CEN

WORKSHOP

AGREEMENT

CWA 17514

June 2020

ICS 03.100.01

English version

Systematic assessment of innovative solutions for crisis management - Trial guidance methodology

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No.:CWA 17514:2020 E

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European foreword

This CEN Workshop Agreement (CWA 17514:2020) has been developed in accordance with CEN-CENELEC Guide 29 'CEN/CENELEC Workshop Agreements – The way to rapid consensus' and with the relevant provision of CEN/CENELEC Internal Regulations – Part 2. It was approved by a Workshop of representatives of interested parties on 2019-04-29, the constitution of which was supported by CEN following a public call for participation made on 2019-03-28. However, this CEN Workshop Agreement does not necessarily include all relevant stakeholders.

The research leading to the results incorporated in this CEN Workshop Agreement received funding from the European Union's 7th Framework Programme for Research, Technological Development and Demonstration under Grant Agreement (GA) N° #607798. The final text of CWA 17514 was provided to CEN for publication on 2020-04-07. It was developed and approved by:

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[1] The project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 740689.

Introduction

This CWA is based on the results of DRIVER+[2] (Driving Innovation for European Resilience) that was a research project funded by the European Commission[3]. The aim of that project was to develop a rigorous, yet pragmatic methodology for the assessment of innovative solutions in the area of crisis management. The results of this project together with this CWA will be used to establish a methodology that will:

— enable practitioners to systematically assess the added value of an innovative solution;

— enhance dialogue and co-operation among solution providers and practitioners;

— support the goal to have a more objective assessment in the procurement process.

The trial guidance methodology (TGM) is designed for crisis management (CM) practitioners who have identified one or more capability gaps or who have in mind solutions that can address their needs or their belief that improvements in processes, practices or procedures might be possible. Before adopting those solutions and investing time and money to figure out what fits best, the TGM provides step-by-step guidelines on how to assess solutions in non-operational contexts (such as a trial) through a structured approach. The TGM directly addresses the context of CM and deals with investigating and assessing innovation through a broad set of tools available within the DRIVER+ test-bed. The DRIVER+ test-bed consists of three elements: The trial guidance methodology, the technical-test-bed infrastructure (TTI) and the accompanying training module (TM). Within the scope of this CWA only the trial guidance methodology, excluding the TTI and TM have been addressed.

CM organizations often face difficulties in assessing the potential impact of a change in their socio-technical setup for several reasons, for instance because they lack adequate methodological know-how to assess innovative solutions. Investments in new, but inappropriate socio-technical solutions can produce significant costs and might lead to unintended consequences for the operational performance of response organizations. Introducing specific solutions, such as new software or new training or workflow processes, requires adaptations of existing practices with the aim of improving certain functions or activities. The objective of the trial guidance methodology is to assess the changes triggered by the introduction of new solutions. Assessing the impact of any kind of change is not a trivial task, as it points to both capability development and identification of innovation. For this purpose, a specific methodology has been developed which consists of three phases (preparation, execution, evaluation) and is broken down into steps within each phase. This methodology is the topic of this CWA.

This document presents this methodology, explains its phases and steps, and also provides guidance on the organization of the assessment of solutions that can bring potential innovations, and provides an overview of what is needed to initiate this process, in terms of tools and resources.

[2] www.driver-project.eu

[3] This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement No 607798.

1 Scope

This document defines a methodology that enables a systematic assessment of one or more socio-technical solutions (hardware, software, training, procedure, or a mix of those) within a realistic crisis management scenario. The target group of the CWA are crisis management practitioners concerned with innovation or procurement, public authorities concerned with procurement (or writing tenders), as well as research and development departments in industry and research.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
assessment
test, examination or similar, designed to assess a candidate's knowledge, understanding or skills in a defined area

Note 1 to entry: A candidate can be a person or a solution, example given: assessment of a solution in a trial.

3.2
solution
means that contributes to a crisis management function

Note 1 to entry: A solution is either one or more processes or one or more tools with related procedures.

3.3
innovation
implementation of a new or significantly improved product (good or service), or process, new marketing method, or new organizational method in business practices, workplace organization or external relations

[SOURCE: ISO 37500:2014-11, 3.6]

3.4
crisis management
holistic management process that identifies potential impacts that threaten humanitarian aspects of disasters and provides a framework for building resilience, with the capability for an effective response that safeguards the well-being of the society, as well as effectively restoring operational capabilities

Note 1 to entry: Crisis management also involves the management of preparedness, mitigation response, and continuity or recovery in the event of an incident, as well as management of the overall programme through training, rehearsals and reviews to ensure the preparedness, response and continuity plans stay current and up-to-date.

[SOURCE: ISO 22300:2018-02, 3.60, modified – "an organization" has been replaced by "humanitarian aspects of disasters" and "interests of the organization's key interested parties (3.124), reputation, brand and value-creating activities (3.1)" has been replaced by "the well-being of the society"]

3.5
trial guidance methodology
TGM
structured approach for designing and conducting a trial and for evaluating its outcomes including the identification of lessons learned

3.6
trial
event for systematically assessing solutions for current and emerging needs in such a way that practitioners can do this following a pragmatic and systematic approach

3.7
trial owner
role mainly responsible for managing the trial

Note 1 to entry: This role can be executed by one person or a team.

3.8
practitioner coordinator
role mainly responsible for managing the practitioner (3.11)

Note 1 to entry: This role can be executed by one person or a team.

3.9
evaluation coordinator
role mainly responsible for preparing and executing the evaluation of the trial

Note 1 to entry: This role can be executed by one person or a team.

3.10
technical coordinator
role mainly responsible for managing the technical testbed infrastructure, the technical set-up, the solution providers (3.13) as well as managing the training on the solutions

Note 1 to entry: This role can be executed by one person or a team.

3.11
practitioner
trial participant with the knowledge, experience or ability needed to effectively and timely respond to a crisis in order to minimize damage to society

3.12
observer
trial participant who witnesses or attends the trial while remaining separate from trial activities

Note 1 to entry: Observers may be part of the evaluation process.

[SOURCE: ISO 22300:2018-02, 3.154, modified – "trial" has been added, "exercise" has been replaced by "trial"]

3.13
solution provider
entity providing the solutions that will be assessed within a trial

3.14
preparation phase
first phase of organizing a trial

Note 1 to entry: Contains 2 steps: step zero and the six-step approach. To be completed before entering the execution phase.

3.15
step zero
step of the TGM that includes the gap definition and trial context

Note 1 to entry: This is part of the preparation phase of a trial.

3.16
gap
shortfall between the existing capabilities of responders and what is actually needed for effective and timely response

Note 1 to entry: Capability is here defined as "the means to accomplish one or more tasks under specific conditions".

3.17
need
prerequisite identified as necessary to achieve an intended outcome, implied or stated

[SOURCE: ISO/TR 21245:2018-11, 3.15]

3.18
trial context
context of use

Note 1 to entry: Users, tasks, equipment (hardware, software, and materials), and the physical and social environments in which a product is used.

Note 2 to entry: A product in this case is synonymous with a solution.

3.19
objective
result to be achieved

Note 1 to entry: An objective can be strategic, tactical or operational.

Note 2 to entry: Objectives can relate to different disciplines (such as financial, health and safety, and environmental objectives) and can apply at different levels (such as strategic, organization-wide, project, product and process).

Note 3 to entry: An objective can be expressed in other ways, e.g. as an intended outcome, a purpose, an operational criterion, as a societal security objective or by the use of other words with similar meaning (e.g. aim, goal, or target).

Note 4 to entry: In the context of societal security management systems standards, societal security objectives are set by the organization, consistent with the societal security policy, to achieve specific results.

[SOURCE: ISO 22301:2019-10, 3.20, modified – "as a societal security objective" has been added, "security operations management" has been replaced by "societal security management", "security operations objectives" has been replaced by "societal security objectives", "security operations policy" has been replaced by "societal security policy"]

3.20
data collection
process for gathering data by different means

Note 1 to entry: This includes activities such as web monitoring.

