, Procedures situations, DURING, Damage control and containment, Assess emergency and response, AFTER, Learning, Assess performance
- **Functions of crisis management:** BEFORE, Preparation, Build knowledge of crisis

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4.3. Noticing brittleness

The interventions proposed here aim to support organisations to identify sources of *brittleness* in order to invest in their correction.

Brittleness is experienced in situations of goal conflicts and trade-offs, or when there is a competition for resources and a need to establish priorities under time pressure. Other difficulties emerge when an organisation struggles to manage *functional interdependencies* between different parts of the same organisation, or when there is insufficient *buffer capacity* to provide additional resources. Noticing brittleness also means observing *operational variability* and comparing *work-as-done* with *work-as-imagined*, so to reveal how the system might be operating riskier than expected. In addition, brittleness manifests itself when the organisation is unable to learn from past events, such as near misses and accidents.

IMPLEMENTATION

INTRODUCTION

What is needed to notice brittleness:

- Engage personnel at all levels of the organisation in understanding and noticing brittleness.
- Create the conditions for personnel across the organisation to expose and discuss things that do or might not go well in crisis situations.
- Implement recommended activities regularly to facilitate the personnel's capacity to notice and discuss brittleness.
- Rely on external experts if resilience or safety managers familiar with notions of resilience are not available.
- Select methods for the identification of possible sources of brittleness with the involvement of roles and actors at different levels in the organisation, making sure to account for an adequate diversity of perspectives. In order to achieve such diversity, combine individual interviews and workshop-based techniques, taking into account time constraints and availability of resources.

- Plan the methods around triggering questions to be used as guide for the analysis (see examples of triggering questions below for the phases 'Before', 'During' and 'After' a crisis).
- Use the outcome of your analysis to revise your internal guidelines or to create ad-hoc ones.

Note Brittleness is a useful concept because it can be easier to describe and notice when systems can break down. However, this focus on "what goes wrong" is complementary to the approach described in [Identifying sources of resilience](#). It would actually be counter-productive to only focus on the negative aspects of systems and operations: it is fundamental to also understand the nature and characteristics of resilience and how it exists in the organisations considered.

Air Traffic Management – Introduction



Including specific question "what is needed to notice brittleness" when applying - Toolkit: Systems Thinking for Safety/Principle 5. Resources and Constraints

" Practical advice Consider the adequacy of resources. With field experts, consider how resources (staff, equipment, information, procedures) help or hinder the ability to meet demand, and identify where there is the

opportunity for improvement. Consider the appropriateness of constraints. Consider the effects of constraints (human, procedural, equipment, organisational) on flow and system performance as a whole. Reflect on the implications for individuals and the system when people have to work around constraints in order to meet demand."

(see [Toolkit:Systems Thinking for Safety/Principle 5. Resources and Constraints](#))

BEFORE A CRISIS

The assessment of potential sources of brittleness can be performed in two types of situations:(1) on a periodic basis, as part of established self-assessment activities; (2) In anticipation of specific events, to ensure resilience capabilities are in place. Relevant examples of the latter case include especially:

1. Anticipated surge in demands (e.g., due to seasonal peak of activity, or to the approach of an identified threat)
2. Relevant change brought to the system of interest (e.g. a new technology, a new policy, a new role being introduced).

In all of these cases, the analysis should aim to reveal and discuss potential issues that the system under investigation might experience when handling a crisis. For those organisations which have already identified a list of mitigation measures in case of accidents and crises (e.g., in classic risk management activities), the assessment of brittleness should also focus on understanding what might go wrong when applying the mitigation measures.

What is needed to notice brittleness Before a Crisis

For both the situations described above, noticing brittleness can be achieved through the organisation of a short workshop or focus-group for which:

- participants are introduced to principles of resilience,
- a facilitator leads a discussion about anticipated crisis situations and potential pitfalls,
- the discussion is guided by the triggering questions presented below (the full set or a selection of them).

In such workshop or focus group, it is possible to use actual past events or fictional scenarios, to ground and direct discussions (see [Practice 1](#) for an example related to surge in demand and [Method 2](#) for an example associated to a technological change).

TRIGGERING QUESTIONS

Lack of Resources (human, technical, material)

- Are there situations in which the resources we expect to have to respond to a crisis/emergency may not be available?
- What can we put in place to relieve, lighten, moderate, reduce and decrease stress or load?
- Where could we easily add extra capacity to remove stressors?

Lack of Information

- Can we anticipate situations in which we will lack the necessary information to handle a certain event?
- Do we have a protocol in place to gather the missing information?
- Can we anticipate situations in which we may experience uncertainty based on the history of our operations?
- Which processes and/or plans are insufficiently defined and may represent a source of uncertainty?

Goal Conflicts

- What goal conflicts and trade-offs may arise or increase?
- In such situations, will we be able to establish priorities?
- Can some goals be temporarily relaxed or sacrificed to reduce the trade-offs?

Constraints and Bottlenecks

- What constrains us in our ability to execute?
- What conditions may push our system towards its limits?
- Who will be most heavily loaded/stressed?
- Can we anticipate situations in which our operations will be constrained by other organisations?
- Can we anticipate situations in which our operations act as a constraint for other organisations managing a crisis?

Difficulties to adjust

- Do we have the capacity to reallocate existing resources if needed. What may prevent us from reallocating them?
- Do we have a policy that allows us to modify normal operations when needed?
- Do we expect that major mismatches between official procedures and actual practices may occur?

Limits of mitigation plans

- If we have safety/emergency plan, what can go wrong when applying the planned mitigation actions?
- What could prevent us from applying some of the mitigation actions?

Healthcare – Before



Example of situations of relevance to healthcare:

- **Periodic assessment** of potential sources of brittleness can be performed during the regular evaluations of the capability to answer the population health needs.
- The **anticipation of specific critical events** is illustrated by the risks of influenza peaks. Every year influenza virus changes bringing about a crisis to cope with. The virus could be a novel one that needs to be covered by a new vaccine. Healthcare organisations therefore need to ensure that resilience capabilities are in place at all levels, specific prevention measures are taken, to contain the crisis and reduce risks.
- **Relevant changes to the system** may be due to the introduction of a novel technology, for instance a new healthcare device or a new kind of vaccine.

In general, some common actions can be identified to assess potential sources of brittleness in situations that are relevant in a healthcare perspective:

- carrying out a rapid assessment for a quick and efficient identification of sources of brittleness;
- selecting indicators that could be predictive of a certain type of brittleness;
- measuring the predictors identified to improve the preparedness.

See in addition the Healthcare Practices, Methods and Tools below.

DURING A CRISIS

During time-critical types of crisis, it may be difficult to use triggering questions as a checklist to be read step-by-step. However, it is important that all the professionals involved in the management of the crisis are fully aware of the topics addressed by the triggering questions and can consider such topics, even without reading them.

For crises that develop over longer time (e.g. Icelandic volcano eruption, or Ebola outbreak) it is possible to organise workshops or operative meetings to reflect with other colleagues on the possible sources of

brittleness, and use the triggering questions to support the reflection. The same approach can be used during a drill or a simulation by a facilitator to guide the simulation and stimulate participants to notice brittleness.

TRIGGERING QUESTIONS

Lack of Resources (materials, information, personnel..)

- Do we need additional resources (human, technical, material) to manage the event?
- Are other part of our organisation able to renounce to some of their resources, to support us in managing the event?

Lack of information

- Is there additional information available to address the crisis that we are not considering?
- In case of lack of relevant information to handle the situation, can we put a protocol in place to gather the missing information?
- Can we ask the advice of a colleague who is not involved in the crisis, to support us in correctly interpreting the situation?

Constraints and Bottlenecks

- Are our operations during the crisis blocked by member of other organisations?
- Are we hindering the operations of the members of other organisations during the crisis?

Difficulties to Adjust

- Are we in a capacity to reconsider our priorities?
- Can we delay the achievement of some goals, in favour of more urgent ones?
- Can we consider deviations from normal procedures to manage the event?

Difficulties to learn from the crisis

- Are we able to capture experiences from the crisis, in a format that support the dissemination of “lessons learned” inside the organisation
- Will the format of such “lessons learned” encourage remedial actions by the management?

Difficulties to learn from previous events.

- Are we adequately considering “lesson learned” from the past?

Healthcare – During



- During **time-critical type of crisis**, health first responders organisations and local health units working on the territory are fully engaged on

managing the emergency in the field. Methods and tools (i.e. triggering questions) to notice brittleness are hardly applicable. However, operational personnel need to be fully aware of them (e.g. by integrating them to their everyday practices at no-crisis time).

- For **crises developing over longer time**, as in the case of infectious diseases, interdisciplinary work groups/ *ad hoc* crisis units are established according to the emergency to analyse the crisis situation, identify criticalities and set-up a response strategy. The generic triggering questions of this card - related to the *during phase* - could be used within these groups, to evidence possible sources of brittleness during the application of the mitigation actions.

At international level, in case of highly impacting infectious disease (i.e. Ebola), the *European Centre for Disease Prevention and Control* and WHO regularly perform risk assessments by means of which roadmaps are provided to countries. Roadmaps include indicators with the Countries' capacity assessment to cope with the crisis.

AFTER A CRISIS

Adverse events usually provide information that helps identify sources of brittleness (similarly to the way accidents and incidents can be used for safety-related purposes). However it should be emphasised that analyses must focus on processes, i.e. how operations were conducted, rather than on outcomes, i.e. what the consequences were.

What is needed to notice brittleness after a crisis

Depending on time of implementation, resources and objectives, organisations can:

- Conduct quick assessments based on methods such as the focus groups described in Practice 1, for instance during debriefing sessions.
- Conduct more in-depth analyses based on methods that focus on understanding operations in context (e.g., CTA – see Method 1). Data used in such analyses can come from data recorded during the crisis experienced, investigation reports or debriefings, whether it was an actual event or an exercise.
- Across longer timeframes, assessments need to be conducted about how the organisation has reacted after crisis events, for instance whether it has prioritised and invested resources in the analysis and enhancement of resilience. Failures to do so correspond to forms of brittleness (see Method 3).

TRIGGERING QUESTIONS

Lack of Resources

- Were our resources (human, equipment, material) adapted to the scale of the event?
- Which were the missing resources, competences, strategies (if any)?

Lack of Information

- Did we experience cases in which the information we had was insufficient to effectively handle the situation?
- Were there difficulties to put in place protocols to gather the missing information?
- Did the crisis we experienced reveal wrong assumptions we had about the nature of threats we are exposed to, and about our capacity to handle them?
- Did the crisis we experienced challenge the plans we had established?

Goal Conflicts

- What goal conflicts and trade-offs did we experience?
- Were the goal conflicts unusual or unexpected?
- Were we able to establish priorities?
- Did we sacrifice any goal in a way that reduced our ability to adapt to certain circumstances?

Constraints and Bottlenecks

- What were the bottlenecks?
- Where our operations dependent on others?
- Were the operations of others' dependent on ours?
- Was collaboration with other organisations effective? If not, which were the constraints?

Difficulties to adjust

- Were we able to deploy or mobilise additional resources when needed? If not, what prevented us from doing so?
- Were other parts of the organisation able to renounce to some of their resources when needed? If not, what prevented them from doing so?
- Were we able to adjust goals and priorities when needed? If not, what prevented us from doing so?
- Were we able to modify normal operations when needed.
- Did we observe an excessive mismatch between official procedures and actual practices during operations.

Difficulties to learn from the crisis

- Were we sufficiently able to capture experiences from the crisis and collect them in a format easy to share inside the organisation?

- Were we sufficiently able to use these experiences to promote "after action review" inside the organisation?

Difficulties to learn from previous events

- Have past, potentially similar, events in our own organisation sufficiently helped us being prepared for this crisis?
- Have similar events in other organisations or domains sufficiently helped us being prepared for this crisis?

Limits of mitigation plans

- If a safety/emergency plan was available, what went wrong when applying the planned mitigation actions?
- Did we miss any mitigation action that would have been necessary?
- What prevented us from applying some of the mitigation actions?
- Did some mitigation actions result insufficient to handle the associated hazards?

Healthcare – After



Case studies are usually implemented to evaluate what went wrong when applying the mitigation measures.

A **differential analysis of brittleness factors** needs to be performed to identify: a) **temporary factors** to take into account in reviewing emergency plans; b) **structural factors** concerning institutions and policies to be recognised in order to start a change process that needs a wider temporary perspective.

In the case of Ebola, the analysis of data collected during the crisis and its management, allowed the review of the reference legal framework (i.e. International Health Regulation).

Air Traffic Management – After



Triggering questions can be implemented as part of lessons learned within ATM. In Skybrary - 'Lessons learned' is validated working knowledge derived from successes or failures that, when reused, can significantly impact on organisation's processes. (Secchi, 1999).

The EUROCONTROL advisory material to regulations ESARR3 - Use of safety management systems by ATM service providers gives generic guidance on the

processes to be established for lesson learned and dissemination that includes collecting lessons, dissemination and training" (see [Lesson Dissemination](#))

Also airlines performance relies on reporting culture which encourages the pilot community to report high and low level incidents to enable the company to learn possible lessons from these incidents to help avoid recurrence. The preface to the Flybe Operations Manual reads: "All employees are urged to help provide the highest levels of safety in the industry, and so are encouraged to report any information which may affect flight or ground safety. To promote a free flow of information the Company will not normally take disciplinary action against any employee reporting an incident affecting safety. The only possible exception may be where someone has acted recklessly or maliciously or omitted to take action, in a way that is not in keeping with their training, responsibilities or experience. In such cases, the fact that a person has made a report will be taken into account in their favour. The Company will take very seriously, however, occasions where an incident is discovered that has not been reported. Not reporting anything which could affect flight or ground safety is considered serious misconduct."

(see [Skyway Spring 2013 - p44-45](#))

UNDERSTANDING THE CONTEXT

DETAILED OBJECTIVES

As part of the assessment of resilience, noticing brittleness is the approach that aims at revealing and understanding deficiencies in and challenges to resilience in the system under consideration.

The opposite of a resilient system is a brittle one. Brittle systems break down especially in the face of surprising situations at the boundaries of what the system typically handles. In those situations, they are unable to accommodate even minor disturbances without ceasing to function. Examining the factors that undermine resilience is important in order to identify the most effective measures to actually enhance resilience and reduce brittleness. This assessment supports preparedness (e.g., related to planning or training) and the avoidance of situations that would result in potential harm or damage, for instance by anticipating potential bottlenecks in the response to a crisis situation.

TARGETED ACTORS

Managers are expected to implement the interventions in two ways:

- setting up regular activities that lead to discussions about brittleness and its identification;
- involving actors at all levels of the organisation, in particular **team leaders and other operational personnel** who are engaged in crisis management activities.

In addition, members of the organisation familiar with resilience notions (e.g., resilience or safety managers), possibly with the help of external experts, play a key role in conducting events, leading and moderating discussions about brittleness.

Healthcare – Actors



Actors should be identified in the following areas:

- scientific experts in the fields;
- policy makers and regulation bodies at different levels: International Organisations (WHO, ECDC), Ministry of Health, Regions/ Counties;
- operational institutions that operate on the territory (hospital, local health units, etc.).

Air Traffic Management – Actors



The roles and responsibilities of involved actors change according to the type of crisis and the related environment of operations. "Noticing brittleness" must encompass most of the activities of the organisation, at all levels starting from senior management to front line operators.

The actors involved are those listed below:

- Air Navigation Service Providers (both civil and military)
- Aircraft owners and operators
- Aircraft manufacturers
- Aviation regulatory authorities (National and International)
- ATFCM (Air Traffic Flow and Capacity Management)
- International aviation organisations (i.e. EUROCONTROL, ICAO, CANSO, etc)
- Investigative agencies
- Airport operator (if airports and/or ground operations are concerned by the crisis)

- Firefighters (if airports and/or ground operations are concerned by the crisis)
- Police (if airports and/or ground operations are concerned by the crisis)

EXPECTED BENEFITS

Understanding brittleness in the system allows organisations to address its sources and underlying factors and avoid situations that would result in potential harm or damage.

RELATION TO ADAPTIVE CAPACITY

Noticing brittleness occurs through understanding when the system lacks adaptive capacity, or, more generally, faces challenges with adaptation. Through investigating brittleness, organisations can notice signs that indicate that their adaptive capacities are either eroding or ill-matched to the demands that are about to occur, allowing them to invest in order to adjust those capacities. This can happen before, during, or after a crisis event.

RELATION TO RISK MANAGEMENT

As part of the Resilience Engineering paradigm, noticing brittleness affords proactive safety management. Brittleness relates to how the system under investigation *behaves* under stress, more than to specific characteristics of the system or of threats. This approach contrasts with the traditional industrial safety paradigm of counting errors after accidents or mishaps and deriving specific risk-based interventions to reduce this count.

ILLUSTRATION

A firefighting case and analysis illustrate the *assessment of brittleness during operations*:

Companies arrive on the fire scene and implement standard operating procedures for an active fire on the first floor of the building. The first ladder company initiates entry to the apartment on fire, while the second ladder gets to the second floor in order to search for potentially trapped victims (the 'floor above the fire' is an acknowledged hazardous position). In the meantime, engine companies stretch hose-lines but experience various difficulties delaying their actions, especially because they cannot achieve optimal positioning of their apparatus on a heavily trafficked street. While all units are operating, conditions are deteriorating in

the absence of water being provisioned on the fire. The Incident Commander (IC) transmits a 'all hands' signal to the dispatcher, leading to the immediate assignment of additional companies. Almost at the same time, members operating above the fire transmit a 'URGENT' message over the radio. Although the IC tries to establish communication and get more information about the difficulties encountered, he does not have uncommitted companies to assist the members. Within less than a minute, a back-draft-type explosion occurs in the on fire apartment, engulfing the building's staircase in flames and intense heat for several seconds, and erupting through the roof. As the members operating on the second floor had not been able to get access to the apartment there due to various difficulties, they lacked both a refuge area (apartment) and an egress route (staircase). The second ladder company was directly exposed to life-threatening conditions.

In spite of the negative outcome of the situation described, it illustrates a practice of noticing brittleness during the response to a crisis. The Incident Commander (IC) recognised and signalled a 'all hands' situation, in order to inform dispatchers that all companies were operating and to promptly request additional resources. ICs are particularly attentive to avoid risks of lacking capacity to respond to immediate demands as well as to new demands. The 'all hands' signal is a recognition that the situation is precarious (brittle) because operations are vulnerable to any additional demands that may occur.

