DARWIN Resilience Management Guidelines

VERSION
Version 06

DATE
01-10-2018

ABSTRACT
The DARWIN project aims to develop state of the art resilience guidelines and innovative training modules for crisis management. The guidelines, which will evolve to accommodate the changing nature of crises, are developed for those with responsibility for protecting the population or critical infrastructure/services from policy to practice.

This deliverable presents the final version of the DARWIN Resilience Management Guidelines (DRMG), as developed during the lifetime of the project. The guidelines aim at supporting organisations in developing and enhancing their resilience in the context of crisis management. The guidelines are developed around the Capability Cards (CC), which represent sets of interventions proposed in order to develop and enhance specific resilience management capabilities captured in the conceptual requirements. The document describes the process to develop the Capability Cards, enrich them with domain-specific content and improve them based on evaluation and operational input. The description of the development process also includes considerations about involvement of end-users and other relevant stakeholders. It also provides information concerning the implementation of the guidelines considering contextual needs. The full guidelines are accessible in the DARWIN Wiki and provided in this deliverable in the form of the DRMG Book. Some guidance is provided on how to use the DRMG. The final sections describe the achievements related to the DRMG and reflect on strengths and limitations of the guidelines proposed. Future directions are proposed as a result.

Readers from industry and researchers can use this document as guidance to improve crisis management based on resilience concepts. Readers from the DARWIN Community of Crisis and Resilience Practitioners might use the work documented in this deliverable towards pursuing the development of resilience management guidelines.

KEYWORDS:
Resilience, Resilience Engineering, Resilience Management, Crisis Management, Development, Guidelines, Knowledge Management

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*The project uses a multi-stage internal review process, with defined milestones. Milestone names include terms (in bold) as follows:

- **PCOS proposed**: Describes planned content and structure of different sections. Document authors submit for internal review.
- **PCOS revised**: Document authors produce new version in response to internal review comments.
- **PCOS approved**: Internal project reviewers accept the document.

- **Intermediate proposed**: Document is approximately 50% complete – review checkpoint. Document authors submit for internal review.
- **Intermediate revised**: Document authors produce new version in response to internal reviewer comments.
- **Intermediate approved**: Internal project reviewers accept the document.

- **External proposed**: Document is approximately 100% complete – review checkpoint. Document authors submit for internal review.
- **External revised**: Document authors produce new version in response to internal reviewer comments.
- **External approved**: Internal project reviewers accept the document.

- **Released**: Executive Board accepts the document. Coordinator releases the deliverable to the Commission Services.
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Executive Summary

This deliverable presents the final version of the generic DARWIN Resilience Management Guidelines (DRMG), as developed during the lifetime of the project. The guidelines aim to support organisations in developing and enhancing their resilience in the context of crisis management.

The DRMG are not prescriptive guidelines for crisis management per se, but rather guidelines at a meta-level: the context is that of organisations that already have a number of processes and tools in place to support their management of crises (e.g., preparation activities, contingency plans, procedures, learning activities). The DRMG provide a perspective on these processes and tools grounded in research and practice on resilience management inspired by the fields of Resilience Engineering and Community Resilience.

The guidelines are developed around the Capability Cards (CC). Synthesising knowledge captured during from a worldwide literature survey, practitioners interviews and requirements. The CCs propose specific interventions in order to develop and enhance specific resilience management capabilities captured in the conceptual requirements. CCs are at the heart of the guidelines’ development process described in this document; they are built and revised by incorporating managerial and operational perspectives. It supports evolution of the guidelines. The CCs are organised in higher-level themes and related to each other as well as to basic categories and functions associated with crisis management.

The guidelines provide information about the underlying approach, principles and objectives in order to facilitate their implementation. They target specific resilience management capabilities through Capability Cards and currently include a set of 13 CCs. 9 of these CCs have been evaluated during Pilot Exercises, which led to a set of recommendations to improve their content and usability. They are more mature than the 4 remaining CCs, which were developed and improved based on end-user involvement, but without formal evaluation. These CCs cover a range of themes: coordination of distributed operations, management of adaptive capacity, resilience assessment, development and revision of procedures, public involvement, and management of system failures.

The full guidelines are accessible in the DARWIN Wiki and provided in this deliverable in the form of the DRMG Book. The DARWIN Wiki was developed to facilitate the development, management and future use of the guidelines. It is described in details in previous deliverables. The platform offers opportunities to reconsider common views on the nature of guidelines, their necessary evolution and their multi-faceted, multi-purpose content. Some guidance is provided on how to use the DRMG, based on experiences and lessons learned in the project.

The final sections of the document describe in significant detail the achievements by the DRMG development work (especially relative to initial requirements and recommendations from evaluation) and reflect on strengths and limitations of the guidelines proposed. Future directions are proposed as a result.
Expect the unexpected and know how to respond

Readers from industry and researchers can use this document as guidance to improve crisis management based on resilience concepts. Readers from the DARWIN Community of Crisis and Resilience Practitioners might use the work documented in this deliverable towards pursuing the development of resilience management guidelines.

**About the project:** The DARWIN project aims to develop state of the art resilience guidelines and innovative training modules for crisis management. The guidelines, which will evolve to accommodate the changing nature of crises, are developed for those with the responsibility of protecting population or critical services from policy to practice.

The guidelines address the following resilience capabilities and key areas:

- **Capability to anticipate**
  - Mapping possible interdependencies
  - Build skills to notice patterns using visualisations
- **Capability to monitor**
  - Identify resilience related indicators, addressing potential for cascade
  - Establish indicators that are used and continuously updated
- **Capability to respond and adapt (readiness to responds to the expected and the unexpected)**
  - Conduct a set of pilot studies
  - Investigate successful strategies for resilient responses
- **Capability to learn and evolve**
  - Explore how multiple actors and stakeholders operate in rapidly changing environments
  - Enable cross-domain learning on complex events
- **Key areas:** social media and crisis communication; living and user-centred guidelines; continuous evaluation and serious gaming
1 Introduction

1.1 Purpose of the document
This deliverable represents the final version of the DARWIN Resilience Management Guidelines (DRMG), as developed during the project.

The guidelines proposed are the result of:

- Generic guidelines development work initiated (process and content) based on requirements ([5], [6]),
- Enrichment and improvement of generic content through adaptation process in Healthcare and Air Traffic Management ([7], [8]),
- Improvements of content based on recommendations from evaluation (described in [12]),
- Improvements of content and expansion of scope based on interactions with DARWIN Community of Practitioners (described in [13], [14] and [16]).

The guidelines do not address all potential topics associated with resilience management for Critical Infrastructures. However, the DRMG cover the most essential resilience capabilities identified and prioritised in WP1 and in further interactions with outside experts (from the DCoP especially).

In addition, the guidelines aim to keep on evolving after the project. For this purpose, this document provides descriptions of the content development process as well as manuals, and the ownership of the DARWIN wiki platform aim to be transferred to the DCoP and limitations in order to inform such future efforts.

1.2 Authorship and licenses
The preparation of the deliverable was coordinated by SINTEF, with the support of all the partners involved in Task 2.1. This final deliverable for WP2 is based on the collection of all the content produced in all the different guidelines development activities that were carried out during the course of the project.

SINTEF led the overall development of the guidelines. SINTEF, DBL, FOI and BGU collaboratively developed, reviewed and revised specific Capability Cards and associated content. Adapted content from the domains of Healthcare (HC) and Air Traffic Management (ATM) came from [7] and [8], and is integrated into the final version of the DRMG. The adaptation process was led by ISS with the support of KMC and FOI for HC, and by ENAV with the support of DBL and SINTEF for ATM.

The DRMG content benefits from interactions, inputs and co-co-creation involving members from the DARWIN Community of crisis and resilience Practitioners (DCoP).

SINTEF developed the DARWIN wiki used to create, revise and access the DRMG. Guidelines’ formats were developed by SINTEF with the help of DBL and the graphic template for handouts was provided by CARR as part of WP6 exploitation efforts.

The DARWIN Wiki creative commons license CC-By 4.0 license. Thus, people using the DRMG Wiki can: share, copy and redistribute the material in any medium or format. Adapt, remix, transform, and build upon the material for any purpose, even commercially. The attribution is that people using the guidelines must give credit to the DARWIN project and EC support. No warrants are given.

1.3 Intended readership
As one of the final deliverables from the project, this deliverable is entirely intended for external readers. The document aims to support:
• Primarily, members of the DCoP and of the DARWIN consortium who might be involved in pursuing this work, expanding and improving the guidelines described here,
• practitioners and researchers outside the project that are involved in enhancing the resilience of Critical Infrastructures,
• other developers of guidelines, who might find insight in the content and process described.

The development process (including assessment and revision activities) is described in detail in order to provide potential methodological support, the content, organisation and nature of the guidelines can serve as a source of reference, the development of the DAWIN Wiki highlights the issues of knowledge management and access associated with the evolving guidelines content, and implements various capabilities to support such efforts.

1.4 Structure of this document

Chapter 1 introduces the document by describing its purpose and intended readership, and by relating it to other deliverables in the DARWIN project. A list of acronyms used in the document is provided. Note that since a terminology is part of the guidelines, a sub-section about terms and definitions has been added to Chapter 3 and to the Annexes, rather than in Chapter 1.

Chapter 2 focuses on the guidelines’ development process. It summarises the core elements of the process (described in previous WP2 deliverables) and elaborates on activities conducted in collaboration with external experts.

Chapter 3 describes the various elements of the DRMG. For readability purposes, the content of the guidelines is only summarised and illustrated in the chapter and provided fully in Annexes.

Chapter 4 describes the deliverable’s achievements, in particular in relation to initial requirements and evaluation recommendations, which drove the development process. The chapter also reflects on achievements and limitations of WP2 results in the wider context of the project.

Chapter 5 concludes by summarising the deliverable main results and proposing direction for future work.

Annexes provide: manuals for users and developers; template for Capability Cards development; example of template for user format; full details on fulfilment of requirements and evaluation recommendations; examples of Capability Cards in Handout format; full guidelines in the DRMG Book.

1.5 Relationship with other deliverables

This version of the DARWIN Resilience Management guidelines presented in this document benefits and addresses requirements, recommendations and lessons learned from the following deliverables:

• **D1.1 – Consolidation of resilience concepts and practices for crisis management**: This deliverable presents the analysis of concepts, approaches and practices for resilience management, and is accompanied by different products (e.g., SLR database, interview data). This content provided the base material for the guidelines proposed in this document.

• **D1.3 – Practitioner and academic requirements for resilience management guidelines**: This deliverable provides the various types of requirements for the development of the guidelines

• **D2.1 – Generic Resilience Management Guidelines**: D2.4 is a follow-up on D2.1 and pursues the work described in this deliverable to target conceptual requirements and implement the development process established.

• **D2.2 and D2.3 – Resilience Management Guidelines adapted to Healthcare and Resilience Management Guidelines adapted to Air Traffic Management**: These deliverables describe the adaptation process and provide domain-specific content that enriches the generic guidelines developed in D2.1. It complements D2.4 in terms of providing detail information on how the guidelines can be adapted to specific critical infrastructures.
- **D3.2 – Diverse representation and evolution of the guidelines support – final**: This deliverable outlines tools and resources that enable easy access, flexibility and evolution to the DRMG including elements such as DARWIN Wiki, field guide.

- **D3.3 – DARWIN Resilience management guidelines toolkit**: It contains simulation tools and serious games associated to specific capability cards (previously called concept cards). This deliverable proposes ways to use simulation and serious games in combination with capability cards with the purpose of training, pre and debriefing. This deliverable uses the content of the DRMG.

- **D3.4 – Resilience Management Concepts and application tutorials**: This deliverable proposes different tutorials and training material associated to the DRMG. It aims to enhance understanding on resilience management during crisis and everyday situation. It uses DRMG content.

- **D4.1 – Evaluation Plan**: it describes the methodology of the evaluation of the DRMG.

- **D4.2 – Initial Evaluation of the Guideline**: this document presents lessons learned that helped to improve the effectiveness of the DRMG evaluation.

- **D4.3 – Pilots’ implementation and evaluation**: this deliverable produced the detailed evaluation plan and designed the evaluation strategy base for the present Summative and Formative Approach used for the assessment of the DRMG and it provided initial feedback from the direct application of the CCs.

- **D4.4 – Final Guidelines Evaluation Report**: this document is the final evaluation of the guidelines and produced all the evacuation feedback collected during the project and generated the recommendations for improving the final set of the DRMG.

- **D5.2 – DARWIN Community of Resilience and Crisis Practitioner (COCR) resilience concepts, users and academia interactive workshops (WS1)**: The deliverable provided users’ inputs in the preliminary phase of development of the guidelines.

- **D5.3 – DARWIN Community of Practitioners (DCoP) workshop resilience concepts, users and academia interactive workshops (WS2)**: The deliverable provided users’ inputs co-creating specific concept cards and input to the DARWIN wiki.

- **D5.5 – DARWIN DCoP resilience concepts, users and academia interactive workshops**: The deliverable provided users’ inputs to 10 capability cards, selection of additional resilience concepts and participation to rapid prototyping.

- **D7.4 – DARWIN ethical approvals**: It provides templates and guidance for involving DCoP members, considering data sensitivity, privacy and GDPR (e.g. letter of information, letter of consent).

### 1.6 Acronyms and abbreviations

A comprehensive list of terms used in the DRMG is included in the DARWIN Wiki and DRMG Book. Below are acronyms and abbreviations used in this document.

**Table 1. List of abbreviations**

<table>
<thead>
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<th>Term</th>
<th>Explanation</th>
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<tr>
<td>CC</td>
<td>Capability Card (referred to as Concept Card in previous documents)</td>
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<td>CI</td>
<td>Critical Infrastructure</td>
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<td>DCoP</td>
<td>DARWIN Community of Practitioners</td>
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<td>DRMG</td>
<td>DARWIN Resilience Management Guidelines</td>
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<tr>
<td>GDPR</td>
<td>General Data Protection Regulation</td>
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2 Guidelines development process

The initial efforts in the project consisted of the collation of several sources of inputs to guide the subsequent development and evaluation of the guidelines: a literature review, various collections of input from practitioners, and a process to develop and prioritize requirements. These efforts are described in detail in [3], [4] and [5], and this section describes the process that uses these results as a starting point for the development of guidelines’ content.

Based on this input, the development of the DRMG involves various partners from diverse backgrounds. The process is established to be collaborative and iterative, each main step involving multiple iterations through internal feedback and revisions. The parallel development of the DARWIN Wiki as the supporting content management platform had a significant impact on the capacity of the team to follow this process: the creation, review and revision of the DRMG content occurs directly in this platform through the use of web forms that serve as templates for the different kinds of elements (more information about this aspect is provided in [6] and in the developer’s manual described in section 3.4.1 and available for identified developers in the DARWIN Wiki).

The Capability Cards are the elemental objects constituting the guidelines. The DRMG development process described here therefore focuses on the process of developing and revising content for the CCs.

The process is inspired by user-centred design and agile development principles and includes end-user input early and as often as possible to generate new iterations and improve the applicability of the guidelines created [1][2]. Steps 1-3 in Figure 1 are specifically aimed at developing the content of Capability Cards. The corresponding following sub-sections synthesise the development process provided in these deliverables. Section 2.4 provides details on activities carried to involve external experts, as these activities were key to the improvement of the guidelines’ content, in particular in terms of enhancing clarity and implementability.

![Figure 1. From draft to mature Capability Cards: overview of the DRMG development process](image)

2.1 Drafting: initial development of generic content

The first step is the selection of an unaddressed requirement, based on established priorities (level of importance, essentially) provided in [5]. This selection is followed by initial efforts to collaboratively agree on the meaning and intent of the requirement, i.e. the nature and scope of the targeted resilience management capability. Such clarification is necessary because requirements capture in one single compact sentence potentially complex ideas and concepts that might be interpreted or addressed differently by different persons, depending on background and objectives.
The development of a draft CC consists essentially of identifying relevant content in the literature survey and interviews material and synthesising this content in the appropriate template fields. Drafts consist in capturing: (1) what the concept addressed describes relative to resilience management, potential challenges or typical situations; (2) who the main actors might be; and (3) how associated interventions can be implemented to develop the capability targeted, for instance through identifying relevant practices, methods and tools.

For each CC, the development team consists of a leader (main author) together with co-authors and potential additional reviewers. The leader of the development is in charge of organising these tasks to initiate and improve the content. The main author might rely on another organisation (or more authors), e.g., the organisation more familiar with the literature survey material in order to find relevant information, and might organise exchanges within the team to address specific topics or issues. The CC template available in the DARWIN Wiki (see section 3.4.1) provides areas for review, which the co-authors and reviewers can use to point to issues and make suggestions for improvement. As a result, the development of the CC draft is a collaborative and iterative process within the development team.

2.2 Adaptation: specification and improvement of generic content

The DARWIN guidelines are of generic nature, i.e. aim at providing guidance across CI domains. However, an adaptation process is used to enrich the generic content of the Capability Cards drafted previously. Such enrichment consists of specifying the cards’ content with a more operational perspective, providing domain-specific illustrations, practices or strategies, contextual and implementation elements, etc. relevant to the topic addressed. Enriched CCs aim to serve as reference for the specific domains considered but can also be a source of insights for other critical infrastructure domains (e.g., the railway industry could be interested in practices and strategies from the ATM domain due to operational similarities).

The steps of the adaptation process and the relationships between generic and adapted content are described in Figure 2 and the associated comments. During the project, the adaptation process was developed and piloted in the domains of Healthcare and Air Traffic Management (details can be found in [7] and [8]). The process was led by the end-user partners from the respective domains (ISS and KMC for healthcare, ENAV for ATM). The partners relied on their internal experts (operators and managers) to provide the necessary domain perspective and knowledge.

While it is not explicitly an evaluation process, the adaptation of the guidelines is the process during which potential end-users had the most detailed (and usually first) look at content of the guidelines developed and provided input and feedback from the perspective of CI domains. The adaptation therefore played a key role in transitioning the CCs from initial drafts mostly based on literature and researchers’ experience to enhanced cards more grounded in crisis and resilience management practices (as illustrated in Figure 1).
2.3 Improvement: implementation of recommendations from evaluation

The summative and formative evaluation (described in detail in [11]) was the basis to produce recommendations to improve the DRMG at the end of the DARWIN project. The collection of feedback and the qualitative analysis of the results was directly used to formulate specific proposals for improvement. The recommendations aim at achieving a greater level of compliance of the DRMG with the requirements established at the beginning of the project and at improving the perception by the practitioners of the potential impact of the DRMG in improving the resilience capabilities of critical infrastructures. On the other end, the scoring achieved by each Capability Card in the summative part of the evaluation was the basis to prioritize the recommendations, taking into account which areas required more improvements. Therefore, the recommendations are classified for their criticality, distinguishing among “Critical”, “Important” and “Nice to Have” suggestions for improvement. In order to ensure traceability with the results from the evaluation, the recommendations also include pointers to specific sources of evidence, such as the feedback received during specific pilot exercises, also formulated in terms of quotes from the discussions had with the expert end-users involved (members of end-user partners, of the DCoP, or other external experts). When the recommendations aim at a better compliance with a requirement set at the beginning of a DARWIN project, a rationale is also provided to facilitate the interpretation of the proposed change.
The revision of CC content is, again, an iterative process. It is led by the CC’s main author (as defined in the drafting phase) who is primarily responsible for the implementation of recommendations for the evaluation. Once recommendations have been implemented, the second author reviews the CC, ensuring the recommendations have been addressed appropriately, and provides feedback and comments to the first author to finalise the revision iteration.

2.4 Involving external end-users and other stakeholders (DCoP)

Previous deliverables have described in detail how end-users and other relevant stakeholders have been involved in interviews ([7], [8]) and pilot studies ([11]) in order to provide feedback and input to the guidelines. This section provides details on a variety of other activities conducted, in particular with the DCoP, in order to involve external experts.

2.4.1 Interactive sessions at DCOP workshops and webinars

Feedback on the CC was gathered from the DCoP during both physical meetings as part of DCoP Workshops and through virtual meetings as webinars (see [16] for further details about the sessions and results). The aim if the DCoP meetings were to give DCoP members an opportunity to reflect on integrating the DARWIN CCs with their own knowledge and field of expertise, as well as for the DARWIN team to gather evaluation feedback for the CCs. The aim of the webinars were more diverse and included both informing and educating regarding the DRMG, but also collecting feedback and ideas for the development of CCs.

DCoP Sessions

To collect feedback on the developed CCs a series of interactive sessions were conducted as part of the third DCoP workshop in March of 2018. Thirty-seven members of the DCoP participated at the event, covering expertise of crisis, risk and resilience management, CBRNE, human factors and safety, marketing, social sciences, computer engineering, disaster and emergency medicine and epidemiology in domains such as health care, information-communication technologies, energy, transport, academia, defence, civil protection, government, NGOs and private companies.

Throughout the sessions the participating DCoP members were asked to apply or reflect on the use of a specific CC in relation to an ongoing crisis in the fictive setting of the town “Wedgewood”. Four interactive sessions were conducted in total, using a new scenario in each session. The participants were divided into six groups where each group participated in three to four sessions and for each session applied a new CC. In such a way, each CC was discussed by at least two different groups of participants using two different scenarios. The used scenarios covered everyday operations, expected and unexpected situations and different phases before, during and after events. The included scenarios were “Dam Collapse”, “Contagious disease on a plane”, “Cyber Attack in Wedgewood” and “Hostile event” (all scenarios are described in detail in D5.5 appendix 5). The purpose of the set of scenarios was to cover a wide spectrum of events to include all represented critical infrastructures and areas of expertise.

In preparation for each session the participants were asked to read the shorthand version (i.e. Guideline handouts) of the relevant CCs. The discussion was led by a facilitator from the DARWIN team and each group consisted of six practitioners. Each session was started by a brief introduction of the scenario and the main triggering question for the participants was: “If applied, can this Capability Card improve your organisation’s ability to respond in case of crisis/emergency?” The session was thereafter dedicated for the participants to express their view of the application and use of the CC with respect to the scenario and their domain. At the end of the sessions the discussion was summarized and presented in plenum with the other groups. Notetakers were present during all the sessions to document the discussions and relevant feedback on the CC.
Webinars

During the DARWIN project, webinars have been used to facilitate a continuous dialog with members of the DCoP and/or other interested experts. In late 2017 a Webinar was held were two members of the DARWIN consortium discussed how ISS and ENAV in Italy adapted the content of the Capability Cards 4.3 Noticing Brittleness and 2.3 Understanding Roles and Responsibilities to their respective domain, Health Care and Air Traffic Management. These adaptations for each domain are also documented and included as part of each of the Capability Cards. In February of 2018 an introduction webinar was held that presented and demonstrated the use of the DARWIN wiki. During June and July in 2018 three webinars were held to collect input to further refinement of three Capability Cards that began being developed during the DCoP workshop in March. These webinars were thus a continuation of the rapid prototyping of “Managing available resources effectively to handle changing demands”, “Increasing the public’s involvement in resilience management” and “Supporting development and maintenance of alternative methods”. The final webinar held in September 2018, “The sharing of experiences on how to implement the DARWIN Resilience Management Guidelines through workshops and simulations – an end-user perspective” aimed at presenting examples on how the DRMG have been implemented and used during the DARWIN project to showcase how organizations can approach and implement them in their respective organization.

2.4.2 Stakeholder survey

The stakeholder analysis provides input to the development and implementation of the DRMG. The main uses of the DARWIN stakeholder analysis are:

- Identify individuals, groups and organizations likely to be affected directly or indirectly by the DRMG
- Identify barriers for the implementation of the guidelines
- Identify topics to be included in the guidelines
- Identify constrains, interest and training needs

The literature reveals that a static approach for an stakeholder analysis often fails to consider that stakeholders and organizations, priorities, needs change overtime. Therefore, the stakeholder analysis is used as “sondeo” and has been used periodically to monitor changes and developments. The survey and analysis has been conducted three times during the project involving partners and members from the DCoP. At the end of the project, the DARWIN stakeholder questionnaire is an approach that can evolve and be used by organizations interesting in application or development of resilience management guidelines.

The process for creation and update of the DARWIN stakeholder analysis is based on the validated method of lean start-up ([18], creation is described in [6]). Updates of the survey questionnaire builds on the minimum viable product concept (called MVP). Its purpose is to facilitate the build-measure-learn feedback cycle as quickly and efficient as possible. The update follows a three-step cycle. First step consists in revisiting and revising existing fields in the questionnaire as considered appropriate. Additional resilience concepts to be operationalized can be included by using existing literature reviews and interviews with practitioners (e.g., [5]). Before conducting the survey, a pre-test of the updated questionnaire is performed within a small group to determine the adequacy of the instructions and questions. A far as possible the pre-test should not involve participants that will be included in the survey ([19]). Second step deals with experiment gather how “end users” respond to the stakeholder survey. Third, learn from the “end user feedback” and decide whether to continue or change.

The updates and analyses involved a multidisciplinary team including people knowledgeable in the area of resilience, crisis management together with potential guidelines users. The survey confirms the identification of three different groups of stakeholders involved in the DRMG, a primary, secondary and tertiary group of stakeholders. Primary stakeholders are those persons or organizations who manage crises and emergencies. They are direct recipients of the guidelines and represent a high priority need.
These are the most important professionals and end-users of the guidelines. They influence the development of the guidelines. Secondary stakeholders influence the development or are affected by the guidelines e.g. operational roles, front line operators, policy makers, national or international committees. It is essential that their interests be considered for the proposed innovation to fit into the existing arrangements (e.g. compatibility with existing procedures, practices and systems). Tertiary stakeholders are external actors who do not benefit directly or make decisions that affect the development of the guidelines but have an influence of its success (e.g. consultants).

Results from the survey enabled the update of identification of barriers and training needs based on stakeholders involved in the guidelines. In particular, the last stakeholder analysis enabled a reprioritisation of remaining resilience concepts to be operationalised. These new topics were further elaborated and included in the DRMG by using the rapid prototyping approach. Appendix B includes the latest issue of the stakeholder questionnaire.