[SOURCE: ISO 19731:2017-06, 3.14, modified – "information" has been replaced by "data"]

3.21
data collection plan
document that details the means, persons and kind of data to be collected in the trial

3.22
evaluation
process of estimating the effectiveness, efficiency, utility and relevance of a service or facility

[SOURCE: ISO 11620:2014-06, 2.19]

3.23
evaluation approach
conceptual way of designing and conducting the evaluation

Note 1 to entry: This can be recorded as a document that details the methods and techniques to collect the data from the data collection plan (3.21).

3.24
scenario
pre-planned storyline that drives a trial, as well as the stimuli used to achieve trial project performance objectives

[SOURCE: ISO 22300:2018-02, 3.21, modified – "exercise" has been exchanged by "trial"]

3.25
execution phase
second phase of the TGM (3.5)

Note 1 to entry: This contains four steps.

Note 2 to entry: In this phase the data will be collected by using the data collection plan and the evaluation approach.

3.26
dry run one
first rehearsal of a trial, focusing on the technical integration of solutions, reference implementation of the test-bed, and scenario validation

Note 1 to entry: It also serves as a readiness review to approve the maturity of technical solutions.

3.27
dry run two
full-scale rehearsal of a trial without external end-users' participation, aimed at the detection of technical and/or organizational issues and last fine-tuning

Note 1 to entry: It is organized as a complete mirror of the trial.

3.28
evaluation phase
third phase of the TGM (3.5)

Note 1 to entry: This contains four steps.

3.29
societal impact assessment
process of identifying, analysing and managing intended and unintended (positive or negative) societal consequences

3.30
baseline
agreed reference value or set of values which can be derived from past experience or baseline runs during trials, often used for comparing with ongoing performance data, values and/or outcomes

[SOURCE: ISO 37500:2014-11, 3.1, modified – "or baseline runs during trials" has been added]

3.31
innovation-line
extension of the baseline (3.30) by adding the innovative solutions and embedding them in the baseline-processes

Note 1 to entry: By means of this, the foreseen changes become visible.

3.32
crisis
unstable condition involving an impending abrupt or significant change that requires urgent attention and action to protect life, assets, property or the environment

[SOURCE: ISO 22300:2018-02, 3.59]

3.33
(emergency management) capability
overall ability to effectively manage prevention, preparedness, response and/or recovery before, during and after potentially destabilizing or disruptive events

[SOURCES: ISO 22325:2016-10, 3.2, modified – "or" has been added]

3.34
tool
device, equipment or piece of software used to carry out a particular process or procedure

3.35
test-bed
software tools, middleware and methodology to systematically conduct trials and evaluate solutions within an appropriate environment

Note 1 to entry: An "appropriate environment" is a testing environment (life and/or virtual) where the trialling of solutions is carried out using a structured, all-encompassing and mutual learning approach.

Note 2 to entry: The test-bed can enable existing facilities to connect and exchange data, providing a pan-European arena of virtually connected facilities and crisis labs where users, providers, researchers, policy makers and citizens jointly and iteratively can progress on new approaches or solutions to emerging needs.

3.36
test-bed infrastructure
software tools and middleware to systematically create an appropriate (life and/or virtual) environment in which the trialing of solutions is carried out

Note 1 to entry: The Test-bed infrastructure can enable existing facilities to connect and exchange data.

3.37
training
activities designed to facilitate the learning and development of knowledge, skills and abilities, and to improve the performance of specific tasks or roles

[SOURCE: ISO 22300:2018-02, 3.265]

3.38
incident
situation that can be, or could lead to, a disruption, loss, emergency or crisis

[SOURCE: ISO 22300:2018-02, 3.111]

3.39
socio-technical solution
any tool which not only comes with technological and technical functionalities but, by being used, is automatically exposed to the organizational and procedural changes of the user's system

Note 1 to entry: This includes the user's culture, value and belief system etc. but also factors of the human-machine-interaction.

3.40
co-creation
process in which different domains work together to create value

Note 1 to entry: Within the TGM this means that crisis management practitioners, solution providers and researchers work with one another, share knowledge and experience and create the trial together.

3.41
six step approach
iterative, co-creative approach for preparing a trial by following its six specific steps and by iterating them until the execution phase of a trial

3.42
legacy system
(crisis management) system currently in operational use

3.43
execution specification
set of documents covering all drawings, technical data and requirements necessary for the execution of a particular trial

[SOURCE: ISO 22966:2009, 3.8, modified – "set of" has been added, "project" has been replaced by "trial", Note 1 to entry has been removed]

3.44
key performance indicator
KPI
quantifiable measure that an organization (person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives) uses to gauge or compare performance (measurable result) in terms of meeting its strategic, tactical and operational objectives (result to be achieved)

[SOURCE: ISO 22300:2018-02, 3.131, modified – definitions of "organization", "performance" and "objectives" have been added, "tactical" has been added]

3.45
lesson learned
structured production and application of experience-based knowledge to develop and improve doctrine, organization, training, materiel, leadership, personnel and facilities to achieve more efficient and effective operations

3.46
lesson learned library
database driven website that documents the results of the lessons learning process by several trial organizers

3.47
societal impact
dimension of crisis management that refers to its unintended positive or negative impacts on different societal groups or society as a whole, as well as on its core values and societal principles as captured for example in fundamental rights, constitutional laws, but also in public debate

3.48
measurement
process to determine a value

Note 1 to entry: According to ISO 3534-2, the value determined is generally the value of a quantity.

Note 2 to entry: This constitutes one of the common terms and core definitions for ISO management system standards given in Annex SL of the Consolidated ISO Supplement to the ISO/IEC Directives, Part 1. The original definition has been modified by adding Note 1 to entry.

[SOURCE: ISO 9000:2015-11, 3.11.4]

3.49
observation
method of data collection in which the situation of interest is watched and the relevant facts, actions and behaviors are recorded

Note 1 to entry: There can be rating scales that the researcher would use when observing the behavior.

[SOURCE: ISO 16439:2014, 3.41]

3.50
operator
person engaged in task performance, considered as a monitoring, controlling or directing element in a system or process capable of a dynamic response to system inputs and disturbances.

[SOURCE: ISO 9996:1996-12, 3.5, modified – "(human)" has been removed, Note 1 to entry has been removed]

3.51
reference data
data which, by general agreement, may be used as a standard or as a basis for prediction and/or comparison with observed data

[SOURCE: IEC 62059-41:2006-03, 3.2]

4 Symbols and abbreviations

- CM crisis management
- CMINE crisis management innovation network europe
- DRIVER+ driving innovation in crisis management for European resilience
- DRR disaster risk reduction
- ELSI ethical, legal, social issues
- L3 lessons learned library
- NGO non-governmental organization
- KPI key performance indicator
- SIA societal impact assessment
- SMART specific, measurable, achievable, reasonable, time-bound
- SOP standard operating procedure
- TGM trial guidance methodology
- TM training module
- TRL technology readiness level
- TTI technical test-bed infrastructure

5 Introduction to the trial guidance methodology

5.1 Generalities and dimensions of a trial

5.1.1 General

Crisis management can be directly concerned with any kind of change in a society. In order to keep pace with those changes and the differing threats they pose, new solutions to meet CM challenges need to be developed and evolved. However, experience shows that the uptake of such new solutions remains uncomfortably low. One reason for this low uptake is that solutions cannot be assessed in daily CM due to various ethical concerns, resulting in gaps arising between the growing needs of CM organizations and their current capabilities. Hence a systematic assessment of innovative solutions (even at low TRLs) needs to be performed in a specific event such as a trial – in a realistic and relevant scenario, but outside of emergencies. Such an assessment, when done correctly, supports a better development of innovative solutions and better decisions on purchasing the best fitting solutions.

The TGM addresses this need in CM by enabling an easier uptake and also more dedicated development of innovative solutions. The TGM offers a rigorous yet pragmatic step-by-step approach that leads practitioners (CM professionals) but also the other involved parties (such as solution providers) through a transparent and systematic process towards the design, creation, staging and interpretative stage of validation of a trial. Within a trial one or more solutions will be assessed against their ability to bridge a specific gap the end-user experiences in a scenario that is as realistic as possible.