Healthcare – Illustration



Lack of overseeing capability as a source of brittleness.

A first responder organisation operating in Rome relies on the recruitment of associations of volunteers in crisis periods, whose accreditation is not subject to a proper assessment. During large scale emergencies, this organisation would integrate additional front-line staff, usually provided by externally accredited associations of volunteers. However, the regional institution responsible for releasing such accreditation lacked in control and monitoring capability – in particular check of personnel skills. Therefore, the leaders of the first responder organisation were aware that during large scale emergencies they had to deal with the additional burden of managing low competency staff, a condition that can contribute to operational brittleness. The situation highlighted a source of brittleness that is

external to the concerned organisation and that, therefore, requires a system-level intervention to be addressed (DARWIN, 2016).

This example shows how a potential source of resilience becomes a source of brittleness. This because, in case of insufficient buffer capacity of the healthcare organisation, additional resources were provided, but not systematically monitored and assessed.

Air Traffic Management – Illustration



Several ATM illustrative cases and lessons learned are available on [17]. The website presents the most [18] and related accidents and serious incidents. For each incident/accident, a description, analysis of the event and main findings of the investigation are reported. The more the Safety Culture is spread in ATM organisation, the more illustrative cases and lessons learned are available.

IMPLEMENTATION CONSIDERATIONS

Challenges

- Noticing brittleness requires that actors are familiarised with the principles of resilience. It is nonetheless a perspective and skill that can be learned (see Practice 1).
- Enhancing resilience also requires understanding why things go right. Noticing brittleness is a useful way to anticipate, react to, and learn from challenging situations, but should not be the sole focus of a resilience assessment.
- Because noticing brittleness focuses on how the system behaves under challenging situations, it is also different from understanding the threats or vulnerabilities of the system.

Implementation cost

Some of the methods described can be carried out in short amounts of time, e.g., through workshops or focus groups (e.g., Practice 1, Method 2). However, they require:

- to be carried out by appropriately trained and knowledgeable people who can act as facilitators;
- to involve a sufficient diversity of participants to yield the most information and best results.

Cognitive Task Analysis (see Method 1) is a well documented and practiced method coming from the field of human factors. However, it is a resource- and

knowledge-demanding method, best carried out by experts in the field.

Noticing brittleness requires that actors are familiarised with the principles of resilience. Resources need to be anticipated in order to develop the associated perspective and skills (see Practice 1).

Healthcare – Implementation considerations



Associated challenges

Healthcare is a complex adaptive system in which the non-linearity, the unpredictability and tensions are inherent. Within this complexity, people are at the same time source of brittleness and of flexibility and resilience for the system (Nemeth et al., 2008). *Brittleness* is a theoretical concept that is not necessarily part of the vocabulary of healthcare personnel, neither at managerial nor at operative level. Healthcare personnel need to familiarise with this concept and the principles of resilience. This process will support the personnel to move beyond the blame and shame cultures that have hampered the open flow of information and learning about vulnerabilities in healthcare (Nemeth et al., 2008).

Some other factors – internal to the healthcare domain - could hinder the application of the *noticing brittleness* principles within the contexts, among them (Vincent, 2006):

- Hierarchical structure of the healthcare system. Hierarchies within professions tend to be rigid and relationships between professions and specialties complicated by issues of power and status;
- Organisational culture and professional groups cultures;
- National culture may be also influential (for example different approach to seniority, hierarchy, etc.);
- Inability of the healthcare system to efficaciously communicate with the generic public in order to reduce sources of brittleness (for instance, an epidemic spreading due to a lack of vaccination).

Furthermore, the implementation of brittleness exercise requires an organisational context - and also the management support - that gives value to a proactive approach to crisis response (for instance by reporting errors and failures). Brittleness assessment requires an organisational context where personnel can express critical aspects (DARWIN, 2016).

Minimum viable solution

The triggering questions proposed are relevant to be considered during a workshop before and after the crisis, both to increase the awareness of potential sources of brittleness in a preparedness perspective, and to explore the after crisis-phase. In case of crises that develop over longer time, the triggering questions can be also used in operative meetings in order to reflect on the effectiveness of the mitigation measures applied.

Air Traffic Management – Implementation considerations



The concept of "Brittleness" in ATM is strictly linked to the concept of **Just Culture** and **Safety Culture** which represent internal factors that could help in facilitating the identification of brittleness in each organisation. Notwithstanding the concept of "Just culture" [19] *"has become better understood and accepted by people employed in the aviation industry, the need for a "just culture" is generally not understood by many legislators and therefore not accepted within their State judicial systems. This issue causes increased fear of sanctions against the reporter, particularly if partly or fully responsible for the reported occurrence. Furthermore, certain elements of the media may deal aggressively with apparent breaches of flight safety within certain airlines and ANSPs. These factors - punishing Air Traffic Controllers or pilots with fines or license suspension and a biased focus by some media on aviation safety issues – may have the cumulative effect of reducing the level of incident reporting and the sharing of safety information. This hinders safety improvement and as a cascading effect resilience. Concerns about possible misuse of information regarding "Brittleness": One of the major problems with systematically collecting and analysing information is that such information can be a very powerful tool and, like any powerful tool, if used properly it will provide great benefit. However, it can also be used improperly and if that occurs considerable harm can be caused*

RELEVANT MATERIAL

RELEVANT PRACTICES, METHODS AND TOOLS

Practices

1. **Brittleness assessment practices in industrial maintenance.** Lay and Branlat (2014) describe

how the necessary participants' skills can be built through the use of study groups that aim at observing and discussion resilience and brittleness at play. A table in the document summarises examples of observations of brittleness at play. A workshop can be conducted prior to anticipated peak season (increased demands and risk of events) during which a facilitator helps participants notice brittleness. The document describes a set of guiding questions.

2. **"All hands" alarm in firefighting operations.** The 'all hands' signal is used by an Incident Commander and by the dispatcher to quickly request additional resources when all companies on site are busy. It is a recognition that the situation is precarious (brittle) because operations are vulnerable to any additional demands that may occur. See illustration in this card and Woods and Branlat (2011).

Methods

All of the methods below are relevant to both Noticing brittleness and [Identifying sources of resilience](#); these topics simply represent different focus of attention during the discussions. The corresponding cards can be used conjointly during the implementation of the methods.

1. **Cognitive Task Analysis (CTA)** - TRL 9 - CTAs are typically based on different techniques that capture aspects of the situations under consideration. Analyses can occur after situations were experienced. CTAs can be conducted during training situations, which provide rich and more controlled situations during which crisis-relevant data can be captured more easily. See Crandall, Klein, and Hoffman (2006).
2. **Resilience Engineering assessment guidance** - TRL 6 - The method was developed as a complement to a traditional safety assessment, in the context of technological changes in the Air Traffic Management domain. It focuses on understanding the variability the system (people and technology) needs to handle in everyday operations, how it currently adapts and handles the more challenging situations, and, finally, to anticipate how adaptation might be hindered or improved after the implementation of the new technological system. The method relies on short workshops/interviews led by a resilience assessment expert and involving relevant stakeholders such as operators (direct users of

the system or operators they interact with), managers and designers of the technology.

3. **Q4 Framework** - TRL 2 - Visualisation to assess how the organisation is prioritising and investing in safety, how it has reacted to adverse events. Assessment could also include measuring brittleness and evaluation of cost-effectiveness of countermeasures. See Woods, Herrera, Branlat and Woltjer (2013).

Healthcare – Practices, methods and tools



Practices

- **Periodic assessment** of potential sources of brittleness: an example is provided by the monitoring activities periodically performed by the Italian Regions to evaluate their capability to answer the population health needs. This **assessment system is based on indicators established at national level.**
- **Anticipation of specific critical events:** In Italy, the Ministry of Health performs a **situation analysis** before seasonal epidemic peaks and provides recommendations to all levels of the national health system to set up a response strategy. These recommendations include information on case definitions, analysis of data collected during the previous year, notifications, actions, institutional PoCs, reference laboratories.
- **Relevant changes to the system:** in Italy, every time a new technology is introduced, a **Health Technology Assessment (HTA)** is performed and a national inquiry is provided for data analysis on existing similar technologies, possible relevant issues, costs and benefits ratio. HTA refers to the systematic evaluation of properties, effects, and/or impacts of health technology (i.e. medicines, medical devices, vaccines, procedures and systems developed to solve a health problem and improve quality of life). The assessment is conducted by interdisciplinary groups using explicit analytical frameworks, drawing on clinical, epidemiological, health economic and other information and methodologies. HTA is used to inform policy and decision-making in healthcare. More information about HTA available at: [\[20\]](#)
- **Pre-drill brittleness assessment.** The brittleness assessments can increase ecological validity of drills if included in their planning phase. The brittleness assessment is an opportunity to really understand the capacities and challenges of

responders during a particular scenario. A deep understanding of these factors could provide greater insights about real difficulties and challenges that can arise during an emergency (DARWIN, 2016).

Methods

- **Business Process Modeling (BPM)** allows to represent processes of an organisation, so that they may be analysed and improved, in order to increase quality and reduce criticalities, also in terms of costs. Often, it supports change management programs (Scheuerlein et al., 2012).
- **Cognitive Work Analysis (CWA)** and its modified form, Team CWA. Typically the CWA was used in healthcare as an approach to understand how people work in complex environments involving technology. It supports people making better and quicker decisions (Vicente, 1999).
- **Hazard Vulnerability Assessment (HVA)** consists in: a) recognizing hazards that may affect demand for the health care system and infrastructures; b) identifying assets and resources of the system; c) assigning quantifiable value/rank order and importance to those resources; d) identifying the vulnerabilities or potential threats to each resource; e) mitigating or eliminating the most serious vulnerabilities for the most valuable resources to improve the preparedness (Arboleda et al., 2009; Du et al., 2015).

Air Traffic Management – Practices, methods and tools



EUROCONTROL has initiated **Skybrary** ([21]) which is an electronic repository of safety knowledge related to flight operations, air traffic management (ATM) and aviation safety in general. It is also a portal, a common entry point, that enables users to access the safety data made available on the websites of various aviation organisations - regulators, service providers, industry.

With specific reference to **Brittleness** Skybrary provides a list of generic system thinking methods that can be used in ATM relevant for Brittleness. In the section called "Toolkit:Systems Thinking for Safety" it includes systems methods, observation, discussion, data and document review and survey methods, for more information: (see [Toolkit:Systems Thinking for Safety - Principles in action](#))

- **Threat and Error Management (TEM)** is an overarching safety concept regarding aviation

operations and human performance. It has been developed as a product of collective aviation industry experience. (<http://www.skybrary.aero/index.php/TEM>)

- **Normal Operations Safety Survey (NOSS)** is based on the TEM framework. It provides the organisation with a picture of the most pertinent threats and errors in a specific operation, how they are managed and how effectively any resulting undesired states are managed during normal ATC operations.

An enhancement of NOSS considering brittleness and questions proposed within DRMG could be possible. More information about NOSS available at: [22]

NATS promotes several activities (i.e. Events, Seminars, workshops, training, etc) in order to improve the management of Emergency situations. Some of them are:

- **TRUCE** (Training for Unusual Circumstances and Emergencies) which is a course for pilots that includes discussion and practical simulations to cover various scenarios that could happen in the air or on the ground – anything from severe weather to aircraft or passenger-related issues [ref. <http://nats.aero/blog/2016/01/working-with-atcos-to-safely-handle-emergencies-a-pilots-perspective/>]
- **STAC** (Scenario Training for Aircrew and Controllers) which is a forum for pilots and controllers offering the possibility to jointly explore the risks and hazards inherent in emergency situations, and to promote mutual awareness of the protocols and options to be observed or considered. The workshops use actual emergency scenarios to help promote increased awareness by all participants of the separate and often competing demands on attention and responses in unusual and emergency situations. They are facilitated by NATS TRM Specialists and airline CRM instructors and follow structured discussions relating to:
 - Communication issues within the flight-deck and externally with ATC agencies
 - Sharing situation awareness in an emergency scenario within and between the two groups
 - Issues of overload and decision making for both parties
 - Handover issues between controllers, and sharing the situation within and between the aircraft crews
 - The use of SOPs, including emergency quick reference checklists by both groups

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NAVIGATE IN THE DRMG

- **Parent theme:** Assessing resilience
- **Resilience abilities**
 - Contributes to: Learn and Evolve
 - Supported by: Monitor
- **Categories:** Evaluation, Situation understanding, Learning lessons, Planning, Training
- **Functions of crisis management:** BEFORE, Preparation, Build knowledge of crisis situations, Anticipate demands in crisis response, DURING, Damage control and containment, Assess emergency and response, AFTER, Learning, Assess performance

CHAPTER 6

Developing and revising procedures and checklists

ASSOCIATED CARDS

6.1. Systematic management of policies

Policies are a form of statements of intent and are often used to guide decision making throughout all levels of operation within in both public and private organisations. Policies are not static documents, but evolve with the organisation and must thus be managed. The purpose of **Systematic management of policies** is to support structured development and management of policies for dealing with emergencies and disruptions characterized by occurrence of emerging risks and threats. The aim is to achieve adaptive and holistic policy management involving policy makers and operational personnel, both within public and private organisations. Note, that when this capability card is used by operational personnel, it rather refers to systematic management of plans, procedures or checklists.



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IMPLEMENTATION

INTRODUCTION

To achieve a systematic management of policies, several activities and perspectives need to be considered regarding: *the policy management process*, *the policy assessment*, and *the policy training and implementation support*. The policy management process needs to consider how to involve several stakeholders (e.g. operational personnel) to ensure a viable applicability of the policies. The assessment of policy needs to consider how the policies actually work in an operational context and in the context of other policies. Policy training and implementation support needs to consider how policies can be implemented in the organization, in an appropriate and supportive manner for the operational personnel, to manage the change of work practices.

BEFORE A CRISIS

Proactive systematic policy management can be achieved by organizing working groups, policy-specific or general discussion workshops, regular policy review meetings, policy-testing exercises, and other policy revision activities, within and between different roles and organizations. The analysis of the policy

management process and specific policies can be done with for example a structured walkthrough of the policy, or having a more loosely organized brainstorming session.

Letting stakeholders meet and discuss the policies that they are jointly using and how policies are managed is key to holistic assessment of policies. Both formal and more loosely-structured assessments can benefit from imagining future use of a policy by going through hypothetical scenarios, or by recalling situations from actual operations or exercises. Understanding the working methods and point of view of other organizations are important in [Supporting coordination and synchronisation of distributed operations](#). This can be increased by cross-organizational assessments and reviews of policies. Between similar organizations a peer review process for policies can also help to homogenize and increase the quality of policies.

In the planning of policy revision activities should also consider aspects regarding training and implementation of policies in the operational setting.

Below are suggested themes to be included in these activities, through the use of the corresponding triggering questions.

TRIGGERING QUESTIONS

Policy Management Process

- Reflect on the policy management process

- How are emergent risks and threats identified and described?
- How are identified risks and threat used in the policy management process?
- How well is the cross-domain, cross-organizational or cross-border perspective included?
- Involve operational personnel in the policy management process
 - Are operational personnel included and invited to participate and provide expertise and experience in the processes involved in policy making?
 - Are bottom-up organizational processes provided to encourage dialogue between policy-makers and operational personnel?
 - How do these processes support establishment of common ground, understanding and trust between policy-makers and operational personnel?
- Design policies for flexible use
 - Can policies be designed so that their parts (items, sections, etc.) can be used flexibly and as inputs to decision making in specific situations, rather than sequentially procedures to strictly follow?
- Have operational personnel developed alternative ways of working, compensating strategies, or work-arounds during their actual use of policy? Why?
- Has this actual use of policy in terms of difficulties of application, alternative ways of working, compensating strategies, or work-arounds been analysed with the purpose to understand them (instead of counting and condemning “violations”)?
- Have gaps between policies and reality been analysed and identified?
- Assess policies as part of the whole context, rather than individual policies
 - Has a joint validation of purpose and underlying intent of policies been performed?
 - Have sets of policies been evaluated together in order to assess their joint applicability, complexity, overlaps, bureaucratization, and conflicts?
 - Have different roles’ and organizations’ perspectives and views on the same policies been included in assessments?
 - Have the amount of policies and expectations on policy-driven actions versus actions that cannot or should not be covered by policies been addressed and put into context?
 - Has the need for support for interpretation of policies, pre-authorizing exceptions, and handling exceptions been identified and addressed?
 - Can policies that have low fitness-for-purpose be redesigned or removed?

Policy Assessment

- Identify and evaluate existing policies
 - How many and which policies are operational personnel expected to work by?
 - Have conflicts between these policies been analysed (between different roles and organizations)?
 - Have conflicts between policies of operational personnel of different organizations following different policies been analysed?
 - Are there situations where operational personnel would need support but policies do not apply?
 - Is operational personnel supported sufficiently by the existing policies?
- Identify weaknesses in application of existing policies
 - Are policies easy to understand in various situations?
 - Are policies too constraining to deal with actual situations or too general to give concrete guidance?

Policy Training and Implementation Support

- Impose strategies or mechanisms for communication, training, and support
 - Is a communication strategy in place on how information on new, modified, redesigned, or discontinued policies will be communicated to relevant actors (both policy-makers and operational personnel)?
 - Is a training strategy developed on when and how operational personnel will be trained on policies?
 - Are supporting mechanisms put in place to provide support to operational

- personnel when applying policies during response operations?
- Consider implementation aspects of new or revised policies in the planning of policy revision activities
 - Are preparations and processes established for how to provide guidance to operational personnel on when to apply policies and when policies are known not to be applicable in some situations?
 - Are preparations and processes established for making policy-makers available during response operations?
 - Are preparations and processes established for resolving policy conflicts during response operations?
 - Are processes in place for tracing policy changes over time and following-up the effect of these changes?

- Is guidance provided to operational personnel on when to apply policies and when policies are known not to be applicable?

Policy Training and Implementation Support

- Is guidance provided to resolve policy conflicts during response operations?
- Are policy-makers available during response operations?

Healthcare – During

Checklists and routines derived from policy that are well implemented can be applied during an incident. Strategic "back office" management can evaluate if current practices and protocols are suitable for the current operation. National agencies should be involved in parallel to the incident management if conflicting policies are revealed in the crisis.

Healthcare – Before

Education, training, and exercise on the operationalization of guidelines is needed. Workshops can be employed to review incident reports.