2.4.3 Rapid prototyping experiment

A rapid prototyping experiment was conducted to test the participatory initiation and drafting of three Capability Cards based on pre-selected requirements (prioritised by DCoP and project members through stakeholder analysis survey). This experiment was initiated in two interactive sessions during a DCoP workshop: the first session was used to agree on scope and discuss initial directions, while the second allowed for some revisions and additions. Between the two sessions, DARWIN partners who had led the discussions provided quick evaluation and feedback on the other group’s results, which was used to suggest directions for their revision. Work initiated during the workshop was followed by a first revision by project members, and, a few months later, by 3 separate DCoP webinars to present and discuss the results in order to improve the initial content.

The three CCs drafted are “Managing available resources effectively to handle changing demands”, “Increasing the public’s involvement in resilience management” and “Supporting development and maintenance of alternative methods”. Relative to the overall process represented in Figure 1, they only correspond to the fulfilment of the first step, since they have not gone through a formal adaptation process. They are therefore at a lower level of maturity than the previous 10 CCs. However, through the involvement of a large and diverse group of DCoP members from the beginning (including in clarifying the nature of the requirement), this experiment proved useful in rapidly generating usable content and generating several cycles of revision motivated by expert and user perspectives.

2.4.4 Additional mechanisms

Evaluation activities led to a variety of data sources for the DRMG evaluation:
- Four Pilots Exercises in which the CC were applied
- The 3rd DCoP Workshop in which all the CCs were analysed in at least two group sessions with potential users.
- Other small-scale evaluation activities (including conferences and workshops with the participation of DARWIN partners showing the CCs to potential users not part of the DARWIN consortium)
- Periodic DCoP Webinars
- Additional Pilot Exercise conducted with experts of emergencies in case of mass casualty accidents on the highways (organized at the Italian Red Cross premises of Bologna on the 7th of May 2018)

Given the heterogeneity of the sources of evidence, the mechanism created to collect the feedback was organised in a series of questionnaires built and adapted around a set of core questions that were common for all the mechanism used to collect feedback.

The core questions were adapted accordingly to the type of the evaluation event and repeated across evaluation sessions to gather feedback on all the different CCs analysed in the different event (see [11] and [12]). This was achieved by administering a combination of Likert scales and open fields, both in presence and online. The main core topics of the questions used to trigger the feedback were about: (a) support to the improvement of resilience management capabilities, (b) coverage of the most relevant topics, (c) compatibility with existing practices, (d) applicability in the specific organization, (e) existence of methods and practices potentially useful to complement or enrich the card, (f) issues potentially generated by the application of the card.

In addition, the maturity of the cards was also standardised through the feedback mechanism, asking to select one among four different statements representing different levels in the TRL scale adopted by DARWIN and to provide a rationale for their choice.

Online questionnaires were built based on the same topics and questions, tailored and linked to individual Capability Cards in the DARWIN Wiki. Such mechanism provided the capability to collect feedback directly from external experts having access to the guidelines. This mechanism was introduced relatively late during the life of the project and was not used at a large scale. It nonetheless provides a basis for future work in order to involve external experts more regularly and easily than through specific events.
3 DARWIN Resilience Management Guidelines

3.1 Nature and scope

The guidelines produced during the project represent 13 topics belonging to 6 higher-level themes, captured in Table 1 below. CCs 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). Following examples such as [20], 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.

The following sub-section will present a summary or illustrations of some of these different types of content for three examples of DRMG Capability Cards (in italic in the following table).

**Table 2. Themes and topics covered in the DARWIN Resilience Management Guidelines**

<table>
<thead>
<tr>
<th><strong>DRMG Themes</strong></th>
<th><strong>DRMG Topics</strong></th>
</tr>
</thead>
</table>
| Supporting coordination and synchronisation of distributed operations | • Promoting common ground for cross-organisational collaboration in crisis management  
• Establishing networks for promoting inter-organisational collaboration in the management of crises  
• *Ensure that the actors involved in resilience management have a clear understanding of roles and responsibilities in own and other organisations involved in the management of the crisis* |
| Managing adaptive capacity | • 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 | • Assessing community resilience to understand and develop its capacity to manage crises  
• Identifying sources of resilience: learning from what goes well  
• *Noticing Britteness* |
| Developing and revising procedures and checklists | • Systematic management of policies involving policy-makers and operational personnel for dealing with emergencies and disruptions |
Involving the public in Resilience Management

- Communication strategies for interacting with the public
- Increasing the public’s involvement in resilience management

Managing system failures

- Supporting development and maintenance of alternative working methods

The DRMG Map in Figure 4 on the next page represents the relationships between CCs, based on the links made in each to other CCs. Three types of relationships are represented based on the CCs content:

- “enables”, when a CC provides means that support another CC (through the interventions described);
- “provides input to”, when the information gathered through the implementation of a CC can feed into the interventions of another;
- “complements”, when two CCs mutually enrich themselves.

3.2 Examples of Capability Cards

This sub-section only gives an overview of 3 of the 13 CCs developed in order to illustrate the variety of topics and kind of information captured in the guidelines. Full content is provided in the DRMG Book at the end of the document. The guidelines are also accessible directly in the DRMG Wiki.

Supporting coordination – Ensuring mutual understanding of roles and responsibilities

The purpose is to establish pre-crisis relationships between the organisations that may be jointly involved in managing a crisis, in order to pave the way for more effective collaboration and communication during crisis and post crisis responses across organisations.

Implementation – Stakeholders involved in resilience management need to have clear idea of roles and responsibilities. Therefore, there is a need to ensure in each organisation an adequate level of expertise about the resources, plans, and experiences they have, and what responsibilities other actors may have during a crisis. This is vital in order to identify gaps and cooperate before, during and after a crisis. What is needed to understand roles and responsibilities includes: (1) Who needs to be contacted during a crisis; (2) Which are the relevant roles for the management of specific crises; (3) What should be expected from other organisations during a crisis. Interventions proposed to capture and exchange such information:

- Coordination between different organisations with shared responsibilities in the management of specified crises, to ensure mutual awareness regarding who should do what.
- High-level procedure identifying points of contact, roles and responsibilities to be periodically checked with dedicated coordination activities.
- Dissemination of the shared procedure to each organisation with dedicated training activities.
- When possible, design of a quick-reference version of the procedure.

Examples of triggering questions include: Is there a need to involve new organizations in the coordination activities about shared roles and responsibilities for the management of a crisis? Did we recently experience within our organization changes of roles and responsibilities that could affect emergency procedures shared with other organizations? 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?
Expect the unexpected and know how to respond

The research leading to these results has received funding from Horizon 2020, the European Union's
Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement nº

Figure 4. DRMG Map
Background and context information – Major crises and emergencies that require the joint intervention of more organisations are luckily quite rare to occur. A negative consequence of this is that when a crisis occurs, managers and first responders may have lost familiarity with the best way to cooperate with other organisations and in case they have never experienced such coordination, establishing new links may be even harder. During the response to hurricane Katrina in 2005, a general lack of coordination and of understanding of responsibilities led for instance to different agencies duplicating work [21].

Therefore, there is a need to ensure in each organisation an adequate level of expertise in relations to aspects of the other organisations such as who needs to be contacted during a crisis, which are the relevant roles for the management of specific crises and what one should expected that these roles will do during a crisis. Stakeholders need to have sufficient insight into their own responsibilities. This includes knowing what resources, plans, experiences and expertise they have and it is required for them to have insight into other actors’ responsibilities. This is vital in order to identify gaps and cooperate before, during and after a crisis taking into consideration both intra and inter-organisational coordinated action.

A stronger and more effective coordination among different organisations involved in the management of a crisis is expected to improve the overall capability of such organisations (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 organisation (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.

Relevant material – In the Air Traffic Management / aviation domain, the Federal Aviation Administration produced an Airport Emergency Plan [22] that refers to and provides details about different related activities, among which:

- Orientation Seminars to discuss the AEP and initial plans for upcoming drills and exercises, and to become familiar with roles, procedures, responsibilities, and personalities of all those involved.
- Drills to test, develop or maintain skills in a single emergency response procedure.
- 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.

Assessing resilience – Noticing brittleness

The purpose is to identify brittleness factors 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 organization struggles to manage functional interdependencies between different parts of the same organization, 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 [23], to reveal how the system might be operating riskier than expected. In addition, brittleness manifests itself when the organization is unable to learn from past events, such as near misses and accidents.

Implementation – Interventions support noticing brittleness across the organisation, including:

- developing actors’ resilience-related knowledge and skills to notice how brittleness occurs in certain conditions
- implementing and conducting phase-specific activities within organisation to probe for and/or notice brittleness, for instance: Reading groups, workshops and similar activities help operators and managers develop the skills to notice and discuss brittleness; scenario-based, game-inspired methods allow for the gathering of various perspectives about brittleness and
potential solutions; methods and tools to collect information during crises allow for their analysis after the fact.

Different conditions are necessary to the successful implementation of such activities: the organisation must be willing to invest resources to understand and address pitfalls, even if they have not yet manifested in catastrophic outcomes; specific actors in the organisation serve as facilitators / champions in the process; the organisation is willing to develop a culture beyond traditional risk and safety management.

Examples of **triggering questions** include: Can we delay the achievement of some goals, in favor of more urgent ones? Are we hindering the operations of the members of other organizations during the crisis? What goal conflicts and trade-offs did we experience?

**Background and context information** – The topic of “Noticing brittleness” was developed as a mirror to the notion of resilience. The motivation for addressing this topic comes especially from the field of Resilience Engineering [20], [24]. While the notion of brittleness can be new or even controversial, our observation is that it often resonates with practitioners’ experience and allows to discuss the complex notion of resilience through describing its absence. Undermining factors to resilience are sometimes easier to notice and describe. However, it is fundamental that the positive side of resilience is also considered in resilience assessment.

Expected benefits of the implementation of the Capability Card include: improved capability to identify and discuss factors that make the organisation brittle in certain conditions, for all phases of crisis management, based on input from actors at all levels; better identification of potential measures to reduce brittleness, thereby enhancing resilience; improved preparedness and prevention of crisis situations.

**Relevant material** – Brittleness assessment practices have been implemented in the context of industrial maintenance and described in [20]. The necessary participants’ skills can be built through the use of study groups aims at observing and discussion resilience and brittleness at play. A table in the paper summarizes examples of observations of brittleness at play. A workshop can be conducted prior to anticipated peak season (increased demands and risk of events) is which a facilitator helps participants notice brittleness. The paper also describes a set of guiding questions.

In healthcare, the Health Technology Assessment (HTA) [25] 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.

**Involving the public – Increasing the public’s involvement in resilience management**

The **purpose** is to integrate a CI organisation 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 organisation’s ability to respond to both its own needs as well as to those of the local community in times of change and emergency.

**Implementation** – The integration 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 organisations can be very helpful in using their vast databases to help the authorities – municipalities create a good status snapshot at certain times.
During non-emergency periods, organisations 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. 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”.

During an emergency, the CI organisation 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 centres 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. 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 [26].

In the post-crisis period, both organisations and communities bear the task of rehabilitation and returning to normalcy. After the dust (real and metaphoric) has settled, is the 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. 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.

**Background and context information** – The rationale for creating links between organisations and community members is to have each partner know the other’s structure and capabilities and integrate them to work efficiently in time of crisis [27]. Such mutual involvement of the public and local organisations (including the business sector) is largely dependent on the type and nature of the latter. 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 CI organisations. 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.

### 3.3 Possible ways to use the guidelines in an organisation

The DRMG are envisioned by the DARWIN consortium to be exploited by critical infrastructure organisations in four possible ways: (1) including the DRMG in training for external targets in multiple domains; (2) adapting and implementing the DRMG within one domain; (3) as an enabler for the development of new research projects dealing with resilience management and (4) supporting further implementation in health care and air traffic management. The use can be based on the idea of adopting and adapting. In this way, a potential user can adopt the proposed guidelines and adapted them to their context and needs using the processes and examples provided in the guidelines.

The DRMG are already used integrating its content into specific courses on resilience management and is expected to generate new training modules based on the resilience thematic areas presented in DRMG. These training modules can be directed both to generic resilience management abilities in multiple domains, or towards specific critical infrastructure. Quote from DCoP member - simplified: “In our organisation, we had several healthy discussions based on the capability cards, we are now in the process of developing training. It’s been helpful going through - selecting questions, also reminding about; before, during and after!!”
The DRMG are designed as a portfolio of approaches, methods and tools, organised in the form of Capability Cards. It includes guidance on how to implement them. By doing this, the DRMG achieves flexibility and scalability that is necessary to consider in the adaptation and adoption specifics and scope of crisis management in different regions of Europe. In addition, the DRMG and the DARWIN Wiki represent a potential starting point for new or already existing research projects, representing a building block to be integrated and expanded to take in consideration an even wider and ever-growing context of resilience for crisis management infrastructures. This could support the evolution of the DRMG with the DCoP members, enriching the guidelines with further material in terms of commentaries and experiences from implementing the guidelines. The DARWIN Wiki supports to achieve a pan-European and even global dissemination of the DRMG.

The DRMG emphasizes implementation activities directed at both intra- and inter-organisational context. An actor, such as a public body, voluntary organisation or private entity, can use selected CCs in the intra- or inter-organisational context, focusing, for instance, on noticing brittleness and identifying sources of resilience of internal processes. The same actor may, at the same time, work with another set of cards for developing resilient capability in a cross-border setting or inter-organisational multi-event constellation. Implementation in such settings or constellations may primarily give attention to the topics of establishing networks and developing collaboration across actors.

3.3.1 Prioritising resilience management capabilities

The underlying philosophy to this flexible and scalable implementation of the DRMG considers that potential actors are likely to be at different stages of implementation of the DRMG as well as different levels of maturity with respect to their management of resilience. Some actors may have come a long way and are actively managing resilience-related processes, while for others, the idea of resilience or the content of the DRMG, in part or as a whole, might be something completely new. The degree of maturity of organisations (separately or collectively) may moreover vary across capability cards, with some parts already implemented to varying degrees. The presence of the appropriate context (i.e. the circumstances such as cultural, legal, resource, and structural circumstances) to implement the DRMG may also vary creating different preconditions for activity implementation per DRMG across countries and critical infrastructure domains. Such flexibility and scalability of the DRMG means that their implementation requires that the actors have the ability to identify and analyse:

- where they are with respect to their resilience management capabilities and enabling contextual circumstances;
- what Capability Cards are of relevance for them; and
- how the selected DRMG should be incorporated in their existing practices and development activities such as their current policy management, training and exercise programs.

The DRMG Map above (Figure 4) can serve as a mechanism to guide the DRMG users and help them setting priorities in the implementation of the guidelines. For instance, “A enables B” relationships suggest that A should be implemented before B. Various points are worth noting:

- A left/right divide appears between “enables” links and “provides input to” links and is only a result of bottom-up identification of links in the content of CCs. It suggests that synchronization/coordination interventions tend to be preconditions for other interventions, while resilience assessment activities provide information that is useful for other activities.
- As a result of these links, the themes of “Supporting coordination and synchronization” and “Assessing resilience” are good candidates for initial efforts in developing resilience in an organization. In the case of a general lack of familiarity with resilience concepts, “Assessing resilience” CCs allow to start the discussion on resilience topics and principles in the organization.
The figure shows that there is no linear path to follow, as many topics and themes complement each other. These cyclical relationships suggest that there is no particular starting point or endpoint to the process of enhancing resilience, and that CCs need to be revisited regularly.

Further information of other ways to use the guidelines such as evaluation of resilience management guidelines are defined in D4.4 and training in D3.5

3.3.2 Experience from pilots

The DRMG are intended as a meta-guideline for the organizations managing critical infrastructures, to review the specific guidelines, procedure and practices available at local level or to integrate them with new guideline elements. The WP4 pilot exercises targeted different users, thus the DRMG flexibility allows the use of different aspects of the CCs, in different context.

The three “Italian pilot exercises” were mostly addressed to policy and decision makers, as well as to high and middle managers, with the aim of presenting them a set of different implementation activities, designed to allow the simulated application (and evaluation) of the CC principles in actions. For this purpose, a simplified “field guide” format of the cards – mainly including the ‘implementation part’ of the original CC - was extracted from the different cards under evaluation. The field guide consisted of a series of handouts distributed to the participants during the pilot exercises. The handouts were intended to provide quick access to the most relevant contents of the cards to practitioners who are not familiar with the DARWIN project, and thus providing the first essential information to managers that usually are not resilience experts and have a very limited time to consult the full version of the card, before deciding to invest time and effort on it. In addition, the handouts were tailored to the needs of different crisis management scenarios that were used as reference example (aviation and healthcare domains).

Complementary to the “Italian Pilots”, the main target of the Swedish Pilot Exercise was evaluation of the DRMG with operational personnel within the healthcare domain. With operational personnel as a target audience of the DRMG, instead of policy makers, the DRMG need to be operationalized and contextualized into practical capabilities during an implementation directed toward operational personnel. The DRMGs was operationalized into resilience intervention, through educational workshops and exercises for the HC professionals in the regional medical management (in Swedish: Regional särskild sjukvårdsledning, RSSL), which are responsible for managing the medical response in the event of a major incident. This approach made it possible to evaluate the full process of creating interventions on the operational level based on the DRMG, as well as evaluate the effect of such interventions. The intervention evaluated in Pilot 4 included both specific activities suggested in the DRMG, as well as domain specific activities based on a synthesis of several parts of the DRMG. The outline and content of Pilot 4, organized as a series of sessions introducing and applying DRMG content in different stages, are thus mimicking the gradual introduction of new activities and concepts into operations, as would be the case in actual operations. The DRMG was used by the facilitators to guide the implementation of operationalized resilience concepts taking in account actual organizational-specific work conditions, culture, level of competence and existing level of resilience. See Annexes in [11] for more details on how guidelines were operationalized for pilot in Sweden.

3.3.3 Training on the guidelines

The experience of conducting pilot exercises described above suggest a progressive approach based on:

1. Lectures, to familiarize users with the overall approach and content of the guidelines,
2. Workshops, to discuss CCs in greater detail, especially using the triggering questions as guides to explore the various aspects of resilience covered in a CC,
3. Exercises, to implement interventions in the context of more concrete operational situations.

These types of interventions are also progressively more complex and resource-intensive. However, various project efforts outside of the guidelines’ development can serve as a basis for the various activities:

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement no 27 of 100
3.4 Developing and accessing the guidelines

The central location for the development and access to the guidelines is the DARWIN Wiki, available at https://h2020darwin.eu/wiki/. As described in [6], The DARWIN Wiki is a collaborative content management platform (wiki), which uses the Semantic MediaWiki extension in order to produce structured content rather than simple pages. Structured information provides the capability to separate the structure of content from its format (two elements that are typically joined in regular documents). As a result, elements of content underlying the DRMG can be selected, reorganised, collated and formatted in various ways. Such capability provides the basis for the existence of multiple guidelines formats aimed at various users and uses.

This section will describe the main elements of the development and access to the guidelines and provide some examples. The reader will be invited to consult directly the DARWIN Wiki for elements accessible openly there, i.e. for the public pages developed for users of the guidelines. Other elements are restricted to identified users of the platform, i.e. to developers of guidelines’ content and to developers / administrators of the platform itself. Comments and explanations will be provided when necessary.

Figure 6 below shows the full left menu of the DARWIN Wiki. Different parts of this menu are accessible to different types of profiles. In relation to these elements:

- Section 3.4.1 describes aspects for the developers of the guidelines,
- Section 3.4.2 concentrates on aspects for users of the guidelines,
- Section 3.4.3 describes succinctly elements of the development of the DARWIN Wiki.
3.4.1 Developing the guidelines

Access to the developers’ pages of the DARWIN Wiki is restricted to identified people that contribute to the content of the guidelines. This section provides an overview of the main mechanisms to develop and revise the DRMG. The main documents used to develop and revise Capability Cards are provided in Annexes A.1 and A.2 and described in the following sub-sections.

General approach – creating content through Semantic Mediawiki

Documents created in the DARWIN Wiki take advantage of the Semantic Mediawiki extension that constitutes the basis for the guidelines’ development approach and process. Types of pages (categories in the Semantic Mediawiki jargon) used in the DARWIN Wiki include: Capability Cards, Themes, Resilience abilities, Terms, etc.

Each type of page is a structured document fully described through a list of (1) properties and (2) values for these properties. The creation of content then simply corresponds to specifying the values for the properties that describe the page created. In the case of the Capability Cards, for instance, properties include, a title, a description of overall implementation approach, specific interventions (by phase), domain-specific properties, etc. Most properties used are free text, but a number of properties use pre-existing information: pre-defined lists of values, links to existing pages.
**Distributed creation and revision of guidelines content**

Properties of a page are specified using a web form. The form used to develop a Capability Card is provided in Annex A.2. On the DARWIN Wiki, each property actually uses 2 fields, one for the content that will be used in the guidelines, visible in the end-user formats, and one for review purposes. In addition, the description provided in the table is available online via help bubbles next to each property. This description was copied in the table in Annex A.2 as an explanation of the content of the Capability Cards and of the guidance provided to authors.

More detailed guidance about the provided is provided in the guidelines’ developer manual shown in Annex A.1. The developer manual describes many aspects of the creation and revision of content of the guidelines, but focuses on the content of the Capability Cards.

In addition, two representations are used to pilot the development of guidelines:

- The Map of requirements (Annex A.3) represents the state of development of the guidelines in relation to initial requirements. Compared to the initial list of requirements, which serves as a basis for the development efforts, it highlights the potential groupings and relationships between the requirements, as well as integrates potentially new topics (e.g., which might arise during interactions with experts). Such map, which needs to be updated regularly, shows both what has been accomplished as well as the envisioned remaining efforts. This representation is produced using CMapTools, a free software that allows for distributed development of concept maps.

- In comparison, the DRMG Map above (Figure 4) focuses on CCs that have been developed and on the relationships between them. By highlighting the links present in the CCs description, it suggests potential gaps to the developers.

On the DARWIN Wiki, a special page has been developed as part of the “Management pages” accessible to developers only. It recapitulates in a table the status of development of all initiated Capability Cards. This table serves as a convenient location to have access to the CCs for the developers, and, for people leading the overall development of the guidelines, to get an overview of development status. Such table, which is a convenient development tool, is generated automatically by extracting and displaying a small set of properties from all CCs.

### 3.4.2 Access to the guidelines

**Guidelines user manual**

A user manual was developed and is available directly in the wiki in the left menu visible to users (see Figure 6). This manual essentially describes the various elements of the menu and guides users in understanding the content, some of the features (e.g., possibility to expand or contract information, formats) and navigation principles (e.g., using relationships) of the guidelines.

**Formats for visualisation of the guidelines**

Three main formats have been developed for end-users:

- **The end-user view** used on the DARWIN Wiki extracts and displays all information from the Capability Cards besides review fields and properties used for content administration purposes. Content is organised in various sections (described in section 3.1 above), implementation sections being presented first as the core content of the guidelines.

- **The DRMG Book** provided fully in Annexes is a semi-automatic extraction of all the same information as in the end-user view, presented slightly differently and in a printer-friendly way, and concatenated in a single document. A full list of terms is added (extracted from the Wiki) at the end of the document. This format is intended as a constituting a reference about the content of the guidelines, which can be consulted on screen or paper when the user has time to explore the details of the guidelines.
• *The DRMG Handouts*, of which a few examples are provided in Annexes, are also generated semi-automatically from the DARWIN Wiki. It focuses on the implementation fields (interventions proposed by phase and associated triggering questions) and organises this content in a clearer and more graphic way. It is intended as a short and convenient reference on the guidelines and has been used successfully as such in various workshops and other events with external stakeholders, in situations where the full content of the guidelines was not necessary or would have been overwhelming.

The existence of the different formats highlights the capabilities provided by the DARWIN Wiki in supporting different uses depending on the needs and context of the users. Basing the platform on Semantic MediaWiki allows for the extracting, combining and displaying of structured information, which serve as basic capabilities in order to generate the various formats.

### 3.4.3 Overview of the development of the DARWIN Wiki

In addition to the webmaster of the DARWIN website, who provided the infrastructure to host the Wiki, only one person served as developer and administrator of the DARWIN Wiki itself during the course of the project. Such work is typically produced by a restricted team of individuals with special rights on the platform (see Figure 6). Based on “Special pages” only accessible and editable by them, their role is essentially to define the various pages, templates and forms that constitute the DARWIN Wiki. Such role requires knowledge about Semantic MediaWiki and wiki syntax, as well as and basic web development skills.

Annex A.4 provides a representation (generated also with CMapTools) of the various elements that constitute the DARWIN Wiki and relationships between them. The pages on which the end-users and developers of the DRMG navigate are instantiations of these elements. Note that this particular representation is outdated in terms of the exact names of some of the elements (e.g., some pages and templates), but it is provided to give the reader insights into the underlying components of the DARWIN Wiki. The map will be updated as part of the future efforts to transfer of the DARWIN Wiki to the DCoP, since it will facilitate the handover of Wiki developer / administrator role.

As an example of the type of documents created, Annex A.5 provides the template used to generate the handout format for one Capability Card. It extracts specific fields (implementation fields) from the Capability Cards and displays them in a webpage using a combination of wiki syntax and HTML code (including Cascading Style Sheet). The full DRMG Handouts are generated by concatenating content created through this template and can be printed directly from the DARWIN Wiki this way. However, the DRMG Handouts provided in Annexes are generated through an additional step, by copying and pasting this content in a Word template in order to have more control on the document generated. The DRMG Book is generated following the same approach. While the DARWIN Wiki highly facilitates the generation of such formats, this semi-automatic process is discussed further in the current limitations of the wiki.