5.1.2 The three dimensions of a trial

Every trial has three performance measurement dimensions (as depicted in Figure 1) which need to be considered in order to allow the evaluation of a trial:

— Solution dimension includes:

  — the influence a solution (its use, functionalities etc.) has on the trial;

  — the added-value a solution brings to CM functions;

  — practitioner assessment of the solution.

— Crisis management dimension includes:

  — the influence the crisis management (SOPs, roles, responsibilities, etc.) has on the trial;

  — the impact that a solution has on the performance of the CM organization.

— Trial dimension includes:

  — the influence the trial organization (logistics, availability of key staff, hardware, software, etc.) has on the trial;

  — the changes the trial organization brings to the success of the trial.

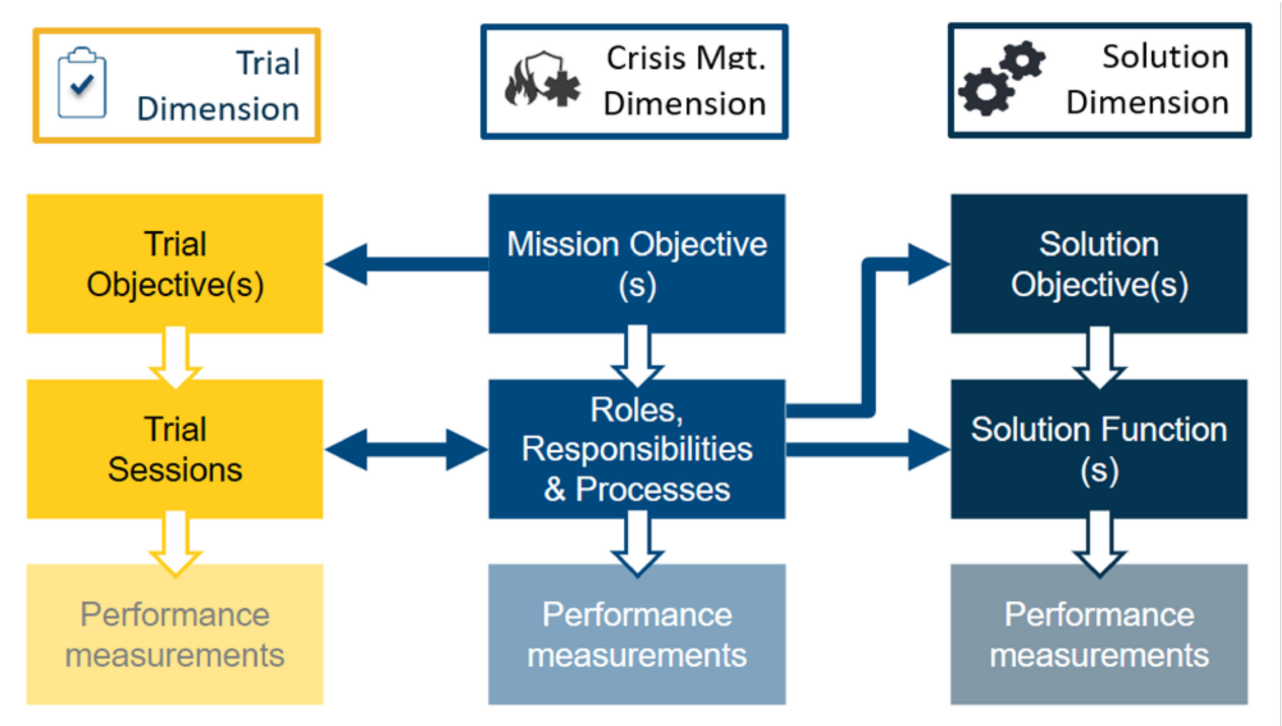

Figure 1 — The three dimensions of a trial

The three dimensions guide the performance measurement and evaluation of a trial, as the overall assessment of the innovative solutions needs to be interpreted with regards to all three of these dimensions.

NOTE Such an example might be that a trialed solution did not address the whole gap in the expected way, with possible reasons for this being:

— The solution dimension: the functionality did not address the gap in its entirety.

— The CM dimension: the SOPs prohibited the functionality from being used in the most favorable way.

— The trial dimension: a breakdown of the Wi-Fi or a missing key person prohibited the solution from being used in the foreseen way.

The three dimensions have to be identified and it has to be understood how they are entwined and influence each other. This leads to the fact that each trial result can only be seen and interpreted within the boundaries of the trial. The results are by design not generalizable, as they are rooted in a specific CM context and one exemplary CM operation. However, the trial results might be transferable to other scenarios, situations, or stakeholders. In this case only rough predictions about the impact of solutions can be given, which are to be assessed in the respective new setups (i.e. other scenarios, situations or stakeholders).

5.2 Overview on the phases and steps

The trial guidance methodology consists of three phases: preparation, execution and evaluation (see **Error! Reference source not found.** 2). Those phases come with different steps, which are reflected in the table of contents for Sections 7, 8, and 9 of this document. The goal of a trial is the systematic assessment of an innovative solution's added value to a specific CM context and gap or need. Hence the evaluation phase is the most important phase and should be taken into account from the beginning.

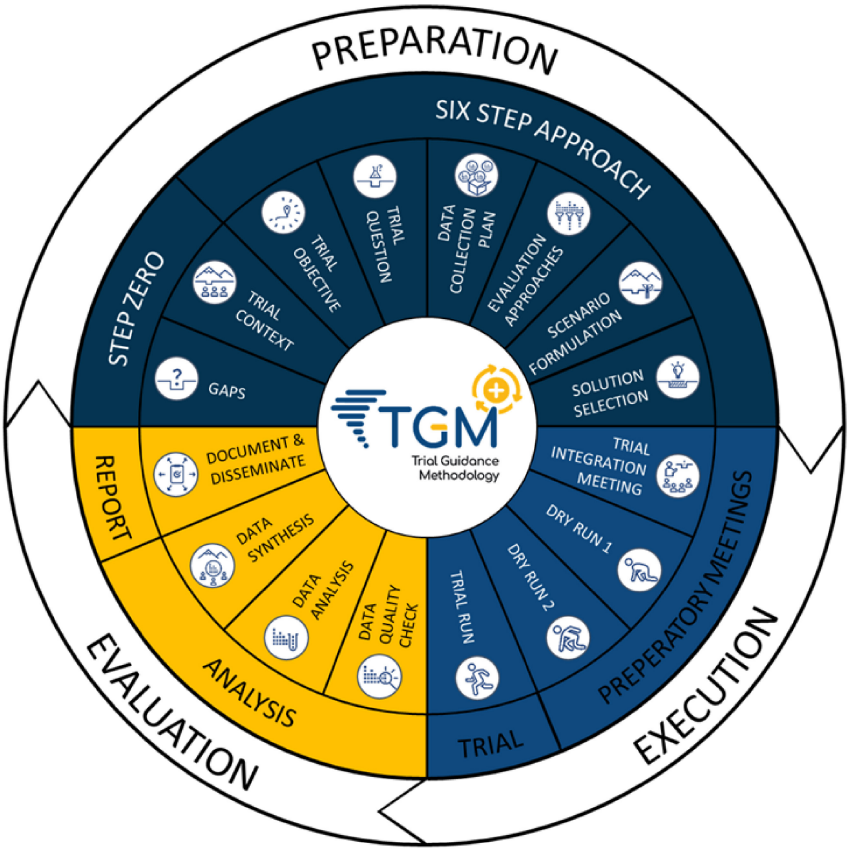

Figure 2 — Overview of the trial guidance methodology

5.3 Trial committee

5.3.1 General

The trial committee is responsible for correct measurements, analysis as well as reporting of the trial results by applying the TGM as presented in this CWA. It consists of the trial owner, the practitioner coordinator, the evaluation coordinator and the technical coordinator.

Table 1 — Responsibilities of the trial committee

trial owner	practitioner coordinator	evaluation coordinator	technical coordinator
1) Scenario development	1) CM practitioners´ (co-) participation	1) Overall test-bed application	1) Technical test-bed application
2) Trial hosting	2) CM practitioner relationship management	2) Trial evaluation management	2) Solution provider management
3) Trial directing		3) Solution evaluation management	3) Training management
4) Trial management		4) CM evaluation management	

The main responsibilities of these roles can be found in **Error! Reference source not found.** 1. These roles can be covered by one or more persons, depending on the scale of the trial and the emerging needs. Each role comes with specific responsibilities, but they all have to work together and should ensure that the TGM is considered for each of their actions. All decisions should be taken by the respective role and communicated within the trial committee.