DURING A CRISIS

During crises, consider which roles could need support in applying policies or resolving situations where policy use is problematic. Allocate specific roles in your organization that have the responsibility for addressing these policy issues during crises. Below are suggested themes and triggering questions to be included in these activities.

TRIGGERING QUESTIONS

Policy Management Process

- How is the information regarding application of policies documented to facilitate organizational learning?

Policy Assessment

- Do operational personnel know how to act or who to contact when conflicts between policies occur, a policy is not fit for purpose, or when policies are missing?

AFTER A CRISIS

Actual crises often provide ample opportunity to learn how and why policies did or did not have the desired effects in actually supporting the crisis management operation. During after-action reviews, debriefing sessions, and analysis work for lessons learned, allocate explicit attention to the use of policies and potential opportunities for improvement. These can be complemented with specific follow-up interviews, workshops, and analyses of communication logs or operational documentation and other recorded data when it is necessary to inform the lessons learned process regarding the use of policies. Consider the perspectives of multiple organizations and roles, as opinions and experiences on the same policy can differ widely. Include the following themes and triggering questions in these activities.

TRIGGERING QUESTIONS

Policy Management Process

- Has feedback been collected on applied policies from different organizations, domains, and levels in order to have a holistic perspective?
- Has the use of the sets of policies in the context of work and the situation been analysed, and has the fitness of policies for the event been assessed?
- Did operational personnel employ alternative ways of working, compensating strategies, or

work-arounds during their actual use of policy? Why?

- Has this actual use of policy been analysed with the purpose to understand them (instead of counting and condemning “violations”)?
- Could the changes in operational environment leading up to and during the event have led to outdated of policies?
- What lessons can be learned from the actual use of policies?
- What lessons can be learned about the flexibility of use of policies?

Policy Assessment

- Could additional policies (as part of suggesting lessons to be learned) risk negative effects, by increased documentation and bureaucratization of work, increased workload, diminished creativity and innovation, or decreased ability to meet unexpected events?
- How are lessons learned fed back into the policy design process?
- How are lessons learned fed back into redesign of more flexible policies?
- Are recommendations for policy redesign followed-up in a systematic way?

Policy Training and Implementation Support

- Have the operational personnel applied current policies in an advisable manner that could be included in training or policy revision?
- Have the operational personnel had sufficient training and support to be able to apply current policies?
- Have policy conflicts or other policy related problems been identified and how were they resolved?

UNDERSTANDING THE CONTEXT

DETAILED OBJECTIVES

Response operations to emergencies and disruptions build upon different types of policies, including for example plans, procedures, or checklists. There is a wide span of challenges related to policy management for response operations where emerging risks and threats may occur. These kind of response operations are characterized by multiple policies necessary and being applied. Such policies may be developed and modified separately by various actors in independent processes at different levels. A risk during such development is that feedback or involvement from

operational personnel are overseen or that the development is guided by incorrect priorities.

Policies may be modified too often or with insufficient frequency. Policies may also be too specific, too constraining or too general with respect to the operational environment and its emerging risk and threats. In turn there is a risk for both too many and too few policies. There is also a risk for incoherent or conflicting policies or policies (within or between organizational units) that are difficult for operational personnel to apply. Moreover, operational personnel may not have enough time to notice changes in policies or understand the modified content of the policies.

This may result in policies that to varying extent are not fit-for-purpose, meaning the goals that a policy aims to achieve are not actually supported by the policy. Operational personnel may need to improvise and in the long term develop alternative ways of working (compensating strategies) to get their tasks done, despite policies that aim to support their work. How to create and maintain a legitimate space of manoeuvre relative to policies in situations where they are not fit-for-purpose are covered in [Adaptation relative to procedures](#). A suitable implementation of flexible use of policies can be a source of Resilience (see [Identifying sources of resilience](#)) and similar an overly rigid use of policies can be a source of brittleness (see [Noticing brittleness](#)).

The purpose of this capability card is to encourage systematic work with management of policies and using relevant means to facilitate dialogue among operational personnel and policy-makers, as well as among policy-maker groups. Systematic work refers to work that is performed methodologically according to decided procedures, for example in a step-by-step manner that, in principle independently of context, always include the same procedures at each step.

In order to achieve adaptive and holistic policy management for emerging risks and threats such dialogue needs to take place across domains, organizations, and geographical borders. Such dialogues are thus dependent on [Establishing networks](#), [Establishing common ground](#) and [Understanding roles and responsibilities](#).

This policy management includes simplifying, modifying, or redesigning policies to learn from ways of working and compensating strategies that operational personnel use to handle emerging risks and threats and get the job done. Since novel or complex crises can challenge policies such compensating strategies need to be expected and seen as feedback to the policy management (see [Adaptation relative to](#)

[procedures](#)) The overall goal of such policy management is a set of policies with high fitness-for-purpose. A set of high fitness policies refers to an appropriate number of (preferable joint) policies with an appropriate level of detail that are adapted on need-basis with an appropriate frequency. On need-basis corresponds to a combined approach of a bottom-up (operational needs, experience and observed unanticipated emergent risks and threats, etc.) and a top-down (anticipated emergent risks and threats, regulatory and management needs, etc.) perspective.

TARGETED ACTORS

The actors that are concerned by this capability card are public and private entities with tasks and roles related to dealing with emergencies and disruptions. This capability card relates to the following stakeholders: operational personnel and policy-makers. Operational personnel are those who select, use, apply or follow regulations, procedures and policies during dynamic situations (emergencies and disruptions). Examples of operational personnel are emergency managers, medical coordinators, on-duty engineers, and traffic controllers. Policy-makers are those who design, review, validate and sign off regulations, procedures, and policies (here in sum called "policy"). Examples of policy-makers are subject-matter experts, policy officers, and preparedness managers.

The scope of this capability card is response operations to all types of emergencies and disruptions.

The applicability of this capability card is to all administrative and management levels, all types of actors and to cross-border, cross-organizational, and cross-domain settings.

Air Traffic Management – Actors



Air Traffic Management (ATM) work is governed by the rules of the aviation field. In Europe the main policy makers of the aviation system are:

- **the European Commission**
- **the European Aviation Safety Agency (EASA)**
- **National Aviation Authorities**

The aviation regulations and policies are directly applicable in all **EU Member States** and cover all key areas of aviation including airworthiness, aircrew, aerodromes, air operations and provision of air navigation services.

Moreover:

- **International Civil Aviation Organization (ICAO)** is a "UN Specialized Agency acting as the global forum for civil aviation. ICAO works to achieve its vision of safe, secure and sustainable development of civil aviation through cooperation amongst its member States. The legal basis for ICAO is the Chicago Convention of 1944. ICAO works with the Convention's 191 Member States, International Organizations as well as other global aviation organizations to develop international Standards and Recommended Practices (SARPs) which States reference when developing their legally-enforceable national civil aviation Regulations" [1]
- **EUROCONTROL** among its activities "supports the European Commission, EASA and National Supervisory Authorities in their regulatory activities." [2]

Concerning **Industry standards in Europe**, **EUROCAE** is an organization whose mission is to develop worldwide recognised industry standards for aviation. [3]

EXPECTED BENEFITS

Relevant and applicable policies for dealing with emergencies and disturbances characterized by occurrence of emerging risks and threats.

Systematic management of policies contributes to a higher degree of predictability of which actors may be involved and when, as well as what they may do and how. In turn it also contributes indirectly to an increased mutual understanding and calibrated mutual expectations among the actors.

RELATION TO ADAPTIVE CAPACITY

Policy management is more adaptive and holistic with the application of this capability card. The need for development of new, modification of existing or discontinuing of irrelevant policies is identified systematically, based (if applicable) on cross-domain, cross-organizational, or cross-border perspectives.

RELATION TO RISK MANAGEMENT

Traditionally risk management generates new policies when new risks are discovered, which may result in fragmentation of the policy management process. Systematic management of policies involving policy-makers and operational personnel enables a holistic

perspective on the overall impact and support of policies on operational work.

ILLUSTRATION

Healthcare implementation – Illustration



There is a need of continuous revision of crisis management protocols. New risks and emerging threats can be identified on operative levels at one section of the organization, compiled by policymakers, and then operationalized globally in the organization. For example:

- Recent antagonistic attacks in Europe has involved hijacked trucks and resulting injuries on pedestrians. The scenario involves uncertainties of scene security and many casualties dispersed over a sometimes big area.

This example illustrate an emerging challenge to health care organizations. Healthcare organizations has shared operative data on response and challenges for national policymakers to review. Policymakers must review available documentation and evaluate if current response plans need revision or amendments and subsequent swift operationalization.

Air Traffic Management – Illustration



Existence of a high number of available policies make it difficult to completely and consecutively apply these in critical situations / under time pressure. For example:

- Qantas flight 32 (QF32), an Airbus A380 that suffered an uncontained engine failure on 4 November 2010 and made an emergency landing at Singapore Changi Airport.
- US Airways flight 1549 (AWE1549), an Airbus A320 that on January 15, 2009 from New York's LaGuardia Airport was forced to make an emergency water landing in the Hudson River.

Both of these accidents that were successfully handled by flight crew show the need for operators' judgment and prioritization between a high number of applicable (and in the QF32 case automation-suggested) procedures [policies] that in a time-pressured situation are difficult to completely and consecutively apply.

IMPLEMENTATION CONSIDERATIONS

Challenges

An associated challenge or pre-condition for achieving the objectives and ambitions of this capability card is the presence of an attitude, "culture" or "tradition" for working and interacting across organizational management and administrative levels, in cross-domain, cross-organizational, or cross-border settings.

An additional challenge may be legal constraints limiting the development of joint policies.

Air Traffic Management – Implementation considerations



The European aviation safety system is based on a comprehensive set of common safety rules, which are overseen by the **European Commission**, the **European Aviation Safety Agency (EASA)** and the **National Aviation Authorities**. These rules are directly applicable in all **EU Member States** and cover all key areas of aviation including airworthiness, aircrew, aerodromes, air operations, and provision of air navigation services.

On the **European Commission** website there is a page dedicated to **Aviation Safety Policy in Europe**[\[4\]](#). According to the **2015 EU Aviation Strategy: steering force for the next decade** : *"The functioning of the European aviation safety system was subjected to a review as part of the 2015 EU Aviation Strategy [\[5\]](#). This strategy recognises the crucial role that aviation plays in promoting economic growth, job creation, trade and mobility in the EU, and underlines the importance of high safety standards for competitiveness of that sector within the EU economy."* *"The 2015 Aviation Strategy includes a Commission Proposal for a new Framework [\[6\]](#) for Aviation Safety Regulation , which aims to prepare the EU aviation safety system for the challenges of the future, including a new era of innovation and digital technologies. It consists of a shift towards a risk and performance-based approach, measures to increase efficiency of the system and promotion of cooperative safety management between the EU and its Member States."*

"In 2015, the Commission also presented a revised European Aviation Safety Programme [\[7\]](#), which describes how aviation safety is managed in the EU."

RELEVANT MATERIAL

RELEVANT PRACTICES, METHODS AND TOOLS

Methods

Exercises to assess and validate. Exercises are important for testing and gather suggestions for improving policies. These exercises can be either of lower fidelity, such as tabletop exercise (TTX), or with higher fidelity, such as command post exercises (CPX). Exercises can be a useful method to assess and validate policies.

Gathering feedback. Observational methods, combined with focus groups and other workshop and discussion methods can be used to discover strategies and work-arounds that may indicate problems with policies that need to be managed.

Peer review. By implementing a process where similar organizations peer review each others' policies the organizations can better learn from each other.

The use of frameworks. A descriptive "strategies framework" (e.g. Rankin et al., 2014a) may be used to uncover the strategies used by operational personnel in a more systematic way, when and how they are applied, and how they relate to policies and policy-makers' objectives. The categories in the framework target three main areas: (a) a contextual analysis, (b) enablers for successful implementation of the strategy, and (c) reverberations of the strategy on the overall system. A learning loop (Rankin et al., 2014b) may be used to learn from adaptive performance.

Air Traffic Management – Practices, methods and tools



Nowadays, the exchange of information is facilitated thanks to the development of the internet. Some examples are provided hereafter:

- On both the **European Commission** [8] and the **European Aviation Safety Agency (EASA)**[9] websites "it is possible to "follow the life cycle of a legislative proposal from the moment it is launched until the final law is adopted. A timeline gives a visual representation of the procedure. All interventions by the institutions & bodies involved in the decision-making process are represented. From the timeline, you can access detailed information about each institution's decisions &

how they were taken; the services & departments involved; the legal basis of the act, etc." [...] "The Commission evaluates every Regulation and carries out an in-depth technical evaluation study involving key stakeholders and Member States' authorities. The intention is to gather information via Open Public consultation which will complement the overall evaluation study. [...] All interested stakeholders are welcome to participate in consultations."

- On the **EASA** website there is a useful **Frequently Asked Questions** section which helps to clarify the current regulations. It is constantly updated with new questions coming from users and stakeholders. [ref. <https://www.easa.europa.eu/the-agency/faqs>]

Also, in the page **EASA & you** [10] all the links to the main topics are provided.

- In the **BLUE MED** context, the BLUE MED ANSP Committee organizes the periodic **BLUE MED FAB Social Forum**. "It is the place where International Unions and Professional Staff Associations can get an overview of all the BLUE MED FAB activities and an update on the progresses made in the BLUE MED Implementation Programme." "The BLUE MED FAB values the contribution of International Unions and Professional Staff Associations towards an efficient and fully harmonized Functional Airspace Block, and is willing to always address in a transparent manner any remark or request for information they may arise regarding the FAB." [11]
- In the **FABEC** context, Social Dialogue in FABEC is structured in 3 layers [12]:
 - The first and most formal layer is the **Social Dialogue Committee**, "a meeting comprised of the FABEC ANSP CEOs and the staff representatives from the various unions in each ANSP. The first layer gives the framework and is, ultimately, the decision-making body."
 - The second layer is more **informal**. "It takes the form of meetings (or workshops) around a specific theme. The request for second layer workshops may come from either the ANSPs or the staff representatives. The meetings comprise experts from both sides and are conducted in a manner to ensure cooperative discussion and mutual understanding of the various positions."
 - The third layer takes the form of **bilateral meetings** between "the social

dialogue manager and specific staff representatives on specific FABEC topics.”

“Additionally, there are **yearly meetings** between the FABEC States, the ANSPs and the staff representatives. These discuss FABEC matters that are transversal or pertain specifically to the States.”

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NAVIGATE IN THE DRMG

- **Parent theme:** Developing and revising procedures and checklists
- **Resilience abilities**
 - Contributes to: Learn and Evolve
 - Supported by: Anticipate, Monitor, Respond and Adapt
- **Categories:** Collaboration, Planning, Procedures, Governance
- **Functions of crisis management:** BEFORE, Preparation, Plan for crisis, DURING, Command and control, Execute and revise plan, AFTER, Learning, Revise crisis management processes, Assess performance

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CHAPTER 7

Involving the public in Resilience Management

ASSOCIATED CARDS

7.1. Communication strategies for interacting with the public

The response of the general public that is potentially affected by a *crisis*, or could be helpful in resolving a crisis, has an impact on the outcome of the crisis response work. Therefore, *organizations* need to develop and implement communication strategies for **Interacting with the public** that can help facilitate beneficial responses to crises and crisis response efforts. Communication and interaction with the public during a crisis will be facilitated if daily communication strategies and regular interaction with the public is already well established. The recommendations presented here are aimed at both public and private entities at all levels that are involved in crisis management, in particular crisis managers and roles within the organizations related to design, development and evaluation of communication plans and strategies. Even though not all personnel involved during a crisis or incident needs to communicate directly with the public, being aware of communication strategies aimed at the public and the need of communication *competencies* can be of use.

7.2. Increasing the public's involvement in resilience management

To integrate the organization in a network of relevant actors and agencies (community members and local business that typically don't conduct crisis management). The integration is aimed at enhancing the organization's ability to respond to the needs of both the organization as well as the local community in times of change and emergency.



7.1. Communication strategies for interacting with the public

The response of the general public that is **potentially** affected by a *crisis*, or could be helpful in resolving a crisis, has an impact on the outcome of the crisis response work. Therefore, *organizations* need to develop and implement communication strategies for **Interacting with the public** that can help facilitate beneficial responses to crises and crisis response efforts. Communication and interaction with the public during a crisis will be facilitated if daily communication strategies and regular interaction with the public is already well established. The recommendations presented here are aimed at both public and private entities at all levels that are involved in crisis management, in particular crisis managers and roles within the organizations related to design, development and evaluation of communication plans and strategies. Even though not all personnel involved during a crisis or incident needs to communicate directly with the public, being aware of communication strategies aimed at the public and the need of communication *competencies* can be of use.

IMPLEMENTATION

INTRODUCTION

There are several considerations to explore and investigate in order to achieve the full potential of effective communication with the public that are applicable to all phases of crisis management and everyday operations. These considerations have been formulated in terms of *triggering questions* that can be used within the organization, in the context of workshops, focus groups involving communication strategists and other domains experts, to check the effectiveness of the communication strategy that the organization is adopting. The triggering questions are different depending whether we are Before, During or After a crisis or emergency situation.

Healthcare implementation – Introduction

Building public engagement and trust in healthcare authorities requires long-term actions. Crises in healthcare in the last decade (e.g. disease outbreaks)

showed that the public's noncompliance with the government measures taken to contain the crisis (e.g. vaccination campaigns), the lack of trust between the public and national authorities on one hand, and between the public and international organizations on the other hand, are the consequence of a deficit of theoretical and applied knowledge in the area of risk communication and public inclusion through social media (TELL ME, 2014a).

In order to implement effective risk communication and to overcome these deficits in case of pandemics, some relevant questions have to be taken into account by institutions in charge of managing the crisis, across the different phases:

- How can the general population be persuaded through public health communication to take effective preventive actions?
- What are the most appropriate communication methods to deal with the complexity, uncertainty, misinformation, and fake information?
- What are the best communication strategies to maximize compliance with vaccination, and to assist health professionals and agencies to cope with vaccine-resistant groups? (TELL ME, 2014a)

In the case of a pandemic, the stages to implement the communication strategy are identified in the four pandemic phases (Inter-pandemic, alert, pandemic, transition) that correspond with the new approach to the WHO Influenza Threat Index (TELL ME, 2014c).