Technical information for the development of the DARWIN Wiki came from the numerous online resources available (e.g., [https://www.mediawiki.org/](https://www.mediawiki.org/)), as well as specific resources dealing with Semantic MediaWiki [28]. These were key resources in order to undertake the developing efforts without prior experience or knowledge in the team about developing a wiki or using Semantic MediaWiki. Prior experience of web development was useful, however.
4 Achievements and discussion

4.1 Fulfilment of requirements and other recommendations

4.1.1 D1.3 requirements

For the guidelines, the requirements can be classified in two broad categories: conceptual, and non-conceptual. The conceptual requirements provide the basis for increasing resilience through identified capabilities. The non-conceptual requirements address the process for developing the guidelines including e.g., easy use, fitness for purpose context ([5]). The final guidelines evaluation report ([12]) describes in ample detail in sections 3 and 4 the level with which the CCs evaluated cover the requirements from [5]. The evaluation report provides as a result an update informed by data collected during evaluation events on the table provided in annexes in [6] (this table was an initial analysis of such coverage, largely based on expert judgment made by the guidelines’ development team). One limitation is that analyses are based on the CCs evaluated during WP4 events, i.e. on 9 of the final 13 CCs only (1 CC dealing with Community Resilience was not directly usable for the organisations involved in the exercises, and 3 CCs were developed later through rapid prototyping, in the final 6 months of the project).

The evaluation report also provides in section 5 recommendations for the whole DRMG and for individual CCs. As these recommendations were implemented following the release of this document, coverage of the requirements (in particular of the non-conceptual ones) improved since the evaluation analyses were conducted and reported.

The following table and charts provide an overview of the fulfilment of requirements.

Table 3. Number of requirements fulfilled, per category

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Conceptual only</th>
<th>Non-conceptual only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieved</td>
<td>81</td>
<td>47</td>
<td>34</td>
</tr>
<tr>
<td>Partially achieved</td>
<td>27</td>
<td>6</td>
<td>21</td>
</tr>
<tr>
<td>Not achieved</td>
<td>8</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Not applicable</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>118</strong></td>
<td><strong>60</strong></td>
<td><strong>58</strong></td>
</tr>
</tbody>
</table>

Figure 7. Level of fulfilment of requirements
The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement n°\ldots

The table provided in Annex C reflects both the results of the evaluation report and the improvement of coverage of conceptual and non-conceptual requirements. Some adjustments were made:

- In Section 3.2 of the evaluation report, the guidelines compliance with non-conceptual requirements is rated on a scale from 1 to 5 (1=No Compliance; 2=Limited; 3=Partial; 4=High; 5=Full Compliance). For simplicity and consistency purposes, the table in Annex C maps these scores into “Not addressed” (1), “Partially addressed” (2 and 3), “Addressed” (4 and 5). The reader is invited to consult D4.4 for the full details on evaluation results.
- A number of requirements were evaluated at the level of individual CCs (section 4). The table in Annex C provides an estimate of the result at the DRMG level.

### 4.1.2 Recommendations from evaluation

The final guidelines evaluation report ([12]) provides in section 5 recommendations for the whole DRMG and for individual CCs. These recommendations were implemented in the current version of the DRMG following the release of the report. The following table and charts provide an overview of the fulfilment of evaluation recommendations.

#### Table 4. Number of evaluation recommendations addressed, per category

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieved</td>
<td>85</td>
</tr>
<tr>
<td>Partially achieved</td>
<td>3</td>
</tr>
<tr>
<td>Not achieved</td>
<td>20</td>
</tr>
<tr>
<td>TOTAL</td>
<td>108</td>
</tr>
</tbody>
</table>

![Figure 8. Level of fulfilment of evaluation recommendations](image)

The table in Annex D provides details on how the recommendations from evaluation were considered and implemented. Given the limited amount of time, the indication of criticality provided with the recommendations served as the main prioritisation criteria. As seen in the table:

- All the “Critical” recommendations were achieved
- 4 “Important” recommendations remain not achieved. However, 2 of them appear out of scope, and 1 still appeared unclear after analyses within the team. The only remaining Important recommendation not achieved relates to the improvement of adapted content, which was difficult to do in the later months of the project.
- Other recommendations that were not achieved, or only partially, relate to “Nice to have” criticality. They were all considered but appeared not feasible during the project.

### 4.2 Significance of progress: theoretical and practical implications

The DRMG build and consolidate an extensive body of knowledge on resilience concepts and practitioners’ experiences and needs. It describes in a comprehensive manner how the guidelines can be developed as well as how they can be adapted to a particular critical infrastructure. The DRMG represent
an ecosystem of resilience capabilities with different levels of maturity, some of them closer to practical use, other requiring further work.

The guidelines represent advances on specific resilience concepts under the category themes and categories (47 concepts covered). Due to resource limitations, there are concepts not covered. Newer capability cards are included. Their content is achieved through rapid prototyping. These newer capability cards require further work to be adaptable. In addition, the world-wide literature survey [3] covered journals only. While such choice consisted a reasonable selection criterion given the scope of the topic, there is a larger body of knowledge from Resilience Engineering in the form of books, conference papers and recent publications. Hence, there are possibilities for the current guidelines to evolve and include new knowledge.

The DARWIN Wiki prototype contributed to development, easy use and evolution avoiding the DRMG being outdated or dust collectors. It contributes to knowledge management in the area of resilience. To our best knowledge, we are not aware of such resilience guidelines being developed and available with the proposed content, format combining resilience engineering and community resilience. Other resilience guidelines focus for example on city resilience (H2020 SMR project), societal resilience following the risk management process (H2020 IMPROVER project).

Efforts from end-users within the consortium and DCoP members in a systematic, iterative and open way have contributed on bringing the theoretical knowledge on resilience closer to its practical use. The guidelines benefit from deep knowledge, experience and constructive critics from partners representing knowledge and experience in ATM and HC. This feedback enabled current guidelines being adaptable to specific CIs. The DCoP community, being at its peak composed by 173 members from 25 countries, contributed to ensure transnational, cross-sector applicability and relevance of the guidelines to other domains different than HC and ATM ([16]).

4.3 Lessons learned: challenges, choices, successes, limitations

4.3.1 On choice, success and surprise

Concerning adaptation to specific critical infrastructures as a first sight, ATM and HC seemed to be very different contexts, but during meetings, the DARWIN team discovered that these domains shared many similarities and many common issues (e.g., criticalities of the infrastructures, impact on the public, etc.). At the same time these domains have specificities. There were benefits on having a DRMG with adaptation to both HC and ATM domains, especially as a source for sharing knowledge within and across domains. A surprising outcome of the adaptation process was the discovery of more uses than expected at the beginning of the project. Besides the guidelines being useful, they can be adapted and adopted in many occasions and such as training, workshops and meetings [29] as well during emergency preparedness activities such as table top exercises.

The rapid prototyping was attempted as a means to reach two objectives: (1) involving end-users from the very beginning of the development process, therefore co-developing content with them rather than simply requesting feedback and comments; (2) producing a limited set of CCs quickly, with fewer resources than in previous efforts. This experience proved successful, in particular in its effectiveness in producing operationally motivated content quickly. The engagement of members of the DCoP during the interactive sessions was also high.

4.3.2 Aspects that remain work in progress

The functional modelling had the ambition to capture aspects of crisis management and act as guide for the development efforts. A representation of the functional modelling was proposed during the initial phases of the development of the guidelines ([6]). Subsequent work consisted on the adaptation of the guidelines to specific domains. Results from the functional modelling kept on being used, but the model itself was not further explored and revised. It would have required significant efforts and more
knowledge to implement ways to organize, navigate and support evolution of the guidelines. The added value of the functional modelling to the guidelines remains unexplored at the end of the project.

Initial plans included other similar pages that aimed to complement the Capability Cards. On such example is the development of pages to describe a limited number of Practices, Methods and Tools (PMT) in greater detail. The intent was to develop fairly short pages providing more information than in the CCs themselves and to describe more aspects of the PMT selected, such as examples of application. Such page could then be linked within the content of the CCs together with a short description of its relevance in the context of the capability described. Over the full guidelines, a catalogue of resilience management PMTs could then be created based on these pages. Due to the priority given on the improvement of CC content in order to make it more operational, only a couple of such pages were drafted and available directly on the DARWIN Wiki. Due to the priority given on the improvement of CC content in order to make it more operational. These efforts remain limited in scope and should be pursued.

The focus during the project have been the development of the guidelines. Further work should focus on implementation as follow up, based on sharing experiences from different domains. While implementation efforts are on-going in the organisations of some DARWIN end-user partners and DCoP members, no detailed feedback was available yet during the lifetime of the project, and it was not possible to integrate well the implementation phase as part of the development process. Only insights about implementation and basic guidance are provided based on experiences in the project.

The adaptation process proved instrumental in enriching and allowing for the improvement of the guidelines content. However, the extent with which this content was evaluated in pilot exercises and revised in later phases of the project was limited due to the way the work was structured. The adaptation process also constituted a significant effort requiring the participation of experts from the organisations of end-user partners. It remains needed to investigate how this process can be integrated as a more continuous effort rather than as a single intensive step in the guidelines development process.

4.3.3 Synthesis of feedback/reflection from partners

The following summarizes some comments from the partners:

Concerning the question: What went well?

- Early adopters have been identified. The DRMG capability cards are being used. This is a success;
- The work of content experts from different countries and the repetitive review were an excellent approach to producing a truly multidisciplinary, multicultural, useful document;
- The use of end users (the DCoP) made a great contribution to the process and outcome of DARWIN by providing a broad range of visions;
- The DCoP members appreciate the possibilities to learn interventions to be more resilient and learning about the guidelines
- The rapid prototyping was effective

Concerning the question: What could be improved?

- Lot of work of developing different and “nice-looking” versions. Not all partners are publishing experts.
- During the development process the “Author’s guide” details were missing. This lead to diversity in how cards were written. A more organised process was defined. For the future, continuous distributed self-organized way as Wikipedia, more “formal” revisions will be necessary.
- The quality control combined with different editors for different cards found to be difficult.
- Track changes not available in wiki, difficult to work with through comments.
4.3.4 Limitations

Broad scope and diversity of contexts

The DRMG address crisis management across CI domains and across Europe. Such scope is very broad and corresponds to a wide diversity of contexts. However, various elements of context can have an impact on the applicability of the guidelines.

Differences between domains were highlighted, especially during the adaptation process. Implementing resilience management guidelines in ATM can have a different signification than in healthcare:

- ATM has a track record of safe operations in challenging conditions, even if disruptions happen routinely and crises occasionally. A number of practices and methods corresponding to resilience management capabilities identified in the project already exist, especially related to handling and learning from disruptions.
- Healthcare is a more heterogeneous and unpredictable domain. Practitioners display individual as well as team resilience routinely and during unusual circumstances. However, managing this resilience, i.e. systematically creating the conditions for resilient practice to occur, has shown to be challenging in this domain.

Moreover, the involvement of partners from Sweden and Italy, as well as the conduction of pilot exercises in these countries highlighted cultural aspects that are likely to affect how the guidelines can be applied:

- Preparedness vs. Response emphasis
- Centralised vs. Decentralised
- Flat vs. Hierarchical organisational structures
- Trust vs. lack of trust in governmental institutions

In addition, the term “crisis” covers a wide variety of situations. Depending on events and domains impacted, crises events vary widely in terms of: available knowledge, number and variety of organisations involved, time constraints and duration, etc.

Proposing common guidelines for all these situations and contexts is challenging. In particular, it leads to regular tensions between the need to be sufficiently generic to be implementable in many contexts, and the need to be sufficiently specific by proposing concrete and useful interventions. The approach presented in this document addresses the issue in part, supported by the use of the DARWIN wiki to propose a non-linear mechanism to access content.

Strengths and limitations of the DARWIN wiki

The DARWIN Wiki was the selected solution by the development team and positive responses were received by potential end-users within and outside the consortium ([14]). While the capabilities provided by the approach based on Sematic MediaWiki proved useful and interesting in exploring innovative ways to develop and use guidelines, a certain amount of limitations are worth noting:

- In spite of being fairly simple to use and requiring only limited knowledge of wiki syntax, technical support was often necessary and entailed significant work for the administrator,
- We have used specific review fields as the main mechanism to support feedback and revisions, and versioning is managed well in a wiki. However, capabilities such as track changes and comments are more convenient and precise in a document such as a Word document and make it easier to work with comments (note that they have their limitations too),
- As a result of both points above, it has been more effective in a limited number of instances for partners to copy/paste information in a Word document and exchange it between authors. However, the vast majority of the content development and revision was done directly in the DARWIN Wiki, which supported this work successfully.
• To help users and developers, manuals are needed. Existing users’ and developers’ manuals were created but will need to be updated and expanded (e.g., not focused solely on Capability Cards) to better support transfer of the DRMG to members who have not participated in the efforts from the beginning.

• Semantic MediaWiki is an extension developed for MediaWiki. Various other extensions were used in the development of the DARWIN Wiki. For instance, some extensions simplify authentication when transitioning between the DRWIN Website to the Wiki. One issue is that various MediaWiki extensions have different requirements in terms of versioning, leading to potential incompatibilities between them. Some useful capabilities of MediaWiki, such as extensions supporting export to different formats (e.g., PDF) were not used as a result of such incompatibilities (in this case, priority was given to authentication goals).

• Finally, wikis are not meant to design very complex web pages. The instructions available when developing templates are fairly limited and provide less control than in other web development environments. Such limitation explains the need to rely on a semi-automatic generation of graphic user formats such as the Handouts and Book. While the Wiki supported this process successfully, the generation of the final products remained tedious. It is expected that it will be easier when it is done continuously, but future efforts will investigate how to further facilitate the process.

4.4 Factors underlying the successful development and use of the DRMG

Guidelines are a challenging object of design: the development of such object is a typical “ill-defined” problem, i.e. corresponds to a problem for which there is no clear end-goal, nor clear path to a solution. Hence, we discover goals and solutions as we pursue them. The nature of such problem is further complicated by the typical scope, scale and complexity of the context of crisis management in Europe CIs for which the guidelines are developed. As a consequence, the first success factor is the establishment of a development process that was an iterative and collaborative discovery process: following the requirements defined, the team made attempts and learned about what the end-product (the guidelines) should be, as well as about the process to reach a satisfying solution. In general, diverse methods to define, develop and evaluate the guidelines were needed and were not readily available; they therefore had to be created or adapted from existing approaches. The reliance on a multidisciplinary team representing knowledge and experience from different scientific and operational domains makes reaching consensus more challenging. However, such approach leads to clearer and more concise content due to the revisions operated through the iterative process (particularly in the initial drafting phases when the purpose of a guideline developed needs to be clear across the development team).

Because an essential objective is to develop guidelines that are usable, the involvement of end-users throughout the project was very instrumental in ensuring applicability in potential users’ operational and managerial contexts. End-user partners and members of the DCoP have provided their knowledge and resources and shared diverse expertise and experiences. The enrichment and assessment of the guidelines occurred thorough different interactions surveys, focus groups, interviews, interactive workshops and webinars. Active participation of end-users also contributed to a learning process across CIs, which was highlighted as one of the main elements of satisfaction after each DCoP workshop. In particular, the adaptation process led by end-user partners was a key step in the development of useful and usable content, by favouring the transition of the content from a draft, often too conceptual form to a more applicable guideline. While evaluations were quite positive, end-users and domain experts usually emphasised the need for compact and clear guidelines (a challenge for a wide topic requiring new concepts). In that respect, the tools and mechanisms underlying the guidelines content and use were perceived very favourably by end-users, such as the use of the triggering questions as pointers to key issues, and of the DARWIN Wiki as the guidelines repository.
4.4.1 Need for supporting mechanisms: training and tools

To enable development, deployment and implementation of the guidelines, different tools and training material were developed (see [10]). The content and use of the guidelines is not self-explanatory, for instance due to the need to introduce concepts that might be new to the operational environment targeted (such as the concept of brittleness). The approach taken by the project was to develop and explore innovative uses of technology to support end-users. In particular, The DARWIN Wiki knowledge platform offers opportunities to reconsider common views on the nature of guidelines, their necessary evolution and their multi-faceted, multi-purpose content.
5 Conclusions

5.1 Main results

The approach to development through the involvement of all levels of entities affected by a disaster situation in the process is unique and made a great contribution to this project: it is truly multidisciplinary, multicultural, flexible, adaptable and renewable. Supported by the convenience of a central online platform for development and access to guidelines, the DRMG Wiki, the network of contributors has the potential to remain sustainable for future actions.

Distributed and collaborative development with continuous end-users involvement

The scope of the project required that the development of the guidelines was organised across partners distributed in space and with a diversity of competences and experience. The establishment of a structured development process was instrumental to enable such distribution of efforts. The DARWIN Wiki facilitated the consistency of results through the use of structured information.

The process involved end-users through the adaptation process (partners leading these efforts) and through various interactions with outside experts (especially with the DCoP). In particular, end-users’ role was not limited to a traditional provision of feedback and input, but also involved the co-creation of content together with the development team. Such user-oriented development ensures that efforts are made to improve the applicability of the results and facilitates their future adoption.

For partners, it has been extremely useful to be forced to be explicit about how the state-of-the-art knowledge on resilience can be summarised and communicated to various organisations, and to receive their feedback in order to make sure that the latest methods and concepts can be put into practice. During this co-creation progress, many insights were gained in the practical hurdles to implement resilience concepts and how to overcome them.

Added value of the DRMG

Guidelines are most useful for guiding organisations, communities, managers and leaders to create a more resilient and sustainable environment. Management of disaster situations, throughout the cycle of disaster, can be directed by the guidelines. Even end-users who are from the lay population may seek and find help in them.

Contextualisation in pilot studies and interviews (see DARWIN website) shows that guidelines can provide added value and that practitioners as part of DCoP and DARWIN practitioner partners are enthusiastic about applying the guidelines to their respective organisations.

Some organisations met during the development of the guidelines already implement a potentially vast number of activities similar to those described in the guidelines. However, such activities typically correspond to separate initiatives or divisions in the organisation, limiting their coherence and, as a result, impact or effectiveness. The DRMG propose a centralised and coherent approach to resilience management in order to support CI-related organisations in their efforts to improve in the face of crises.

In spite of some limitations, the DARWIN Wiki facilitated the development of the guidelines, and provided a means to explore different approaches to creating and using the content of guidelines. For instance, it constitutes a non-linear mechanism to navigate content. Such nature is relevant in the context of resilience discussions because: (1) the targeted resilience capabilities and underlying concepts are highly interdependent; and (2) improvements of such capabilities should be part of a continuous process in which organisations regularly revisit topics based on progress on others, rather than follow a step-by-step path. The DARWIN Wiki also represents an interactive website that can be maintained at a reasonable cost to facilitate ongoing sharing of information, tools, experiences, lessons learned, etc.
5.2 Future of the DRMG

Exploitation considerations are described in detail in [17]. While some organisations have started to implement the DRMG, one of the main activities in the short-term is the transfer of ownership to the DCoP. DARWIN partners will be part of the DCoP, at least in its initial phases, providing technical and knowledge support for both the development of the guidelines and the use and development of the DARWIN Wiki.

Based on the strengths and limitations described in the previous section, pursuing the work on the DRMG will involve improving and expanding the content of the guidelines and will be an opportunity to implement additional features which were insufficiently developed or explored during the lifetime of the project. Among such features are:

- The creation of means for users to provide content, in particular related to return of experience or domain-specific content in other domains than Healthcare and ATM.
- Better leveraging discussion forums in wiki, as on Wikipedia discussions might be had on different sections of the CCs, with DCoP members exchanging experiences on applying the various steps and triggering questions that are suggested.
- Method pages could be added that detail specific methods (e.g., RAG, FRAM, TORC, etc.) where DCoP members (researchers and practitioners) share experiences and descriptions of implementations in more detail, and provide feedback and how-to discussions of local implementations of the CCs and associated methods.
- Experiences with metrics and evidence of improvement programmes that indicate further evidence of application and tangible improvement, as well as success stories from the field, could be shared on discussion pages.
- Relevant conferences and events may be a meeting point for DCoP to meet every other year and keep the mission running.

The DARWIN Wiki does not have the ambition to become a “regular” wiki in which content quality and moderation largely emerges for the vast number of contributions (apart from a limited number of controversial topics). One challenge ahead is the scaling up of the guidelines’ development team by the inclusion of new members. While already challenging, the maintenance of a high-level of content control and coherence was facilitated by the limited size of the development team.

5.3 Contribution to the DARWIN project objectives

The main objective and core result of the DARWIN project was the development of European resilience management guidelines, this deliverable addressed this main objective by documenting the DARWIN evolving Resilience Management Guidelines, their development process, and their intended use.

This deliverable contributes to achieve the following DARWIN project sub-objectives (O):

- Make resilience guidelines available for a particular critical infrastructure operator, the DRMG includes adaptation of the guidelines to the needs of the Air Traffic Management (ATM) and Health care domains (O1);
- Facilitate evolution of resilience guidelines proposing DARWIN Wiki as knowledge management platform that enables involvement and integration of views, concerns, needs, expertise and experience of ATM, HC and practitioners from other CIs (O3);
- Build on lessons learned in the area of resilience as the establishment of the link between resilience concepts, approaches and practices to domain specific practices. This is based on the experience shared from experts and practitioners from diverse domains (O5);
- Revise and update DRMG addressing both requirements from worldwide literature survey and practitioners interviews as well as recommendations and lessons learned from evaluation pilots’ exercises (O6);
**5.4 Impact of the deliverable outside the project**

The current DRMG provides evidence on the following impacts being achieved:

- Integrate results in from a comprehensive world-wide literature survey and knowledge from a large community of practice (DCoP members).
- Contribute to increased adaptive capability. The guidelines provide means and propose interventions to service providers and managers responsible for critical infrastructure to analyse their resilient performance and improve efficiency and effectiveness when dealing with crises and disasters. At the end of the project, DCoP members have started to adopt the guidelines in their organizations.
- Resilience concepts are more mature as the updated guidelines in this document benefit from adaptation and evaluation processes. Readers can use the DRMG and the capability cards to identify improvements of their inherent resilience prior, during and after crisis. Moreover, the capability cards can be used to address everyday operations and training.
- Provide means for further evolution of the guidelines. The development process, stakeholder analysis and rapid prototyping supporting with the DARWIN Wiki allows readers in adapting the guidelines in their own organizations integrating both managerial and operational experience.
- The presentation of the approach, principles and objectives provides knowledge on resilience management as complement to risk management when dealing with crises.
- The DARWIN Wiki is seen as successful tool that supports knowledge management and information sharing and supports integration of new knowledge beyond the project.

The DARWIN resilience management guidelines provide a common understanding on resilience across many domains. The current version of the guidelines includes adaptation to Health care and Air Traffic Management. The guidelines include knowledge and shared views on resilience among the following critical infrastructures: Aviation, Railway, Maritime, Road, Disaster preparedness and civil protection, Energy, Fire and Rescue, CBRNE, Police, Government, Water and water waste, Financial and Information and Communication technologies ([12], [16]).
6 References


Expect the unexpected and know how to respond


ANNEXES
A Reference documents for the development and use of the DRMG

A.1 Filling guide for DARWIN Capability Card

1. General process

Quick reminder: what are we trying to do?

The starting point is the belief that, in order to manage crises in a resilient way, organizations need to manage their systems’ resilience. This means that they need to be able to assess, understand and improve how resilient they are in the face of crises (before, during, after).

The conceptual requirements constitute a set of resilience-related capabilities or characteristics. By describing how those capabilities or characteristics can be implemented in the systems, the CCs aim at constituting the building blocks of the management of resilience. The DRMG will propose a coherent organization of the cards in order to describe aspects of crisis management the users could be interested in.

There are different kinds of people impacted by the guidelines. Some, the DRMG users, will use the guidelines directly in order to build / enhance resilience in their organizations, for instance through writing more resilience-inspired training programs or procedures for crisis management. Others, the actors of crisis management, will manage crises based on their work.

Working on a card

Each card is assigned to an author (partner) and a reviewer (partner). Within each partner, the preferred method is that work on a specific CC is undertaken by 2 or 3 individuals (mainly because of the amount of expert judgment needed in filling a card). The author and reviewer are responsible for updating the card’s status column in the excel file and coordinating with each other in order to make progress on the card. It is expected that a reviewer is an active collaborator, making comments and suggestions for improvements, helping with issues identified. However, the reviewer’s task should be lighter than that of the author who has the primary responsibility for the card and provides the initial content.

Use the comment column of the card template in order to keep track of potential issues during the filling of a card, and support the dialogue between authors and reviewers.

Finding relevant content

A lot of analysis work has been done during the Systematic Literature Review (SLR); we want to leverage it as much as possible in addition to personal knowledge and expertise. We also want to avoid (re)doing analysis. Material generated during the SRL appears especially useful as a starting point to a Capability Card.

The following process is proposed to find relevant content in D1.1 and the SLR database:

1. Identify potentially relevant sections of D1.1 with the help of the summary table (see section 2)
   a. The content of some of these sections can be used directly in a card, you will have to see where the information fits best in the template (e.g., some descriptions in the section “Needs” can be used for the “Further description” field in the template; elements in the section “Issues” can be used for the “Associated challenges” field in the template; some descriptions in the section “Solutions and practices” can be used for the “Examples” field in the template)
   b. The relevant sections point to a number of documents described in the SLR database

2. Look at the various cells in the SLR database for the potentially relevant documents identified above
Expect the unexpected and know how to respond

a. The content of some of those cells (e.g., abstract) can confirm whether the document described is relevant for the purposes of the card
b. Pay attention to TRL level when available, and prioritize higher TRL
c. The content of some cells can be used to build content of the card (use where appropriate)

3. When the document described looks particularly relevant, but the information provided in the SLR database is limited, it may be interesting to look more in details at the primary document for interesting content and ideas

Additional sources of information include data from the interviews (especially related to needs and practices), relevant literature you might know of (that is not covered in the SLR – e.g., some of the RE literature), practices you might know about, standards and guidelines. Prioritize things you know firsthand (limit as much as possible new searches for content).