5.3.2 Trial owner

The trial owner is the CM organization which is mainly responsible for the trial itself. Trials are collective efforts; but there should be one organization that takes up the responsibility for planning, coordinating and evaluating the activities. This important role encompasses the following responsibilities:

1) Scenario development: Developing a proper scenario so that the gaps and needs of the main stakeholders are captured in the trial (scenario development).

2) Trial hosting: Hosting the trial itself using one or more locations and ensuring that the chosen location is apt to the purpose of the trial (trial hosting).

3) Trial directing: The director has a prominent role in all phases and, as the name suggests, the director gives the right directions: for instance, the director initiates the trial during the actual execution and is entitled to stop it any time, in case of problems and/or to put in place mitigation actions.

4) Trial management: Managing the trial-event in terms of logistics (e.g. rooms and equipment), safety (e.g. make sure that the people involved in the trial are not in danger), media (e.g. dealing with the media before, during and after the event) and participants (from active to passive actors: players, observers and guests).

5.3.3 Practitioner coordinator

The TGM stands for a practitioner-driven approach, which is by-design reflected in every phase and step. The term "practitioners" stands for all relevant CM stakeholders. Starting the selection of potential solutions with the gap assessment in a specific CM practitioner context up to the final assessment of the potentially innovative solutions, it is the practitioner who has the last word about what should be assessed, in which context, how and what the results mean from the practitioner's perspective. In order to ensure the practitioner-driven nature of the TGM, a dedicated practitioner coordinator should serve as a proper guard. This role encompasses the following responsibilities:

1) CM practitioners´ (co-) participation: It is key to identify relevant stakeholders for each trial context. Ideally, the practitioner coordinator should have a CM background. This would facilitate the identification of the right profiles of CM practitioners needed to develop an as realistic as possible trial scenario. Moreover, it would facilitate the identification of the main metrics for the CM dimension. Additionally, a clear communication of expectations needs to be ensured, so that all practitioners are aware that their participation is also needed after the trial execution to contribute to the sense-making and dissemination of the trial results. The practitioner coordinator should be very sensitive to effectively request a minimum commitment of a CM practitioner's involvement while respecting the tight side restrictions practitioners have with regards to their daily duties. At the same time, this role will be regularly confronted with rather high expectations from the other roles in the trial committee, so that a proper translation and communication of practitioners' realities becomes vital.

2) CM practitioner relationship: This rather management oriented task goes beyond the content-related (co-)participation of CM practitioners, because it refers to the establishment and maintenance of a pool of practitioners as direct trial participants and (indirectly participating) trial observers. The main functions cover contact management, communication, and reporting tasks.

5.3.4 Evaluation coordinator

Similar to the practitioner coordinator, the evaluation coordinator requires a dedicated role because of the importance of evaluating trials. The overall goal of trials is a robust assessment of potentially innovative solutions. In turn, the actual evaluation calls for neutrality, independence and an adequate degree of decision-making power. Therefore, it is recommended to confide the following responsibilities to someone who is not in charge of the activities of the other roles. This role encompasses the following responsibilities:

1) Overall test-bed application: In order to ensure a high evaluation quality, the evaluation coordinator needs to carefully question and verify the overall test-bed application from the very beginning up to the end of a trial. To do so, a close interaction with the practitioner coordinator is important. As a next task, an alignment between the practitioner's inputs and the trial owner decisions is needed and should be secured by the evaluation coordinator. These results need to be communicated continuously to the technical coordinator, who in turn should feed back the alignment checks on a regular basis. In an ideal setup, this might lead to a highly robust assessment of innovative solutions in realistic setups. However, reality implies several limitations like the partial availability of practitioners, an insufficient length of the trial execution or inadequate depiction of real scenarios in virtual simulations. Therefore, trade-offs need to be done and the evaluation coordinator plays a key role in balancing costs and benefits of different setups.

2) Trial evaluation: The evaluation coordinator is in charge of translating the agreed objectives and side restrictions of the trial dimension into proper metrics and target values. This task requires a strong collaboration with the trial owner.

3) Solution evaluation management: In this area, the evaluation coordinator is tasked to transform the solution specifications, expressed as solution functions or features according to the CM taxonomy, into the solution dimension of the data collection plan. The main collaboration takes place with the technical coordinator, who should align the suggested metrics with the involved solution providers. Their feedback should be properly incorporated, so that the solutions are assessed according to what they are supposed or intended to support. In turn, the evaluation coordinator is in charge of an adequate feedback of the assessment results to the solution providers.

4) CM evaluation management: The evaluation coordinator relies on the input on how the practitioners perceive the effectiveness of CM operations simulated during the trial. Those definitions are key to elicit the real impact of a solution on the CM performance. In consequence, the required CM practitioner profiles need to be communicated in advance to the practitioner coordinator in order to have access to this necessary basis of a trial. Another important step during the preparation phase is to communicate the scenario-related metrics to the trial owner, in order to ensure an adequate depiction of the actual work practices in the scenario. The technical coordinator also needs to be informed about which data is required from the test-bed, so that the relevant data will be collected and stored in a proper quality, format and amount. Finally, during the evaluation phase the main task is to relate the results in the CM dimension to the results in the trial and solution dimensions. Changes in the CM performance have to be explained through a proper sense-making regarding a potential cause-effect relationship.

5.3.5 Technical coordinator

The technical coordinator is responsible for the technical set-up of the trial scenario, so that an adequate assessment of the selected solutions is ensured. Specifically, the following three responsibilities should be covered by the technical coordinator:

1) Technical test-bed application: The technical coordinator makes sure that the test-bed technical infrastructure is adjusted according to the decisions taken in the preparation phase and to the lessons learned during the rehearsal and that all components work together smoothly with the trialed solutions. During the trial, the technical coordinator oversees all technical aspects (e.g. integration with legacy tools at the trial location and data exchange).

2) Solution provider management: Solution providers are involved in the development of the trial, as they know how to best integrate their solutions in the trial scenarios. Therefore, solution providers need to participate in relevant meetings prior to the execution phase so that they can get a comprehensive overview of the activities. The role of the technical coordinator does not end at the end of the trial execution. In fact, the technical coordinator works closely with the evaluation coordinator to provide insights on the overall test-bed application.

3) Training management: The technical coordinator takes decisions with regards to the training needs by deciding how to train the players who use the selected solutions during the trial. To do this, solution providers should be instructed and involved in the overall trial design from the onset.

5.4 Practitioner participant

The practitioner participants are mainly needed during the execution phase of the trial. Ideally, they represent the domain from which the gap originates and have worked in the gap area for some time. If they are experts on a specific part of the gap, they can also be included in the preparation phase, but those persons should not then take part in the execution, as they may be biased. This role has the below responsibilities.

In the preparation phase:

1) Support with expert knowledge (e.g. in creating the baseline (3.30) and innovation-line (3.31)).

In the execution phase:

1) Take part in the trial.

2) Use the solutions.

3) Agree on being observed while using the solution to enable data collection.

4) Take part in evaluation actions (e.g. filling in questionnaires and taking part in focus groups).

5.5 Observer

The observer is mainly needed during the execution phase. Ideally this role is taken by a practitioner with sufficient knowledge of the trial context and of the CM function this role is assigned to observe. This role has the following responsibilities:

1) Observing the practitioner participants' interaction and use with the solution.

2) Taking part in the observer training during the execution of the trial.

3) Writing down their observations.

4) Taking part in the observer debriefing.

5) Being available for further questions that arise during the evaluation phase.

5.6 Solution provider

The solution provider is the person or party that offers their solution to be trialed. Ideally this role is taken by one or more persons who are very familiar with the solution and all its functionalities, and are able to adapt the solution, if the trial requires so. This role has the following responsibilities:

1) Deploy the solution at the trial location/facility.

2) Provide support in creating and finally signing an agreement on how data protection should be handled within the trial (in cooperation with the trial owner and evaluation coordinator).