BEFORE A CRISIS

The *triggering questions* **BEFORE** are meant to stimulate organizations to assess their communication strategies in order to increase their preparedness and capability to respond in the face of a crisis or emergency situation. When planning for crisis response, it should be taken into account that the public can be helpful both in the prevention phase and during the actual occurrence of the crisis. Therefore, it is important to give proper value to this opportunity through adequate messages. To be able to benefit from resources and assistance provided by the public there is a need for proper organization, planning, education, and training.

TRIGGERING QUESTIONS

Adequacy of the Plan

- Do we have a communication strategy or crisis communication plan that gives guidance on who and how to communicate?
- Are relevant roles aware of their responsibilities with regard to communication?
- Is our communication plan sufficiently coordinated with other relevant authorities/organizations?
- Do we have mechanisms to prevent misalignment or conflicts regarding communication among both different organizations and/or different parties of the same organization (e.g. through an appointed common spokesperson)?

Capability to guide effective crisis response by the public

- Does the communication plan include adequate information on how to guide crisis response by the public?
- Are we making sure the information shared with the public does not cause unnecessary alarm or distress?
- Does the communication plan include information to the public on how to avoid using resources that may be needed by others during a crisis?
- Do we provide information on crisis management also during normal/ordinary situations?

- Have we prepared standard public messages or information blocks for use during crises?
- How do we communicate the individual responsibility to increase public preparedness, avoiding an overreliance on authorities?

Communication Channels

- Through what kind of channels are we able to communicate?
- Do we use communication channels that people already use every day?
- Are the communication channels sufficiently up-to-date?
- Does the selection of our communication channels take into account the needs or routines of the public in target?
- Is there a risk of our communication channels being overloaded?

Adequacy of Competencies

- Are we proficient at using the available communication channels?
- Are relevant roles trained, educated, and exercised using this strategy/plan?
- Are we using the appropriate terminology for communication with the public (consider, for instance, different demographics)?
- Do we have access to the appropriate competences (subject matter experts, domain experts etc.) while developing communication strategies/plans?
- Does the communication officer/s have the appropriate (technical) domain knowledge in order to understand, and respond to, information requests from the public (and thus have the ability to work independently)?

Clarity and Accessibility

- Are people aware of where they can access the information?
- Have we considered in which languages the information needs to be communicated?
- What processes or routines do we have to fact-check/quality-assure before we communicate it?
- Do we clearly communicate responsibilities of individuals, as well as of the agencies involved in crisis management?

Acceptability and Trustworthiness

- Does our communication strategy adequately encourage trust and acceptance by the public?
- Is our information presented in a way or place that makes it trustworthy?

- Is our communication avoiding any expression of blame culture, which could be seen as unhelpful or counterproductive scapegoating?
- Are we adequately communicating the benefits of being prepared in case of crisis and not just prescribing how to be prepared?

Prevention of Misinformation

- Do we have procedures to monitor and react to misinformation spread by non-official communication channels?
- Do we have a strategy to counter misinformation and rumours?
- Do we have adequate technical information security in order to prevent misuse or manipulation of our social media/web channels (i.e. prevent hacking and spoofing in order to distort or change official information)?

Ability to listen and collect feedback

- Are we able to engage with the public in order to understand and recognize the diversity of local communities, the local needs, and the available or lacking resources? How?
- Are we able to integrate information from the public or other sources into our communication? How?
- How do we seek feedback from the public?
- What capability do we have to respond to information requests or other interactions with the public?
- How do we communicate the need for people to be self-reliant to a certain degree?

Capability to trigger public engagement

- Does our communication strategy/plan facilitate public participation? How?
- How do we ask for help/resources that corresponds to actual *needs*?
- Are we prepared to communicate in a timely manner (i.e. do we have prepared messages, websites or other forms of communication)?

Healthcare implementation – Before



The development of a communication plan and strategy is relevant to every phase of the crisis. The plan should comply with the specific objectives and the public in target during each phase (e.g. inter-pandemic, alert, pandemic, transition).

Setting-up strategic communication means getting a targeted, goal-driven message out at the opportune time through the appropriate channel.

When developing the communication plan, some actions are relevant in healthcare:

- **Including Healthcare Professionals (HCPs) in the planning stage.** This can be done by involving HCPs in workshops where they can express their concerns, or by means of an e-learning platform providing a two-way channel between HCPs and national and international health organizations. This action allows HCPs to be familiar with the plan and effectively apply it when dealing with patients. Because of their role as ‘trusted translator’ between health agencies and patients, their recommendations are the major influencers for patients’ decisions (Tell ME, 2014a, 2014b).
- **Public segmentation.** Priority groups need to be identified through profiles in order to enable mutual communication, in terms of understanding risk perceptions and responsiveness. Profiles should be identified by taking into account many variables (e.g. origin, gender, language, age, religion, culture, education, perception, etc.) (Tell ME, 2014a).
- **Identifying specific indicators to assess the communication plan.** Evaluating the strategy helps identify weaker areas which need to be addressed and strengthened.

See in addition Tools 1.1, 1.2, 2, 3, 4 and 5 in the Healthcare Practices, Methods and Tools section.

Air Traffic Management – Before



In the Air Traffic Management (ATM) context, a good level of **Safety Culture** and **Just Culture** is fundamental in order to guarantee, at all levels of the organization, the right sensibility to handle the information: "transparency and honesty always pay".

- **"Preventive communication"** is important to protect the organization against contradictory, incorrect or ambiguous messages. In this case it is important to "interpret the signals from *outside*" before an event happens.

DURING A CRISIS

The triggering questions **DURING** can be used to assess and adjust the communication strategies

employed by the crisis management team or communications strategist in order to continually tune communications to the most appropriate form and content during crisis management.

Issues such as management of acceptance and trust, collection and sharing of relevant and accurate information, as well as the prevention of misinformation, should be constantly monitored as the crisis develops.

TRIGGERING QUESTIONS

Adequacy of the Plan

- Do we need to coordinate our current communication with other authorities/organizations?
- Do we need an appointed common spokesperson to manage the communication towards the public and the media (to avoid misalignment or conflicts among both different organizations and/or different parties of the same organization)?

Capability to guide effective crisis response by the public

- Are we communicating the information required to avoid being affected by the consequences of a crisis?
- Is our communication informing the public on how to avoid using resources that may be needed by others or interfere with our response?

Communication Channels

- What communication channels are we using (i.e. websites, media, social media)?
- Are we using relevant communication channels that people already use every day?
- Are the communication channels sufficiently up-to-date?
- Is there a risk our communication channels are overloaded?

Adequacy of Competencies

- Are we proficient at using the available communication channels?
- Are we using the appropriate terminology for communication with the public (consider, for instance, different demographics)?
- Do we have access to the appropriate competencies (for instance, a communications officer on duty)?

Clarity and Accessibility

- Is the public in target able to understand the information (e.g. use of complex probabilistic models, language barriers etc.)?
- Is our information sufficiently accessible to the public?
- Is our communication adequate to meet the actual needs of the public/media?

Acceptability and Trustworthiness

- Are we communicating in a way to lessen the psychological impacts of people involved and to avoid them feeling a sense of isolation?
- Does the public perceive our communication as trustworthy?
- Do we need to disclose more information and be more transparent to increase acceptance and trust by the public?
- Are we communicating the benefits of following our communication or adhering to our advice?

Prevention of Misinformation

- How do we check if misinformation is spread by non-official communication channels?
- Do we know if the public is ill-informed or diverted by rumours and misinformation?
- How can we counter and mitigate the effects of misinformation (and rumours)?
- How can we redirect the public to official channels for trusted information?
- How are we responding to information needs of the public, to avoid making them look for answers elsewhere?
- How are we checking the accuracy of our information?

Ability to listen and collect feedback

- How are we using the public as a partner in the crisis?
- Are we giving the public sufficient opportunities to help in gathering and spreading relevant information?

Capability to trigger public engagement

- Does our plan include guidance for the public on how to contribute with resources/capabilities to the management of the crisis?
- How are we recognizing and reinforcing supportive behaviours by the public?
- Does our communication encourage the public to provide support to us?

Healthcare implementation – During



During a crisis, it is important that public health authorities communicate in time with the public, in an open and reliable way, addressing their specific needs. In particular, local health authorities play an important role in planning, activating and assessing communication activities. The main goal is to help people – also including public health workers - by steering their fears and concerns towards acknowledgement of the situation and appropriate level of vigilance (see tools 1.3 and 2 in the Healthcare Practices, Methods and Tools section below).

- **A public survey to assess risk perception of the public should be carried out.** In case the risk perception is difficult to be estimated. This, for instance, for a new emerging or unknown infectious disease (see tool 1.1). In fact, there is a linear correlation between the epidemic curve and the public's compliance with the public health authorities' recommendations (i.e. higher is the risk perception, higher is the public's liability to follow recommendations).

Timing of communication, target groups and manner and scale of communication should be assessed and identified (TELL ME, 2014a). Specific tools can be used for this purpose (see tools 1.3 and 2 in the Healthcare Practices, Methods and Tools section). In particular, the use of social media accelerates the speed of communication during public health emergencies or outbreaks (see Practice 2 and Tools 4, 5 in the Healthcare Practices, Methods and Tools section) (ECDC, 2016).

Air Traffic Management – During



According to the **International Air Transport Association (IATA) Guidelines [13]** an *"integrated, consistent and authentic communication response to an accident is essential, using all available channels to engage with its internal and external stakeholders"*.

Before the introduction of the social media, there was the so-called **"Golden Hour"**, now it has been literally zeroed. Actually if before ATM Communication experts were "information providers", now with social media, they are "information certifiers". It is noteworthy that real-time communication cannot be translated in rigid procedures, it depends on the type of crisis and on the experience of the communicators. Several activities and related timelines are suggested as follows:

- **T+15 mins:** Release first "tweet" acknowledging initial reports. Update regularly with short posts as new information is confirmed.
- **T+60 mins:** Issue longer summary of information confirmed to date, via multiple channels and posted on website. Release new summaries hourly, or as key developments are confirmed, while maintaining regular flow of short updates.
- **T+60 mins:** Change branding to monochrome/remove promotional images and messaging from all online platforms. Dark Site activated (i.e. a pre-made website to be activated in the event of a crisis or emergency). Ensure consistent messages/information appears on every online platform, with simultaneous updates.
- **T+3 hrs:** First media appearance/statement by most senior executive to arrive at location where families, media, and authorities are congregating (usually at/near the accident scene or arrival/departure airport).
- **T+6 hrs:** First in-person press conference with CEO or most senior executive available (may be at HQ, departure/arrival airport or accident location).
- **T + 6-24 hrs:** Further statements, media interviews and press conferences as relevant information is confirmed (may be done jointly with emergency services, response agencies, airport operator, government representatives or investigating body).

During a crisis it is fundamental also to:

- Monitor online conversations ("social listening" on Twitter, Facebook, etc.) about the event and company itself and decide whether to answer/reply to the conversations or not.
- Pay particular attention to the use of technical language.

AFTER A CRISIS

Conducting post-event learning in relation to the way the communication was managed during the crisis, can improve the readiness for future crisis events. This may be done as part of analysis, after-action review in the context of workshops and focus groups, using the triggering question **AFTER**.

TRIGGERING QUESTIONS

Adequacy of the Plan

- Was our communication plan sufficiently coordinated with other relevant authorities/organizations?
- Can we derive lessons-learned, which are worth documenting and feeding into future plans?
- How can these lessons learned be captured into communication strategies/policies (see also [6.1 Systematic management of policies](#))?

Capability to guide effective crisis response by the public

- Was the information on guiding crisis response by the public included in our plan adequate?

Communication Channels

- Were the communication channels used during the crisis sufficiently up-to-date?
- Was the selection of our communication channels adequate to the public in target?
- Did we experience an overload of our communication channels during the crisis?

Clarity and Accessibility

- Did people experience difficulties in accessing our information source during the crisis?
- Was the necessary information communicated in a language, or in different languages, understandable by the public in target?
- Were the responsibilities of individuals, as well as of the agencies involved in crisis management properly communicated?

Adequacy of Competences

- Do we need to acquire new available communication channels?
- Are relevant roles trained, educated, and exercised using this strategy/plan?

Acceptability and Trustworthiness

- Did the public perceive our communication during the crisis as trustworthy?

Prevention of Misinformation

- Were we successful in counteracting misinformation and rumours?

Ability to listen and collect feedback

- Did we adequately engage with the public during the crisis to understand and recognize different needs, due to local specificities and diversity of the involved communities?
- Were we able to integrate information from the public with other sources of information in an effective manner?

- Were we able to respond to information requests by the public in a timely manner?

Capability to trigger public engagement

- Did the rescuers involve the public in an appropriate way?
- Was the involvement and interaction with the public useful?
- How did the public experience the crisis and their involvement in the response/relief efforts?

Healthcare implementation – After



After the crisis, assessment of the communication plan and strategy is highly recommended to analyse data and information gathered from the public, and to gain inputs for improving the plan. A methodological road map to analyse lessons learnt, should be set-up. An example of methodology used in the healthcare domain is found in the **KAP Survey Model (Knowledge, Attitudes, and Practices)** (see in addition Method 1 in the Healthcare Practices, Methods and Tools section).

Air Traffic Management – After



After the crisis an issue, not mentioned in the generic field, could be related to the decision on when start the transition back to the normal promotional branding on the website. Particular attention must be paid to the synchronization with other communications and marketing activities.

UNDERSTANDING THE CONTEXT

DETAILED OBJECTIVES

A major part of crisis management is managing people – the people involved in the response and the public, both the people directly affected and the people that are at risk of being affected. The response of the public is a contributor and in some situations a decisive factor to the outcome of a crisis. In a sense, the public may become part of the response. Therefore, organizations need to develop communication strategies that facilitate interactions with the targeted public and increase the probability of public responses that are beneficial for the management of a crisis.

A relevant distinction between different groups of the public is here between those who are currently affected by or helping to resolve (e.g. on-site) a crisis and those who are at risk of becoming affected by a crisis or could potentially help (e.g. a current or anticipated crisis). The aim of this capability card is to support development of communication strategies directed towards the public, including those potentially affected by, or could be helpful, in a crisis.

The three main goals of the communication strategies are to guide the public that are potentially affected by the crisis or that could be helpful in crisis, to:

- Avoid being affected by the consequences of a crisis.
- Avoid using resources more needed by others, or to otherwise interfere with the response.
- Contribute resources/capabilities to the response.

The rationale for these goals are the limited resources available to organizations, which mean a need for collaboration and cooperation. The high-level means of achieving these goals are:

Achieve wide information dissemination and negate disinformation

The public needs correct and relevant information to enable informed personal choices. The public needs to have the opportunity to verify information.

Encourage specific behaviour by the public

The organization should see a benefit in encouraging/directing the public to act in a way that is not interfering with relief efforts or worsening the crisis.

Receive off-site resources from the public

The public can offer private resources to help the disaster management, e.g. shelter refugees in their home.

Not all personnel involved in crisis management communicate directly with the public. However, communication is an important aspect of crisis response operations, and a vital part of [Establishing common ground](#) between collaborating organizations as well as [Establishing networks](#), and [Understanding roles and responsibilities](#).

TARGETED ACTORS

The actors that are concerned by this capability card are public and private entities with tasks and roles related to dealing with emergencies and disruptions. The capability card relates to 1) crisis managers that see the need to interact with the general public to avoid, affect, or stimulate their involvement in the crisis, and 2) those who design, review, validate and sign off

communication strategies/policies in these organizations, such as managers in general, or specific information, communication, or media officers/strategists.

Indirectly affected actors: formal and informal leaders, and individual citizens of the general public potentially affected by, or helpful in, crises (including those not yet directly affected by or engaged in the response).

The scope of the capability card is response operations during all types of emergencies and disruptions.

Healthcare implementation – Actors



Specific actors/stakeholders can be engaged in the risk communication, according to the different types of crises in public health.

In the **Outbreak Risk Communication domain**, a new **Framework Model** was developed within the TELL ME project (TELL ME, 2014a).

The Framework Model emphasizes the interactive nature of outbreak communication among several groups of actors (TELL ME, 2014a) as follows:

- **Government/ policy/ institutional actors (IAs).** Political structures and organizations, competent public authorities, regulatory standards bodies, funding agencies and advisers responsible for design and implementation of communication strategies in the case of major infectious disease outbreak. IAs operate on different levels (see the table below): international (transnational, European), national and local (see: http://www.tellmeproject.eu/sites/default/files/ST3_2.3-Documents-Spreads.pdf).
 - *Transnational level:* World Health Organization (WHO); International Organization for Migration (IOM); World Organisation for Animal Health (OIE); United Nations Children's Fund (UNICEF); United Nations World Tourism Organization (UNWTO); World Trade Organization (WTO); World Bank.
 - *European level:* European Centre for Disease Prevention and Control (ECDC); European Directorate for the Quality of Medicines (EDQM); European Medicines Agency (EMA)/ex European Agency for the Evaluation of Medicinal Products (EMEA); European Commission (DG SANCO, DG ENTR, DG RTD, etc.).
 - *National level:* Ministry of Health; National (Surveillance) Public Health Institutes;

Medicine Regulatory Agency; other Ministries.

- *Local level:* Local Public Health (LPH) agencies; LPH authorities (e.g. Regions); Prefectures (Public Health Division); Local political parties.
- **Pharmaceutical industry** and commerce: manufacturers, suppliers, distributors, exporters involved in liability issues.
- **Community-based public institutions and infrastructures** as schools, hospitals, day care centres, clinics and public transport.
- **Civil society organizations** at the national level: Non-Governmental Organizations (NGOs), foundations and charities. At local level: community-based organizations, faith-based groups, etc.
- **Public sphere** is the heart of the model, where the public opinion rules. It includes:
 - *Public* is at the centre of the communication process. In order to effectively communicate with it, priority groups need to be identified by means of segmentation.
 - *Health workers* possess high accessibility by the population and hold high levels of credibility and trust from the public. They often have a personalized relationship with patients and are able to target communication to at-risk groups. They have a crucial role in activities for prevention. Among them: general practitioners (family physicians), nurses and midwives (both hospital and community based) play a special role.
 - *Media and social media* include broadcast, print, mobile, Internet. Social media are represented by different channels, including internet forums, social blogs, weblogs, wikis, podcast, social networking, video/photo sharing. Each of them has different features and audiences. However, during a crisis they have to be dealt with as one monolithic entity.
 - *Opinion leaders* comprise trustworthy members of peoples' social networks whose identification - especially at local and social media levels – is relevant to effectively mediate communication.
 - *Research* entails building public profiles through qualitative and quantitative studies pinpointing different subpopulations and identifying different trends in public discourse, or the public sphere.