Writing content

Try as much as possible to remain concise and clear.

Some concepts are broad and generate a lot of content. Consider addressing a requirement through different CCs if it makes filling the cards easier, and if you anticipate that it will make reading the cards easier as well.

Suggestions to facilitate the consistency and usability of Capability Cards

1. Intro: Right now some CC present no introduction on the user-view wiki. Consider an initial brief summary of the actions required for this card, to guide the end-user on the use of the card across the phases.

2. Methods: A description of “what is needed” to use the card can help understand “when and how” the triggering questions can be used (e.g. focus group with the management? A checklist to be used during a drill…?). This information may be already present in the DRMG, but are not immediately visible to users for some CC.

3. Triggering Questions only in the “Before-During-After” phases
   A. Any generic “across-phases triggering questions” are re-distributed across the three phases.
   B. The triggering questions are grouped under THEMATIC “CATEGORIES”, repeated across all phases, when possible. (e.g. In the concept card “Noticing Brittleness”, the category “Lack of Resources” and “Difficulties to adjust”)

4. One Question address only one topic at time. Very long/multiple questions should be avoided and, if needed, split into simpler and shorter questions (i.e. one topic, one question).

2. Identification of potentially relevant sections of D1.1

See the following tables to identify the sections containing relevant content.
### Concepts (p. 33)

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>P</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Link between Community Resilience and other efforts</td>
<td>34</td>
<td>Community Resilience (CR) is a distinctive domain associated with resilient properties on unique premises (see Category E below for elaboration). In this category A, specific links with other areas of effort, relevant to the scope of DARWIN, are identified.</td>
</tr>
<tr>
<td>B. Continuity and persistence of critical services and functions</td>
<td>35</td>
<td>The persistence and continuity of (and within) critical functions and services are easily taken for granted in disaster planning. Hence, they are focused specifically.</td>
</tr>
<tr>
<td>C. Attention to vulnerable groups</td>
<td>36</td>
<td>In a crisis/disaster situation, sensitivity to special needs and vulnerabilities may be hard to maintain, and possibly be lost in the “average” categorization of needs and issues. Hence, vulnerable groups are explicitly addressed as &quot;clients&quot; of resilience.</td>
</tr>
<tr>
<td>D. Generic characteristics of resilience concept</td>
<td>37</td>
<td>A large number of common denominators for the overall &quot;resilience&quot; concept are recognized as relevant for DARWIN. The premise of complexity is inherent in practically all of them.</td>
</tr>
<tr>
<td>E. Special characteristics of Community Resilience</td>
<td>39</td>
<td>Community resilience is commensurate with the general resilience concept (D), but is distinguished by the fact that it is constituted comparatively more on cultural, social and civic &quot;community&quot; facets rather than a formally managed organization or institution. There is a substantial literature on these issues, and it is kept as a separate category because disaster management professionals need to understand the specificities of community resilience in order to collaborate in a fruitful manner.</td>
</tr>
<tr>
<td>F. Sensitivity to social and cultural foundations</td>
<td>40</td>
<td>In some situations and contexts, resilience must be attached to an enhanced and deepened sensitivity to cultural and social traits that are typical for the (community) resilience (E) of a specific civic or indigenous community. This extended reach is equally applicable for traditional, indigenous culture and &quot;new&quot; urban/megacities aspects phenomena.</td>
</tr>
<tr>
<td>G. Resilience in context of compliance, planned protection and risk management</td>
<td>42</td>
<td>Although resilience surely is a whole concept in its own right at the abstract level, in practice it often has to be implemented in a context of prevalent paradigms that are differently, even contradictory oriented. It is therefore important to address the coexistence and conditioning and mediation from concepts like proceduralism, bureaucratic values, planning and contingencies, and risk management.</td>
</tr>
<tr>
<td>H. Resilience of critical infrastructure</td>
<td>43</td>
<td>The resilience of critical infrastructures (transportation, energy, supplies, ICT) is treated as a separate category.</td>
</tr>
</tbody>
</table>

### Theories (p. 44)

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>P</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Link between pre-disaster and post-disaster resilient capabilities</td>
<td>45</td>
<td>Category A conduce the claim that investment in pre-disaster resilience is beneficial for post-disaster resilience, whatever the &quot;onset&quot; of the disaster. However, there are no papers that convey solely this category.</td>
</tr>
<tr>
<td>B. Sources of resilience</td>
<td>46</td>
<td>This category conduce the various claims of sources that can2are available and can be activated to build and nurture resilience. These sources may be Built, Natural, Individual, Social, Cultural, Economic or Institutional.</td>
</tr>
<tr>
<td>C. Contextual conditioning of resilience</td>
<td>49</td>
<td>This category accommodates modes and ways in which resilient properties influence, or are influenced/mediated by, other paradigms with other preferences (e.g., compliance, planning), and how they can meet.</td>
</tr>
</tbody>
</table>
Expect the unexpected and know how to respond

<table>
<thead>
<tr>
<th>D. Assessment of community resilience in face of disaster</th>
<th>50</th>
<th>Community resilience turns out to be a major factor in most considerations of disasters. This category reflects the wish and need to be able to assess the level of community resilience in advance.</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Core principles of resilience theory (system)</td>
<td>51</td>
<td>This category conduces various proposals on the core principles to which a resilient system, or parts thereof, must function in order to work, including some overarching, holistic principles for how various sources and components of resilience can be arranged and mobilized in order to function resiliently. The category also rests on a conceptual dimension concerning the level(s) of ambition to be associated with the label of “resilience”.</td>
</tr>
<tr>
<td>F. Integrating properties of Community Resilience with other institutionalized efforts</td>
<td>52</td>
<td>Community resilience turns out to be a major object of attention in the literature. This category F conduces various proposals on how community resilience can be supportive of, or benefit from other crisis management efforts that are institutionalized or managed outside the (normal) confines of the notion of community.</td>
</tr>
<tr>
<td>G. Special attention to “non-average” stakeholders, clients and populations</td>
<td>53</td>
<td>Principles and functions to cater for the &quot;non-average&quot; in populations and situations may be useful.</td>
</tr>
<tr>
<td>H. Categorization of needs in disaster situations</td>
<td>54</td>
<td>While the principles and practice of “triage” is well established in the medical sphere, principles for categorization of needs are believed to be potentially useful also in other disaster management contexts.</td>
</tr>
<tr>
<td>I. Cross-scale interactivity (at junctions)</td>
<td>54</td>
<td>As resilience is a relatively boundless concept with many and interrelated meanings, understanding cross-scale interactivity is an area of interest in its own respect.</td>
</tr>
<tr>
<td>J. Critical infrastructure resilience</td>
<td>55</td>
<td>Attention to critical infrastructure resilience is inevitable.</td>
</tr>
<tr>
<td>K. Sensitivity to indigenous and other “non-professional” domains of experience and practices</td>
<td>56</td>
<td>We already have established theoretical categories that address the sources of resilience (B) and the core principles of resilient systems (E). Both include the special type of constitution and coherence typical for community resilience that was given a specific conceptual category (E). Still, as also signified by the conceptual category F4, even in the domain of community resilience there is an inherent danger of gravitating towards simplistic stereotypes of &quot;communities&quot;, in which attention to indigenous, cultural and other &quot;non-professional&quot; domains of experience and practices is lost. Hence, we use this category K as a placeholder to maintain necessary attention to theoretical contributions to this issue.</td>
</tr>
<tr>
<td>L. Stress management for human actors in disaster management</td>
<td>57</td>
<td>As already signified by the conceptual category B (Continuity and persistence of critical services and functions), there is a danger of taking the continuity and persistence of critical contributors to resilience for granted. This may be boiled down to the risk of putting too much expectation, stress and burden on the individual person. Hence, we use this category L as a placeholder to maintain necessary attention to theoretical contributions to this issue.</td>
</tr>
</tbody>
</table>

**Models (p. 58)**

<table>
<thead>
<tr>
<th>A. Factors of resilience</th>
<th>59</th>
<th>This category accommodates the factor-oriented models of resilience in general, of team, community and infrastructure resilience, but also factor-oriented intervention approaches.</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Human behavior and group cohesion</td>
<td>60</td>
<td>Models of human behavior and group cohesion.</td>
</tr>
</tbody>
</table>
## Expect the unexpected and know how to respond

<table>
<thead>
<tr>
<th>C. Measure and evaluate resilience</th>
<th>61</th>
<th>This category accommodates models that devise measurement and evaluation of community resilience, teams, investment efficiency and infrastructures.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Practices and guidelines</td>
<td>62</td>
<td>This category conveys model-based recommendations and guidelines at a practice level, addressing generic resilience, community resilience and design for resilience.</td>
</tr>
<tr>
<td>E. Resilience in a broader context</td>
<td>64</td>
<td>This category conveys models that address the need to balance opposing rationalities, manage processes of reconciliation between resilience and &quot;best practice&quot; in the intersection between the foreseen/expected and the unexpected, integrate resilience measures with prevalent approaches both theoretically and practically (including indexing of critical infrastructures), and capture the impact of broadening the risk assessment process by including a resilience perspective.</td>
</tr>
</tbody>
</table>

### Practices, guidelines or information on needs from stakeholders/end-users (p. 65)

<table>
<thead>
<tr>
<th>Needs</th>
<th>66</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What does one need to be able to achieve a certain goal?</strong></td>
<td></td>
</tr>
<tr>
<td>A. Prioritize</td>
<td></td>
</tr>
<tr>
<td>B. Develop strategies</td>
<td></td>
</tr>
<tr>
<td>C. Support Recovery</td>
<td></td>
</tr>
<tr>
<td>D. Prepare for events</td>
<td></td>
</tr>
<tr>
<td>E. Adaptation</td>
<td></td>
</tr>
<tr>
<td>F. Coordination</td>
<td></td>
</tr>
<tr>
<td>G. Clarification of roles</td>
<td></td>
</tr>
<tr>
<td>H. Involve stakeholders</td>
<td></td>
</tr>
<tr>
<td>I. Ensure health, safety &amp; security</td>
<td></td>
</tr>
<tr>
<td>J. Define, assess and compare resilience</td>
<td></td>
</tr>
<tr>
<td>K. Situation understanding</td>
<td></td>
</tr>
<tr>
<td>L. Respond</td>
<td></td>
</tr>
<tr>
<td>M. Mitigation</td>
<td></td>
</tr>
<tr>
<td>N. Logistics</td>
<td></td>
</tr>
<tr>
<td>O. Understand/recognize local needs/diversity/perception/resources</td>
<td></td>
</tr>
<tr>
<td>P. Information sharing</td>
<td></td>
</tr>
</tbody>
</table>
### Issues

<table>
<thead>
<tr>
<th>No.</th>
<th>What are the barriers to fulfill the need?</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>A. Role ambiguity</td>
</tr>
<tr>
<td></td>
<td>B. Lack of adequate information or the presence of faulty information</td>
</tr>
<tr>
<td></td>
<td>C. Time constraints</td>
</tr>
<tr>
<td></td>
<td>D. Economic constraints</td>
</tr>
<tr>
<td></td>
<td>E. Cognitive constraints</td>
</tr>
<tr>
<td></td>
<td>F. Poor relationships, involvement and commitment</td>
</tr>
<tr>
<td></td>
<td>G. Organizational constraints</td>
</tr>
<tr>
<td></td>
<td>H. Cultural constraints</td>
</tr>
<tr>
<td></td>
<td>I. Political constraints</td>
</tr>
<tr>
<td></td>
<td>J. Training/exercise/experiences</td>
</tr>
<tr>
<td></td>
<td>K. Trade-offs and conflicting goals</td>
</tr>
<tr>
<td></td>
<td>L. Lack of useful tools and assessments</td>
</tr>
<tr>
<td></td>
<td>M. Challenges</td>
</tr>
</tbody>
</table>

### Solutions and practices

<table>
<thead>
<tr>
<th>No.</th>
<th>Solutions: What could be incorporated (method, tools, framework etc.) in order to overcome one or several issues/barriers?</th>
<th>Practices: What has been incorporated in order to overcome one or several issues/barriers?</th>
</tr>
</thead>
<tbody>
<tr>
<td>73</td>
<td>A. Collaboration</td>
<td>A. Collaboration</td>
</tr>
<tr>
<td></td>
<td>B. Coordination</td>
<td>B. Coordination</td>
</tr>
<tr>
<td></td>
<td>C. Information/communication/information channels</td>
<td>C. Information/communication/information channels</td>
</tr>
<tr>
<td></td>
<td>D. Integration</td>
<td>D. Integration</td>
</tr>
<tr>
<td></td>
<td>E. Involve/engage</td>
<td>E. Involve/engage</td>
</tr>
<tr>
<td></td>
<td>F. Joint briefing</td>
<td>F. Joint briefing</td>
</tr>
<tr>
<td></td>
<td>G. Learning</td>
<td>G. Learning</td>
</tr>
<tr>
<td></td>
<td>H. Measure/assess resilience</td>
<td>H. Measure/assess resilience</td>
</tr>
<tr>
<td></td>
<td>I. Planning</td>
<td>I. Planning</td>
</tr>
<tr>
<td></td>
<td>J. Responses</td>
<td>J. Responses</td>
</tr>
<tr>
<td></td>
<td>K. Training and education</td>
<td>K. Training and education</td>
</tr>
</tbody>
</table>
### A.2 Template for creation and revision of Capability Card

<table>
<thead>
<tr>
<th>MAIN INFORMATION AND ICMO SUMMARY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title</strong></td>
</tr>
<tr>
<td><strong>Title (handout)</strong></td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
</tr>
<tr>
<td><strong>Purpose (handout)</strong></td>
</tr>
<tr>
<td><strong>Actor(s) of crisis management</strong></td>
</tr>
<tr>
<td><strong>Actors (handout)</strong></td>
</tr>
<tr>
<td><strong>Actor(s) of crisis management healthcare</strong></td>
</tr>
<tr>
<td><strong>Actor(s) of crisis management ATM</strong></td>
</tr>
<tr>
<td><strong>ICMO - Intervention</strong></td>
</tr>
<tr>
<td><strong>ICMO - Outcome</strong></td>
</tr>
<tr>
<td><strong>ICMO - Mechanism</strong></td>
</tr>
<tr>
<td><strong>ICMO - Context</strong></td>
</tr>
</tbody>
</table>
Expect the unexpected and know how to respond

<table>
<thead>
<tr>
<th>CONCEPT CARD MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Author</strong></td>
</tr>
<tr>
<td><strong>Reviewer</strong></td>
</tr>
<tr>
<td><strong>DRMG reference</strong></td>
</tr>
<tr>
<td><strong>D1.3 Requirement reference(s)</strong></td>
</tr>
<tr>
<td><strong>Status</strong></td>
</tr>
<tr>
<td><strong>Published</strong></td>
</tr>
<tr>
<td><strong>Handout image</strong></td>
</tr>
<tr>
<td><strong>Versioning</strong></td>
</tr>
<tr>
<td><strong>Sources of information</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RELATIONSHIPS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relevant stakeholders</strong></td>
</tr>
<tr>
<td><strong>Categories</strong></td>
</tr>
<tr>
<td><strong>Resilience abilities - Concept contributes to</strong></td>
</tr>
<tr>
<td><strong>Resilience abilities - Concept is supported by</strong></td>
</tr>
<tr>
<td><strong>Functions of crisis management</strong></td>
</tr>
<tr>
<td><strong>Terms used</strong></td>
</tr>
<tr>
<td><strong>Parent theme</strong></td>
</tr>
<tr>
<td>CC rank</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>Parent card</td>
</tr>
</tbody>
</table>

### INFORMATION TO BETTER UNDERSTAND INTERVENTIONS PROPOSED

<table>
<thead>
<tr>
<th>Further description of purpose</th>
<th>Provide more details on why the concept is relevant for crisis management, for instance what challenges it helps avoiding or addressing, what capabilities it helps building or enhancing. Refer to origin of the claims when possible.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected benefits</td>
<td>1. How it contributes to reduce the impact of crises and disasters? 2. Is there any positive impact social, economic stability and sustainability?</td>
</tr>
<tr>
<td>Relation to adaptive capacity</td>
<td>Does the concept relate to adaptive capability? If so, how does it relate to adaptive capability? If not, why?</td>
</tr>
<tr>
<td>Relation to risk management</td>
<td>Indicate how the implementation of the concept relates to typical approaches to crisis or risk management. Describe especially how it complements those approaches, or how it addresses known limitations. Refer to origin of the claims when possible.</td>
</tr>
<tr>
<td>Associated challenges</td>
<td>Explain the challenges associated with the concept, especially in the context of crisis management. Refer to origin of the claims when possible.</td>
</tr>
<tr>
<td>Cost of implementation</td>
<td>Indicate when possible elements about what resources are required to implement the concept described in the card (e.g., to use a method listed).</td>
</tr>
<tr>
<td>Illustrative case, lessons learned</td>
<td>When possible, describe a case that highlights the need expressed above and/or the practices, methods and tools below. Sources of info in WP1: field 21 in SLR database, interviews.</td>
</tr>
</tbody>
</table>

#### Illustrative case, lessons learned (healthcare)
Illustration specific to healthcare.

#### Illustrative case, lessons learned (ATM)
Illustration specific to ATM.

#### Background and context

##### Background and context information (healthcare)
Background and context information specific to healthcare.

##### Background and context information (ATM)
Background and context information specific to ATM.

### INTERVENTIONS PROPOSED

<table>
<thead>
<tr>
<th>Implementation - across phases</th>
<th>Describe here generic considerations of how the concept can be implemented by actors. When possible, refer to the functions in your description, and to the relevant practices, methods and tools that are not phase-specific in crisis management.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementation - across phases</td>
<td>Simplified.</td>
</tr>
</tbody>
</table>

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement n°
<table>
<thead>
<tr>
<th>Implementation - across phases</th>
<th>- Indicate here questions that can orient the reader to the relevant topics and issues.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementation - across phases (handout)</td>
<td>- Simplified.</td>
</tr>
<tr>
<td>Implementation - across phases (healthcare)</td>
<td>Describe here interventions across phases, specific to healthcare.</td>
</tr>
<tr>
<td>Implementation - across phases (ATM)</td>
<td>Describe here interventions across phases, specific to ATM.</td>
</tr>
<tr>
<td>Implementation - Before</td>
<td>Describe here how the concept can be implemented by actors <em>before</em> a crisis, i.e., in efforts to prevent or prepare for events. When possible, refer to the functions in your description, and to the practices, methods and tools relevant for this phase of crisis management.</td>
</tr>
<tr>
<td>Implementation - Before (handout)</td>
<td>Simplified.</td>
</tr>
<tr>
<td>Implementation - Before (handout)</td>
<td>- Indicate here questions that can orient the reader to the relevant topics and issues.</td>
</tr>
<tr>
<td>Implementation - Before (handout) (healthcare)</td>
<td>- Simplified.</td>
</tr>
<tr>
<td>Implementation - Before (ATM)</td>
<td>Describe here interventions for Before phase, specific to ATM.</td>
</tr>
<tr>
<td>Implementation - During</td>
<td>Describe here how the concept can be implemented by actors <em>during</em> a crisis, i.e., in efforts to respond to events. When possible, refer to the functions in your description, and to the practices, methods and tools relevant for this phase of crisis management.</td>
</tr>
<tr>
<td>Implementation - During (handout)</td>
<td>Simplified.</td>
</tr>
<tr>
<td>Implementation - During (handout)</td>
<td>- Indicate here questions that can orient the reader to the relevant topics and issues.</td>
</tr>
<tr>
<td>Implementation - During (handout) (healthcare)</td>
<td>- Simplified.</td>
</tr>
<tr>
<td>Implementation - During (ATM)</td>
<td>Describe here interventions for During phase, specific to ATM.</td>
</tr>
<tr>
<td>Implementation - After</td>
<td>Describe here how the concept can be implemented by actors <em>after</em> a crisis, i.e., in efforts to recover and learn from events. When possible, refer to the functions in your description, and to the practices, methods and tools relevant for this phase of crisis management.</td>
</tr>
</tbody>
</table>
Expect the unexpected and know how to respond

| Implementation - After (handout) | Simplified. |
| Implementation - After - Triggering questions | Indicate here questions that can orient the reader to the relevant topics and issues. |
| Implementation - After - Triggering questions (handout) | Simplified. |
| Implementation (healthcare) - After | Describe here interventions for After phase, specific to healthcare. |
| Implementation - After (ATM) | Describe here interventions for After phase, specific to ATM. |

### ADDITIONAL MATERIAL

#### Relevant practices

*Practices are here defined as descriptions of ways of working, which may or may not be formally decided upon. Guidelines may take many forms, such as checklists, descriptions of methods, manuals, principles, policy suggestions, etc. Stakeholders/users may include crisis management organizations, but also the general public.*

Indicate practices that match the concept, and their TRL. Sources of information are: - WP1: D1.1, field 18 in SLR database, - other literature, not considered in SLR.

Provide references to where the practice is documented. Explain potential issues of applicability.

#### Relevant methods

*A method is here defined as a way of proceeding or doing something in a systematic or regular manner, here related to the assessment or evaluation of resilience. An indicator or metric is here considered a method for evaluating or assessing. Methods can be implemented in various ways, for example IT-tool for assessing/evaluating resilience.*

Indicate methods that match the concept, and their TRL. Sources of information are: - WP1: D1.1, field 19 in SLR database, - other literature, not considered in SLR.

Provide references to where the practice is documented. Explain potential issues of applicability.

#### Relevant tools

*By technical tools we mean IT-systems, web-based tools, networks or similar tools. The purpose of this question is to list any technical tool that focus on enhancing or building resilience specifically. Tools that are constructed with the purpose of only assessing/evaluating resilience are instead covered/listed in methods above.*

Indicate tools that match the concept, and their TRL. Sources of information are: - WP1: D1.1, field 20 in SLR database, - other literature, not considered in SLR.

Provide references to where the practice is documented. Explain potential issues of applicability.
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing artifacts and processes</td>
<td>Provide example and descriptions of relevant artefacts and processes that exist in your domain.</td>
</tr>
<tr>
<td>Practices, methods and tools (healthcare)</td>
<td>Provide example and descriptions of relevant practices, methods and tools specific to healthcare.</td>
</tr>
<tr>
<td>Practices, methods and tools (ATM)</td>
<td>Provide example and descriptions of relevant practices, methods and tools specific to ATM.</td>
</tr>
<tr>
<td>References</td>
<td>References from the literature, cited in the text.</td>
</tr>
<tr>
<td>References (healthcare)</td>
<td>References from the literature, cited in the text, specific to healthcare.</td>
</tr>
<tr>
<td>References (ATM)</td>
<td>References from the literature, cited in the text, specific to ATM.</td>
</tr>
</tbody>
</table>
A.3 Map of requirements

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement n°
A.4 Map of DRMG Wiki elements
A.5 Template for the visualisation of a Capability Card in the Handout format

This is the "ConceptCard Handout format" template, which is short version targeted at new users of the DRMG (e.g., during training or evaluation events).

It should be called in the following format:

<pre>
{{ConceptCard_Handout_format
CardTitle=
LastEditedOn=
CardTitleHandout=
CardImage=
CardName=
CardPurpose=
CardPurposeHandout=
CCRank=
ParentTheme=
Actors=
ActorsHandout=
Implementation=
ImplementationHandout=
ImplementationQuestions=
ImplementationQuestionsHandout=
ImplementationBefore=
ImplementationBeforeHandout=
ImplementationBeforeQuestions=
ImplementationBeforeQuestionsHandout=
ImplementationDuring=
ImplementationDuringHandout=
ImplementationDuringQuestions=
ImplementationDuringQuestionsHandout=
ImplementationAfter=
ImplementationAfterHandout=
ImplementationAfterQuestions=
ImplementationAfterQuestionsHandout=
}}
</pre>

Edit the page to see the template text.
</noinclude><includeonly>

{{#if: {{{?CardImage|}}} |
<DIV class="handoutImageContainer">
<DIV class="handoutImage">
[[File:{{{?CardImage|}}}|link=|640px]]
</DIV>
<DIV class="DisplayTitleImage">{{{?CardTitleHandout|}}} </DIV>

{{#if: {{{?CardPurposeHandout|}}} |{{{?CardPurposeHandout|}}} |{{{?CardPurpose|}}}}

===Actors targeted by the concept card===

{{#if: {{{?ActorsHandout|}}} |{{{?ActorsHandout|}}} |{{{?Actors|}}}}

</DIV>
</noinclude>
Expect the unexpected and know how to respond

==Introduction==

==Before a crisis==

==During a crisis==

==After a crisis==

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement n°
B Stakeholder survey questionnaire

B.1 Intro page to survey considering GDPR

The DARWIN project focuses on improving responses to expected and unexpected crises that may affect critical infrastructure. The main aim is to develop European resilience management guidelines.

The purpose of this survey is to gather needs and stakes that might affect the making crisis management more resilient. The survey will take approximately 10-20 minutes to complete.

In the survey you will be presented with questions concerning stakeholders’ roles, interests and views. We ask you to specify your role, type of critical infrastructure that you are concerned with, expectation and influence in making crisis management more resilient. You will also be asked to rate the degree that you can affect or be affected by the guidelines. There is no right or wrong answer; please just state your honest opinion. If you do not feel qualified to agree or disagree you can use the "I don't know" alternative. Please refrain from using this option as much as possible, as your opinion is highly valued by us.

The survey is conducted as part of a stakeholder analysis (i.e. a process for a participatory approach for the development of the guidelines). Different stakeholder analyses will be conducted. Its purpose is to provide updated input to the development of the guidelines.

Your response to the survey is completely anonymous. No personal information will be collected. Upon completion of the survey, you will be sent to a separate page where you can register your email address. The email address entered on this page can in no way be connected to your survey response.

If you have any questions regarding the survey or the project, please send an email to Ivonne Herrera (ivonne.a.herrera@sintef.no).