3) Prepare and execute timely training on the solution for the practitioner participants.

4) Integrate the solution in the technical set-up.

5) Enable data collection.

6) Hand over collected data for evaluation purposes.

7) If the TTI is used:

— integrate his/her solution in the TTI; and

— enable data exchange with other solutions, if applicable and reasonable.

6 Initial trial preparation

The starting point of a trial is the appearance of a trial need and a potential trial owner. The trial owner role can be taken by CM professionals, solution providers, researchers, public authorities or other parties. The trial owner has a direct need (faces the gap) or indirect need (represents an organization facing the gap) for a trial. These needs can be of different nature, like new responsibilities or procedures to be followed by the organization, outdated equipment, appearance of new promising solutions or the need to cooperate with different organizations and to adapt tools and or procedures. However, in the initial trial preparation, the trial owner has the following tasks:

1) Familiarize with the trial guidance methodology.

2) Set up a trial committee (see Section 5.3):

   — In the early stage potential trial committee members should be suggested by the trial owner.

   — The roles need to be agreed upon and the respective responsibilities need to be explained.

   — The roles do not have to resemble the number of persons performing the tasks assigned to the role; i.e. if it is feasible within a specific organization one person can perform and fulfil more than one role.

3) Set up a kick-off meeting with the trial committee members as well as CM professionals that can support with the expert knowledge surrounding the initial need the trial initiator has. In this kick-off meeting the prerequisite of the preparation phase should be addressed and a way forward should be decided.

7 Preparation phase

7.1 Step zero

7.1.1 Identify a gap/ need

The core of a trial are the gaps that should be addressed by conducting a trial. Every gap is based on the underlying need to improve the current situation. Relevant CM gaps have to be identified. Furthermore, the underlying need should be formulated as well, as this eases the communication of the gap to outside parties (such as the solution providers).

In order to identify a gap, and the underlying need, a diverse audience of experts from within the organization that wants to initiate a trial is needed. If this organization is not a CM organization, then it is recommended that CM professionals are included in that task.

Possible methods include creativity methods (brainstorming etc.), desk research (analyzing of internal trial owner sources), focus groups, structured interviews, workshops or a mixture of these.

It is recommended to list several gaps and needs and then decide on the one(s) that should be addressed in the trial. Here a use-value analysis can be used (criteria can be cost, frequency, type of involved roles, number of involved people, involved organizations etc.).

7.1.2 Describe the trial context

The gap is embedded in a certain context. It is entwined with a bundle of roles, responsibilities, situations, equipment etc. In order to find a socio-technical solution that addresses the gap, when and where exactly this specific gap occurs should be identified. This is done by depicting the trial context. Here the trial context template (see Annex A) can be used.

It is important to define the kind of trial: table top exercise, field exercise or mixed approach. Based on this, the location/facility of the trial should be determined. This should be done at an early stage as it impacts the data collection, evaluation approach and scenario as well as the whole execution phase.

The information from the trial context template will also help creating a baseline. The baseline is a depiction of the as-is-process that includes all roles, actions and information exchanges (including the means by which they are done). An example can be found in Annex C.1. The aim of the baseline is to analyze the current situation in a detailed way. This enables later the identification of the exact changes an innovative socio-technical solution will require (more in Section 7.2.7).

7.2 Six step approach

7.2.1 Co-creating and iterating

The six step approach is an iterative process in which some steps in some iterations might need to be skipped. It is recommended to do one full run-through of all six steps and then iterate these steps in the most useful way.

The process is co-creative, which means that all stakeholders should be involved: CM professionals and solution providers. It has proven helpful to get everyone around one table to discuss the gap as well as the underlying need on one hand and the specific functionalities (or even development options) of the solutions on the other hand. This can only happen after one or more iterations, as the solutions need to be chosen to enable this kind of discussion.

7.2.2 Step 1: Identify the trial objective

The objective is defined as the result to be achieved. In the beginning of each project the goals and aspirations have to be set. In this step the gaps and the trial context should be used to identify the main challenge within the gap. This can best be done by discussing the baseline, which is a depiction of the "gap-process". The below questions have to be discussed within a group that faces gaps:

— What exactly is the challenge?

  — Is it a technical challenge? Maybe the machine is complex and not easy to use.

  — Is it a process challenge? Maybe the standard operating procedure (SOP) does not fit the way things are handled to be most efficient.

  — Is it a knowledge/ skill challenge? Maybe the wrong role is supposed to do a task it is not trained to do.

— What is/ are the need(s) underneath the challenge?

— What is preventing the organization from tackling the challenge at this point?

— Until when should the challenge be tackled (to avoid cascading effects or to improve the working conditions)?

NOTE There can also be more than one main challenge or the challenge can have different facets.

The task in this step is to formulate the identified main challenge following the SMART [7] criteria to guide the setting of objectives as applied for example in project management or performance management in human resources. The SMART criteria are defined below.

Specific (S)

— reference to a unique point

— opposite of general, broad or vague

Measurable (M)

— ideally identifying a specific metric or key performance indicator

— making sure that it can be objectively ascertained whether the objective has been reached or not

EXAMPLE The time an ambulance can take to reach the incident scene. This is an example of a KPI.

Achievable (A)

— setting of realistic objective

EXAMPLE An example to formulate: "We need every 112 call taker to speak each language spoken by somebody in our city." This is not realistic. But to formulate "We need every 112 call taker to be able to say some basic words in English and French.", might be realistic, if courses are provided.

Relevant (R)

— the objective has to have a meaning for the trial initiator and it has to address the gap

EXAMPLE An example is, if the gap is the language barrier in 112 calls, the objective to teach every emergency number switchboard operator a specific local dialect will not be a relevant one (too specific). But also the objective to have every call taker learn any language they prefer will not be relevant (too broad).

Time-bound (T)

— the objective has to have a deadline

EXAMPLE An example is to say in the objective "every call taker shall learn a second language" – might lead to the fact that no one actually learns it, as they are busy people. To say "every call taker shall learn this set of words in French within the next three months" is an objective that will be more likely to be achieved. This way of formulating SMART objectives eases identifying KPIs and metrics later on.

7.2.3 Step 2: Formulate trial questions

This step supports the communication of the objective, by re-stating it in a question. The iterative nature of the process will lead to a question that gets more and more detailed with time. Some guidelines on trial questions can be found in Annex C.3.

EXAMPLE An example is to say in the objective that "every call taker shall learn this set of words in French within the next three months". A corresponding trial question can be: "How can a solution support our staff to learn a set of words in French in three months' time?", or "How can a set of words be identified that our staff needs to be able to understand and speak in French in order to improve the call taking?"

7.2.4 Step 3: Formulate data collection plan

The aim of a trial is to gather data in order to analyze how an innovative socio-technical solution can address a gap. This is only possible by comparing the baseline to the new setup that uses a solution. Reference data can be obtained in three ways.

1) By use of historic data: This means that the trial scenario needs to be as close as possible to the past event. Furthermore, it is important to find the needed type of data in the stored information from that event. This approach can be seen as the ideal approach, as next to a quite high degree of realism of the scenario, the required efforts to provide this data are relatively low.

2) By a physical baseline run: This means that the whole trial scenario will be re-enacted twice or executed in parallel: Once by using the legacy solutions and once by using the innovation.

3) By simulating: It can be possible to use simulation software to gather specific data. It has to be noted that this third option is the most difficult one, as not only the scenario information needs to be entered into the simulation software, but especially all relevant legacy systems including the respective human behavior. Both the gathering and validation of this data is a highly time-consuming task.

As data is the core part of the TGM, this step of creating a data collection plan is very central. The goal here is to determine:

— Which of the above ways of gathering reference data will be used?

— Which data shall be collected?

— How can that kind of data be collected? This data can e.g. be collected through:

  — being logged in software;

  — observers;

  - self-reflection through questionnaires or focus groups.
- When will which data be collected?
- Who or which tool will collect the data? For example:
  - an observer;
  - a role that leads a focus group;
  - a technological system.
- How can biases be minimized?
- How can legal and ethical aspects be addressed?