The framework aims at **reversing the typical top-down model** in which the information flow is unilateral (from the health authorities to the public), in favour of a perspective that sees the public as a partner, by means of communication technologies that allow accessible and immediate public participation (see <http://www.tellmeproject.eu/node/314>).

Air Traffic Management – actors



During a crisis, several actors are involved, in a greater or lesser degree.

They have to provide timely information to the news media and public. They are:

- Airlines (including codeshare or franchise partners, third-party contractors)
- Emergency services
- Investigating body
- Government agencies
- Arrival and departure airports
- Air Navigation Service Provider
- Aircraft and engine manufacturers (including suppliers of key systems or components)

EXPECTED BENEFITS

A suitable communication strategy has the expected benefits of:

- Reducing the number of people that are affected by consequences of a crisis.
- Reducing the strain on resources needed on-site during a crisis.
- Increasing the attainable and manageable resources and capabilities, which can aid the relief effort.

Overall, the expected benefit is thus a more resource-efficient and flexible response and management of a crisis.

RELATION TO ADAPTIVE CAPACITY

Facilitate resource mobilization, sharing, and balancing.

RELATION TO RISK MANAGEMENT

The interactions between the public and organizations are to a large extent neglected.

ILLUSTRATION

Following the 2005 hurricane Katrina, the White House commissioned a review of the Federal response during the event. "Public communications" is one of the critical challenges identified by the report on lessons learned from this review. While the dissemination of weather and hurricane tracking information preceding its landfall is one of the success stories of the management of the event, the report mentions two essential areas in which communication to the public was not sufficiently effective:

- The lack of a mechanism for officials to communicate disaster information and instructions at the Federal, State, and local levels. The review notes that setting up the structure, processes and resources for public communication, lacking at the beginning of the event, took several weeks.
- As a result, uncoordinated, and sometimes contradictory, information provided by officials caused confusion. In addition, uncorroborated information provided continuously by the media interfered with emergency response efforts. According to the report, inadequate and ineffective communication fed the public's perception of government sources lacking credibility.

Some cases describe experiences from government - civil society partnership. (Chen, Chen, Vertinsky, Yumagulova, & Park, 2013).

Healthcare implementation – Illustration



Lack of communication strategies and coordination between policy makers and first responders in case of healthcare emergencies. The successful management of health emergencies requires the involvement of the public by means of clear communication strategies between policy makers and local first responders (healthcare professionals). The importance of such coordination is illustrated by the 2009 H1N1 - flu pandemic. During this event, many Italian regions got a poor response due to lack of communication with the public. First, disagreements were reported to occur among the Ministry of Health and some regional health authorities. Then, local health authorities bemoaned the absence of centrally defined guidelines about how to inform the population. Eventually, great uncertainty grew from the people about the social groups that had to be vaccinated. Also controversial messages by the Ministry of Health and other ministries released by

media were not aligned. The media initially released alerting claims about the consequences of the disease, while later reassured about possible dangerous effects. Also, the communication departments of different ministries did not pursue a coordinated response to the population, acting on singular basis. On the other hand, a few regions (e.g. Emilia Romagna) with an established communication plan developed by the regional health authority, supported coherent communication from the top to the bottom. These regions were effective in countering misleading messages arriving from the media.

However, during this crisis, a new data mining tool to collect information from the public on its health status was included in the integrated epidemic surveillance system managed by the local health authorities. It allowed to enhance data promptness and richness for epidemiological surveys.

During H1N1, contradictory messages were communicated not only at national, regional and local levels, but also among countries and international agencies. The illustrative case underlines how these differences generated confusion among citizens about whose advice to follow. Therefore, information sharing and cooperation among all professionals, institutions and healthcare services involved in risk management is a prerequisite for coordinated planning of activities, as well as it simplifies the communication process with the public and thus allows for responsible and informed communication with the community.

Air Traffic Management – Illustration



In the **International Air Transport Association (IATA)** guidelines, the following examples are reported:

- *"After the Asiana Airlines OZ214 accident at San Francisco in July 2013, the first photo was posted on Twitter in less than one minute, by a passenger waiting to board another flight. Once ignited, the social media "firestorm" spread so quickly that it generated more than 44,000 tweets within the next 30 minutes."*

"Coverage of Malaysia Airlines MH370 led the prime-time evening news on all three major US TV networks (ABC, CBS and NBC) for 11 consecutive nights in March 2014 – an unprecedented level of domestic interest when only three American citizens were among the 239 people on board."

IMPLEMENTATION CONSIDERATIONS

Challenges

Organizations need to see the potential contribution of the general public. Further important enablers are creating functioning networks of volunteers and leaders during non-crisis periods, development of two sided communication, and taking into account the cultural characteristic of the public. When developing communication strategies and plans it is important to consider cultural and technical backgrounds of those involved and to include experts with different and relevant backgrounds in the process.

Communicating information to the public during a crisis is always a balancing act between being transparent and establishing a relationship of trust but at the same time knowing what information to disclose, when, and how, in order to not disrupt the crisis management efforts.

Implementation cost

Healthcare implementation – Implementation considerations



Some conditions could affect the effectiveness of the communication strategies involving and addressed to the public:

- **The absence of a communication plan and a strategy shared among the stakeholders**, that causes confusion of roles and responsibilities, lack of coordination, inappropriate time to communicate, loss of institutional credibility and acknowledgment.
- **The self-reference of the healthcare system.** In this domain *the one to one* communication (i.e. healthcare worker to patient) is at the basis of the healthcare culture. In particular family physicians “hold the power” to communicate (by deciding how, when, and what) with patients, by influencing their health beliefs and practices.
- **The unawareness of the institutional actors of the local communities’ approaches to healthcare** that have not to be a priori contrasted but understood and integrated in the communication strategy addressed to specific groups.

Minimum Viable Solution

The first action to be undertaken is the setup of a communication plan and strategy. This requires a budget allocation for a minimum number of human

resources including a communication expert in social media/two way communication channels. Their fundamental tasks should be:

- Establishing connection with institutional actors, local healthcare agencies research organizations, and priority groups in the public (identifying Point of Contacts, PoCs).
- Participating to round tables with stakeholders (at least to answer the triggering questions related to the before-a-crisis section but also to discuss the contents of the plan and to define roles and responsibilities).

Air Traffic Management – Implementation cost



The International Air Transport Association (IATA) in its **Crisis Communications in the digital age a guide to “Best Practices” for the aviation industry** (IATA, 2016)

“Aviation accidents and serious incidents are extremely rare. Despite the almost exponential increase in passenger numbers and flights operated since the start of the jet age, the rate at which hull loss accidents occur has steadily improved. Most communication professionals working within the industry (indeed, most airline employees) will therefore never face the unique and emotionally stressful experience of responding to an aviation disaster. Unfortunately accidents do still happen, and the challenges of planning and managing an effective response have never been more complex. Profound – and accelerating - changes to the business, political, social and media environment have created pressures and expectations which did not exist even a decade ago. The proliferation of social media channels, and the exponential growth in mobile smartphone use, have ensured that “breaking news” of an accident or major incident will usually appear first on Twitter, Facebook or Weibo. Photos, commentary and even streaming video may be available, in real time, to a vast global audience before the companies involved are fully aware of what happened. Flight tracker websites will allow anyone to see the aircraft’s last known position, heading, speed, altitude and other parameters, including the history of the aircraft concerned, the service history of the aircraft type and any issues related to the operations of the airline.

The first opportunity to define the event, and to shape the unfolding narrative, will belong to the people who experienced it, those who saw it, and those affected by it. The airline may be left struggling to make its message heard above the cacophony created by citizen journalists, politicians,

government agencies, celebrities, “experts” and self-publicists eager to share their opinions.

RELEVANT MATERIAL

RELEVANT PRACTICES, METHODS AND TOOLS

Practices

Examples of practices regarding guidance of effective crisis response by the public:

- In Australia several emergency management authorities have implemented education programs delivered through the school system. The aim is to increase the community resilience by making the communities “ready, willing and able to do what is necessary” to prepare for or respond in the event of a crisis (Dufty, 2009).
- Texas 2-1-1 is a state program that presents accurate and attainable information from official health and human services to the public. The program applies several communications methods, telephone, web, and physical centres, to create a disaster communication hub between individuals with unmet needs and community services. The information hub is available not only during crises and disasters but at all times and also covers a broad range of every-day issues regarding health care and human services. This means that the place to find information and support in the case of a crisis is the same as in normal cases.

Examples of responses initiated and managed by the public to respond to crisis:

- After Hurricane Katrina there was public engagement to supply shelter/refuge to affected people who lost their homes, e.g. “open your home”-campaigns. Non-profit organizations set up webpages communicating information and guidance to the public on how to support the crisis response.
- Universities accepted students from affected areas and initiated campaigns to supply housing.
- While airline cooperations can help in evacuations bona fide, also individuals donated their frequent flyer-miles to evacuate affected people away from the crisis area.

Methods

There are different ways of communicating with the public, either face-to-face or through different communication channels. The main types of communication during crisis management are more or less one-way communication such as one-to-one and one-to-many, where for instance the crisis response management communicates a message to the one or more people in the general public. There are also methods and tools for the crisis management to gather and receive information from/about the public, for instance localizing people through mobile networks and geographical tagging if different types.

The EU-project Driver’s short paper presented at ISCRAM 2016: “Interaction with Citizens Experiments: From Context-aware Alerting to Crowdtasking” (Havlik, Pielorz, & Widera, 2016) presents the results of an evaluation of four selected crisis management tools: DEWS (Distant Early Warning System sending out alerts based on user profiles and their geographic position), Safe Trip (aimed at tourists, giving safety information etc.), GDACSmobile (facilitates self-organisation of volunteers) and AIT CrowdTasker (supporting communication between crisis response personnel and pre-registered volunteers). The method used to evaluate the tools included a series of experiments with volunteers and professionals within the Driver project.

Tools

Communication channels:

Information regarding crisis management can be communicated by a broad range of channels such as: officials on site or local leaders, word of mouth, letters, notices, one-way radio, two-way radio, telephone, TV, notice boards, internet, and social media.

Examples of one-way communication tools:

- Texas 2-1-1 (<http://www.211texas.org>) represents a governmentally controlled and information supplied information sink reach through internet, telephone or information centres. The aim is to inform the public.
- In a coastal area (Sunshine Coast, Australia), that is a popular tourist destination, public warning systems for warning of natural and manmade disasters, was according to a workshop with experts, considered as a factor contributing to resilience (Singh-Peterson, Salmon, Baldwin, & Goode, 2015).
- DEWS (Distant Early Warning System) (Esbri, Esteban, Hammitzsch, Lendholt, & Mutafungwa, 2010) is a system developed for tsunami warnings is used to distribute alerts

based on user profiles and their geographical positions.

Examples of two-way communication tools:

- Recovers.org is a company-run internet-based framework that can be applied to a specific crisis at the time of need. The framework supports a way to request assistance, donate supply/money and sign up as a volunteer. It can also work as a platform to spread information from “organizers”.
- Safe Trip
(<http://www.hkv.nl/en/products/apps/231-apps.html>) is a mobile application that based on location gives travellers and tourists within Europe relevant safety information. The application can also be used by citizens to inform national authorities of their location, needs and conditions.
- AIT CrowdTasker (<http://crowdtasker.ait.ac.at>) is a mobile application for targeted one-to-many communication for crisis coordination with volunteers. With the tool crisis management professionals can interact with preregistered volunteers by sharing information and assigning tasks to unaffiliated volunteers, as well as collect structured responses from the public.
- Social media platforms allow both authorities and the public to share information and comments. See the following article for detailed guidance on “incorporating social media in risk and crisis communication” (Veil, Buehner, & Palenchar 2011):
- GDACSmobile facilitates self-organisation of volunteers and aims to improve situation awareness of citizens by sharing an easy-to-understand overview of the situation. See Link et al. 2015 for further details.
- I-REACT is a European-wide platform under development (release Oct, 2018) that aim to integrate emergency management data, including social media. The development is funded by the European Commission (see <http://www.i-react.eu>).

media work considerably in early 2014, after it became evident that the institute needed to reach a larger target audience. During their initial listening and engagement activity, NIPH focused on Facebook and Twitter because they were the most popular channels in Norway for their target audience and therefore offered the greatest engagement opportunity (80% of the population had a Facebook account). Twitter also became an important part of NIPH’s social media strategy because it could be used to communicate with health professionals, the media, policymakers, politicians and stakeholders. NIPH also embraced other platforms such as LinkedIn, YouTube, Vimeo and Instagram (ECDC, 2016).

Practice 2. The Facebook page of Public health emergency (PHE.gov) provides updates on Zika spreading. Public Health Emergency.gov is a web portal held by the US Department of Health and Human Services and its cross-governmental partners to serve as a single point of entry for access to public health risk, and situational awareness information. Declared disasters and emergencies are some of the contents populating the US Public Health Emergency website. Besides the pages dedicated to disaster response and to agents, diseases, and other threats, involving the public is a key feature of the portal, either by social media profiles or by constant information and news updating. An outstanding example is about the feroid activity delivered by the Public Health Emergency.gov in updating its Facebook page with posts, maps, infographics of Zika spreading (ASSET, 2017) (see https://www.facebook.com/pg/phegov/about/?ref=page_internal)

Practice 3. In the field of public health, an excellent example of social media management comes from the Centers for Disease Control and Prevention (CDC). Their page dedicated to social and digital tools is a valuable source of information, conceived to encourage people to participate and share information provided by the organization. CDC has many different Twitter accounts: three are national profiles, one is dedicated to the emergencies, and other 23 are related to specific health topics like hepatitis or tuberculosis. They also implemented a Twitter account for their Morbidity and Mortality Weekly Report (@CDCMWR). On the website, a series of guidelines and best practices can be found, through which CDC “encourages the strategic use of Twitter to disseminate CDC health information and engage with individuals and partners”. Something similar is also available for Facebook, in a page dedicated to social media tools, guidelines and best practices. Which also includes two documents of great interest: the Social Media Toolkit and the CDC’s Guide to Writing for Social Media. [...] In 2014, CDC launched the Public Health Nerd online campaign to mobilize people who are passionate about public health, in order to promote awareness about CDC’s work, and to encourage learning and increase knowledge about health topics. The main motto of the campaign was “You are a Public Health Nerd if you...”, and most of the pictures and tweets (with the hashtag

Healthcare implementation – Practices, methods and tools



Practices

Practice 1. The Norwegian Institute of Public Health (NIPH) started using social media in 2010 and strengthened its social

#PHNerd) contained questions and sentences aimed to boost conversation, not just to give information in a strict top-down approach (Bellone, 2017)(see <http://www.asset-scienceinsociety.eu/news/features/public-engagement-and-trust-building-social-media>)

Methods

Method 1. The KAP Survey Model (Knowledge, Attitudes, and Practices) is a quantitative method (standardized questionnaires) that provides access to quantitative and qualitative information. KAP surveys reveal misconceptions or misunderstandings that may represent obstacles to the activities that we would like to implement and potential barriers to behaviour change. KAP survey essentially records opinions, what was said, but there may be considerable gaps between what is said and what is done (see <http://www.medecinsdumonde.org/fr/node/9575>)

Tools

1. The toolbox (ECOM EU project - Effective Communication in Outbreak Management: development of an evidence-based tool for Europe) consists of different products that form an evidence-based behavioural and communication package for health professionals and agencies throughout Europe, in case of major outbreaks of infectious disease (available at: [14]). It includes tools regrouped into three areas:

1.1 Tools to Assess public perception and anticipate behaviour:

- *Assessing Disease & Public Characteristics - Checklist Risk Communication* helps to assess the urgency of risk communication and to decide whom you want to reach, how, and on what scale, for a timely and consistent information that does not cause distress.
- *Assessing risk perception of the public - Standard questionnaire on risk perception of an infectious disease outbreak* measures public risk perception (i.e. knowledge, perception of severity/susceptibility, anxiety, self-efficacy and efficacy of preventive measures, intention to carry out these measures, motivating/ hindering factors and information needs).
- *Conducting focus group discussion* is a guideline aiming at facilitating end-users when preparing a focus group to gain insight on public behaviour regarding future pandemic outbreaks and vaccination.

1.2 Tools to review the preparedness:

- *Identifying your option - Communication and Persuasion Intervention Mix Tools* describe some possible types and forms of intervention (by means of an Intervention Matrix) that can be used to influence the behaviour of citizens and professionals prior to, during, and after a pandemic. It should be used in the pre-preparation phase and managed by those responsible for developing communication and behavioural influence programs.
- *The STELa planning framework* is a guide to the key stages, tasks, and activities that are required when planning delivering, managing, and evaluating an intervention designed to influence health-related behaviour.
- *Specifying the Objectives - Setting SMART Objectives Tool* helps identifying and addressing behavioural targets in pandemic communication and marketing programs.

1.3 Tools to communicate with the public:

- *Recommendations for Communication* gives general and country-specific recommendations how to communicate with the public during influenza pandemics.
- *Journey through a flu-pandemic* is a poster designed as a printed and interactive version that clarifies the phases of a pandemic and gives basic action directives. This helps health officials to give a better understanding to the public in terms of the progress of a pandemic.
- *The Pila Smartphone App* is a prototype of the app 'Pandemic Information & Life Assistant' that teaches the public about the pandemic and how to protect themselves. It will help people to assess their personal risk during a pandemic, based on personal and geographical information.
- *ECOM Animation Movies* include main suggestions for policy makers on Effective Communication in Outbreak Management.