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement n°653289.

B.2 Survey questions - questions bank

The following questions were used during the surveys. These questions can be adapted for further development and implementation of the guidelines.

1. Please indicate critical infrastructure that you are concerned with  
   (As defined by the European Programme for critical Infrastructure protection (EPCIP))
   - Energy
   - Nuclear Industry
   - Information, Communication Technologies, ICT
   - Water
   - Food
   - Health
   - Financial
   - Transport
   - Chemical Industry
   - Space
   - Research Facilities
   - Other - specify

2. Indicate the type of stakeholder that your organization represent when dealing with crises
   - Policy maker
   - Executive management roles
   - Operational management roles
Expect the unexpected and know how to respond

- Operational roles
- Community members
- Academia
- Media
- Citizens
- Other - specify

3. Differentiate type of organisation that your organization represent when dealing with crises
   - Local
   - Regional
   - National
   - European
   - Also differentiate if public or private sector

4. Indicate country
   - List of countries to be included in the survey

5. Indicate position / role
   - Policy officer
   - Regulator
   - Manager
   - Front line operator - First responder - Controller
   - Community leader
   - Research academia
   - Other - specify

6. Indicate your area of responsibility
   - Free text

7. What organisational, personal, operational goals do you typically try to achieve in a crisis situation?
   - Free

8. Please indicate if you agree or disagree that concepts/approaches/practices related to the topics below should be included in guidelines for resilience management, and rank their level of importance
   - Address the impact of interdependencies and interaction between stakeholders before, during and after an event
   - Support planning for reinforcement of resources in resilience management
   - Support balancing resilience management between local and centralized governance
   - Address the best use of available personnel

9. Please indicate if you agree or disagree that concepts/approaches/practices related to the topics below should be included in guidelines for resilience management, and rank their level of importance
   - Support design of tools and methods to monitor readiness to cope with crises
   - Consider unique characteristics of the community into account in resilience management
   - Support building resilience by applying organizational learning techniques (e.g. log-books, debriefings, after-action reviews)

10. Please indicate if you agree or disagree that concepts/approaches/practices related to the topics below should be included in guidelines for resilience management, and rank their level of importance
    - Support evaluating and revising procedures and checklists continuously
    - Support design of procedures that address various magnitudes and complexities of events
    - Development of plans for immediate response as part of resilience management

11. Please indicate if you agree or disagree that concepts/approaches/practices related to the topics below should be included in guidelines for resilience management, and rank their level of importance
    - Specify the need to inform the public of emergency procedures so that citizens can react appropriately
Expect the unexpected and know how to respond

- Include solutions for appropriate interactions with rescuers and the public
- Support a comprehensive response to increase trust between responders and populations
- Address trust in leaders and authorities

12. Please indicate if you agree or disagree that concepts/approaches/practices related to the topics below should be included in guidelines for resilience management, and rank their level of importance
   - Include using advanced technology, communication tools and methods as part of resilience management
   - Support development and maintenance of alternative working methods in case of system failures
   - Support development of checklists that facilitate work during a degraded mode of operation

13. What do you think should be the aim of a course on resilience management (operational goal)?
   - Free text

14. Indicate your needs concerning training, include level of importance
   - Resilience concepts and practices for crisis management
   - Examples when resilience management has been applied
   - Hands-on application of resilience concepts for crisis management
   - Resilience concepts and practices across agencies

15. Indicate level of importance concerning medium for transmission of a course on resilience management
   - How will you rank distant learning
   - How will you rank classroom teaching
   - How will you rank conversations/study group to accompany course
   - How will you rank frontal courses and drills

16. Indicate your influence / power concerning crisis/resilience management guidelines developed in your organization
   - Indicate if you are a stakeholder who can directly affect the development of the crisis/resilience guidelines (high, moderate and low)
   - Indicate if you are affected by the use of the crisis/resilience management guidelines (high, moderate, low)

17. Indicate the level of importance of each constraint (High, Low, Moderate) you see concerning the use of guidelines for resilience in crisis management
   - Resources
   - Economic
   - Time
   - Cognitive
   - Organisational
   - Cultural
   - Openness to new ideas
   - Political
   - Other - specify

18. Is your organization interested/involved in the following activities concerning DARWIN Resilience Management Guidelines (DRMG)
   - Development
   - Training
   - Evaluation
   - Dissemination
   - Exploitation
   - Other - specify

19. Do you have any other needs or comments?
   - Free text
## C Level of achievement of requirements for the development of the DRMG

The table below includes the following elements:

- **DReq-ID**: Requirement as defined in D1.3
- **Req-ID**: Type or requirement from D1.3 (e.g. Format, Concept)
- **Importance**: As identified within D1.3
- **Source**: Traceability of requirements
- **WP2 Means of compliance**: Update of rationale provided within D2.1, using evaluation feedback from D4.4 and revisions to address the evaluation recommendations
- **WP2 Status**: Based on results from D4.4, the column shows evolution between D2.1 and D2.4 indicated with colours as follows: green indicates improvement, red shows lower achievement than previously analysed or expected

<table>
<thead>
<tr>
<th>DReq-ID</th>
<th>Req-ID</th>
<th>Requirement</th>
<th>Importance</th>
<th>Source</th>
<th>WP2 Means of compliance</th>
<th>WP2 status</th>
</tr>
</thead>
<tbody>
<tr>
<td>DR-001</td>
<td>GRF-01</td>
<td>The DRMG should be presented in a form that is understandable for the target users</td>
<td>Main</td>
<td>WS; GfG1, 17, 32, 34, 37; DoA-B p.26, p.28; D1.2 Criteria</td>
<td>Evaluated per CC and improved throughout project through internal and external reviews and implementation of recommendations. Also, the DRMG are developed in a way to support different formats e.g. paper and Wiki. Wiki evaluated as easy to use and understand.</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-002</td>
<td>GRF-02</td>
<td>The DRMG should be concisely written</td>
<td>Main</td>
<td>WS; GfG16, 25, 27, 29, 34</td>
<td>The development of the DRMG include internal quality review to ensure consistency. Test performed in WP4. Tested through workshops and reviews</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-003</td>
<td>GRF-03</td>
<td>The DRMG should support that the content can be rapidly accessed</td>
<td>Main</td>
<td>WS; GfG1, 23; DoA-B p.3, p.5</td>
<td>Implemented in wiki format designed for rapid access. The DRMG are designed in a way that its content has different ways of accessing the information depending on the needs. Test was done in WP4.</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-004</td>
<td>GRF-04</td>
<td>The DRMG should be usable as a practical guide</td>
<td>Main</td>
<td>WS; GfG1, 23; DoA-B p.10, p.24</td>
<td>Implemented in wiki format, DRMG style often as checklist, tested through workshops and reviews</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-005</td>
<td>GRF-05</td>
<td>The DRMG should be presented in a way that takes the target users’ context into account</td>
<td>Main</td>
<td>WS; D1.2 Criteria</td>
<td>The stakeholder analysis identifies stakeholders’ influence and interests in favouring or hindering the success of the intervention and achieving the desired outcomes.</td>
<td>Achieved</td>
</tr>
</tbody>
</table>
### Expect the unexpected and know how to respond

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<table>
<thead>
<tr>
<th>DReq-ID</th>
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<th>Source</th>
<th>WP2 Means of compliance</th>
<th>WP2 status</th>
</tr>
</thead>
<tbody>
<tr>
<td>DR-006</td>
<td>GRF-06</td>
<td>The DRMG should present alternative means to the ends it recommends to achieve</td>
<td>Main</td>
<td>WS; GfG16, 27; D1.2 Criteria</td>
<td>DRMG CCs are written in such a way that many checklist items are presented that aim towards the same goals, i.e. checklist items often present alternative means to achieve ends. The explanation of Purpose and the Implementation addressed on different levels (general and phase-specific) enable understanding of what the Capability Card aims to achieve, so that other means can be implemented that fulfill the same purpose. The DRMG Map and links between CCs provide ways to implement recommendations in various sequences, depending on goals and maturity. See also DR-087</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-007</td>
<td>GRF-07</td>
<td>The DRMG should incorporate innovative uses of social media techniques in real-time management of emergencies</td>
<td>Main</td>
<td>DoA-B p. 26, DoA-A p. 13</td>
<td>Social media guidance is the topic of Capability Cards (7.1).</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-008</td>
<td>GRQ-01</td>
<td>The DRMG should include an explanation of the purpose of the guideline</td>
<td>Main</td>
<td>WS; GfG1, 8, 16, 17, 27, 29, 32, 34, 37</td>
<td>A general page describes the overall objectives of the DRMG. For each CC, two specific fields in the template describe its purpose (one succinctly, one in detail)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-009</td>
<td>GRQ-02</td>
<td>The DRMG should include definitions and explanations of terms.</td>
<td>Main</td>
<td>WS; GfG34; D1.1. Needs; DoA-B p.24, p.25, p.36</td>
<td>A general terminology list contains definitions and explanations was developed, and the individual CCs in the wiki refer to the relevant terms</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-010</td>
<td>GRQ-03</td>
<td>The DRMG should include examples or case studies that illustrate application of the DRMG</td>
<td>Main</td>
<td>WS; DoA-B, p.10</td>
<td>Relevant examples/cases are provided in each CC to illustrate key aspects (need, challenges or solutions) rather than application of the DRMG</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-011</td>
<td>GRQ-04</td>
<td>The DRMG should specify the strength of recommendation</td>
<td>Main</td>
<td>WS; GfG1, 8, 17, 23, 27, 28, 29, 32, 37</td>
<td>Rather than providing a generic “strength of individual recommendations” which does not take the interests and context of users into consideration, the guidelines and content in CCs are structured to support the user in focusing on the more appropriate actions.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-012</td>
<td>GRQ-05</td>
<td>The DRMG should include references to additional sources of information</td>
<td>Main</td>
<td>WS</td>
<td>Main references are included in each CC (to point to key ideas and to original material for practices, methods and tools), as well as in the terminology.</td>
<td>Achieved</td>
</tr>
<tr>
<td>DReq-ID</td>
<td>Req-ID</td>
<td>Requirement</td>
<td>Importance</td>
<td>Source</td>
<td>WP2 Means of compliance</td>
<td>WP2 status</td>
</tr>
<tr>
<td>---------</td>
<td>--------</td>
<td>------------------------------------------------------------------------------</td>
<td>------------</td>
<td>----------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>DR-013</td>
<td>GRQ-06</td>
<td>The DRMG should specify its relation to the EU Risk Assessment and Mapping Guidelines for Disaster Management</td>
<td>Main</td>
<td>DoA-B p.10</td>
<td>The DRMG do not explicitly specify relationships with EU guidelines. A more general relationship to risk management is described in the introductory page and contained as a field in the CC template. Given the generic nature of the DRMG, emphasis was put on indicating differences with traditional concepts and approaches of risk management rather than specific EU guidelines (mostly domain specific).</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-014</td>
<td>GRQ-07</td>
<td>The DRMG should be evidence-based</td>
<td>Main</td>
<td>D1.2 Criteria; GiG1, 8, 16, 17, 23, 25, 27, 28, 29, 32, 34, 37, 44; DoA-B p.6, p.24</td>
<td>DRMG guidelines build on existing resilience concepts with TRL higher than TRL1. The Capability Cards build on practices, methods and tools used operationally and/or based on scientific literature - some are more experimental in nature.</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-015</td>
<td>GRQ-08</td>
<td>The DRMG should contain a training and maintenance package (TMP) that facilitates the introduction of the DRMG</td>
<td>Main</td>
<td>WS; GiG8,29,32,44; DoA-B p.5, p.25</td>
<td>The DRMG contains material concerning resilience management and concepts. The Capability Cards are supported by training covered in WP3.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-016</td>
<td>GRQ-09</td>
<td>The DRMG TMP should contain a plan how the DRMG should be updated</td>
<td>Main</td>
<td>GiG1, 16, 23, 27, 32, 34, 37; DoA-B p.3, p.5, p.7, p.24, p.25, p.27</td>
<td>WP2 focuses on the production of content for the DRMG. A process to update content is provided in D2.4, as well as a developers’ manual.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-017</td>
<td>GRQ-10</td>
<td>The DRMG TMP should include a plan for wide dissemination among users</td>
<td>Main</td>
<td>WS; GiG8, 29</td>
<td>Outside the scope of WP2</td>
<td>Not applicable</td>
</tr>
<tr>
<td>DR-018</td>
<td>GRT-01</td>
<td>The DRMG should specify the targeted scope</td>
<td>Main</td>
<td>GiG1,17, 23, 25, 27, 28, 32, 34, 44</td>
<td>The scope of each CC is specified through a number of fields that are part of the template: purpose, detailed purpose, ICMO, Categories, Functions, Resilience abilities, Actors. These jointly specify the card’s scope.</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-019</td>
<td>GRT-02</td>
<td>The DRMG should include use of social media by emergency authorities, first responders and the public as part of resilience management.</td>
<td>Main</td>
<td>DoA-B p.3, p.22-23</td>
<td>Social media guidance is the topic of Capability Cards (7.1 Communication with the public). Cf. DR-007.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-020</td>
<td>GRT-03</td>
<td>The DRMG should address specific users</td>
<td>Main</td>
<td>WS; GiG1, 8, DoA-B p.4</td>
<td>For each CC, targeted actors are specified through dedicated fields in the template: a generic field, and domain-specific fields when this information is relevant.</td>
<td>Achieved</td>
</tr>
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Expect the unexpected and know how to respond

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<tr>
<td>DR-021</td>
<td>GRT-04</td>
<td>The DRMG target users are policy-making (European, national, regional, organisational), managerial, and operational roles, at infrastructure operators, service providers and related stakeholders, who have responsibility for critical infrastructures that might be affected by a crisis, as well as the public (community members, municipalities, voluntary services, and other recognised services and legal entities that can act by mandate) and media (regarding communication to general public during response, use of social media, and mass communication)</td>
<td>Main</td>
<td>Scoping Decision 01; DoA-B p. 3, 24, 45, 98; WS</td>
<td>An initial identification of stakeholders has been performed and documented in DARWIN D3.1. The stakeholder analysis needs to consider the dynamic nature of stakeholders that need to be capture through the duration of the project and beyond (Reed et al, 2009). Therefore, the stakeholder analysis needs to cover identification of stakeholders as an iterative process. A third stakeholder analysis was conducted as part of D2.4 in order to prioritise remaining conceptual requirements and identify a limited set to address in new CCs. Achieved</td>
</tr>
<tr>
<td>DR-022</td>
<td>GRT-05</td>
<td>The DRMG should be adapted to specific domains (health care and ATM), including guidelines for its application</td>
<td>Main</td>
<td>DoA-A p. 13-14; DoA-B p. 5, 6, 12</td>
<td>D2.2 and D2.3 provided details on the adaptation process to Healthcare and ATM. The final guidelines in D2.4 provide the key elements of the process and include enriched content developed in these deliverables. Achieved</td>
</tr>
<tr>
<td>DR-023</td>
<td>GRT-06</td>
<td>The DRMG should be applicable to generic kinds of crises</td>
<td>Main</td>
<td>WS</td>
<td>The DRMG have been written for a general type of crisis using an ISO definition of crisis Achieved</td>
</tr>
<tr>
<td>DR-024</td>
<td>GRP-01</td>
<td>The DRMG should contain a description of the DRMG’s development process</td>
<td>Main</td>
<td>WS; GrG8, 16, 17, 23, 27, 28, 29, 37</td>
<td>The development process is provided in D2.4 and summarizes the key steps presented in D2.1, D2.2 and D2.3 (generic content, adapted content and overall process). Achieved</td>
</tr>
<tr>
<td>DR-025</td>
<td>GRP-02</td>
<td>The DRMG should contain a description of the DRMG’s evaluation process</td>
<td>Main</td>
<td>WS; GrG27, 28, 34</td>
<td>Provided in WP4 deliverables, implementation of evaluation results provided in D2.4 Partially achieved</td>
</tr>
<tr>
<td>DR-026</td>
<td>GRP-03</td>
<td>The DRMG should facilitate implementation activities towards adherence to the DRMG</td>
<td>Main</td>
<td>WS</td>
<td>A specific section is provided in D2.4, building especially on lessons learned from T2.2/T2.3 and pilot exercises. Partially achieved</td>
</tr>
<tr>
<td>DR-027</td>
<td>GRC-01</td>
<td>The DRMG should support that the stakeholders involved in resilience management have a clear understanding of their responsibilities</td>
<td>Essential</td>
<td>D1.2 Concepts ID5</td>
<td>Covered by Capability Cards (2.1 Promoting common ground, 2.3 Understanding roles and responsibilities) Achieved</td>
</tr>
<tr>
<td>DR-028</td>
<td>GRC-02</td>
<td>The DRMG should address the impact of interdependencies and interaction between stakeholders on resilience management</td>
<td>Important</td>
<td>D1.2 Concepts ID 21</td>
<td>Covered by Capability Cards (2.1 Promoting common ground, 2.3 Understanding roles and responsibilities) Achieved</td>
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Expect the unexpected and know how to respond