To start this step, it is recommended to revisit the objectives and trial questions already formulated for the trial. Especially questions can be helpful in identifying the kind of data. In Annex C.4 is a data collection template that supports this task.

NOTE There are several ISO standards that can support, for example, usability (ISO 9241 – Ergonomics of human-system interaction – Part 11: Usability: Definitions and concepts). The ISO 9241 is the recommended approach for measuring the usability of the solutions in the solution dimension and explicitly referenced in the TGM and TGT.

It can be helpful to create another table with the following columns:

- What happens in the "gap-process"?
- What is the need behind this gap?
- What kind of data might be apparent in this process?
- Who/what can possibly provide this data?
  - in the baseline
  - in the innovation-line

EXAMPLE An example can be the gap of an unclear location of a caller making an emergency call. The root of the gap is that people just do not know where they are or cannot describe it sufficiently:

- What happens in the "gap process"? Emergency caller calls emergency switchboard operator.
- What is the need behind the gap? Get a precise location of the incident scene.
- What kind of data might be apparent in this process? Street name, name of a town or another geographical reference, name of a store, street name, house number, number of an apartment, etc.
- Who/what can possibly provide this data?
  - In the baseline – the emergency caller via voice.
  - In the innovation-line – the emergency caller via sending the GPS location via an app.

7.2.5 Step 4: Formulate evaluation approach

Once a decision is made on the type of data needed, it has to be detailed which techniques and tools will be used to analyze the set of data in order to answer the trial questions. The data collection plan is key here, as it gives a clear indication of the evaluation approaches that have to be considered.

The main question to decide on evaluation approaches is how to make sense of the data. The main starting point here is the application of the three-dimensional performance measurement approach. The trial dimension offers an overview of the initially defined targets and the actual results. Typical questions in this dimension are e.g. how the degree of realism has been assessed by the practitioners or if the allocated time was sufficient in order to simulate the operation in which a gap has been observed. The crisis management dimension catches the relation between the main outcomes of the operations, e.g. the resulting situational overview or the response time, and the reference data. Finally, the solution dimension contains feedback from the participating CM practitioners as well as the assessments of the observers regarding the perceived user-experience of the innovative solutions and the availability, relevance and maturity of particular solution features.

It is important to anticipate which parts of the evaluation approach remain purely quantitative, and which parts require further investigations through qualitative data. The final evaluation approaches should fit several side restrictions of the trial owner (e.g. analytical capabilities) and of the trial setup (e.g. duration of each trial session or the debriefings) and disadvantages of specific techniques and tools.

7.2.6 Step 5: Formulate scenario

The scenario should be created in a way that all baselines for all gaps are covered. The baselines already determine the roles, processes, equipment and situations needed for the trial. In a first step it is recommended to analyze whether those baselines can form one coherent scenario or demand more distinct scenario blocks.

Each trial question can be covered by the whole scenario or just one scene. Different episodes can then form a scenario. By using visualization tools the relation between scenes and/or scenarios can be depicted and a flow through them can be created – that is the storyline that follows with a timeline. The timeline has to be divided in the real time that moves minute by minute and the trial time that can afford time jumps, if needed.

In this step the iterative nature of the six step approach is also very apparent. Depending on the solution, the innovation-line will be created – depicting the foreseen changes the innovative solution will bring. It is important to create a scenario that is very similar, but still challenges the participants enough, if the data collection plan foresees a baseline run and an innovation-line run.

During the iterations the scenario will get more detailed. To organize a trial and ensure its smooth flow different kinds of materials have to be developed: storyline, actions, injects to trigger those actions etc. This can then be depicted in one comprehensive scenario script, which may be an excel file with the columns:

— day;

— real-time timeslot;

— episode;

— required action;

— operational time;

— injects;

— simulated element (if applicable);

— needed capability (technology) in the baseline;

— needed capability (technology) in the innovation-line;

— roles involved (Recommendation: create one column for each role); and

— KPIs, metrics.

This kind of script can be used as a management tool during the trial to make sure that the needed actions are triggered so the "gap" appears and can be addressed by the innovative socio-technical solution.

7.2.7 Step 6: Select solutions

The aim of trials is to address specific gaps with a socio-technical solution. This can be a piece of hard- or software, a training course, a new procedure or a mixture of these. Something that is promising to improve the current situation should be identified.

The first task is to get a first impression by potential future users. Here, the solution providers should answer the following questions in order to assess the suitability of their solutions to the trial objective:

— Mission: How does the solution contribute to CM?

— Integration: How is it integrated into the existing CM operations?

— Readiness: How mature is the solution and has it been tested or proved?

— Motivation: How does the solution address problems of practitioners?

— References: Which references on solution application exist?

In order to get prepared for the next task within this step, the questions can be extended by optionally asking for the required resources and know-how to use the application, its technical specifications as well as the investment costs needed to deploy the solution. In order not to overload the solution provider, the length of the answers should be limited (e.g. two pages in total). Once the answers are collected the potential users (i.e. CM practitioners) should review the answers of the solution providers. The results are to be discussed in the trial committee in order to conclude which solutions appear to be promising to address the gaps. This discussion can be supported by considering the following questions:

— Can the solution be used to address the initial gap and to provide an answer to the main trial question(s) of the trial?

— Is the solution provider able to provide an appropriate training so that potential end-users can apply the solution in the trial?

— Does the solution require special technical setup in order to be trialled and – if needed – is the technical test-bed infrastructure able to fulfil them?

— Is the solution provider willing and able to participate and contribute to the trial-related tasks and meetings?

It is recommended to organize a physical or virtual meeting with the trial committee and the solution providers where those questions should be carefully explained and discussed. However, the final decision should be made within the trial committee and should be communicated shortly after the meeting. In case a solution is not selected, it is important to provide a proper answer so that the solution provider gets a better understanding of the reasoning.

8 Execution phase

8.1 General

The execution is not just the running of the trial but it also requires all kinds of preparations, rehearsals and tests. This will also allow for the possibility to adjust and check that all that is needed for the trial is in place and is functioning properly. Therefore, it has to be underlined that there is some flexibility of the number of dry runs. One could be enough or two could not be sufficient. At any time, the trial owner can decide to cancel the trial.

8.2 Trial integration meeting

The trial integration meeting is the first joint physical meeting of the CM practitioners, the technical test-bed and the selected solution providers. The following persons should be present: the practitioner coordinator, the technical coordinator, the trial owner and the evaluation coordinator acting as the leader of the meeting.

This trial integration meeting is essential to align the perspectives of the practitioners, the solution providers and the trial committee. Based on the discussions, the practitioners' and solution providers' needs will be further identified. This meeting will help to draft the data integration plan as well as the solution integration plan. The use cases and the trial script will be prepared based on the different information collected. At this stage, the preliminary data collection plan, as well as the evaluation plan should be tested and, if necessary, adjusted.

This will be the appropriate time to address any possible legal issues related to the confidentiality of data (signature of "Non-Disclosure Agreements" might be necessary) or checking any ethical or societal issue (societal impact assessment) if this was not previously addressed during the preparation phase. The trial integration meeting workflow is depicted in Figure 3.