2. TELL ME Communication Kit (TELL ME EU project - Transparent communication in Epidemics: Learning Lessons from experience, delivering effective Messages, providing Evidence). It supports public health officials in the development of a communication strategy within the wider framework of a national or international preparedness and response plans for major infectious disease outbreaks. It also addresses health communicators and healthcare professionals who are required to communicate risk and uncertainties to the general public. The communication kit provides a spectrum of practical recommendations and tools to support the development of evidence-based messages,

tailored for different sub-populations and target groups across various cultural contexts with the aim of minimizing deviations between perceived and intended messages in the communication process. It comprises four different guidance documents:

- *New communication strategies for healthcare professionals and agencies*
- *New communication strategies for working with different subpopulations/at-risk group*
- *New communication strategies for institutional actors*
- *New communication strategies for preventing misinformation* (see TELL ME, 2014b)

3. ASSET Tool Box (ASSET EU project -Action Plan on Science in Society Related Issues in Epidemics and Total Pandemics) (ASSET, 2016) consists of eight tools mainly meant for pandemics (but adaptable also to other healthcare domains). They are learning modules (e.g. Reporting health issues by journalists), checklists (e.g. Checklist for patient and public involvement in research along with checklist for basic research considerations), glossaries and guidelines (e.g. How to organize citizen participatory meetings). In general, the tools aim at: increasing awareness in the health workers who have direct contact with patients to assess their knowledge, attitude, and willingness to facilitate their preventive activities; facilitating communication, avoiding linguistic misunderstandings with so many different disciplinary, geographical, and cultural backgrounds; including citizens in decision making; and training journalists in health reporting. Among them, *Citizen Participatory Meetings*, enhance a participatory governance approach. They aim at including citizens in decision making processes that have implications for their wellbeing, by understanding their point of views and learning from their everyday experiences (The Asset Tool Box is available at: <http://www.asset-scienceinsociety.eu/outputs/deliverables/asset-tool-box>)

4. European Centre for Disease Prevention and Control (ECDC) guidelines for a social media strategy development in public health communication. The guide provides public health organizations and practitioners with a practical approach to strengthening the integration of social media into their overall communication activities. In particular it focuses on identifying effective ways to use social media in communicable disease prevention and control (ECDC, 2016).

5. ECDC guidelines for building trust on communication on immunization. The guide aims at supporting Member States in planning and implementing communication initiatives on vaccination, by presenting an overview of the main issues that public

health institutions need to consider in relation to building and maintaining trust (ECDC, 2012).

Air Traffic Management – Practices, methods and tools



On the company's official website: activate Dark Site, change branding to monochrome, remove inappropriate images and messaging, publish a “blog” from the CEO, launch a “live blog” with rolling updates.

Regarding information channels:

- Determine which social media channels (i.e. Facebook, Twitter, YouTube, etc.) are already used by the organization, and who manages them.

Regarding information adequacy of competencies:

- Exercise the crisis communication plan (ECDC, 2012) “at least once per year, conduct an exercise to test the plan and to ensure that everyone understands their role, and the purpose of the plan. An exercise may be a simple table-top or a full-scale input-response exercise run by a control team”.

Regarding information adequacy of competencies, communications exercises also should include:

- *Notification exercise:* Check contact numbers are valid and key players can be reached quickly.
- *Slow walk-through:* Take a potential scenario and ask a series of questions of your team. Check whether your current plan provides the answers.
- *Tabletop:* Run through a simple scenario and test one aspect of the plan – for example, developing updated press statements.

Input-response exercise: Test the entire communication plan by using an exercise control team to provide “inputs” via phone calls, emails, social media posts and “news reports”.

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NAVIGATE IN THE DRMG

- **Parent theme:** Involving the public in Resilience Management
- **Resilience abilities**
 - Contributes to: Monitor, Respond and Adapt
- Supported by: Learn and Evolve
- **Categories:** Collaboration, Communication, Resources, Planning, Procedures
- **Functions of crisis management:** BEFORE, Preparation, Plan for crisis, DURING, Damage control and containment, Short-term recovery, Execute and revise plan, AFTER, Learning, Revise crisis management processes, Assess performance

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7.2. Increasing the public's involvement in resilience management

To integrate the organization in a network of relevant actors and agencies (community members and local business that typically don't conduct crisis management). The integration is aimed at enhancing the organization's ability to respond to the needs of both the organization as well as the local community in times of change and emergency.

IMPLEMENTATION

INTRODUCTION

The integration of various levels of organizations and public requires a constant examination of this process, including ethical issues of balancing between different needs and interests. Formal or informal leadership could represent the public interest. It is important to integrate community leaders in mapping resources and needs in planning for potential crisis. Business organizations can be very helpful in using their vast databases to help the authorities – municipalities create a good status snapshot at certain times. To increase response, integrating the educational system is an effective option to advance preparedness plans, and school children are a target population, with preparedness training adapted to their level of knowledge and emotional development.

BEFORE A CRISIS

During non-emergency periods, organizations should be involved in building relationships and networks with other relevant agencies. The involvement of the public (community members as well as business sector) in the process of preparedness may be through participation in drills and exercises and in planning joint SOPs for times of emergencies. The SOPs should include definitions of interfaces between the public sectors and organizations within them. Public leadership – formal and informal alike – and business

sectors should understand the all-hazards approach and its implications and prepare the public as well as the businesses for multiple scenarios. The business sector can contribute with knowledge and expertise in adding their professionals as well as technology. In order to enhance capacity during the preparedness phase, it is important to publish preparedness plans, keeping the balance between increasing public awareness without creating panic, making sure to prevent "crisis fatigue." The local authorities should involve the public in promoting and creating CERTs (Community Emergency Response Teams). Among possible uses of business-sector resources is designating corporate clinics to work with the municipality when disaster strikes or joining the community effort in rebuilding supply chains.

TRIGGERING QUESTIONS

- Does the organizations SOP address emergency situations other than workplace emergencies?
- How does an organization maintain alertness without introducing anxiety?

DURING A CRISIS

During an emergency, the organization and the local community must handle challenging situations, balancing between needs and limited resources. The public and business sectors may initially help identify resources by actively participating in the local authorities' efforts to monitor the existence or lack of resources through social networks, calling call centers and reporting systematically (especially the corporate

sector) on available resources. The business sector should try and maintain working supply chains and work with the municipalities through crisis communications practices to ensure the public receives basic services. Communication companies could be instrumental in using applications and survey techniques monitoring population reactions. Social media and other forms of communication should be used to spread two-way information between professionals and the population. The informal leadership and business sectors may participate in directing the public to alternate resources. Challenges for heterogenic population including formal and informal leaders:

- Prevent confusion and contradicting guidelines.
- Balancing between human rights and following the guidelines (e.g. evacuation).
- Identify the languages – communication with leaders.
- Updated information for agencies.

It is important to think creatively in order to reveal hidden resources, (e.g., mapping professional skills of each organization and business). For example, rather than viewing the aging population as a burden, it should be viewed and utilized as a resource. As such, beyond providing special needs for the ageing population, the elders may contribute to the community in a range of capacities.

TRIGGERING QUESTIONS

- Assuming cellular communication fails, are people aware of where landlines are located?
- How can the elderly population be trained as a resource for emergency situations?
- If infrastructures are cut off, does the specific organization (from the business sector, for example) have special means that could deliver emergency supplies?

AFTER A CRISIS

In the post-crisis period, both organization and community bear the task of rehabilitation and returning to normalcy. After the dust (real and metaphoric) has settled, it is time to examine the lessons learned, map the functioning of the various actors, and the effectiveness of the networks. This is the time to rebuild, a process in which the business sector, and organizations within it, play a major role providing work power and resources. SOPs that were enacted during the emergency must be flexible enough to relax back into routine mode. Both the public and the

organization will need strong and reliable leadership, clear information, and a vision of the benefits of continued cooperation. The business sector may offer incentives in the form of jobs to those taking place in rebuilding.

TRIGGERING QUESTIONS

- How can organization-community relationships be enhanced following their cooperation during the crisis?
- How can they “cash in” on the momentum created?
- In your organizations, which incentives can you offer people working to rebuild the community?

UNDERSTANDING THE CONTEXT

DETAILED OBJECTIVES

The rationale for creating links between organizations and community members is to have each partner be familiar with the other’s structure and capabilities and integrate them to work efficiently in time of crisis. Such mutual involvement of the public and local organizations (including the business sector) is largely dependent on the type and nature of the organization. Because local authorities are usually the main agencies to deal with crisis and emergencies throughout the lifecycle of the event, from preparedness to recovery and readiness for the next event, they are in position to initiate collaboration with businesses and organizations. Further information regarding this issue could be found at the Capability Card of [Interacting with the public](#).

TARGETED ACTORS

The idea of creating a network integrating organizations and the community is innovative, and one which will require engaging organizational decision makers to address the administrative and logistical aspects. During the implementation phases, the operational level as front line workers will be involved.

EXPECTED BENEFITS

Enhanced preparedness through collaboration between organizations, agencies, and the community for efficient implementation when needed. The organization will have plans to mobilize its capacities to

cope in emergency situations and work with the public. Integration of organizations with the public may enhance the resiliency of the local community. Further information regarding community resilience can be found in the Capability Card regarding [Assessing Community Resilience](#).

RELATION TO ADAPTIVE CAPACITY

Creating multi-level relationships between organizations and the local community to promote their mutual and reciprocal adaptive capacities.

RELATION TO RISK MANAGEMENT

The relationships between organizations and the public has not been studied and explored sufficiently.

IMPLEMENTATION CONSIDERATIONS

Challenges

For organizations, considering communal aspects during routine time, is a change in perception of crisis management. Communication with the public is a fundamental issue and requires defining the target group and using channels for the flow of two-way information. Community culture calls for involving community leaders (formal and informal), especially in multicultural, heterogenic communities. Involving local volunteers who present sub-populations. During routine times, organizations should invest resources to promote relationships with their local communities.

Implementation cost

For the public and business sectors to be able to understand the bigger picture and react in coordination with other actors, all stakeholders must be coordinated. This requires investing time and human power in learning the system of crisis management, learning the SOPs and alternating solutions, and above all, taking responsibility for the partnership. At the same time, having invested in the resources in the pre-crisis period, will allow for mobilizing resources, having effective communication between all concerned, and these could improve dealing with the situation at hand and considerably lower costs.

RELEVANT MATERIAL

RELEVANT PRACTICES, METHODS AND TOOLS

Practices

- In disasters, availability and response times of the first responders are critical factors in the strive to save lives, to mitigate disability and to minimize damage to infrastructure. Professional emergency services are the best trained and equipped organizations to offer assistance following disasters. Nevertheless, their arrival at the scene of the disaster may be delayed for a significant period of time, due to size of the affected area, inaccessibility of communication means, destruction of transportation routes and roads, as well as the extent of the event, which may overwhelm existing capacities and necessitate utilization of the limited resources according to different priorities. Remote communities, which may be located at a distance from densely populated areas, may need to provide a local response based only on resources that are immediately available in the community. Stemming from this understanding, the value of Community Emergency Response Teams (CERTs) has been globally recognized as a crucial component of disaster management. The CERT initiative reflects a community based approach toward emergency preparedness derived from the comprehension that every community should have the capacity to immediately respond to disasters and various emergency situations based on its own resources, and provide for the immediate needs of its residents, when external emergency responders are not available or are unable to reach the affected area/populations in due time
- Examples of responses initiated and managed by the public to respond to crisis:
 - After Hurricane Katrina there was public engagement to supply shelter/refuge to affected people who lost their homes, e.g. "open your home"-campaigns. Non-profit organizations set up webpages communicating information and guidance to the public on how to support the crisis response. Universities accepted students from

- affected areas and initiated campaigns to supply housing.
- While airline cooperations can help in evacuations bona fide, also individuals donated their frequent flyer-miles to evacuate affected people away from the crisis area. More information regarding this issue can be found in the Capability Card of [Interacting with the public](#).

Tools

Key issues to reach the public are through available technological systems. The technological systems should be readily used for the applications to be functional during an actual emergency, the public need to feel comfortable with the application. While the use of technology is good plans and procedures also have to prepare for the adverse effects inflicted by fake news and deliberate spreading of disinformation that can have detrimental effects on the outcome of a response.

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NAVIGATE IN THE DRMG

- **Parent theme:** Involving the public in Resilience Management
- **Resilience abilities**
 - Contributes to: Learn and Evolve
 - Supported by: Anticipate, Respond and Adapt
- **Categories:** Collaboration, Communication, Planning, Procedures, Resources, Training
- **Functions of crisis management:** BEFORE, Communicate, Cooperation and coordination, DURING, Information gathering, Information sharing, Train, Address vulnerabilities, Learning

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CHAPTER 9

Managing system failures

ASSOCIATED CARDS

9.1. Supporting Development and Maintenance of Alternative Working Methods

The card supports the development and the maintenance of **Alternative Working Methods (AWMs)** in case of system failure. System failures are situations in which an essential component to ensure continuity in the service offered by the organization is either lost or functioning in a degraded mode and there is no backup, emergency or contingency solution available by design. Applying an AWM means performing one or more activities within the organizations in a way which is remarkably different from what described in existing procedures or practices, in order to bypass the constrain created by the system failure. It may imply following different steps in the way to perform the activity, using different tools or cooperating with different people (or all of the above) with respect to what is normally done without the system failure.



9.1. Supporting Development and Maintenance of Alternative Working Methods

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IMPLEMENTATION

INTRODUCTION

What is needed to manage Alternative Working Methods (AWMs)

1. **Identify major system failure scenarios** affecting the critical infrastructure capability managed by the organization to ensure continuity of its service
2. **Define AWMs** to ensure business continuity in the event of system failure:
 - 2.1 Revise existing working methods;
 - 2.2 Consider the applicability of older working method;
 - 2.3 Propose new AWMs.
3. **Disseminate the information** on the AWMs inside the organization and/or **organize training** activities to ensure mastery of them by the personnel of the organization.

The triggering questions provided for the before/during/after phases are intended to guide the different actions suggested by the card through self-assessment. The questions should be selected in a flexible way depending of priorities within the organisation. Once a question is considered relevant,

the response to it should always come with a rationale. Simple 'Yes' or 'No' answers will not suffice.

BEFORE A CRISIS

1. **Organize a Focus Group** with representatives of the managerial levels and front-end operators to address the topic of AWMs.
2. **Identify major system failure scenarios** affecting the critical infrastructure capability managed by the organization to ensure continuity of its service:
 - Focus on *major system failures* such as loss of essential functions or degraded modes of operations with a potential of jeopardizing the business continuity of the organization and the safety of people inside or outside the organization (normal maintenance operations or activation of backup systems in ordinary scenarios to be considered out of scope);
 - Consider the analyses made through the CC [Noticing brittleness](#) (if available);
 - Involve experts of specific system failures as appropriate to receive specific advisory.
3. **Define alternative working methods** to ensure business continuity in the event of system failure, while maintaining the safety of people inside and outside the organization:
 - Revise existing AWMs;

- Consider the applicability of older working methods;
- Propose new AWMs;
- Consider the analyses made through the CC [Manage available resources](#) (if available);
- Consider the analyses made through the CC [Adapting plans and procedures during crises](#) (if available)
- Select on or more alternative AWMs for each of the identified system failure.

4. Assign to a person or role in the organization the **responsibility to approve the adoption of the AWM** in case one of the considered system failures will occur.

5. Write a report describing the defined (or revised) AWMs.

6. Organize awareness campaign to disseminate the description of the defined working methods to the relevant personnel and/or arrange **training activities** focussed on the same contents (training activities should be preferred in case the adoption of the AWM is not straightforward for personnel who never applied it and if allowed by budget constraints).

7. Inform other organizations that may be impacted by the application of the AWMs, as appropriate.

TRIGGERING QUESTIONS

Identification of System Failures

- What kind of system failure has the potential to compromise the continuity of the service offered by our organization?
- Can we think of an unprecedented system failure with the potential to compromise the continuity of the service offered by our organization?
- Can we think of a system failure for which there is no straightforward backup, emergency or contingency procedure identified by design?
- For which kind of system failure the identification of an AWM represents a priority for our organization?

Review of Existing AWMs

- Is our personnel aware of the AWMs we identified for specific system failures
- Did we verify if the AWMs we identified for specific system failures are still applicable and fit for the purpose? Did the last check occur too long ago?
- Did we check if the tools necessary to support the identified AWMs are still usable?

- Did we check if the tools necessary to support the identified AWMs are still accessible to the personnel?
- Are the skills and competences of our personnel adequate to apply the AWMs if needed?

Consideration of Older Working Methods

- Can we revert to 'old school methods' that existed before the system affected by the failure was available in the organization?
- Would the older working methods be capable of managing the complexity of the process that we previously supported with the system affected by the failure?
- What is the level of obsolescence of the tools used as part of older working methods?
- Do we maintain the tools formerly used in older working methods in a way that would allow us to reuse them in case of system failure?
- Can we make adaptations to the tools used as part of older working methods to compensate for their obsolescence?
- Are we periodically refreshing the skills and competences that would be needed by the personnel to reuse the older working methods?
- Does the cost to rebuild skill and competences to reuse older working methods exceeds the expected benefits?

Definition of New AWMs

- What kind of physical redundancy we may use to compensate for the system failure?
- What kind of functional redundancy we may use to compensate for the system failure?
- What kind of human backup we may use to compensate for the system failure?
- Can we provisionally use a tool to compensate for the system failure in a way different from what originally intended in its design?

Limitations of Selected AWMs

- Is the AWM we have identified expected to reduce the level of safety of operations until the system failure is not repaired?
- Does the AWM we have identified rely on the same infrastructure that has caused the failure of the main system?
- Does the AWM we have identified rely on resources of other organizations on which we do not have full control?
- Is the AWM we have identified at risk of causing undesired side effects on other organizations with whom we collaborate?

Dissemination and training on AWMs

- Did we inform properly all the relevant personnel in our organization regarding the identified AWMs?
- Do we need to organize a dissemination campaign in order to make sure the relevant personnel in the organization is aware of the identified AWMs?
- Do we need to inform the point of contacts of other organizations of the AWMs we have identified?
- Do we need to develop training modules to make sure the relevant personnel in our organization have the necessary competences and skills to master the identified AWMs?

DURING A CRISIS

1. As soon as a system failure occurs, check whether the failure corresponds to one of the typologies for which an AWM was identified and start the process for applying it.

- Ask approval for the application of the AWM to the person or role to whom this responsibility was assigned
- Adopt measures to inform about the application of the AWM all the personnel whose activity might be impacted by the alternative methods
- Check whether the alternative working method requires on-the-fly adaptations
- As soon as permitted and at regular time intervals, verify whether the system failure has been recovered and if the adoption of the AWM can be suspended

2. If no AWM was previously identified for the ongoing system failure, establish a task force to identify an AWM aimed at ensuring business continuity and safety, until the system failure has not been repaired. The task force should:

- Consider the applicability of older working methods
- Propose new AWMs
- Consider the analyses made through the CC [Manage available resources](#) (if available and allowed by time constraints).
- Select one or more AWMs to operate until the system failure has not been repaired.