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<tr>
<td>DR-029</td>
<td>GRC-03</td>
<td>The DRMG should support that the stakeholders involved in resilience management have a clear understanding of the responsibilities of other involved stakeholders</td>
<td>Important</td>
<td>D1.2 Concepts ID 6</td>
<td>Covered by Capability Cards (2.1 Promoting common ground, 2.3 Understanding roles and responsibilities)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-030</td>
<td>GRC-04</td>
<td>The DRMG should support the establishment of coordinated networks of stakeholders to ensure close cooperation between stakeholders</td>
<td>Important</td>
<td>D1.2 Concepts ID 2</td>
<td>Covered by Capability Cards (2.2 Establishing networks for promoting inter-organizational collaboration)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-031</td>
<td>GRC-05</td>
<td>The DRMG should support that stakeholders that need to collaborate have a mutual understanding of each other’s goals</td>
<td>Important</td>
<td>D1.2 Concepts ID 7</td>
<td>Covered by Capability Cards (2.1 Promoting common ground, 2.3 Understanding roles and responsibilities)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-032</td>
<td>GRC-06</td>
<td>The DRMG should support coordination and synchronization of systems to ensure efficient collaboration</td>
<td>Important</td>
<td>D1.2 Concepts ID 52</td>
<td>High level goal, not Capability Card but one of the main themes for DRMG (Theme 2 Support Coordination and synchronization).</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-033</td>
<td>GRC-07</td>
<td>The DRMG should support national collaboration in resilience management</td>
<td>Important</td>
<td>D1.2 Concepts ID 3</td>
<td>Not addressed explicitly due to limited project resources and priorities set by end users. Implicitly covered by Capability Cards (2.1 Promoting common ground, 2.2 Establishing networks, 2.3 Understanding roles and responsibilities, and 6.1 Systematic management of policies) as collaboration at local, regional, national, and international levels is explored and enhanced as part of these cards.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-034</td>
<td>GRC-08</td>
<td>The DRMG should support a comprehensive response to increase trust between responders and populations</td>
<td>Important</td>
<td>D1.2 Concepts ID 56</td>
<td>Covered by Capability Cards (4.2 Identified source of resilience, 7.1 Communication strategies for interacting with the public)</td>
<td>Achieved</td>
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<tr>
<td>DR-035</td>
<td>GRC-09</td>
<td>The DRMG should support clarification of the link between resilience management and other efforts aimed at ensuring continuity</td>
<td>Important</td>
<td>D1.2 Concepts ID 1</td>
<td>Covered by Capability Cards (4.2 Identified source of resilience, 4.3 Noticing brittleness) and as part of general presentation of DRMGs approach and objectives</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-036</td>
<td>GRC-10</td>
<td>The DRMG should address potential interdependencies between the different stakeholders and systems</td>
<td>Important</td>
<td>D1.2 Concepts ID 8</td>
<td>Covered by Capability Cards (2.1 Promoting common ground, 2.2 Establishing networks, 2.3 Understanding roles and responsibilities, 4.2 Identified source of resilience, 4.3 Noticing brittleness)</td>
<td>Achieved</td>
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<td>DR-037</td>
<td>GRC-11</td>
<td>The DRMG should support international collaboration in resilience management</td>
<td>Important</td>
<td>D1.2 Concepts ID 4</td>
<td>Not addressed explicitly due to limited project resources and priorities set by end users. Implicitly covered by Capability Cards (2.1 Promoting common ground, 2.2 Establishing networks, 2.3 Understanding roles and responsibilities, and 6.1 Systematic management of policies) as collaboration at local, regional, national, and international levels is explored and enhanced as part of these cards.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-038</td>
<td>GRC-12</td>
<td>The DRMG should support the establishment of a common terminology concerning</td>
<td>Essential</td>
<td>D1.2 Concepts ID N1</td>
<td>Covered by Capability Cards (2.1 Promoting common ground, 7.1 Communication strategies for interacting with the public) as well as through the Terminology page within the DRMG</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-039</td>
<td>GRC-13</td>
<td>The DRMG should address development of plans for immediate response as part of</td>
<td>Important</td>
<td>D1.2 Concepts ID 54</td>
<td>Covered by Capability Cards (3.2 Managing available resources effectively to handle changing demands, 4.2 Identified source of resilience, 4.3 Noticing brittleness)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-040</td>
<td>GRC-14</td>
<td>The DRMG should address the public’s key needs, especially of vulnerable groups, to achieve resilience management</td>
<td>Important</td>
<td>D1.2 Concepts ID 49</td>
<td>Covered by Capability Cards (4.1 Assessing community resilience, 7.1 Communication strategies for interacting with the public)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-041</td>
<td>GRC-15</td>
<td>The DRMG should address planning for resilience management based on routine practices</td>
<td>Important</td>
<td>D1.2 Concepts ID 31</td>
<td>Covered by Capability Cards (3.1 Enhancing the capacity to adapt to both expected and unexpected events, 3.2 Establishing conditions for adapting plans and procedures during crises and other events that challenge normal plans and procedures, 4.2 Identified source of resilience, 4.3 Noticing brittleness)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-042</td>
<td>GRC-16</td>
<td>The DRMG should support maintenance of national operational contingency plans that describe the responsibilities of the involved stakeholders</td>
<td>Important</td>
<td>D1.2 Concepts ID 32</td>
<td>Covered by Capability Cards (2.3 Understanding roles and responsibilities, 4.3 Noticing brittleness, 6.1 Systematic management of policies)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-043</td>
<td>GRC-17</td>
<td>The DRMG should address trust in leaders and authorities</td>
<td>Important</td>
<td>D1.2 Concepts ID 50</td>
<td>Covered by Capability Cards (4.1 Assessing community resilience, 7.1 Communication strategies for interacting with the public)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-044</td>
<td>GRC-18</td>
<td>The DRMG should support taking unique characteristics of the community into account in resilience management</td>
<td>Important</td>
<td>D1.2 Concepts ID 48</td>
<td>Covered by Capability Cards (4.1 Assessing community resilience, 7.1 Communication strategies for interacting with the public)</td>
<td>Achieved</td>
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*The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement nº 691384.*
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<td>DR-045</td>
<td>GRC-19</td>
<td>The DRMG should support the use of resilience management support systems as a part of everyday practices</td>
<td>Important</td>
<td>D1.2 Concepts ID N3</td>
<td>Covered by Capability Cards (3.1 Enhancing the capacity to adapt to both expected and unexpected events, 3.2 Establishing conditions for adapting plans and procedures during crises and other events that challenge normal plans and procedures, 4.2 Identified source of resilience, 4.3 Noticing brittleness)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-046</td>
<td>GRC-20</td>
<td>The DRMG should be easily adaptable to both expected and unexpected events (all-hazard approach)</td>
<td>Essential</td>
<td>D1.2 Concepts ID 24</td>
<td>Covered by Capability Cards (3.1 Enhancing the capacity to adapt to both expected and unexpected events)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-047</td>
<td>GRC-21</td>
<td>The DRMG should support the users to adjust procedures during crises to the changing reality</td>
<td>Essential</td>
<td>D1.2 Concepts ID 28</td>
<td>Covered by Capability Cards (3.1 Enhancing the capacity to adapt to both expected and unexpected events, 3.2 Establishing conditions for adapting plans and procedures during crises and other events that challenge normal plans and procedures)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-048</td>
<td>GRC-22</td>
<td>The DRMG should support flexibility in resilience management beyond adherence to procedures</td>
<td>Essential</td>
<td>D1.2 Concepts ID 29</td>
<td>Covered by Capability Cards (3.1 Enhancing the capacity to adapt to both expected and unexpected events, 3.2 Establishing conditions for adapting plans and procedures during crises and other events that challenge normal plans and procedures, 4.2 Identified source of resilience, 6.1 Systematic management of policies)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-049</td>
<td>GRC-23</td>
<td>The DRMG should support compliance with rules and regulations in resilience management</td>
<td>Important</td>
<td>D1.2 Concepts ID 23</td>
<td>Clarified and covered by Capability Cards (3.2 Establishing conditions for adapting plans and procedures during crises and other events that challenge normal plans and procedures, 6.1 Systematic management of policies)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-050</td>
<td>GRC-24</td>
<td>The DRMG should support evaluating and revising procedures and checklists continuously</td>
<td>Important</td>
<td>D1.2 Concepts ID 26</td>
<td>Covered by Capability Cards (2.3 Understanding roles and responsibilities, 3.2 Establishing conditions for adapting plans and procedures during crises and other events that challenge normal plans and procedures, 4.3 Noticing brittleness, 6.1 Systematic management of policies)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-051</td>
<td>GRC-25</td>
<td>The DRMG should support design of procedures that address various magnitudes and complexities of events</td>
<td>Important</td>
<td>D1.2 Concepts ID 27</td>
<td>Covered by Capability Cards (3.2 Managing available resources effectively to handle changing demands)</td>
<td>Achieved</td>
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<tr>
<td>DR-052</td>
<td>GRC-26</td>
<td>The DRMG should be clear and non-judgmental</td>
<td>Important</td>
<td>D1.2 Concepts ID 30</td>
<td>Covered by all Capability Cards</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-053</td>
<td>GRC-27</td>
<td>The DRMG should support development of checklists that define how work should be performed during a degraded mode of operation</td>
<td>Important</td>
<td>D1.2 Concepts ID 37</td>
<td>Not addressed explicitly due to limited project resources and priorities set by end users. Identified as topic for Capability Card related to managing system failures theme. Checklists are covered by many Capability Cards, in particular in ATM-adapted content.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-054</td>
<td>GRC-28</td>
<td>The DRMG should specify the need to conduct joint training exercises to ensure efficient collaboration</td>
<td>Important</td>
<td>D1.2 Concepts ID 53</td>
<td>Covered by Capability Cards (2.1 Promoting common ground) and training</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-055</td>
<td>GRC-29</td>
<td>The DRMG should specify the need to train for resilience management routinely</td>
<td>Important</td>
<td>D1.2 Concepts ID 39</td>
<td>Not addressed explicitly due to limited project resources and priorities set by end users. However, training is a central theme in almost all CCs, and often emphasised as part of the triggering questions.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-056</td>
<td>GRC-30</td>
<td>The DRMG should specify the need to define training and exercises in a manner that enables personnel to improvise during the handling of situations when required</td>
<td>Important</td>
<td>D1.2 Concepts ID 25</td>
<td>Covered by Capability Cards (3.1 Enhancing the capacity to adapt to both expected and unexpected events, 3.2 Managing available resources effectively to handle changing demands)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-057</td>
<td>GRC-31</td>
<td>The DRMG should address different magnitudes of emergencies, disasters and crises in training programs</td>
<td>Important</td>
<td>D1.2 Concepts ID 43</td>
<td>Covered by Capability Cards (3.1 Enhancing the capacity to adapt to both expected and unexpected events, 4.2 Identified source of resilience, 4.3 Noticing brittleness)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-058</td>
<td>GRC-32</td>
<td>The DRMG should support design of scenario-based exercises to prepare for worst-case scenarios</td>
<td>Important</td>
<td>D1.2 Concepts ID 38</td>
<td>Not addressed explicitly in a CC due to limited project resources and priorities set by end users. However, training is a central theme in almost all CCs. In addition, the content of exercises and trainings go beyond worst-case scenarios and into specific guidance and triggering questions (the DRMG provide more nuanced input than the requirement specifies).</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-059</td>
<td>GRC-33</td>
<td>The DRMG should support development of education programs that focus on resilience management</td>
<td>Important</td>
<td>D1.2 Concepts ID 40</td>
<td>Part of general content about DRMG approach, principles and objectives, and addressed in training package</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-060</td>
<td>GRC-34</td>
<td>The DRMG should address critical infrastructure needs in resilience management</td>
<td>Essential</td>
<td>D1.2 Concepts ID 16</td>
<td>Not a specific requirement, rather a higher level goal pursued by the DRMG as a whole and addressed by all CCs</td>
<td>Achieved</td>
</tr>
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<tr>
<td>DR-061</td>
<td>GRC-35</td>
<td>The DRMG should support development and maintenance of alternative working methods in case of system failures</td>
<td>Important</td>
<td>D1.2 Concepts ID 18</td>
<td>Covered by Capability Cards (9.1 Supporting development and maintenance of alternative working methods)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-062</td>
<td>GRC-36</td>
<td>The DRMG should advocate the use of standards to ensure secure and reliable information systems</td>
<td>Important</td>
<td>D1.2 Concepts ID 20</td>
<td>Not addressed explicitly due to priorities set by end-users. Appears out of scope, the purpose and underlying resilience capability targeted could be clarified with end-users.</td>
<td>Not achieved</td>
</tr>
<tr>
<td>DR-063</td>
<td>GRC-37</td>
<td>The DRMG should specify the need to develop and maintain alternative technological back-up systems in case of system failures</td>
<td>Important</td>
<td>D1.2 Concepts ID 19</td>
<td>This is covered by robustness and redundancy strategies covered by traditional risk management, out of the scope of the DRMG</td>
<td>Not applicable</td>
</tr>
<tr>
<td>DR-064</td>
<td>GRC-38</td>
<td>The DRMG should support the incorporation of advanced technologies into resilience management</td>
<td>Important</td>
<td>D1.2 Concepts ID 17</td>
<td>Not addressed explicitly in a CC due to limited project resources and priorities set by end-users. Appears out of scope, the purpose and underlying resilience capability targeted could be clarified with end-users.</td>
<td>Not achieved</td>
</tr>
<tr>
<td>DR-065</td>
<td>GRC-39</td>
<td>The DRMG should specify the need to inform the public of emergency procedures so that citizens can react appropriately</td>
<td>Important</td>
<td>D1.2 Concepts ID 11</td>
<td>Covered by Capability Cards (4.1 Assessing community resilience, 7.1 Communication strategies for interacting with the public)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-066</td>
<td>GRC-40</td>
<td>The DRMG should support development of proactive procedures through transparency (open dialogue) and risk communication</td>
<td>Important</td>
<td>D1.2 Concepts ID 10</td>
<td>Covered by Capability Cards (7.1 Communication strategies for interacting with the public)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-067</td>
<td>GRC-41</td>
<td>The DRMG should address the need for supplementary communication tools and methods as part of resilience management</td>
<td>Important</td>
<td>D1.2 Concepts ID 9</td>
<td>Covered by Capability Cards (7.1 Communication strategies for interacting with the public)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-068</td>
<td>GRC-42</td>
<td>The DRMG should support that resilience management systems are flexible enough to handle different types of situations</td>
<td>Essential</td>
<td>D1.2 Concepts ID 15</td>
<td>Covered by Capability Cards (3.1 Enhancing the capacity to adapt to both expected and unexpected events, 3.2 Establishing conditions for adapting plans and procedures during crises and other events that challenge normal plans and procedures, 3.3 Managing available resources effectively to handle unusual and changing demands)</td>
<td>Achieved</td>
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<tr>
<td>DR-069</td>
<td>GRC-43</td>
<td>The DRMG should support balancing resilience management between local and centralized governance</td>
<td>Important</td>
<td>D1.2 Concepts ID 13</td>
<td>Identified as potential topic for Capability Card related to managing adaptive capacity and related to polycentric control. However, governance issues are likely to be difficult to address at a European level due to the variety of cultural contexts relative to distributed vs. centralized organisational forms. Might be inapplicable as a result.</td>
<td>Not achieved</td>
</tr>
<tr>
<td>DR-070</td>
<td>GRC-44</td>
<td>The DRMG should support centralizing and managing assistance in order to provide services to a large as possible portion of the population</td>
<td>Somewhat Important</td>
<td>D1.2 Concepts ID 14</td>
<td>Not addressed due to lower priority set by end-users. However, governance issues are likely to be difficult to address at a European level due to the variety of cultural contexts relative to distributed vs. centralized organisational forms. Might be inapplicable as a result.</td>
<td>Not achieved</td>
</tr>
<tr>
<td>DR-071</td>
<td>GRC-45</td>
<td>The DRMG should specify the need to conduct resilience assessments prior to, during and after emergencies, disasters and crises</td>
<td>Important</td>
<td>D1.2 Concepts ID 12</td>
<td>Covered by most of the Capability Cards as relevant (2.3, 3.1, 3.2, 4.1, 4.2, 4.3, 6.1, 7.1)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-072</td>
<td>GRC-46</td>
<td>The DRMG should support design of tools and methods to monitor readiness to cope with crises</td>
<td>Important</td>
<td>D1.2 Concepts ID N2</td>
<td>Existing practices, tools and methods are referenced in the DRMG, but not designed as part of the project. Triggering questions and processes and steps mentioned in the CCs generally support design of methods to achieve the objectives of each card.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-073</td>
<td>GRC-47</td>
<td>The DRMG should specify the use of joint debriefing sessions to facilitate a shared understanding, reflection and discussion</td>
<td>Important</td>
<td>D1.2 Concepts ID 41</td>
<td>Covered by Capability Cards (2.1 Promoting common ground, 2.3 Sharing information on roles and responsibilities among different organizations, 4.2 Identified source of resilience, 4.3 Noticing brittleness)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-074</td>
<td>GRC-48</td>
<td>The DRMG should support building resilience by applying organizational learning techniques (e.g. log-books, debriefings, after-action reviews)</td>
<td>Important</td>
<td>D1.2 Concepts ID 42</td>
<td>Covered by Capability Cards (2.3 Sharing information on roles and responsibilities among different organizations, 4.2 Identified source of resilience, 4.3 Noticing brittleness)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-075</td>
<td>GRC-49</td>
<td>The DRMG should support planning for reinforcement of resources in resilience management</td>
<td>Important</td>
<td>D1.2 Concepts ID 22</td>
<td>Covered by Capability Cards (3.3 Managing available resources effectively to handle unusual and changing demands, 4.1 Assessing community resilience, 4.2 Identified source of resilience, 4.3 Noticing brittleness)</td>
<td>Achieved</td>
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<tr>
<td>DR-076</td>
<td>GRC-50</td>
<td>The DRMG should address the best use of available manpower</td>
<td>Important</td>
<td>D1.2 Concepts ID 44</td>
<td>Covered by Capability Cards (3.3 Managing available resources effectively to handle unusual and changing demands, 4.1 Assessing community resilience, 4.2 Identified source of resilience, 4.3 Noticing brittleness)</td>
<td>Achieved</td>
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<tr>
<td>DR-077</td>
<td>GRC-51</td>
<td>The DRMG should support development of an overall situation understanding to ensure efficient collaboration</td>
<td>Important</td>
<td>D1.2 Concepts ID 51</td>
<td>Covered by Capability Cards (2.1 Promoting common ground, 2.2 Establishing networks, 2.3 Understanding roles and responsibilities, 4.2 Identified source of resilience, 4.3 Noticing brittleness, 7.1 Communication strategies for interacting with the public)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-078</td>
<td>GRC-52</td>
<td>The DRMG should aim to reduce the impact of crises and disasters</td>
<td>Main</td>
<td>DoA-B p. 24</td>
<td>Covered by all CCs and part of general content about DRMG approach, principles and objectives</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-079</td>
<td>GRC-53</td>
<td>The DRMG should aim to positively impact social and economic stability and sustainability</td>
<td>Main</td>
<td>DoA-B p. 24</td>
<td>Not addressed</td>
<td>Not achieved</td>
</tr>
<tr>
<td>DR-080</td>
<td>GRC-54</td>
<td>The DRMG should aim to increase the adaptive capability in service providers and stakeholders of critical infrastructures</td>
<td>Main</td>
<td>DoA-B p. 24; D1.1 Needs</td>
<td>Covered by Capability Cards (3.1, 3.2, 3.3) and relationship with adaptive capacity is described within template for each Capability Card</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-081</td>
<td>GRC-55</td>
<td>The DRMG should aim to improve the efficiency and effectiveness of the response of service providers and stakeholders of critical infrastructures to expected and unexpected crises</td>
<td>Main</td>
<td>DoA-B p. 24</td>
<td>Covered by Capability Cards (3.1 Enhancing the capacity to adapt to both expected and unexpected events, 4.2 Identified source of resilience, 4.3 Noticing brittleness), one of the main themes for DRMG and part of general content about DRMG approach, principles and objectives</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-082</td>
<td>GRC-56</td>
<td>The DRMG should address the following activities: Anticipate, Monitor, Respond and Adapt, Learn and Evolve</td>
<td>Main</td>
<td>DoA-B p. 3, 4-5, 25; DoA-A p. 13; D1.1 Definitions</td>
<td>Relationship with resilience capabilities is described within template for each Capability Card</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-083</td>
<td>GRC-57</td>
<td>The DRMG should address methods and concepts to assess resilience</td>
<td>Main</td>
<td>DoA-A p. 13</td>
<td>Covered by Capability Cards (4.1 Assessing community resilience, 4.2 Identified source of resilience, 4.3 Noticing brittleness), one of the main themes for DRMG (Theme 4).</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-084</td>
<td>GRC-58</td>
<td>The DRMG should include solutions for appropriate interactions with rescuers and the public</td>
<td>Main</td>
<td>DoA-B p. 10</td>
<td>Covered by Capability Cards (4.2 Identified source of resilience, 4.3 Noticing brittleness, 7.1 Communication strategies for interacting with the public, 7.2 Increasing the public's involvement in resilience management)</td>
<td>Achieved</td>
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<tr>
<td>DR-085</td>
<td>GRC-59</td>
<td>The DRMG should facilitate the communication between policy makers and first responders when dealing with emergencies</td>
<td>Main</td>
<td>DoA-B p. 24</td>
<td>Covered by Capability Cards (6.1 Systematic management of policies, 7.1 Communication strategies for interacting with the public)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-086</td>
<td>GRC-60</td>
<td>The DRMG should support the ability to design case-specific resilience into risk management operation and procedures</td>
<td>Main</td>
<td>DoA-B p. 36</td>
<td>The CCs support the implementation of the guidance to include resilience concepts as shown in the WP4 pilot studies.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-087</td>
<td>GRX-01</td>
<td>The DRMG should be flexible and adaptable to local conditions</td>
<td>Main</td>
<td>WS; D1.2 Criteria; GfG8, 25, 27, 32, 37; DoA-B p.3, p.4</td>
<td>The DRMG have currently been written for a general type of crisis, for general types of actors, so that local adaptations can be made depending on the specific crisis and actors. See also DR-006.</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-088</td>
<td>GRX-02</td>
<td>The DRMG should facilitate the coordination of interdependent organisations</td>
<td>Main</td>
<td>WS</td>
<td>Addressed by 3 Capability Cards in Theme 2 Supporting coordination and synchronisation of distributed operations</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-089</td>
<td>GRX-03</td>
<td>The DRMG should specify the relationship to other related guidelines</td>
<td>Main</td>
<td>WS; GfG1</td>
<td>Reference to relevant standards and recommendation exist in places (e.g., terms defined according to existing standards), but not in a systematic manner.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-090</td>
<td>GRX-04</td>
<td>The DRMG should facilitate the user in checking and explaining the adherence to the DRMG</td>
<td>Main</td>
<td>WS</td>
<td>The DRMG Capability Cards in the Implementation field have a checklist question format so that actors implementing the card can check their activities against the card. The explanation of Purpose and the Implementation addressed on different levels (general and phase-specific) enables the actors understanding of what the Capability Card aims to achieve, so that explanations of adherence are facilitated</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-091</td>
<td>GRX-05</td>
<td>The DRMG should be written as non-mandatory advice</td>
<td>Main</td>
<td>WS; GfG34</td>
<td>The DRMG Capability Cards in their Implementation field have a checklist question format rather than a normative, mandatory, or &quot;to-do-list&quot; format</td>
<td>Achieved</td>
</tr>
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<tr>
<td>DR-092</td>
<td>GRX-06</td>
<td>The DRMG should be compatible with relevant laws and regulations</td>
<td>Main</td>
<td>WS</td>
<td>The current version of the DRMG builds on consortium knowledge on relevant regulations in health care and aviation. Further analysis on aviation, health care and other domains need to be documented and included. In future revisions of the guidelines, it could be fully achieved through including a section in the Capability Card called &quot;Cross reference documents&quot; linking information to other relevant manuals or SOPs as applicable (as ICAO proposes in its SMS manual). No conflicts with laws and regulations have surfaced in extensive pilot testing and consortium knowledge.</td>
<td>Not achieved</td>
</tr>
<tr>
<td>DR-093</td>
<td>DRF-01</td>
<td>The development of the DRMG should consider different formats for the presentation of the DRMG</td>
<td>Main</td>
<td>GfG23, 25; DoA-B p.24</td>
<td>The wiki format and specifically the use of Semantic Media Wiki enables the dynamic presentation of wiki contents based on the type of user accessing the DRMG, the purpose of use, situational context of use, etc. Different format including paper or web-based solutions have been created automatically or semi-automatically from the wiki.</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-094</td>
<td>DRF-02</td>
<td>The development of the DRMG should consider the inclusion of tools as part of the DRMG</td>
<td>Main</td>
<td>D1.1. Issues; Solutions; GfG8, 16, 44; DoA-B p.5</td>
<td>Tools that are considered relevant for the implementation or exemplification of the Capability Card contents are specified through a dedicated field in the template</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-095</td>
<td>DRQ-01</td>
<td>The development of the DRMG should consider stakeholders’ previous experience and lessons learned</td>
<td>Main</td>
<td>WS; GfG32; DoA-B p.4</td>
<td>The DRMG Capability Cards have a checklist question format rather than a normative &quot;to-do-list&quot; format so that actors implementing the card can check their activities against the card but can also disregard the question when not applicable or already fulfilled. See also DR-006 and DR-087</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-096</td>
<td>DRQ-02</td>
<td>The development of the DRMG should aim for TRL6 (defined as «Representative resilience concepts are tested in a relevant environment. Represents a major step up in a concept demonstration»)</td>
<td>Main</td>
<td>DoA-B p. 2, 14</td>
<td>The DRMG represents CCs at different level of maturity. 8 out of 10 were assessed at TRL6 or higher. The 2 remaining were improved based on recommendations, but not re-evaluated. 3 new CCs were developed based on external experts’ input, but were not evaluated. They have lower maturity than the 10 initial CCs. However, CCs build as much as possible on mature practices and methods.</td>
<td>Achieved</td>
</tr>
</tbody>
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Expect the unexpected and know how to respond

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<tr>
<td>DR-097</td>
<td>DRT-01</td>
<td>The development of the DRMG should produce generic guidelines as common reference concepts and methods to improve the resilience of critical infrastructures</td>
<td>Main</td>
<td>DoA-A p.13</td>
<td>The DRMG are generic guidelines with the purpose of improving resilience for critical infrastructure operators based on operationalisation of resilience concepts, and reference to existing practices, methods and tools.</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-098</td>
<td>DRT-02</td>
<td>The development of the DRMG should include a stakeholder analysis</td>
<td>Main</td>
<td>WS; GfG01,16, 28</td>
<td>Three iterations of stakeholder analysis were conducted and documented in D2.1, D2.4 and deliverable D5.3.</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-099</td>
<td>DRT-03</td>
<td>The development of the DRMG should consider the issue with role ambiguity between different stakeholders</td>
<td>Main</td>
<td>D1.1. Issue</td>
<td>The DRMG CCs have a dedicated field on Actors which specifies which roles of Actors are targeted by the CC, which thereby needed to be considered during DRMG development. The clarification of stakeholder roles is addressed in a specific CC (see DR-027)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-100</td>
<td>DRT-04</td>
<td>The development of the DRMG should consider interactions and interfaces between stakeholders</td>
<td>Main</td>
<td>WS; DoA-B p.10</td>
<td>The DRMG CCs have a dedicated field on Actors which specifies which roles of Actors are addressed by the CC, which triggered interactions between actors to be considered during DRMG development. The clarification of stakeholder roles and interactions is addressed in specific CCs (see Theme 2 especially - Supporting coordination and synchronisation of distributed operations)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-101</td>
<td>DRT-05</td>
<td>The development of the DRMG should consider how different services can be provided to varying degrees/levels during crisis to various stakeholders.</td>
<td>Main</td>
<td>WS</td>
<td>This requirement is covered by DR-053</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-102</td>
<td>DRT-06</td>
<td>The development of the DRMG should consider event classifications used in the targeted domains</td>
<td>Main</td>
<td>WS</td>
<td>The DRMG have been written for a general type of crisis, for general types of actors, so that event classifications can be used in specific instantiations of the Capability Cards considering domain-specifics</td>
<td>Not achieved</td>
</tr>
<tr>
<td>DR-103</td>
<td>DRT-07</td>
<td>The development of the DRMG should consider defining characteristics of the ATM and HC sectors along dimensions that enable the comparison of these sectors to other target sectors, so that generalization of guidelines to other sectors can be addressed</td>
<td>Main</td>
<td>DoA-B p. 28</td>
<td>Comparisons between ATM and HC sectors arose during adaptation of guidelines and are described in D2.2 and D2.3. No explicit guidance for other sectors is provided.</td>
<td>Partially achieved</td>
</tr>
</tbody>
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<td>DR-104</td>
<td>DRT-08</td>
<td>The development of the DRMG should consider gender-based differences between people (as reflected in their social roles and interactions, in the distribution of power and the access to resources)</td>
<td>Main</td>
<td>DoA-B p. 18</td>
<td>Consideration of gender is mentioned in CC 7.1 Communication strategies for interacting with the public.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-105</td>
<td>DRP-01</td>
<td>The development of the DRMG should evolve from and further develop the state of Resilience Engineering</td>
<td>Main</td>
<td>DoA-B p. 24</td>
<td>The development of the DRMG considered the RE literature and connected literature found in D1.1 to the extent possible with the RE literature, building the Capability Cards on RE publications and ideas. The work achieved in the DRMG focuses on the operationalisation and organisation of concepts and methods rather than on developing them further.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-106</td>
<td>DRP-02</td>
<td>The development of the DRMG should involve appropriate stakeholders</td>
<td>Main</td>
<td>WS; D1.1 Needs; Solutions; GfG1, 8, 16, 17, 23, 27, 29, 32; DoA-B p.5, p.7, p.24, p.25, p.42, p.45, p.97</td>
<td>The development of the DRMG involved relevant stakeholders as part of end-user partners conducting the adaptation or DCoP members provide direct input and feedback.</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-107</td>
<td>DRP-03</td>
<td>The development of the DRMG should facilitate the strengthening of coordinating and collaborative relationships’ between stakeholders</td>
<td>Main</td>
<td>WS; DoA-B p.10, p.26; D1.1. Needs</td>
<td>Several Capability Cards address coordination and collaboration between stakeholders (Theme 2 Supporting coordination and synchronisation of distributed operations especially)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-108</td>
<td>DRP-04</td>
<td>The development of the DRMG should facilitate increased awareness and knowledge between involved stakeholders</td>
<td>Main</td>
<td>WS; DoA-B p.5</td>
<td>The DARWIN development process facilitated coordination and collaboration between stakeholders (partners and DCoP especially)</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-109</td>
<td>DRP-05</td>
<td>The development of the DRMG should take into consideration the issue of trust between stakeholders</td>
<td>Main</td>
<td>D1.1 Needs</td>
<td>Trust is addressed as Context factor that can facilitate the Implementation of the Capability Cards, where appropriate. The issue of DRMG addressing sufficiently the issue of trust need to be further analysed.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-110</td>
<td>DRP-06</td>
<td>The development of the DRMG should consider the stakeholders’ needs of training for crisis management</td>
<td>Main</td>
<td>D1.1 Issues</td>
<td>The stakeholder analysis cover training needs related to resilience management guidelines.</td>
<td>Partially achieved</td>
</tr>
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<tr>
<td>DR-111</td>
<td>DRP-07</td>
<td>The development of the DRMG should consider the use of the modified CCRAM tool to assess the actual needs, capacities and perceptions that characterise different European communities</td>
<td>Main</td>
<td>DoA-B p. 97</td>
<td>CCRAM is part of the Tools or Methods referenced, especially in Capability Card on community resilience assessment</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-112</td>
<td>DRX-01</td>
<td>The development of the DRMG should consider target domain-specific rules and guidance</td>
<td>Main</td>
<td>WS; GfG1, 23, 25, 29, 34</td>
<td>The current version of the DRMG builds on consortium knowledge on relevant regulations in health care and aviation. The DRMG have currently been written for a general type of crisis, for general types of actors, so that domain-specific rules and guidance can be used in specific instantiations of the Capability Cards</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-113</td>
<td>DRX-02</td>
<td>The development of the DRMG should consider the context of the users</td>
<td>Main</td>
<td>WS; GfG1, 16, 25, 34, 44</td>
<td>Context is considered in the DRMG development through adaptation process, stakeholder analysis and DRMG authors' knowledge of domain and roles. Consideration of context was also part of evaluation efforts. A Context field of the Capability Card template explains which contextual conditions may favour or hinder the success of the intervention and achievement of the desired outcome. See also DR-005</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-114</td>
<td>DRX-03</td>
<td>The development of the DRMG should consider enablers and barriers for the users' implementation and application of the DRMG</td>
<td>Main</td>
<td>GfG16, 29, 37</td>
<td>The Context field of the Capability Card template explains which contextual conditions may favour or hinder the success of the intervention and achievement of the desired outcome. See also DR-005</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-115</td>
<td>DRX-04</td>
<td>The development of the DRMG should consider ethical and equity issues</td>
<td>Main</td>
<td>GfG23, 29, 34, 37</td>
<td>Ethics considered as part of DARWIN ethics board.</td>
<td>Achieved</td>
</tr>
<tr>
<td>DR-116</td>
<td>DRX-05</td>
<td>The development of the DRMG should consider stakeholder risks related to the application of the DRMG</td>
<td>Main</td>
<td>GfG17, 27, 29, 32, 37</td>
<td>Not addressed entirely, due to limited project resources and priorities set by end-users. However, in CCs, Context specifies what needs to be in place, otherwise less chance of success.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-117</td>
<td>DRX-06</td>
<td>The development of the DRMG should consider the users' need to prioritise interventions</td>
<td>Main</td>
<td>D1.1. Needs</td>
<td>The DRMG Map shows relationships between CCs and suggest priorities which the user needs to establish based on needs and maturity.</td>
<td>Partially achieved</td>
</tr>
<tr>
<td>DR-118</td>
<td>DRX-07</td>
<td>The development of the DRMG should consider the users' logistics needs</td>
<td>Main</td>
<td>D1.1. Needs</td>
<td>The management of resources, proper staffing, maintenance of proper response are hard to describe because are very context-dependent. As much as possible, CCs indicate resources needed in order to implement the interventions proposed.</td>
<td>Partially achieved</td>
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Expect the unexpected and know how to respond

D Level and means of implementation of evaluation recommendations

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<td>R1-DRMG-ITA</td>
<td>IMP</td>
<td>(1) In the DARWIN WIKI replace the titles &quot;ATM Perspective&quot; with &quot;Air Traffic Management Perspective&quot; in all CCs, since the non-ATM expert might be confused by this title and do not recognize it as an adaptation to a specific domain. (2) In case icons or images will be used, it is suggested to include a generic title (e.g. &quot;Domain Specific Perspective&quot;) above the section with the icons, to make sure that the user will not associate it with the previous text-box, and will understand that by clicking on the icons, some additional &quot;adapted content&quot; can be found.</td>
<td>A</td>
<td>(1) addressed differently, through presentation of information (and explanation in user manual)</td>
</tr>
<tr>
<td>R2-DRMG-SWE/ITA</td>
<td>IMP</td>
<td>All Capability Cards should make sure that core terminology or academic/technical jargon is defined to facilitate the understanding of the theoretical content for practitioners. Pay also attention to terms not used in the main body of the card but only in the adaptations parts. Consider if the use of pop-up or online explanation is best for the readability (note: when printing the pop-up-definitions are not seen).</td>
<td>A</td>
<td>Mechanism to include definition of terms modified. Each CC provides at the end of the page, before references, a list of key terms. Terms defined are indicated in italic in the text the first time they are used.</td>
</tr>
<tr>
<td>R3-DRMG-SWE/ITA</td>
<td>CRI</td>
<td>Reference are mixed up in several cards. The ATM and HC references are used in parallel with the same numbers. In some cases references are missing. 1) References should not be provided in the &quot;Implementation Part&quot;, but only in the other part (tools, methods, practices, additional material...). Note they should be limited only to the most important, and really focused on the content, and thus they should provide source of the evidence based (Recommendation R3-DRMG-SWE) 2) Each Author should double check the correctness and the presence of the references 3) The style of the reference should use the WIKI syntax, if possible</td>
<td>A</td>
<td>The use of references has been clarified and generalised across CCs. 1) Done 2) Done 3) Not possible technically after investigations due to versioning issues. Instead, APA style is used for citations and references throughout the guidelines.</td>
</tr>
<tr>
<td>R4-DRMG-SWE</td>
<td>NTH</td>
<td>To put the card in a consistent context the DRMG could have gained from a fictive example or scenario that would be used on all the cards. The feedback generated by the use of Wedgewood scenarios during workshops would have thus been able the be added</td>
<td>N</td>
<td>Good suggestion for future improvements</td>
</tr>
</tbody>
</table>

¹ CRI: critical; IMP: important; NTH: nice to have
² A: addressed; P: partially addressed; N: not addressed or dismissed
Expect the unexpected and know how to respond

to the CC itself. Such a scenario would also enable a description/exposee of that variations that can occur between different countries without limiting the card in itself. While it might not be feasible to implement this recommendation on all the current card, it is an idea to keep in mind for future work.