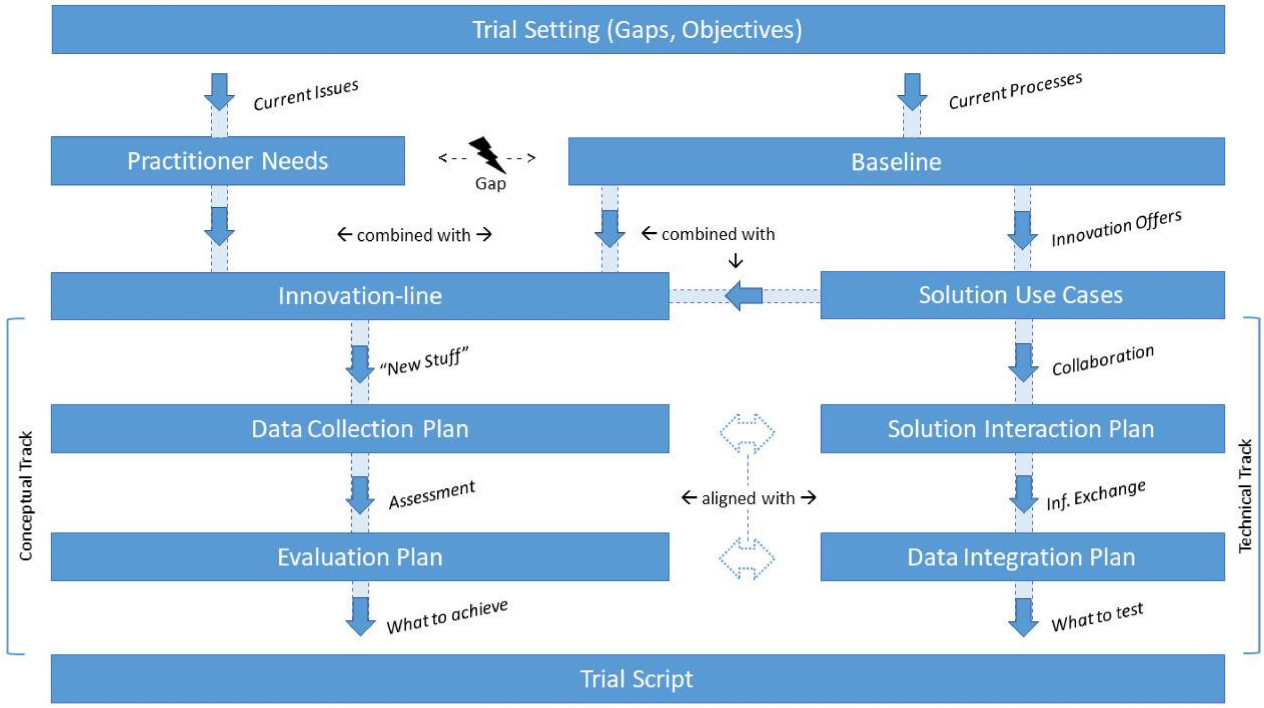

Figure 3 — Trial integration meeting workflow

The expected outputs are:

— draft data integration plan;

— draft solution integration plan;

— draft data collection plan as well as evaluation plan; and the

— overview of appointments on activities to be carried out before dry run one.

8.3 Dry run one

The main purposes of dry run one is to test the technical set-up (the trial design and the technical test-bed), the connection of the solutions to the test-bed and the information exchange between solutions as well as the data collection set-up. The training on solutions should also be validated.

Participants in dry run one are the technical coordinator acting as the leader of this meeting, the evaluation coordinator, the trial owner, the practitioner coordinator, the solution providers, as well as the CM practitioners.

It is worth noting that dry run one should be organized at the location(s) where the trial will take place. It is the occasion to confront the plans with the reality of the trial constraints.

The test-bed should be running under the conditions of the trial needs, injects to the scenario should be reviewed and tested, the data collection plan should be assessed in order to be as realistic as possible. It is also the time to determine how many and which kind of observers will be needed, based on the configuration of the location. Previous output, plans and approaches will be tested in practice.

Dry run one is an important step to detect issues that need to be fixed. Feedback should be collected in order to improve the preparation for the trial. This is the first rehearsal.

Based on the results, the data collection plan as well as the evaluation approach will be adapted.

The expected outputs are the proof of concept of the data collection and the evaluation plan, as well as an overview of appointments on activities to be carried out before dry run two.

If some solutions are not totally ready yet to be integrated, it is possible to accept them to participate in dry run two under agreed conditions.

8.4 Dry run two

Dry run two is a full rehearsal, but possibly still with a limited number of participants. This is the ultimate possibility to adjust the trial set-up; key elements of the trial should be fixed after dry run two, while the identified minor shortcomings should be fixed afterwards. It should be ensured that all further adjustments are checked again before the trial run.

Participants in dry run two are the trial owner acting as the leader of the meeting, the practitioner coordinator, the technical coordinator, the CM practitioners and all other trial participants.

Being a full test, the trial design and technical test-bed arrangements are tested at the location of the trial run. Adjustments identified during dry run one should have been implemented. This will also be the opportunity to train the CM participants on using the solutions and to get their feedback on the relevance of the training.

Trials aim to collect data in order to assess solutions. During dry run two, the collection of data will be tested and -if necessary- adjusted again. The main focus will then be on the following elements:

— data collected through solutions and technical test-bed; and

— questionnaires to be filled in by participants.

All the practicalities of the trial also have to be fixed (logistics, communication plans etc.). If the results are not satisfactory and too many things need to be fixed before the trial run, a decision could be made to organize another dry run or to cancel the trial.

The expected outputs are the approved script, tested observations and the validated technical set-up, as well as an overview of appointments on activities to be carried out before the trial run.

At the end of dry run two, solutions should be either confirmed or dismissed.

8.5 Trial run

The trial run aims at collecting all the data necessary for the evaluation of the solutions by comparing the results obtained under the current mode of operation (baseline) with the use of the innovative selected solutions.

Participants to the trial are the trial owner (lead), the practitioner coordinator, the evaluation coordinator, the technical coordinator, CM practitioners and other trial participants.

It is recommended to plan sufficient time to perform the following tasks:

— final testing of the technical set-up and equipment;

— trainings and explanations (solution trainings, observer trainings, explanation about the scenario, etc.);

— running the trial sessions; and

— data collection periods, including debriefings , time to fill-in questionnaires, interviews, etc.

Some participants will join the trial for the first time. Therefore, it is essential to plan enough time for familiarize them with the trial elements.

The total duration of the trial run depends on the complexity of the scenario, as well as the number of gaps and solutions to be assessed.

The expected output is the set of collected objective data as planned in the data collection plan.

The data collected are raw and will be analyzed during the evaluation phase.

9 Evaluation phase

9.1 General

The main objective of the evaluation phase is to make sense of the data collected during the trial. This sense making process is key to understand if and to what extent the trialed solutions are relevant and innovative for a CM organization. Moreover, in this phase results should be disseminated so that the interested CM community can learn from them.

9.2 Check the quality of the data

Before diving deep into the analysis, the collected data should be verified. Practically, this means checking whether the actual data matches with the plan as have been designed in the preparation phase. If this is not the case, for instance if data is missing or major deviations are spotted, this is the moment to carry out corrective actions. These actions depend on potential problems of the dataset and include, for instance, further interviews with trial participants and/or repairing a broken dataset. The tools of the test-bed technical infrastructure can be helpful, in this regard.

Additionally, reliable and high-quality data should be structured based on the previous decisions (data collection plan; evaluation approaches).

All data collected during the trial should be properly checked. Ultimately, this will lead to work on a clean dataset.

9.3 Analyze the data

This is the core of the evaluation phase as it implies making sense of data and drawing preliminary conclusions. The main objective of the analysis is to ensure a robust assessment of potentially innovative solutions.

A comprehensive analysis should be preceded by the organization of the dataset according to the three dimensions: trial, CM and solutions. This is crucial to understand which data refer to which dimension. Moreover, the data collected in each dimension (e.g. data regarding the trial context, data regarding the CM effectiveness and data focusing on the functionalities of the solutions), should be related to the KPIs and metrics defined in the preparation phase.

Next, an empirical analysis based on the evaluation methods defined in the preparation phase can be performed. It is highly recommended to aggregate all collected data in each dimension to identify interesting patterns (e.g. using charts is helpful to detect patterns). In doing so, a more targeted analysis can be carried out. Use *ad-hoc* quantitative and qualitative data analysis techniques, if needed.

It is also advisable to always keep in mind the overall objective of the trial to avoid focusing on data which might look interesting but are not directly related to the initial goals.

Furthermore, a visualization of the evaluation results can be helpful.

9.4 Synthesize the data

This step revolves around the overall conclusions of the trial. The overall conclusions not only cover the three dimensions, but also clearly refer to the objectives, the trial questions and the gaps by providing explanations on if and how the gaps have been addressed.

For instance, if one of the trial questions revolves around information management and its improvement through the use of a common information space, the answer should take into account, *inter alia*, to what extent sense and decision-making have changed in relation to the set of functionalities of a solution, as well as in relation to the conditions in which the trial has been carried out.

The results should be contextualized. The overall context in which the trial has been organized plays an important role. The assessment of the solutions should be considered in relation to the trial dimension.