3. Disseminate the information on the AWMs being selected inside the organization, making sure that the relevant personnel is informed as appropriate

4. Make sure that the personnel required to use the AWMs have sufficient mastery of them, also by

organizing ad-hoc training activities, if allowed by time constraints.

5. Inform other organizations that may be impacted by the application of the AWMs, as appropriate.

6. Inform the relevant personnel in the organization (and the point of contacts in other organizations, if involved) when the failure requiring the AWM has been repaired and it is possible to *revert to the normal working method*.

TRIGGERING QUESTIONS

Identification of System Failures

- Are we experiencing a system failure that could be managed with one of the AWMs we have previously identified?

Review of Existing AWMs

- Based on the information we have, is the AWM previously identified for this type of failure fit to manage the situation?
- Does the available personnel possess the necessary competence and skills to apply the identified AWM?

Consideration of Older Working Methods

- If no specific AWM was previously identified to address the ongoing system failure, can we revert to an older working method in order to manage the situation until the failure is not repaired?
- Does the available personnel possess the necessary competence and skills to apply the older working method?

Definition of New AWMs

- If no specific AWM was previously identified, what kind of physical redundancy we may use to compensate for the system failure?
- If no specific AWM was previously identified, what kind of functional redundancy we may use to compensate for the system failure?
- If no specific AWM was previously identified, what kind of human backup we may use to compensate for the system failure?
- Can we provisionally use a tool to compensate for the system failure in a way different from what originally intended in its design?

Limitations of Selected AWMs

- Do we expect that the use of the identified AWM will maintain operations at an acceptable level of safety?

- If the application of the identified AWM relies on resources from a different organization, are these resources currently available?
- Do we expect that the use of the identified AWM will cause undesired side effects in other organizations?

Dissemination and training on AWMs

- If a decision was made to use an AWM, did we inform all the relevant personnel in our organization?
- If the identified AWM is expected to have side effects on the work of other organizations, did we coordinate properly with the points of contact of these organizations?
- If not all the personnel at hand is adequately trained to use the identified AWM, can we organize ad hoc training sessions to manage the situation until the system failure is not repaired?

AFTER A CRISIS

1. Organize a Focus Group with representatives of the managerial levels and front-end operators to analyse the use of AWMs adopted during the crisis (if any). The Focus Group should:

- Assess to what extent the AWMs were successful in maintaining business continuity and safe conditions until the system failure was not repaired
- Check whether the skill and competences of the personnel were adequate to apply the AWM
- Check whether the AWM caused undesired side effects in other organizations cooperating in the management of the crisis (If available, the analyses made through the CC [Adapting plans and procedures during crises](#) may also be used as input).

2. Consider whether any AWM emerged during the crisis (and previously unknown) proved to be successful in managing the crisis, to an extent that makes it a potential candidate for similar cases of system failure in future.

3. Propose new AWMs to manage the system failure that occurred during the crisis or other potential system failures identified during the post-hoc analysis of the occurred crisis.

- Select or revised one or more alternative AWMs for each of the system failure identified

4. Assign to a person or role in the organization the responsibility to approve the adoption of the AWM in case one of the considered system failures will occur

5. Write a report describing the defined (or revised) AWMs

6. Organize an awareness campaign to disseminate the description of the defined working methods to the relevant personnel and/or arrange *training activities* focussed on the same contents (training activities should be preferred in case the adoption of the AWM is not straightforward for personnel who never applied it and if allowed by budget constraints).

7. Inform other organizations that may be impacted by the application of the AWMs, as appropriate.

TRIGGERING QUESTIONS

Identification of System Failures

- During the development of the crisis, did we experience a system failure that compromised the continuity of the service offered by our organization?
- During the development of the crisis, did we experience a system failure for which there was no straightforward backup, emergency or contingency solution available by design?

Analysis of Emerging AWMs

- During the development of the crisis, did we observe any recovery action that we consider a valid reference to define a new AWM in case of system failure?
- Does the comparison between work-as-done and work-as-imagined during the crisis suggest that a new AWM would be required to manage a given system failure?
- During the development of the crisis, did we observe any successful informal practice that would deserve being converted into an official procedure?

Review of Existing AWMs

- Did we experience situations in which an AWM was used but came out not to be applicable or fit for the purpose?
- Did we experience situations in which there was an attempt to use an AWM, but the necessary tools were not properly maintained?
- Did we experience situations in which there was an attempt to use an AWM, but the necessary tools were not accessible to the personnel?
- Did we experience situations in which an AWM was not used because the relevant personnel

did not have the necessary skills and competences?

Consideration of Older Working Methods

- Did we experience situations in which the adoption of an older working method resulted inadequate to manage the complexity of the process managed with the ordinary working method?

Limitations of Selected AWMs

- Did we experience situations in which the use of an AWM degraded the safety of operations to a level considered unacceptable?
- Did we experience situations in which the use of an AWM was not successful, because its functioning relied on the same infrastructure causing the failure of the main system?
- Did we experience situations in which the use of an AWM was not successful, because its functioning relied on the resources of another organization that came out not to be available?
- Did we experience situations in which the use of an AWM caused undesired side effects in other organizations?

Dissemination and training on AWMs

- Did we experience situations in which an AWM was not used because the personnel was not informed of it?
- Did the crisis reveal that a dissemination campaign concerning an identified AWM was not adequate to the purpose?
- Did we experience situations in which the use of an AWM was not successful, because the point of contacts of other organizations were not informed of it?
- Did we experience situations in which the use of an AWM was not successful, because the training modules focusing on it were inadequate to prepare the personnel of our organization?

UNDERSTANDING THE CONTEXT

DETAILED OBJECTIVES

The card supports the development and the maintenance of Alternative Working Methods (AWMs) in case of system failure. System failures are situations in which an essential component to ensure continuity in the service offered by the organization is either lost or

functioning in a degraded mode and there is no backup, emergency or contingency solution available by design. The ability to adopt alternative AWMs in case of system failure cannot be taken for granted, since crises deriving from major system failures are relatively rare and can take different forms. Therefore, the identification of the AWM appropriate for a specific situation can be quite challenging. First of all, it is important to capitalize on the experience from previous cases of analogous system failures (if any). Then it is important to understand if there is room for reverting to older working methods, but only after a thorough assessment of the applicability in the new context and of the adequacy of the skill and competences of the personnel that is supposed to use it. Finally, the benefits of provisionally adopting the AWM until the failed systems has not be restored should be properly balanced with the negative side effects and potential issues for the safety of people that the use of the AWM might imply. Applying an AWM means performing one or more activities within the organizations in a way that is remarkably different from what described in existing procedures or practices. It may imply following different steps in the way to perform the activity, using different tools or cooperating with different people (or all of the above) with respect to what is normally done without the system failure. AWMs differ from contingency plans and procedures because they indicate solutions that are not included in the design envelop of the organization and can be used only for short periods. Once they are identified or successfully experienced in practice they can be used as input to design new contingency plans and procedures, but only after adequate trials or tests.

TARGETED ACTORS

Executive management roles, Management and Operational roles

EXPECTED BENEFITS

Increased capability of the organization to ensure business continuity in the face of system failures for which there is no straightforward backup solution defined by design.

RELATION TO ADAPTIVE CAPACITY

The capability to adopt AWMs in a wise manner during the development of a crisis resulting from a system failure may represent a very effective way for an organization to adapt to new circumstances that are not covered by existing rules and working practices.

ILLUSTRATION

Example of the measures adopted in a European Area Control Centre to recover from a radar loss event lasting more than two hours during the morning shift. (see Save L., Ruscio D., Cedrini, V., Cafiero L., Mancini M., The Organizational Response to Automation Support Degradation. Identifying Air Traffic Control Sources of Resilience in Cases of Radar Loss, in Proceedings of the 6th Humanist Conference, The Hague, Netherlands, 13-14 June 2018).

The real event occurred in 2017. A minor technical failure occurred at an airport and then propagated into unexpected cascading effects to the Area Control Centre (ACC), causing the freezing of radar screens of the Controller Working Positions (CWPs) for more than two hours, during morning operations. During the emergency, the frozen radar screens prevented all the Air Traffic Controllers (ATCOs) from visualizing the evolution of traffic for more than two hours. Despite the criticality of the situation, the emergency was successfully managed with limited impact on the business continuity of some Regional Airports and no negative effect on the safety of air transportation in the concerned area. Different 'sources of resilience' were activated, which included the use of ordinary backup systems (e.g. recruiting of ATCOs on relief during the emergency), of older working methods (e.g. use of paper flight strips) as well as of alternative working methods. For example, the supervisors were helping the ATCOs on duty by taking advantage of a still active and separate controller working position, normally used only for training and simulation purposes. The full recovery to the normal ACC functionality was achieved in less than four hours.

RELEVANT MATERIAL

REFERENCES

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Rankin, A., Dahlbäck, N., & Lundberg, J. (2013). A case study of factor influencing role improvisation in crisis response teams. *Cognition, technology & work*, 15(1), 79-93.

Healthcare – Reference



Examples of Alternative Working Methods in the healthcare domain

Fairbanks, R. J., Wears, R. L., Woods, D. D., Hollnagel, E., Plsek, P., & Cook, R. I. (2014). Resilience and resilience engineering in health care. *Joint Commission journal on quality and patient safety*, 40(8), 376-383.

Air Traffic Management – Reference



Examples of Alternative Working Methods in the aviation domain

Save, L., Ruscio, D., Cedrini, V., Cafiero, L., & Mancini, M. The Organizational Response to Automation Support Degradation. Identifying Air Traffic Control Sources of Resilience in Cases of Radar Loss.

NAVIGATE IN THE DRMG

- **Parent theme:** Managing system failures
- **Resilience abilities**
 - Contributes to: Anticipate, Learn and Evolve, Respond and Adapt
 - Supported by: Learn and Evolve
- **Categories:** Planning, Procedures, Learning lessons, Infrastructures, Training, Communication
- **Functions of crisis management:** Address vulnerabilities, Anticipate threats in environment, Cooperation and coordination, BEFORE, Execute and revise plan, Learning, Preparation, Prevention, DURING, Short-term recovery, Train

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Terminology

TERMS USED

Actor

Someone or something, outside the system that interacts with the system (Dulak & Guiney, 2003; DARWIN D1.3, 2016)

Ad hoc

Ad hoc refers to something made or happening only for a particular purpose or need, not planned before it happens

(<https://dictionary.cambridge.org/dictionary/english/ad-hoc>)

Adaptation

"The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Comment: This definition addresses the concerns of climate change and is sourced from the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). The broader concept of adaptation also applies to non-climatic factors such as soil erosion or surface subsidence. Adaptation can occur in autonomous fashion, for example through market changes, or as a result of intentional adaptation policies and plans. Many disaster risk reduction measures can directly contribute to better adaptation." (UNISDR, 2009)

Adaptive capacity

"ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences" ISO 14080:2018(en), 3.1.3.5. "The adaptive capacity of a system is usually assessed by observing how it responds to disruptions or challenges. Adaptive capacity has limits or boundary conditions, and disruptions provide information about where those boundaries lie and how the system behaves when events push it near or over those boundaries" (Woods and Cook, 2006, p. 69)

After-action report

"Document which records, describes and analyses the exercise, drawing on debriefings and reports from observers and derives lessons from it" (ISO22300)

All-hazards

"Naturally occurring events, human induced events (both intentional and unintentional) and technology caused events with potential impact on an organization, community or society and environment on which it depends" (ISO22300)

Anticipate

"Anticipate threats, opportunities and cascade effects. It is not only about identifying single events, but how parts may interact and affect each other" (DARWIN DoA).

Authority, autonomy and accountability

These notions are especially important to consider in the context of adaptations. It is indeed necessary to understand: (1) who is in command (*authority*); (2) how much latitude those under this command have to make decisions and take actions (*autonomy*); and (3) who might take responsibility for implementing certain courses of action (*accountability*). Resilient systems require that these aspects are organised in a coherent way, especially to avoid blame games when adaptations that appeared necessary during a situation turn out to be unsuccessful.

Brittleness

Brittleness describes how rapidly a system's performance declines when it nears and reaches its boundary conditions (Woods, 2015).

Buffer capacity

Size or kinds of disruptions the system can absorb or adapt to without a fundamental breakdown in performance. (adapted from Woods, 2006)

Business continuity

"Capability of an organization to continue delivery of product or services at acceptable predefined levels following a disruptive accident" (ISO22300)

Capacity

"The combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals. Comment: Capacity may include infrastructure and physical means, institutions, societal coping abilities, as well as human knowledge, skills and collective attributes such as social relationships, leadership and

management. Capacity also may be described as capability. Capacity assessment is a term for the process by which the capacity of a group is reviewed against desired goals, and the capacity gaps are identified for further action." (UNISDR, 2009)

Capacity development

"The process by which people, organizations and society systematically stimulate and develop their capacities over time to achieve social and economic goals, including through improvement of knowledge, skills, systems, and institutions. Comment: Capacity development is a concept that extends the term of capacity building to encompass all aspects of creating and sustaining capacity growth over time. It involves learning and various types of training, but also continuous efforts to develop institutions, political awareness, financial resources, technology systems, and the wider social and cultural enabling environment." (UNISDR, 2009)

Civil protection

"Measures taken and system implemented to preserve lives and health of citizen, their properties and their environment from undesired events. Note undesired events include accidents, emergencies and disasters" (ISO22300)

Collaboration

"To work with another person or group in order to achieve or do something" (Merriam-Webster Online Dictionary)

Command and control

"Activities of target oriented decision-making, situation assessment, planning, implementing decision and controlling effect of implementation on the incident Note These activities are continuously repeated" (ISO22300, ISO 22320)

Common Ground

Common Ground is a basis agreed by different parties for reaching a mutual understanding. In this context, a common ground between two or more organizations is achieved when the representatives of one organization have at least a high-level knowledge of the activities, goals, values and working environments of the other organization. Reaching common ground means being able to observe from two different perspectives an activity or process on which the two organization have

shared responsibilities. A benefit of common ground is the formulation of correct expectations on how the other organization will operate in a given circumstance so to facilitate a more effective collaboration.

Community resilience

Community resilience (CR) describes the community's ability to overcome unexpected changes and crises, mitigating the community's response. It is a multi-dimensional concept, encompasses both physical and perceptual components (Leykin et al., 2013; Cohen et al., 2016). Comments: Community resilience is perceived as a core element of disaster risk reduction (UNISDR 2015), and as a process rather than outcome. (Source: Norris et al. 2008). Community resilience is not the resiliency of the community members themselves, but their ability to take deliberate, purposeful, and collective action to alleviate the detrimental effects of adverse events on the community (Pfefferbaum et al. 2013). Optimize resource utilization will enhance CR. Communication is essential for capacity building. Ongoing assessment of CR may improve emergency preparedness and response (Leykin et al., 2013; Cohen et al., 2016).

Competence

"Demonstrated ability to apply knowledge and skill to achieve intended results" (ISO22300)

Concept

"A set or conjunction of characteristic features/entities related to a common scope and rationale that is (at least partly) entangled with or concerns the scope of DARWIN, and with a presumed coherence related to an overall and wide understanding of "resilience". What are the characteristic features put together, and how do they incorporate the idea of "resilience"?" (DARWIN D1.1, 2015)

Context

The environment in which a system will operate or operates (Sommerville, 2001, DARWIN D1.3, 2016)

Contingency

"Possible future event, condition or eventuality" (ISO22300)

Coordination

"Way in which different organization or parts of same

organization work or act together in order to achieve a common objective Note 1 Coordination integrated the individual response activities of involved parties (including e.g. public, or private organization and government) to achieve synergy to the extent that the incident response has a unique objective and coordinates activities through transparent information sharing regarding their respective incident response activities Note 2 All organization are involved in the process to agree on a common incident response objective and accept to implement the strategies by this consensus decision-making process" (ISO22300)

Coping capacity

"The ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters. Comment: The capacity to cope requires continuing awareness, resources and good management, both in normal times as well as during crises or adverse conditions. Coping capacities contribute to the reduction of disaster risks" (UNISDR, 2009)

Coupling

Coupling (loose/tight) refers to the time-dependency of a process, the flexibility of action sequences, the number of ways to achieve a goal, and the availability of slack in operational resources (from Perrow, 1984)

Crisis

"Situation with high level of uncertainty that disrupts the core activities and/or credibility of an organization and required urgent action" (ISO22300)

Critical Infrastructure

"The physical and information technology facilities, networks, services and assets that, if disrupted or destroyed, would have a serious impact on the health, safety, security or economic well-being of citizens or the effective functioning of governments in EU countries" (EPCIP, 2006)

Critical facilities

"The primary physical structures, technical facilities and systems which are socially, economically or operationally essential to the functioning of a society or community, both in routine circumstances and in the extreme circumstances of an emergency. Comment: Critical facilities are elements of the infrastructure that support essential services in a society. They include

such things as transport systems, air and sea ports, electricity, water and communications systems, hospitals and health clinics, and centers for fire, police and public administration services." (UNISDR, 2009)

Cross Fertilization

Cross Fertilization is the mixing of the ideas, customs, etc. of different places or groups of people, to produce a better result (<https://dictionary.cambridge.org/dictionary/english/cross-fertilization>). In this context, it should be mainly intended as the creative process by which organizations from different sectors and with different experiences exchange views and get inspiration for the innovative use of an existing technology (i.e. transfer of technology) or for a different application of an existing procedure or practice.

DARWIN Resilience Management Guidelines

Help or advice for DARWIN Resilience Management Guideline users to recognize or improve resilient performance (from the definition of "guidance", Merriam-Webster Online Dictionary) (DARWIN D1.3, 2016)

Deviation

"(1) An alternative method of compliance with the intent of specific requirements (MIL-STD-1574A). A departure from established or usual conduct or ideology. (2) The amount by which a score or other measure differs from the mean, or other descriptive statistic. " (Vincoli, 2006)

Disaster

"Situation where widespread human, material, economy or environmental losses have occurred which exceeded the ability of the affected organization, community or society to respond and recover using its own resources" (ISO22300) "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. Comment: Disasters are often described as a result of the combination of: the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injury, disease and other negative effects on human physical, mental and social well-being, together with damage to

property, destruction of assets, loss of services, social and economic disruption and environmental degradation." (UNISDR, 2009)

Dissemination

Dissemination is the act of spreading information, notions and ideas in relation to given content, in a format that can be easily understood by the people expected to use the information. In this context, the dissemination should be mainly intended as the activity by which relevant members of an organization become aware of pieces of information that are vital to ensure an adequate level of resilience of the organization itself.