<table>
<thead>
<tr>
<th>R5-DRMG-SWE</th>
<th>NTH</th>
<th>The distinction between “target users” and “target actors” need to be clearly defined and implemented throughout the Capability Cards, and checked against what stated in the DARWIN WIKI.</th>
<th>A</th>
<th>The CCs describe target actors, those who might implement the interventions proposed in the CC. Target actors have been clarified for various CCs as a result of evaluation recommendations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R6-DRMG-SWE</td>
<td>NTH</td>
<td>Develop a document that contains the description of the development and evaluation process that is easy to understand for the target user. Integrate this document into the DARWIN WIKI.</td>
<td>P</td>
<td>The development process is part of D2.4 and a developer's manual is included in the wiki. The development process includes the description of the review process. However, no guidance is provided to conduct a similar evaluation process as performed during the project (described in detail in WP4 deliverables).</td>
</tr>
</tbody>
</table>

### 2.1 Promoting common ground

| R1-2.1-ITA | CRI | Provide definition of the term “Dissemination” and ”Common Ground” [DR-09]. | A | Decision to eliminate the term Dissemination to also comply with R2-2.1-ITA. Therefore a definition of Dissemination is not provided. Definition of Common Ground provided in the Terminology page and linked to the first occurrence of ‘common ground’ in the CC, after the title. |
| R2-2.1-ITA | IMP | Consider replace "cross-organizational dissemination" with "Information Sharing Workshops", since Dissemination appears as too unidirectional. | A | "Cross-fertilization dissemination workshops" replaced with "Information Sharing Workshops". |
| R3-2.1-ITA | IMP | Provide definition of Cross-Fertilization | A | Definition of Cross-Fertilization provided in the Terminology page and linked to the first occurrence of ‘cross-fertilization’ in a new text added to the description of "Information Sharing Workshops". |
| R4-2.1-ITA | IMP | Include explicit link to CC 2.2 also in the ”Implementation” part of the card [DR-89]. | A | Explicit links included in the Introduction. |
| R5-2.1-SWE | IMP | The CC could better explain the context of application (e.g. why and under what circumstance one organisation should use this card?). | A | Prerequisites for application clarified in the Introduction. Improvements of the explanations of the context of application still possible. |
The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement no.

| R6-2.1-SWE/ITA | CRI | The CC is lacking explanation of how the different phases are connected and is mainly about the "before a crisis" phase. Add contents also in the generic DURING CRISIS and AFTER CRISIS parts of the cards, clarifying that the DURING PHASE applies only to cases of crisis, since they are longer. Just better explain when common ground is required (R1-2.1-SWE), and add that AFTER you could evaluate if you may need to do common ground with someone else (that you were not expecting before a crisis e.g. R2.2.1-SWE). DURING, add a similar description of the Before phase, but specify that is only for crisis prolonged over time. | A | New text added in the Introduction, in the BEFORE CRISIS, DURING CRISIS and AFTER CRISIS sections. |
| R7-2.1-SWE/ITA | IMP | The CC does not explain how to implement the mechanism in a systematic manner. It is unclear whether the suggested process should be implemented as a single activity or repeated in cycles. Indicate that the action suggested are alternatives, and not a sequence. | A | The advised common ground actions are now proposed as alternative options and not anymore as a process. The mechanism has been better explained in the Introduction, although further improvements to explain how to implement it in a systematic manner might be needed. |

### 2.2 Establishing networks

| R1-2.2-ITA | IMP | Insert references in the "References" field [DR-12]. | A | 10 References added in the "References" field. Some of them were recovered from an older MS Word version of the CC that went lost when passing to the Wiki. In the Health Care specific field of the References there are some items from KMC or FOI converted to the proper format |
| R2-2.2-ITA | CRI | Clarify the difference between crises and emergencies and its implications: i.e. emergencies are quicker and need to be addressed in a very short time (e.g. within hours), while crises are longer and can be managed over a longer time. In addition to this add contents also in the generic DURING CRISIS and AFTER CRISIS parts of the cards, clarifying that the DURING PHASE applies only to cases of crisis, since they are longer. | A | A precise and univocal definition distinguishing crises from emergencies has not been found in literature. Therefore it was decided to emphasize the difference between crises with a longer and shorter time frame, to distinguish the cases in which the card can be used also in the DURING phase or only in the BEFORE and AFTER due to limited amount of time. |
| R3-2.2-ITA | NTH | In ATM perspective part elaborate more on the fact that in the BEFORE CRISIS phase there might be cases in which there is a need to extend the network of relationships in response to new regulations. | A | New text added in the ATM field available after the Triggering Questions of the BEFORE CRISIS phase. |
| R4-2.2-SWE | IMP | The rationale (detailed objective) of the intervention is well described. But the link among the rationale, the proposed process (protocol) and the triggering questions is unclear and needs to be developed and clarified. It is not evident that the proposed implementation | A | Description of the 5 Steps protocol in the Implementation part of the card re-elaborated to clarify the link with the overall rationale. |
Expect the unexpected and know how to respond

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Type</th>
<th>Description</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>R5-2.2-SWE/ITA</td>
<td>IMP</td>
<td>The CC does not include an explanation of prerequisites regarding context. Clarify the context of application (e.g. why and under what circumstance one organisation should use this card?).</td>
<td>A</td>
</tr>
<tr>
<td>R6-2.2-SWE</td>
<td>NTH</td>
<td>The CC contains no or very few explanations, in terms of methods or tools, of how to implement the suggested activities in the process. At the same time the process in its current form could be applied with minimal extra work.</td>
<td>N</td>
</tr>
<tr>
<td>R7-2.2-SWE</td>
<td>NTH</td>
<td>If the CC should be implemented scenario specific, it could be quite resource and time demanding to apply it on all types of scenarios and all the possible actors’ constellations. In that case the CC should therefore provide some sort of guidance on how to identify and prioritize among representative scenarios in order to select a suitable subset of scenarios on which the CC should be applied.</td>
<td>A</td>
</tr>
<tr>
<td>R8-2.2-DCoP</td>
<td>NTH</td>
<td>In the action list suggested by the card, consider adding in the description of the step “specify”, the importance of determining what other organisations may need from us and what we could do for them. Consider also adding possible Triggering Questions to reflect this element [3rd DCoP]</td>
<td>N</td>
</tr>
<tr>
<td>R9-2.2-DCoP</td>
<td>NTH</td>
<td>Consider including also theories of individual social networking and formal/informal Culture in determine and establishing network [3rd DCoP]</td>
<td>N</td>
</tr>
<tr>
<td>R10-2.2-SWE</td>
<td>IMP</td>
<td>The adaptations (HC/ATM) of the CC is uneven to each other. In ATM actors there are some actors with non-obvious connection to ATM (e.g. ERCC, WHO, IAE). Other United Nations Agencies are also listed twice in the same list.</td>
<td>N</td>
</tr>
</tbody>
</table>

The research leading to these results has received funding from Horizon 2020, the European Union’s Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement nº
### 2.3 Sharing information on roles and responsibilities

<table>
<thead>
<tr>
<th>Reference</th>
<th>Type</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1-2.3-ITA</td>
<td>IMP</td>
<td>Insert references in the &quot;References&quot; field [DR-12].</td>
</tr>
<tr>
<td>R2-2.3-ITA</td>
<td>IMP</td>
<td>Include in the periodic coordination activities the verification of the <strong>communication means</strong> to be used for coordination among the different actors jointly taking part in the management of a crisis/emergency (suggest differentiation among different types of means, such as point-to-point communication tools and alarming systems).</td>
</tr>
<tr>
<td>R3-2.3-ITA</td>
<td>NTH</td>
<td>Include in the periodic coordination activities the verification of the common <strong>terminology</strong> adopted to describe the roles, responsibilities, task, communication means in order to reduce the risk of misunderstandings among the different actors.</td>
</tr>
<tr>
<td>R4-2.3-SWE/ITA</td>
<td>IMP</td>
<td>The rationale (detailed objective) of the intervention is rather short and needs to be developed, so that it more clearly connects to the proposed process and triggering questions in the implementation section. Some of the existing text in the &quot;BEFORE&quot; section can be re-used to expand the introduction and anticipate the link with CC 2.2.</td>
</tr>
<tr>
<td>R5-2.3-SWE/ITA</td>
<td>-</td>
<td>The CC does not include an explanation of prerequisites regarding context. Clarify the context of application (e.g. why and under what circumstance one organisation should use this card?).</td>
</tr>
</tbody>
</table>

The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement no 85 [100].
**NOTE THIS RECOMMENDATION WILL BE SUPERSEDED BY TAKING INTO ACCOUNT R4-2.3-SWE/ITA**

| R6-2.3-SWE/ITA | IMP | (1) The recommendation to use a Quick Reference Guide (QRG) could be improved by raising the issue to consider whether it is feasible or not in the domain at hand.  
(2) For instance, in the last bullet point in the "BEFORE" add that this is more convenient for the more structured domains (e.g. Aviation), while it may become obsolete too quickly in less structured domains | A | (1) The following text has been added to the bullet introducing the Quick Reference Guide: "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".  
(2) Sentence added: "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". |
| R7-2.3-SWE/ITA | NTH | The CC can include references to methods such as Table-top-exercise, which can be effective in raising awareness of each other roles/responsibilities and finding the blind spots between organisations. The CC could suggest how to use such exercises to identify/document the concept raised by the CC. | N | This is recognised as an important point. However, in the interest of efficiency in the final part of Task 2.1, priority was given to recommendations classified as ‘Important’ and ‘Critical’. |
| R8-2.3-SWE | NTH | If the CC should be implemented scenario specific, it could be quite resource and time demanding to apply it on all types of scenarios and all the possible actors’ constellations. In that case the CC should therefore provide some sort of guidance on how to identify and prioritize among representative scenarios in order to select a suitable subset of scenarios on which the CC should be applied. | A | This is recognised as an important point, but it must be noted that this card requires that the other 2 CCs supporting the coordination and synchronization of distributed operations are already taken into consideration. Therefore, it was decided to provide guidance to “identify and prioritise the scenarios, intervention and relevant organisation” in the cards 2.1 and 2.2. In addition to this, in the context of answering to previous recommendations, a more explicit link with the... |
Expect the unexpected and know how to respond

| R9-2.3-DCoP | NTH | Consider expanding more the potential issue related to roles and responsibilities when deciding that "the crisis is over" and during the "returning to normal operations". [3rd DCoP] | N | This is recognised as an important point. However, in the interest of efficiency in the final part of Task 2.1, priority was given to recommendations classified as ‘Important’ and ‘Critical’. |
| R10-2.3-SWE | CRI | There are presently EU mechanisms and functions that are already in place that are related to this card, but is not mentioned (e.g. DG Sante / HEOF / SHER-committee). The card should acknowledge these existing platforms. | A | "Practice 4", relating to the Health Emergency Operations Facility (HEOF) by the DG SANTE has been added to the examples of Healthcare Practices. |
| R11-2.3-SWE | NTH | The practices stated in the CC are formulated as statements from academic literature, rather than examples of actual practices. These should be revised to be formulated in a more relevant way for practitioners. Ideally they should reference actual practices already place. | N | This is recognised as an important point. However, in the interest of efficiency in the final part of Task 2.1, priority was given to recommendations classified as ‘Important’ and ‘Critical’. |

### 3.1 Enhancing the capacity to adapt

| R1-3.1-ITA | CRI | Add more references in the "References" field [DR-12]. | A | More references were added |
| R2-3.1-ITA | IMP | Include explicit link with other CCs (such as with 2.1, 2.3, 4.3, 4.2). see [DR-89] | A | Linked added for the proposed CC |
| R3-3.1-ITA | NTH | Include Examples or case studies [DR-10] | N | No action was taken |
| R4-3.1-SWE | IMP | (1) The interventions (e.g. detailed objectives) needs to be reviewed so they are achievable with respect to what mechanisms (e.g. implementation or methods) that are proposed in the CC.  
(2) For instance, the implementation is insufficiently described with too little text explaining in detail what is proposed or intended by the implementations. The suggested implementations need to be more verbose than simple short statements. For instance, the implementation "Understanding adaptations in the operative environment" propose the following implementation: "invest resources in capturing/clarifying strategies, resources and constraints". There are no suggestions of implementations beyond this statement. We find it difficult to understand what is meant by this. The rest of the implementation section is described in a similar way. To large degree there are only bullet lists with single word statements, such as "contingency plans, checklists" or "mobilising extra resources". Almost every actor does that, in one way or another. The short statements make it very hard to understand what is meant. | A | (1) The intervention section was revised.  
(2) The implementation sections expended and revise according to your recommendation  
(3) The CC was updated and revised |
<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Category</th>
<th>Description</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>R5-3.1-SWE/ITA</td>
<td>IMP</td>
<td>The CC does not include an explanation of prerequisites regarding context. Clarify the context of application (e.g. why and under what circumstance one organisation should use this card?).</td>
<td>A The context section was revised and expanded.</td>
</tr>
<tr>
<td>R6-3.1-SWE/ITA</td>
<td>CRI</td>
<td>The CC does not describe any mechanisms to be used. The CC should add a description of the mechanism, to support the understanding of the content in the different before/during/after phases, and also to support the use of the triggering questions (TQ).</td>
<td>A Mechanism to be used was described in different ways in the before/during/after phases. TQ were classified according to this mechanism.</td>
</tr>
<tr>
<td>R7-3.1-SWE</td>
<td>NTH</td>
<td>The CC should make it more transparent how the suggested activates and TQs are relevant for or affect the concept of adaptations to events. For example, are buffers mentioned several times, but it is not explained why these are important and how they can be used for adaptations. References to system coupling, cascades effects could be used to further support the need for buffers to create time or room for maneuverer.</td>
<td>A The issue of managing buffers was moved to the BEFORE section with explanation and linked to other CC (managing available resources). An appropriate TQ was added.</td>
</tr>
<tr>
<td>R8-3.1-DCoP</td>
<td>NTH</td>
<td>Consider also covering specific adaptation (e.g. for economical, communication and roles and responsibilities) and/or also consider to split &quot;expected&quot; and &quot;unexpected&quot; situations in an emergency. [3rd DCoP]</td>
<td>P An explanation about the differences between expected and unexpected event was provided in the purpose section. the issue of role and responsibilities during emergency was expanded among the implementation sections (with a link to the appropriate CC)</td>
</tr>
<tr>
<td>R9-3.1-SWE/ITA</td>
<td>IMP</td>
<td>Consider adding a disclaimer in the &quot;what is needed &quot;section of the card, stating that the implementation of the card may require the support of resilience management expert.</td>
<td>A The CC in itself, provides solutions for promoting resilience management. This content was added to the ACROSS PHASES section.</td>
</tr>
<tr>
<td>R10-3.1-ITA</td>
<td>CRI</td>
<td>Insert thematic areas for the TQ as in all other CCs [DR-01]. Note that this is valid for Before, During and After.</td>
<td>A Thematic areas were added to TQ in all phases</td>
</tr>
<tr>
<td>R11-3.1-ITA/DCoP</td>
<td>IMP</td>
<td>In &quot;Before a crisis&quot; (section: Understanding Adaptation) it is unclear how to define strategies, resources and constrains. It is proposed either to explain it, or connect these terms to specific TQ, in the following TQ section. [DR-04][3rd DCoP]</td>
<td>A The BEFORE implementation section was revised and updated. The TQ were divided according to the themes</td>
</tr>
<tr>
<td>R12-3.1-ITA/DCoP</td>
<td>IMP</td>
<td>In &quot;Before a crisis&quot; (section: Building Mechanism) it is unclear how to define contingency plans and checklist. It is proposed either to explain it, or connect these terms to specific TQ, in the following TQ section. [DR-04][3rd DCoP]</td>
<td>A The &quot;Before a crisis&quot; section was expanded and revised relating to contingency plans and checklists. The section was connected to TQ section. A short explanation to use of buffers was added to the BEFORE section.</td>
</tr>
</tbody>
</table>
**3.2 Establishing conditions to adapt plans and procedures**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Type</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>R13-3.1-ITA/DCoP</td>
<td>IMP</td>
<td>In &quot;Before a crisis&quot; (section: Building Mechanism) it is requested to appoint a specific role in charge of crisis management who should -among other things - define the roles and responsibilities of involved actors. However, it is unclear if these roles are the ones existing during everyday operations or roles specifically defined for the management of a crisis. This point should be clarified [DR-04][3rd DCoP]+S16</td>
<td>A This issue was clarified: 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.</td>
</tr>
<tr>
<td>R14-3.1-ITA/DCoP</td>
<td>IMP</td>
<td>The last three bullet of the “Building Mechanism” section (Integrating buffers in plans; Anticipating demands; Supporting operations from remote locations) are not explained and are very difficult to understand in the context of building mechanism. Either try to explain it, or connect these terms to specific TQ, in the following TQ section. [DR-04][3rd DCoP]</td>
<td>A These sections were revised and expanded.</td>
</tr>
<tr>
<td>R15-3.1-ITA</td>
<td>IMP</td>
<td>Consider re-phrasing the sentence: &quot;Managers should be trained in assessing the situation against prepared-for situations&quot;. The understanding of 'prepared-for situations' is not straightforward.</td>
<td>A The sentence was changed to: &quot;Managers should be trained in assessing the situation against prepared-for specific situations&quot;</td>
</tr>
</tbody>
</table>
| R16-3.1-ITA | CRI | (1) In "During" and "After crisis" the actions to be performed are expressed only with not-explained and very short bullet points that are very difficult to understand.  
(2) An explanation for each action should be provided. | A (1) All the “implementation” sections were updated and revised. Explanations were provided  
(2) All the “implementation” sections were updated and revised. Explanations were provided |

**The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement n°**
### 4.2 Identifying sources of resilience

<table>
<thead>
<tr>
<th>Sheet</th>
<th>Author</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R1-4.2-ITA</strong></td>
<td>CRI</td>
<td>Insert references in the &quot;References&quot; field [DR-12].</td>
</tr>
<tr>
<td><strong>R2-4.2-ITA</strong></td>
<td>CRI</td>
<td>Improve the description of &quot;Actors targeted by the Capability Card&quot; [DR-20].</td>
</tr>
<tr>
<td><strong>R3-4.2-ITA</strong></td>
<td>IMP</td>
<td>Include explicit link with CC 4.3 to clarify the differences between Noticing Brittleness and Identifying Sources of Resilience, and how to choose one or the other [DR-89].</td>
</tr>
<tr>
<td><strong>R4-4.2-SWE</strong></td>
<td>NTH</td>
<td>The intervention of the CC builds upon supportive methods and practices (e.g. work as imagined, work as done, resilience analysis grid) which have their origin from the control room and emergency department related research. The CC would benefit on clarification the supportive methods relate to the implementation section and regarding the use of such methods in ICMO Context.</td>
</tr>
</tbody>
</table>

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The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement n°954870.
Expect the unexpected and know how to respond

| Concept/methods in less persistent organisations such as voluntary disaster response organizations. **This recommendation should be discarded, unless some of us, in the DARWIN Consortium, is aware of additional specific methods to identify sources of resilience** |
|----------------------------------|-------------------------------------------------------------------------------------------------|
| Experts could be involved to better address "less persistent organisations such as voluntary disaster response organizations" |

<table>
<thead>
<tr>
<th>R5-4.2-SWE/ITA</th>
<th>IMP</th>
<th>The CC does not include an explanation of prerequisites regarding context. Clarify the context of application (e.g. why and under what circumstance one organisation should use this card?).</th>
<th>A</th>
<th>Added to ICMO Context.</th>
</tr>
</thead>
</table>

| R6-4.2-DCoP | NTH | In the paragraph "during a crisis" consider adding a Triggering question referring to identification of alternate ways/means of handling a critical situation. [3rd DCoP] |
|--------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------------------------|

| R7-4.2-SWE/ITA | IMP | Consider adding a disclaimer in the "what is needed "section of the card, stating that the implementation of the card may require the support of resilience management expert. A systematic wide scale implementation would likely demand a high level of competence in resilience, the specific domain as well as organizational development. |
|----------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|Se R5 |

| R8-4.2-SWE | NTH | In a healthcare perspective, the "work-as-imagined" is difficult to define. A definition of the terms "work-as-done" and "work-as-imaged" should perhaps be provided also in the main body of the card. |
|-------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|Explanations and reference have been added. |

### 4.3 Noticing brittleness

<table>
<thead>
<tr>
<th>R1-4.3-ITA</th>
<th>CRI</th>
<th>Insert References in the &quot;References&quot; field. [DR-12]</th>
<th>A</th>
<th>References added following common APA format</th>
</tr>
</thead>
</table>

| R2-4.3-ITA | NTH | Improve the description of "Actors targeted by the Capability Card", considering that front-end operators can be involved in noticing brittleness activities (e.g. focus group or TTX) but are not direct users of the CC, which is more likely to be used by policy makers and top/middle managers. [DR-20] | A | Addressed |

<p>| R3-4.3-ITA | IMP | Include explicit link with CC 4.3 to clarify the differences between Noticing Brittleness and Identifying Sources of Resilience, and how to choose one or the other [DR-89]. | A | A short text was added to the &quot;Detailed objectives&quot; with a link to 4.2. Another link was made as intro to the Methods section, because all methods are relevant to both cards. The basic message on the difference between 4.2 and 4.3 is that you shouldn't do 4.3 (brittleness) only, you need to understand what creates resilience. However, as a first approach, brittleness might be easier to notice / discuss. One issue is whether this message is sufficiently visible in |</p>
<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Location</th>
<th>Description</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>R4-4.3-ITA</td>
<td>NTH</td>
<td>Add among the triggering questions of the category &quot;Difficulties to adjust&quot; a question such as &quot;have we considered all the relevant stakeholders for the prevention and management of a crisis/emergency?&quot;. [P1]</td>
<td>N</td>
</tr>
<tr>
<td>R5-4.3-ITA</td>
<td>IMP</td>
<td>Add a group of triggering questions named &quot;Goal Conflicts&quot; also in the &quot;Before crisis&quot; part of the card (currently available only in the &quot;After crisis&quot; part of the CC. [P3]</td>
<td>A Group added, inspired by the &quot;after&quot; questions</td>
</tr>
<tr>
<td>R6-4.3-ITA</td>
<td>NTH</td>
<td>Add among the triggering questions of the category &quot;lack of information&quot; a question such as &quot;in case of lack of relevant information to handle the situation, which protocol can be put in place to gather the missing information?&quot;. [P3]</td>
<td>A done</td>
</tr>
<tr>
<td>R7-4.3-SWE</td>
<td>NTH</td>
<td>The part with practices would be improved if the referenced practices were further explained (e.g. explain what &quot;all hands alarm&quot; actually means and how it is used).</td>
<td>A done</td>
</tr>
<tr>
<td>R8-4.3-SWE</td>
<td>-</td>
<td>The intervention of the CC builds upon supportive methods and practices (e.g. Cognitive Task analysis) which have their origin from the control room and emergency department related research. The CC would benefit on clarification the supportive methods relate to the implementation section and regarding the use of such concepts/methods in less persistent organisations such as voluntary disaster response organizations. <strong>This recommendation should be discarded, unless some of us, in the DARWIN Consortium, is aware of additional specific methods to noticing brittleness</strong></td>
<td>N Interesting point, but it is virtually impossible to anticipate how a CTA should be conducted in a given environment a priori. There is no fundamental issue with conducting a CTA in environments described (the big issue is how)</td>
</tr>
<tr>
<td>R9-4.3-SWE/ITA</td>
<td>NTH</td>
<td>The CC does not include an explanation of prerequisites regarding context. Clarify the context of application (e.g. why and under what circumstance one organisation should use this card?).</td>
<td>A Provided in phases</td>
</tr>
<tr>
<td>R10-4.3-SWE/ITA</td>
<td>NTH</td>
<td>It is unclear which of the suggested methods such as business process modelling, cognitive task analysis and hazard vulnerability assessment should be selected and based on what conditions. Likewise, it is unclear what the benefits of using the suggested methods are. The CC refers to the kind of similar topics as the CC 4.2 (Sources of Resilience), however, suggests completely different sets of methods. Please clarify, taking into consideration also CC 4.2</td>
<td>N Complementarity between 4.2 and 4.3 improved, but not at that level of detail.</td>
</tr>
<tr>
<td>R11-4.3-SWE/ITA</td>
<td>IMP</td>
<td>Despite the sentence &quot;Build the necessary skills...&quot;, consider adding a clearer disclaimer in the &quot;what is needed &quot;section of the card, stating that the implementation of the card may require the support of resilience management expert. A systematic wide scale implementation would likely demand a high level of competence in resilience, the specific domain as well as organizational development.</td>
<td>A Bullet point split in two to address both the need to engage people across the organisation and to facilitate the capacity to notice/discuss brittleness through regular activities</td>
</tr>
</tbody>
</table>
**Expect the unexpected and know how to respond**