Early Warning System

"The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss. Comment: This definition encompasses the range of factors necessary to achieve effective responses to warnings. A people-centered early warning system necessarily comprises four key elements: knowledge of the risks; monitoring, analysis and forecasting of the hazards; communication or dissemination of alerts and warnings; and local capabilities to respond to the warnings received. The expression "end-to-end warning system" is also used to emphasize that warning systems need to span all steps from hazard detection through to community response." (UNISDR, 2009)

Effectiveness

"Extend to which planned activities are realized and planned results achieved" (ISO22300)

Efficiency-Thoroughness Trade-Off (ETTO) principle

People (and organizations) have to make a trade-off between the resources they spend on preparing to do something and the resources they spend on doing it. The trade-off may favor thoroughness over efficiency if safety and quality are the dominant concerns, and efficiency over thoroughness if throughput and output are the dominant concerns (Hollnagel, 2009).

Emergence

"How a system's properties and behavior arise from the relationships and interactions across parts, and not from the individual parts in isolation or properties of

components." (Herrera, 2012; Reason) "In a growing number of cases it is difficult or impossible to describe what happens as result of known processes or developments. The outcomes are emergent rather than resultant. Emergent results are not additive not decomposable into components and consequently not predictable from knowledge on those components" (Hollnagel, 2012)

Evaluation

Evaluation refers to a tool to determine the worth and value of [...], with the purpose of providing information to decision-makers and improve [...] performance in the spirit of looking backwards to improve forward directions" (Vedung, E. (1997). Public policy and program evaluation. London, Transaction Publishers)."

Event

"Occurrence or change of a particular set of circumstances Note 1 An event can be more than one or more occurrences, and can have several causes Note 2 An event can consist of something not happening Note 3 An event can be deferred to as an incident or accident Note 4 An event without consequences can also be deferred to as a near miss, incident, near hit or close call" (ISO Guide 73 ISO 22300) DARWIN Note1 Evaluation scenarios cover different events types in terms of frequency of occurrence and predictability. The distinction between Regular, Irregular and Unexamined events by (Westrum, 2006 and DARWIN, 2016)

Exercise

"Process to train for, assess, practice and improve performance in an organization Note 1 Exercises can be used for validating policies, plans, procedures, training, equipment, and inter-organizational agreements; clarifying and training personnel in roles, responsibilities; improving individual performance and identifying opportunities for improvement; and a controlled opportunity to practice improvisation Note 2 A test is a unique and particular type of exercise, which incorporated and expectation of a pass or fail element within the goal or objectives of the exercise being planned". (ISO22300)

Form (of the guideline)

The design or appearance, with regard to ease of use (DARWIN D1.3, 2016)

Function

A set of actions that a system performs or is used for, which are valuable for the achievement of a set of goals (Woltjer, 2009, DARWIN D1.3, 2016)

Functional interdependence

Interrelationships (mutual dependence) between functions of a system.

Gaps (in plans and procedures)

Gaps are typically described in two ways in the context of plans and procedures:

in reference to the difference between those plans and procedures and how work is actually performed (see for example Antonsen et al, 2008). This corresponds to the idea of work-as-done vs. work-as-imagined.

in reference to the "holes" in the work processes, i.e. the actions that are not described in plans and procedures (see for instance Cook et al., 2000, in the context of patient safety).

In both cases, gaps exist between it is fundamentally impossible to describe work processes exhaustively. There are always limitations in the knowledge an organisation can have about work situations and performance, and situations that arise with unusual characteristics. People fill those gaps routinely in their activities, potentially deviating from plans and procedures as a result.

Governance

Governance describes structures and processes for collective decision-making involving governmental and non-governmental actors (Nye, J.S., and Donahue, J. (Eds). (2000) in Renn, O. (2008). Risk Governance. Coping with uncertainty in a complex world. Earthscan).

Graceful extensibility

"A positive capability to stretch near and beyond boundaries when surprise occurs. Systems and organizations need graceful extensibility as a separate kind of capacity to our everyday performances when the system is far from the boundary conditions" (Woods, 2015, Herrera, 2016).

Hazard

"of potential harm Note Hazard can be a risk source" (ISO22300)

Improvisation

"Act of inventing, composing or performing with little or no preparation a reaction to the unexpected" (ISO22300)

Issues

"Represent problems, difficulties or factors that need to be managed (by a suggested solution) in order to fulfill one or several needs. What are the barriers to fulfill the need?" (DARWIN D1.1, 2015)

Learn and evolve

"Learn and evolve from experience of actual events, successes and failures what to learn and how the learning is reflected in the organization". (DARWINTMs DoA).

Margin

"How closely or how precarious the system is currently operating relative to one or another kind of performance boundary" (from Woods, 2006 - Woods, D. D. "Essential Characteristics of Resilience." In Resilience Engineering: Concepts And Precepts, edited by E. Hollnagel, D. D. Woods, and N. Leveson, 19–30. Adelshot, UK: Ashgate, 2006.)

Mitigation

Measures taken to prevent, limit and reduce impact of the negative consequences of incidents, emergencies and disasters (ISO22300)

Model

"An inventory of interrelated items that claim to represent/operationalize a theory/concept, or parts thereof, (possibly) with a procedure or algorithm for their application. What is the inventory, and how can it be utilized? " (DARWIN D1.1, 2015)

Monitor

"Monitor in a flexible way means that the system'TMs own performance and external conditions focus on what it is essential to the operation" (DARWIN DoA).

Needs

A condition or capability needed by a user to solve a problem or achieve an objective (Hallberg, Jungert, & Pilemalm, 2014)

Operational information

"Information considered in a specific context and analyzed to provide an understanding of the situation and its possible evolution" (ISO22300, ISO 22320)

Operational variability

Variability and uncertainty are inherent in complex work such as disaster response; the conditions and challenges that manifest themselves are many and various. These can take the form of changes experienced in the daily life of operational units everywhere; or surprises that emerge from the interface of system elements that interact in unusual ways (e.g., hidden interactions); or challenges such as volcanic ash that defy prediction capabilities.

Organization

"Person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives Note The concept of organization includes, but not limited to, sole trader, company, corporation, firm, enterprise, authority, partnership, charity or institution, or part or combination thereof, whether incorporated or not, public or private" (ISO22300)

Performance

"Measurable result Note 1 Performance can relate to either quantitative or qualitative findings Note 2 Performance can relate to the management of activities, processes, products (including services), systems or organizations." (ISO22300)

Practice

"Represent a solution that has been incorporated/implemented in a real environment. What has been incorporated in order to overcome one or several issues/barriers?"

Practitioner

person involved in the practice or role of operation or management of critical infrastructure (adapted to DARWIN and critical infrastructure from ISO/IEC 19770 5, 3.31)

Preparedness

"The knowledge and capacities developed by governments, professional response and recovery

organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions. Comment: Preparedness action is carried out within the context of disaster risk management and aims to build the capacities needed to efficiently manage all types of emergencies and achieve orderly transitions from response through to sustained recovery. Preparedness is based on a sound analysis of disaster risks and good linkages with early warning systems, and includes such activities as contingency planning, stockpiling of equipment and supplies, the development of arrangements for coordination, evacuation and public information, and associated training and field exercises. These must be supported by formal institutional, legal and budgetary capacities. The related term "readiness" describes the ability to quickly and appropriately respond when required. (UNISDR, 2009)

Prioritized activities

"Activities to which priority must be given following an incident in order to mitigate impacts Note Terms in common use to describe activities within this group include: critical, essential, vital, urgent and key" (ISO22300)

Process

A sequence of activities designed to produce a specified output (ISO/IEC/IEEE, 2010, DARWIN D1.3, 2016)

Protection

"Measures that safeguard and enable an organization to reduce the impact of a potential disruption" (ISO22300)

Public awareness

"The extent of common knowledge about disaster risks, the factors that lead to disasters and the actions that can be taken individually and collectively to reduce exposure and vulnerability to hazards. Comment: Public awareness is a key factor in effective disaster risk reduction. Its development is pursued, for example, through the development and dissemination of information through media and educational channels, the establishment of information centers, networks, and community or participation actions, and advocacy by senior public officials and community leaders. (UNISDR, 2009)

Quality (of the guideline)

The internal consistency or soundness, and fitness for purpose (DARWIN D1.3, 2016)

Recovery

"Restoration and improvement, where appropriate, of operations, facilities, livelihoods or living condition of affected organization, including efforts to reduce risk factors" (ISO22300) "The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. Comment: The recovery task of rehabilitation and reconstruction begins soon after the emergency phase has ended, and should be based on pre-existing strategies and policies that facilitate clear institutional responsibilities for recovery action and enable public participation. Recovery programs, coupled with the heightened public awareness and engagement after a disaster, afford a valuable opportunity to develop and implement disaster risk reduction measures and to apply the "build back better" principle." (UNISDR, 2009)

Requirement

An expression that specifies what a system should accomplish (Lauesen, 2002)

Resilience

DARWIN adapts the following working definition: "The ability to resist, absorb, accommodate to and recover from the effects of disturbances and changes in a timely and efficient manner, including through adaptation and restoration of basic structures and functions" (DARWIN D1.1, 2015).

Some widely used related definitions that this working definition is based on:

"Adaptive capacity of an organization in a complex and changing environment. Note Resilience is the ability of an organization to manage disruptive related risk" (ISO 22300).

"The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. Comment: Resilience means the ability to "resile from" or "spring back from" a shock. The resilience of a community in respect to potential hazard events is determined by the degree to which the community has the necessary resources and is capable of organizing itself both prior to and during times of need." (UNISDR, 2009).

"Intrinsic ability of a system or organization to adjust its functioning prior to, during, or following changes, disturbances, and opportunities so that it can sustain required operations under both expected and unexpected conditions" (Hollnagel, 2014)

Resilience capabilities

DARWIN builds on proven resilience capabilities: Anticipate threats, opportunities and cascade effects. It is not only about identifying single events, but how parts may interact and affect each other. Monitor in a flexible way means that the system's own performance and external conditions focus on what is essential to the operation Respond and adapt to expected and unexpected crisis in a robust and flexible manner. This capability includes readiness to respond. The system is designed to provide a limited range of responses, there is still a necessity to adjust responses in a flexible way. Learn and evolve from experience of actual events, successes and failures what to learn and how the learning is reflected in the organization. Note This capabilities sometimes are called abilities or cornerstones (DARWIN DoA, adapted from Hollnagel, 2009)

Resilience engineering

The scientific discipline that focuses on developing the principles and practices that are necessary for a system to function in a resilient manner (Hollnagel, 2012)

Respond and adapt

"Respond and adapt to expected and unexpected crisis in a robust and flexible manner. The system is designed to provide a limited range of responses, there is still a necessity to adjust responses in a flexible way." (DARWIN DoA).

Response

"The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected. Comment: Disaster response is predominantly focused on immediate and short-term needs and is sometimes called "disaster relief". The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage." (UNISDR, 2009)

Risk

"Effect of uncertainty on object Note 1 An effect is a deviation from expected: positive and/or negative Note 2 Objects can have different aspects (such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organization-wide, project, product and process) Note 3 Risk is often characterized by reference to potential events, and consequences, or a combination of these Note 4 Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and associated likelihood of occurrence Note 5 Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequence, or likelihood" (ISO Guide 73 ISO 22300)

Risk management

"Coordinated activities to direct and control an organization (2.2.9) with regards to risk" (ISO Guide 73, ISO 22300)

Scenario

"Pre-planned storyline that drives and exercise, the stimuli to achieve exercise objectives" (ISO22300)

Sensitive information

"Information that must be protective from public disclosure only because it would have an adverse effect on an organization, national security of public safety" (ISO22300)

Serious gaming

Tactical decision games, role-playing simulations, etc., where different environments can be used, depending on the training/evaluation needs. Serious gaming systems are often broadly classified in Live, Virtual and Constructive modes. Live means involving real people operating real systems, Virtual means real people operating simulated systems, Constructive means involving simulated people operating simulated systems. DARWIN will use Virtual and Constructive modes as means to test and validate resilience guidelines developed in the project. (Wikipedia and DARWIN DoA 2015)

Situation understanding

Situation understanding refers to understanding of the situation during an unfolding event. During a crisis or disastrous event the responsible actors need to have a

good understanding of the situation (Reissman, D.B. and Howard, J. (2008). Responder safety and health: Preparing for future disasters. Mount Sinai Journal of Medicine. 75:2). This understanding includes knowing what resources are available (and where they are), what resources could be available, (O'Sullivan, T.L. and Corneil, W. and Kuziemy, C.E. and Toal-Sullivan, D. (2014). Use of the structured interview matrix to enhance community resilience through collaboration and inclusive engagement. Systems Research and Behavioral Science), understanding and making sense of the ongoing event (Meshkati, N. and Khashe, Y. (2015). Operators' Improvisation in Complex Technological Systems: Successfully Tackling Ambiguity, Enhancing Resiliency and the Last Resort to Averting Disaster. Journal of Contingencies and Crisis Management. 23:2) and knowing what other actors are doing or are supposed to be doing.

Solutions

"Represent some kind of a way forward to overcome one or several barriers, an intervention (which could be a method, tools, framework etc.). What could be incorporated (method, tools, framework etc.) in order to overcome one or several issues/barriers?" (DARWIN D1.1, 2015) "The description of a system or a component that realizes the design, which means that it should meet both the requirements and the identified needs" (Hallberg, Jungert, & Pilemalm, 2014; DARWIN D1.3, 2016)

Space (margin) for manoeuvre

The space (or margin) for manoeuvre is the cushion of potential actions and additional resources that allow the system to continue functioning and adapting despite unexpected demands (Lay and Branlat, 2015). What creates such space varies, examples include: (1) procedures that leave room for interpretation, i.e. not extremely prescriptive; (2) available extra resources such as tactical reserves. Resilient systems are careful about creating and maintaining margins, because they correspond to a capacity to handle disruptions when they occur... without jeopardising the capacity to do so in the future (Woods and Branlat, 2010; 2011). *Synonyms*: margin of maneuver. *Related notions*: Buffer, slack, wiggle room.

Stakeholder

"Person or group of people that holds a view that can affect the organization" (ISO22300) "An individual or a group of individuals who are affected by, or able to

affect a system. This includes developers, users, and actors." (Sommerville, 2001, DARWIN D1.3, 2016).

Statement

An expression that contains information relevant to the development of the system, which may consist of problem descriptions and ideas for future solutions (Source:Blanchard, 2008, DARWIN D1.3, 2016)

Sustained adaptability

Relates to Resilience Engineering. This term offers new ways to manage interdependencies across scales. It refers to the ability to manage adaptive capacities of systems (organizations) that are part of a layered network (Source:Woods, 2015, Herrera, 2016)

System

A collection of components organized to accomplish a specific function or a set of functions (ISO/IEC/IEEE, 2010).

Target

The guideline scope (DARWIN D1.3, 2016)

Technology Readiness Level (TRL)

Technology Readiness Level (TRL) proposed in H2020 used for technologies is adapted to DARWIN resilience concepts to assess maturity as follows: TRL1. Lowest maturity of concepts and methods. Examples include scientific articles and conference papers TRL2. Concepts formulated with some precision including some case applications. Examples include papers include case studies application. TRL3. Analytical studies, regulation and policy aspects analysed. Examples include concepts that representative for DARWIN end users view included. TRL4. Resilience concept and/or methods have been validated simulations or workshops in one or more security sectors (low fidelity). TRL5. Resilience concepts are integrated with reasonably realistic supporting elements so that the systems can be tested in a simulated environment. TRL6. Representative resilience concepts are tested in a relevant environment. Represents a major step up in a concept demonstration. TRL7. Resilience concepts and guidelines near or at planned operational system. Demonstration of an actual system prototype in an emergency preparedness exercise operational environment. TRL8. Resilience concepts and associated guidelines are qualified by

regulations DARWIN perimeter is between TRL1 (survey at the start) and TRL6 (pilots at the end).

Test

"Exercise whose aim is to obtain an expected, measurable pass/fail outcome Note A test is a unique and particular type of exercise, which incorporates and expectation of a pass or fail element within the aim or objectives of the exercise being planned" (ISO22300)

Theory

"A claimed/hypothetical correlation, order or causal relationship between a set of phenomena, issues or factors that associated with a (resilience) concept. What are the typical relationships and regularities that are worthwhile to pay attention to?" (DARWIN D1.1, 2015)

Training

"Activities designed to facilitate the learning and development of knowledge, skill, and abilities, and to improve the performance of specific tasks or roles" (ISO22300)

User

"An individual or a group of individuals that intentionally operate or interact with the system" (IEEE, 1998)

Validation

"The activity to confirm that the intended usage has been fulfilled by the requirements, the design, or the system" (ISO/IEC, 2007)

Verification

"The activity to confirm that the specified requirements have been fulfilled by an objective review of the design or system" (ISO/IEC, 2007)

Vulnerability

"The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard. Comment: There are many aspects of vulnerability, arising from various physical, social, economic, and environmental factors. Examples may include poor design and construction of buildings, inadequate protection of assets, lack of public information and awareness, limited official recognition of risks and preparedness measures, and disregard for

wise environmental management. Vulnerability varies significantly within a community and over time. This definition identifies vulnerability as a characteristic of the element of interest (community, system or asset) which is independent of its exposure. However, in common use the word is often used more broadly to include the element's exposure. (UNISDR, 2009)

Work-as-done

Work as done refers to the assumptions or expectations of what other people do [as part of their work] is called Work-as-Imagined (WAI), while that which people actually do [as part of their work] is called Work-as-Done (WAD) (Hollnagel, 2018, p. 17).

Work-as-imagined

Work as imagined refers to the assumptions or expectations of what other people do [as part of their work] is called Work-as-Imagined (WAI), while that which people actually do [as part of their work] is called Work-as-Done (WAD). The term 'imagined' is not used in an uncomplimentary or negative sense but simply recognises that our descriptions of work will never completely correspond to work as it takes place in practice - as it is actually done (Hollnagel, 2018, p. 17-18) and how work is being thought of either before it takes place when it is being planned or after it has taken place when the consequences are being evaluated (Wears and Hollnagel, 2015).

Workshop

A workshop is a period of discussion or practical work on a particular subject in which a group of people share their knowledge or experience. (<https://www.collinsdictionary.com/dictionary/english/workshop>).

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