<table>
<thead>
<tr>
<th>R12-4.3-SWE</th>
<th>IMP</th>
<th>In relevant material</th>
<th>Methods</th>
<th>point 2 there is a reference error: “better reference needed”</th>
<th>A</th>
<th>No publication available, yet, so the method was described succinctly.</th>
</tr>
</thead>
<tbody>
<tr>
<td>R13-4.3-ITA</td>
<td>IMP</td>
<td>Propose to replace the Triggering Question: “What assumptions have we made about the availability of resources to respond to these challenging events?” with “Do we expect situations in which the available resources may not suffice to respond to a crisis/emergency?”</td>
<td>A</td>
<td>Question changed, but text suggested modified to better capture the initial idea about assumptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R14-4.3-ITA</td>
<td>NTH</td>
<td>The meaning of the following TQ: “What can we put in place to relieve, lighten, moderate, reduce and decrease stress or load?” is not completely clear, as it is not clear if it is referring to individual-level of “reliefs” or rather to organisational response...</td>
<td>A</td>
<td>Refers to both (all system layers)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R15-4.3-ITA</td>
<td>NTH</td>
<td>We propose to change the order of the thematic areas, in order to facilitate the fruition of the user, guiding the reasoning on similar thematic areas (e.g. first all the &quot;Lack of...&quot;, then reason on potential conflicts and constrains; then on the adjustments and limits of the plan). The following order is proposed: -Lack of Resources (human, technical, material) -Lack of Information -Goal Conflicts -Constraints and Bottlenecks -Difficulties to adjust -Limits of mitigation plans</td>
<td>A</td>
<td>Done, with some adaptations for DURING and AFTER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R16-4.3-ITA</td>
<td>NTH</td>
<td>The TQ: &quot;Did we sacrifice any goal in a way that reduced our ability to adapt to certain circumstances?&quot; is not completely clear... add also a reference to the circumstance that lead to goal sacrifice...</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R17-4.3-ITA</td>
<td>IMP</td>
<td>Refer also to the term &quot;Contingency Plan&quot; for the ATM perspective</td>
<td>N</td>
<td>unclear where this recommendation is the most relevant; requires input from ATM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 6.1 Systematic management of policies

<table>
<thead>
<tr>
<th>R1-6.1-ITA</th>
<th>CRI</th>
<th>Insert references in the &quot;References&quot; field [DR-12].</th>
<th>A</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>R2-6.1-ITA</td>
<td>CRI</td>
<td>Include explicit link with other CCs (such as with 3.2, 4.2, 4.3) [DR-89].</td>
<td>A</td>
<td>Links have been added in Detailed objectives to 2.1,2.2,2.3, 3.2, 4.2 and 4.3</td>
</tr>
<tr>
<td>R3-6.1-ITA</td>
<td>IMP</td>
<td>Consider better defining some terms.</td>
<td>A</td>
<td>More terms have been defined.</td>
</tr>
<tr>
<td>R4-6.1-SWE/ITA</td>
<td>IMP</td>
<td>Consider adding a disclaimer in the &quot;what is needed &quot;section of the card, stating that the implementation of the card may require the support of resilience management expert.</td>
<td>N</td>
<td>This is not considered that relevant in this CC</td>
</tr>
</tbody>
</table>
Expect the unexpected and know how to respond

| R5-6.1-ITA | IMP | The actions proposed in the cards are grouped in three macro-actions: (a) Policy Management Process, (b)Policy Assessment, (c) Policy Training and implementation Support. These macro actions include in turn a set of different actions. However, this hierarchical structure is used only when introducing the triggering questions (BEFORE a CRISIS) and not in the previous introductory text, where the different actions should in principle be described. Actually in the section preceding the TQs only the first macro-level is very briefly explained, while the individual actions are not described nor explicitly presented. The reader can only reconstruct them from the following structure of triggering questions. This causes two problems: the categorization of the triggering questions is based on two hierarchical levels and not on one (as for all other cards and for the final part of this card) and the individual actions are explained only via the TQs. This makes the explanation of actions in the introductory part insufficient and the triggering questions quite difficult to understand (since it is not very clear the connection with the actions). Consider the possibility to: 1) provide some description of the individual actions in the introductory parts 2) make sure that the following triggering questions are presented with a consistent structure (this may be done either with two hierarchical levels, as it is now in the BEFORE A CRISIS, or with one level, as it is now in the DURING and AFTER A CRISIS). |
| R6-6.1-ITA | IMP | In the BEFORE A CRISIS TQs, the triggering question "Are bottom-up organisational processes provided for policy making and dialogue between policy-makers and operational personnel?" refer to two different processes. If they are both needed they should be addressed by two different TQs in the interest of clarity. |
| R7-6.1-ITA | IMP | In the BEFORE A CRISIS TQs, the term "Resource-for-action" is very interesting but should not be taken for granted since it is likely that the reader will not understand it. It is proposed to include a definition of it. |
| R7-6.1-ITA | NTH | In the BEFORE A CRISIS TQs, it is unclear why only "subsets of policies" can be used in a flexible way. This is probably to express the idea that part of the policies requires a strict compliance by the practitioners, while others can be used with more flexibility. However, this is not explained and the reader has to 'deduce' it. |

7.1 Interacting with the public

| R1-7.1-ITA (a) | IMP | Improve the explanations of the examples currently in the field "Relevant Practices, Methods and Tools" by clarifying the links with the Triggering Questions' thematic areas [DR-10]. |

A The structure of the TQs have been aligned throughout the CC.

A The text has been rephrased

A Rephrased and explanations have been added

A Rephrased and explanations have been added

A Rephrased
R1-7.1-ITA IMP Improve the explanations of the examples currently in the field "Relevant Practices, Methods and Tools" by clarifying the links with the Triggering Questions’ thematic areas [DR-10]. A The examples have been rephrased and improved.

R2-7.1-ITA IMP Elaborate more the definition of Actors "Targeted by the Capability Card" specifying the different between B2B (business to business) and B2C (business to customer) relations (e.g. the ANSP generally does not need to communicate directly with the public, but needs to communicate with other aviation stakeholders, such as airport operators) Ref. [DR-20 and P1] N B2B is considered out of scope for this CC. The focus of the CC is on communication to the public (e.g. B2C).

R3-7.1-ITA CRI Include explicit link with other CCs such as 2.1 [see DR-89] A Links added in Detailed Objective

R4-7.1-ITA NTH Consider the possibility to change the title of the category of triggering questions "Adequacy of the plan", with the title "Communication Strategy and Plan" [P1]. N

R5-7.1-ITA NTH Include in the current category "Adequacy of the Plan" one or more triggering questions referring to the importance of having an organizational culture that encourages collaboration among different competences in the implementation of the communication plan (e.g. in case of a crisis, the technical experts in the organization should be open to support the communication strategy and actions even if it is not part of their core competence. On the other hand the communication experts should know when it is important not to interfere with emergency operations, but also be confident on the fact that their non-communication colleagues will duly update them with the relevant information as necessary [P1]. A Covered by TQs

R6-7.1-ITA NTH Add in "Adequacy of the Plan" or in other categories a triggering question to verify if the communication staff is aware and sufficiently trained to distinguish the information which is appropriate to disclose externally to the organization from the ones that need to be filtered or smoothened in order to reassure the public/media and to mitigate the potential negative effect for both the organization and other stakeholders [P1]. A Consideration added as TQ

R7-7.1-ITA IMP Add in "Adequacy of the Plan" or in other categories a triggering question to verify if a mechanism in in place to identify a common spokesperson appointed to manage the communication towards the public and the media in crisis situations , in order to prevent misalignments or conflicts among both different organizations or different parties of the same organization [P1]. A Relevant TQ added in before and during
| R8-7.1-ITA | NTH | Add a triggering question in the category "Adequacy of Competences": to check if the communication staff has sufficient familiarity with the technical terminology used in the reference domain, in order to be able to adequately master the elaboration of contents that can be understood by people with no experience in such domain (e.g. the general public and the media). [P1] | A | Added |
| R9-7.1-ITA | NTH | to check if the communication staff is sufficiently competent in the reference domain, in order to prevent that the request of information and clarifications on the technical contents will create overload or interfere with operations during the development of a crisis [P1]. | A | Covered by TQ |
| R10-7.1-ITA | NTH | Consider the possibility to add a category of triggering questions addressing the problem of finding the right format for the messages and press releases, taking into account the following criteria:  
(1) - need to find the right balance between too long messages (with a risk of being cut by the media) and too short ones (with a risk of being misunderstood or integrated in a non accurate way)  
(2) - need to find the right balance between scientific/technical soundness and simplicity/clarity of the message in order to avoid misunderstandings or false alarms for the general public [P3]. | P | (1) This should be a basic consideration for a communication staff  
(2) Fixed through other means |
| R11-7.1-ITA | NTH | Add in the category "Prevention of Misinformation" or in another category, one or more triggering questions to check if the organization has set any strategy to prevent manipulations of own social media channels (including use of hacking and spoofing techniques) thus compromising the correctness and credibility of the messages addressed to the general public [P3]. | A | Added as TQ and rephrasing |
| R12-7.1-ITA | IMP | Consider the possibility to add in the category "Prevention of Misinformation" or in other categories, one or more triggering questions dealing with the need to monitor and/or react to messages spread by other non-official communication channels, potentially generating rumours or inaccurate information [P3]. | A | TQ added |
| R13-7.1-ITA | NTH | Consider the possibility to add in the categories "Prevention of Misinformation", "Adequacy of the Plan" or others, one or more triggering questions dealing with the need to be prepared to promptly provide information and updates (e.g. in less than 30 minutes) to the media and public, during the development of a crisis. Note that such rapidity is necessary in order to avoid other channels to speak first and potentially undermining the trust and acceptability of own communications [P1-P3]. | A | Added as TQ |
Consider the possibility to add in the categories "Adequacy of the Plan", "Ability to listen and collect feedback" or others, one or more triggering questions dealing with the need to check if normal communication channels are still sufficient during the management of an emergency or crisis or if a dedicated channel (e.g. Toll Free Numbers) should be established in order to prevent overload [P3].

It would be useful to suggest some actions when the answer to some triggering questions is "no" (not compliant). In order to improve awareness and guide the grow of one organisation, it may be not enough to say "be trustful", but the CC could provide more information and instruction on "how to be trustful". [3rd DCoP]

The TQs are to be used as a basis for reflections, rather than as a checklist with a correct answer.
The research leading to these results has received funding from Horizon 2020, the European Union's Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement n°
ABOUT THIS CAPABILITY CARD

Stakeholders involved in resilience management need to have a 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.

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.

The research leading to these results has received funding from Horizon 2020, the European Union’s Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement no. 653289.

Please visit www.h2020darwin.eu/wiki to view the full version of this Capability Card and to view the complete DARWIN Resilience Management Guidelines.
BEFORE A CRISIS

If a shared procedure among the different organisations already exists, the procedure should specify which are the involved organizations and which is expected to take initiative when coordination 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 CC2.2 ‘Establishing Networks’. Actions needed before a crisis:

- Identify organisations with shared responsibilities in the management of a crisis.
- Organise periodic coordination meetings among the organisations, according to needs, time and budget constraints. The meetings should address the following questions:
  - Which roles can be contacted within each organization to coordinate the management of both generic and specific types of crises?
  - What are the high-level responsibilities of these roles?

Triggering questions

INVOlVEMENT OF ORGANISATIONS

Does a shared procedure exist among different organisations required to manage jointly a specific type of crisis?

Is there a need to involve new organisations 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 organisations for the management of a specific type of crisis? (See CC2.2 Establishing Networks)

COORDINATION MECHANISM

When a shared procedure among different organisations exists, is there one organisation clearly appoint to activate and arrange periodic coordination activities with other organisations?

Within our organisation, is a calendar of periodic coordination activities already established, to check roles and responsibilities with other organisations?

IMPACT ON OTHER ORGANISATIONS

Did we recently experience within our organisation changes of roles and responsibilities that could affect emergency procedures shared with other organisations?

Are these changes sufficiently significant to require a communication to other involved organisations?

INTERNAL DISSEMINATION OF CHANGES

Are we providing adequate information and training on relevant changes of roles and responsibilities in other organisations to the personnel potentially involved in the management of crisis?

Can we develop a ‘quick reference guide’ to help the personnel of our organisations to promptly identify shared roles and responsibilities with other organisations during a crisis?
How these roles can be contacted?

What type of communication means should be preferred to coordinate with them?

Which is the most up to date terminology to indicate the roles and describe their responsibilities?

- Ensure at least one representative per organisation participates in the coordination meetings and that each organisation dedicates a Point of Contact for coordination.

- Make sure that the designated POCs will update their organisations internally after coordination meetings.

- Make sure that major changes affecting emergency procedures in each organisation are assessed for their potential impact on the interaction with other organizations and communicated to them.

- If possible, inside each organisation, 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.

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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 organisations.

Actions needed during a crisis:

- Operate taking into consideration the information and/or the training received during internal updating activities 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.
AFTER A CRISIS

The outcome of a crisis is obviously an opportunity to revise any kind of procedure shared among different organisations that were jointly involved in its management. Such review includes the high-level definition of roles and responsibilities inside each organisation.

Actions needed after a crisis:

- Organise 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 organisation, as needed.
- Consider whether new organisations should be included in the shared procedure and periodic coordination mechanism (or if other organisations should be excluded from that, having lost their relevance in the shared procedure).

Triggering Questions

ORGANISATIONS INVOLVED

Did the shared procedure and coordination mechanism involve all the organisations relevant for the management of the crisis?

Considering what happened during the crisis: should new organisations be included in the shared procedures 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 organisation?

Is the frequency of periodic coordination activities sufficient at the light of the occurred crisis?

IMPACT ON OTHER ORGANISATIONS

Does our organisation have ill-defined roles and responsibilities in the shared procedure, which negatively affected the response to a crisis managed in cooperation with other organisations?

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 organisations?

If available, did the quick reference guide supported the identification of roles and responsibilities during the crisis?
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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:

- Anticipated surge in demands (e.g., due to seasonal peak of activity, or to the approach of an identified threat)
- 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.

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 organizations?
Can we anticipate situations in which our operations act as a constraint for other organizations 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?

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**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 parts 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, which protocol can be put in place to gather the missing information?
Should 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**
Should we reconsider our priorities?
Can we delay the achievement of some goals, in favour of more urgent ones?
Should 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?

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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 organization has reacted after crisis events, for instance whether it has prioritized and invested resources in the analysis and enhancement of resilience.

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 observer an excessive mismatch between official procedures and actual practices during operations.

The research leading to these results has received funding from Horizon 2020, the European Union’s Framework Programme for Research and Innovation (H2020/2014-2020) under grant agreement no. 653289.
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?
The research leading to these results has received funding from Horizon 2020, the European Union’s Framework Programme for Research and Innovation under grant agreement no. 653289.
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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 to 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.

<table>
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<tr>
<th>DRMG Themes</th>
<th>DRMG Topics</th>
</tr>
</thead>
<tbody>
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<td>- Promoting common ground for cross-organisational collaboration in crisis management</td>
</tr>
<tr>
<td></td>
<td>- Establishing networks for promoting inter-organisational collaboration in the management of crises</td>
</tr>
<tr>
<td></td>
<td>- Sharing information about roles and responsibilities among organisations involved in the management of the crisis</td>
</tr>
<tr>
<td>Managing adaptive capacity</td>
<td>- Enhancing the capacity to adapt to both expected and unexpected events</td>
</tr>
<tr>
<td></td>
<td>- Establishing conditions for adapting plans and procedures during crises and other events that challenge normal plans and procedures</td>
</tr>
<tr>
<td></td>
<td>- Managing available resources effectively to handle changing demands</td>
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<td>Assessing resilience</td>
<td>- Assessing community resilience to understand and develop its capacity to manage crises</td>
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<tr>
<td></td>
<td>- Identifying sources of resilience: learning from what goes well</td>
</tr>
<tr>
<td></td>
<td>- Noticing Brittleness</td>
</tr>
<tr>
<td>Developing and revising procedures and checklists</td>
<td>- Systematic management of policies involving policy-makers and operational personnel for dealing with emergencies and disruptions</td>
</tr>
<tr>
<td>Involving the public in Resilience Management</td>
<td>- Communication strategies for interacting with the public</td>
</tr>
<tr>
<td></td>
<td>- Increasing the public’s involvement in resilience management</td>
</tr>
<tr>
<td>Managing system failures</td>
<td>- Supporting development and maintenance of alternative working methods</td>
</tr>
</tbody>
</table>

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/inspectors, 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:
<table>
<thead>
<tr>
<th>Risk management</th>
<th>Changes</th>
<th>Resilience management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisations have investment and implemented protective infrastructure</td>
<td>Changing in the nature of crises</td>
<td>Organisation invest in the ability to maintain operation and continuity of operations for different kinds of system, organisations at different levels</td>
</tr>
</tbody>
</table>

**PREPAREDNESS PHASE**

<table>
<thead>
<tr>
<th>Command and control: Appropriate institutional structures, clear mandates supported by policies</th>
<th>Management processes that can be adapted to situational demands</th>
<th>Preparation for flexible and agile management and organisational processes (e.g. through training and other efforts at establishing common ground)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk assessment based on historical events, identification and analysis of threats and hazards and vulnerabilities</td>
<td>Detecting emergent risk require significant efforts.</td>
<td>Forward looking analysis to complement risk assessment</td>
</tr>
<tr>
<td>Scenario based emergency planning, maintenance of equipment and supplies</td>
<td>Address trade-off between highly specialized expert centres or ensuring proximity of response services</td>
<td>Capability planning and network building to ensure various capabilities and capacities are mobilized</td>
</tr>
<tr>
<td>Training to test plans and procedures e.g. table-top exercises or large-scale exercises</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RESPONSE PHASE**

<table>
<thead>
<tr>
<th>Detection and crisis development monitoring: Early warning systems based on monitoring forecasting, warning messages to activate predefined plans (emergency or contingency)</th>
<th>Non-linear dynamics, hidden interdependencies and complexity of modern crises make difficult to detect</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command and control according to hierarchical break-down of tasks and responsibilities</td>
<td>Trade-off between emergency response at local level and centrally managed at national level. Role of civil society (e.g., NGOs) is growing.</td>
<td>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</td>
</tr>
<tr>
<td>Standard Operating Procedures (SOPs) designed and enforced</td>
<td>More flexibility according to situational demands</td>
<td>Flexible and multipurpose crises management teams and facilities</td>
</tr>
<tr>
<td>Strict lines of responsibilities</td>
<td>More flexibility according to situational demands, focus on common ground and cooperative crisis management</td>
<td>Common concepts across agencies to inform leadership with high adaptive capacities</td>
</tr>
</tbody>
</table>
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.
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.

**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 my 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.

Examples 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.

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**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.

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**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.

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### 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 cooperative 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 #)

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### 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 (Kuziemsky 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 (Kuziemsky 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**
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.

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. [11]

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 Krakow, 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 sue 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 transparancy 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, whic 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, firefighters, etc.

**REFERENCES**

Used in text


**Additional references**


**Healthcare – References**

Samverkan Östergötland: Samverkan Östergötland (Inter-agency Coordination County Östergötland)

MSB’s Gemensamma grunder för samverkan och ledning vid samhällsstörningar: See page

Samverkan Stockholm: See page

Socialstyrelsens föreskrift 2013:22 See document

Collaborative indicators: Instruktörsmanssamverkan CBRN, Katastrofmedicinsk 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

*Last edited on 13 September 2018 09:45:03.*
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-crises 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]).

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**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 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 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?

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**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.

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**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 inter-personal relationships 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, non-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-crises 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 (ERCCC) 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 Östergötland 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 Servisces). 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**

p. 30
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 of uninjured - Evacuation within and between counties/regions - Information management between agencies

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/European_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.

REFERENCES


Healthcare – References

Samverkan Östergötland (Inter-agency Coordination County Östergötland): http://www.samverkan-ostergotland.se/SiteCollectionDocuments/Samverkan%20Ostergotland%20Strategi.pdf

MSB’s Gemensamma grunder för samverkan och ledning vid samhällsstörningar (Civil Contingencies Agency Common Ground for Command and Coordination): https://www.msb.se/sv/Produkter--tjanster/Publikationer/Publikationer-fran-MSB/Gemensamma-grunder-for-samverkan-och-ledning-vid-samhallsstorninger/
Samverkan Stockholm (Inter-agency Coordination Stockholm):
http://www.samverkanstockholmsregionen.se/
Socialstyrelsens föreskrift 2013:22 (National Board of Health and Welfare doctrine)
https://www.socialstyrelsen.se/Lists/Artikelkatalog/Attachments/19138/2013-5-46.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
- **Functions of crisis management:** BEFORE, Preparation, Cooperation and coordination

_Last edited on 24 September 2018 14:29:32._
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.

TRIGGERING QUESTIONS

Involvement of organizations

- 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?

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.

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 an 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

See in addition Practice 7 in the Healthcare Practices, Methods and Tools section below.
• 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 polices, 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 coast 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.

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**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 easy 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 acknowledgements due to power issues that are strictly related to the hierarchical structure of the healthcare system. This is a critical issue that severely compromise 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 at 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).


“(…) 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).

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**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 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.

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**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:

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

**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:


- **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 fo 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
The 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.

**REFERENCES**


**Healthcare – Reference**


**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.
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 scarily 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

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 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 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.

REFERENCES


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, it 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.

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**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?

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**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.

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<th>Healthcare implementation – Actors</th>
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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.
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 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)

**REFERENCES**


Healthcare – References


Howard M. Kimmel, DPM, MBA, FACFAS; and Angela L. Robin, DPM

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

_Last edited on 22 September 2018 09:51:15._
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 have 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
  o Ensure local actors have some discretion for using resources due to their knowledge of local context
  o 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
  o Free up resources: changing priorities
  o Deploy resources
  o 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 plan 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.

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

REFERENCES


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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.
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.

**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 informators. 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 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)

REFERENCES


**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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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.

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

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

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

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 (Healthcare 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-crisis]

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]

REFERENCES


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### Healthcare implementation – References


### Air Traffic Management – References


### 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
- **Functions of crisis management:** BEFORE, Preparation, Build knowledge of crisis situations, DURING, Damage control and containment, Assess emergency and response, AFTER, Learning, Assess performance

_Last edited on 20 September 2018 06:17:56._
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

APPLICATION

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 observer 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.

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.

In Air Traffic Management, noticing brittleness is an essential practice to ensure safety and efficiency. The Incident Commander (IC) transmits an ‘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.

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In Healthcare, noticing brittleness is a critical practice for first responder organisations. 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
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).

**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.

**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).

**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](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 emergencies. 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
REFERENCES


Healthcare – References


NAVIGATE IN THE DRMG

- **Parent theme:** Assessing resilience
- **Resilience abilities**
  - Converts 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 threats 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?

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?

  - 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 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?

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**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?

**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

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**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.

**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 outdating 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
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 recognized 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 other’s 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."

REFERENCES


Air Traffic Management – References


**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

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.
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)?

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**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).

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**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.

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**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?

*Capability 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).
- 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?

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**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 roadmap 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.

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**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.

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**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-Document-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](http://www.tellmeproject.eu/node/314)).

### 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 their 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
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).

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 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 fervid 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 (@CDCMMWR). 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
1. 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).

2. 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 on 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”.

### REFERENCES


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Healthcare implementation – References


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Air Traffic Management – References

**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

*Last edited on 27 September 2018 07:06:52.*
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 (form 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 SOP's 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.
  o 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.

REFERENCES


NAVIGATE IN THE DRMG

- **Parent theme:** Involving the public in Resilience Management
- **Resilience abilities**
  - o Contributes to: Learn and Evolve
  - o 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

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.
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.

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?

**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 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?
• 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


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


Healthcare – Reference

Examples of Alternative Working Methods in the healthcare domain


Air Traffic Management – Reference

Examples of Alternative Working Methods in the aviation domain


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 multidimensional concept, encompasses both physical and perceptive 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

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 Unexampled 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

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". (DARWINâ€™s DoA).

Margin

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’s 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 and 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 used to described 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 systemâ€™s own performance and external conditions focus on what it 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 Kuziemsky, 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. 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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ISO, all definitions and standards: Online Browsing Platform (OBP) [https://www.iso.org/obp/ui](https://www.iso.org/obp/ui).


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Expect the unexpected and know how to respond