It is recommended to stick to what the data show and to further discuss in the course of this process with relevant stakeholders involved in the trial.

9.5 Disseminate the results

9.5.1 General

Communicating the results of a trial should not be overlooked. Dissemination has to be both internal and external. A trial does not end on the last day of the execution phase: ensuring that relevant stakeholders have access to the trial results is an important step to letting them know what they actively contributed to.

The same holds true for external dissemination: sharing the lessons learned and experiences with the CM community serves the purpose of enriching it with evidence on innovation.

It is highly recommended to disseminate the results using the right channels (e.g. professional journals, CM platforms like CMINE[4], social media, newspaper articles), according to the communication strategies of the CM organization in which the trial has been carried out. Furthermore, providing/uploading a document with main results and key recommendations can be helpful to get a quick glance at the main outcomes.

9.5.2 Update the lessons learned library

To collect and share key lessons learned for CM events (not just trials), it is advisable to rely on the lessons learned library (see Annex B).

[4] Crisis Management Innovation Network Europe, available on: https://www.cmine.eu/

Annex A
(informative)

Trial context template

The trial world and the real world

In a trial it is important to differentiate between three different realities or worlds:

— The trial world: This refers to everything and every person that is needed to conduct your trial.

— The real world: This refers to the everyday realities that exist whether there is a trial or not. Your trial is embedded in this world.

— The simulated world: This refers to the purely fictional world you want to create for your trial.

All three trial worlds might be needed, but for sure the trial and the real one. Therefore, attention should be paid to the differences those induce in the following template.

Who are we?

Identify the organization(s) your gaps are embedded in. These organizations are crucial for the trial and will most likely also be the ones needed to cooperate with in the real world. Sometimes things can be simulated or re-enacted but involving people is recommended, as it helps with the realization of the trial. As the TGM focusses on CM it can be chosen from the below list of entities:

— Fire brigade

— Medical service

— Police

— Other local service

— Civil protection

— Command and control center

— Defence

— Authority

— International institution

— Monitoring institute

— NGO

— Critical infrastructure provider

— Industry/SME

— Other

Whom to involve how?

Table A.1 should be filled in. Here it can be stated whether an organization only sees itself in the trial or also in the real world.

Table A.1 — Trial participants overview template

Organization	Trial	Real	Comment	Contact	Who will contact them?
US marine corps	x	?	Hard to involve	015677456	Peter
Aerial fire fighters of own country	-	x	Table-top exercise and a former member of them is now working at our organization, so their knowledge is present (maybe consult them once during the process)	mail@mail	Jenny
Fire brigade of the village next door	x	-	Not involved in gap but very eager to see how the trial goes	52684	Cmdr. Perry

Cooperation partners

Depending on the kind of trial there might be additional cooperation partners that are "somehow" linked to your trial.

Here possible cooperation partner can be listed:

Type of trial

There are different forms of trials that can be chosen from or you can also do a mixed approach:

— Table top

— Field exercise

— Mixed approach

Incident category

It might be possible to already point out to decide and specify what kind of incident the trial will be related to:

— Natural incident

  — Animal disease

  — Avalanche

  — Earthquake

- Epidemics/pandemics
- Extreme cold
- Extreme hail/snowfall
- Extreme heat/drought
- Flood: Coastal flood
- Flood: Flash flood
- Flood: River flood
- Forest fire
- Landslide
- Meteorites
- Storm/tornado
- Volcanic eruption

- Technological/human failure
  - Collapse of infrastructure
  - Explosion/gas leak
  - Fire in building/infrastructure
  - Industry: Chemical spill
  - Industry: Explosion/fire
  - Industry: Nuclear accident
  - Outage: Gas supply
  - Outage: Power supply
  - Outage: Telecom/ICT supply
  - Outage: Water supply
  - Transport: Maritime accident
  - Transport: Air crash
  - Transport: Railway accident
  - Transport: Road accident
- Intentional Incident/attack

  - Arson (fire raising)
  - Biological attack
  - Bombing (explosives)
  - Chemical attack
  - Cyber-attack/crime
  - Dumping waste
  - Radiological/nuclear attack
  - Sabotage
  - Vandalism
- Other (cascading) incidents (see options under natural and technological human failures) to indicate follow-up incidents as a consequence of the initial incident

Scale of the event

At this point it should be thought about how large or small the event has to be in order to be in line with the gaps:

- Regional
- National
- Pan-European
- Global

Additionally, the scale of the event can be further specified by indicating different incident challenges:

- High rate of effort in hostile environments
- Low frequency, high impact
- Multi-agency/ multi leadership environment
- High level of uncertainty

Where are we?

The gaps only occur in a certain setting. This has different angles to it. One is the physical location (country, state, city), which comes with certain doctrines, equipment, culture, etc. It can also be aimed for a cross border situation. Of course if it is a table top, the real world location might differ from the trial location. The Table A.2 can be used.

Table A.2 — Trial vs. real world location

	Trial location	Real world location
Country		
State		
City		
Country		
State		
City		

Setting/type of area

Something can be set about the setting, if the country, state, city is known: Is the gap related to a certain landscape (e.g. mountains, sandy shore, sea/lake) or a type of area (e.g. city/town-center, residential, industrial, countryside)?

Specify the required landscape of the trial: _____

Decide where to execute the trial:

— Possible place in the city within the real world: _____

— Landscape needs to be simulated: _____

Special equipment/facility

List the needs and get in touch with the respective representative, if the gap involves the use of special equipment (vehicles, planes) or need to take place at a physical simulator (a training facility where you can make a real fire etc.).Think of for example the following:

— special vehicles; and

— special facilities.

Doctrines, standards, laws, etc.

List for example doctrines and plans that will play a major role in the trial, as it is related to the gap. Furthermore there could be some European or international standards that concern the procedure or tool that will be trialed.

— Doctrines

— Plans

— European or international standards

Ethical, legal, social issues (ELSI)

Related to the gaps, the tools can have different ethical, legal or social issues, e.g. when trialling a drone laws about air-traffic have to be considered.

— Ethical

— Legal

— Social

When are we?

Time is always a factor. There will be two timelines in the trial: The real world time (e.g. today is Friday, March 20, 2020) and the trial time. Trial time means the season or time of day that is related to the scenario. For example, if there is a trouble with fire hose freezing the trial will most probably need to be in the winter. If a field exercise is asked for it has implications on the real time.

Table A.3 — Time dimensions in a trial

	Trial world	**Real world**
Season		
Daytime		
Night time		

Annex B
(informative)

Lessons learned library

B.1 Objectives

The lessons learned library (L3) aims to support organizations in editing, maintaining, consulting and sharing lessons within the domain of CM and disaster risk reduction (DRR) in Europe. Thereby sharing of lessons is not strictly limited to one organization. L3 is especially intended to share lessons across organizations, across sectors, and across countries with the ultimate goal to improve CM and DRR in Europe by learning from each other's experiences.

Lessons may be collected from various types of events: routine, every day operations, near incidents, crisis situations, training and exercises, experiments and tests (such as trials), but also from risk management studies or other preventive activities. Learning lessons can be considered as a structured approach to produce and apply experience-based knowledge to develop and improve doctrines, organizations, training, equipment, leadership, personnel and facilities to achieve more effective, efficient and safe operations.

In simple terms, a lesson is a set of answers to questions such as: What was the situation?, What was the impact?, What went well in emergency management and is worthwhile to implement?, or What went wrong and which improvements are needed?. To this purpose, users can provide precious information and lessons from events by adding a new event to the repository. By filling out a limited number of forms, collected data and experiences can be shared with other emergency management communities in Europe.

Lessons may be of varying nature and of mixed interest outside the organization or sector where they have been collected. Therefore, a filtering mechanism enables users to select the kind of information they would like to consult: information about an event that took place (e.g. a trial in the DRIVER+ project), lessons from a particular type of event (e.g. exercises), from certain types of incidents (e.g. forest fires or bomb attacks), or from specific CM functions (e.g. evacuation or situation assessment).

B.2 Functionalities and structure

The main functionalities of the L3 are to add and edit crisis events and associated lessons from these events, and to find and consult specific events or lessons. Because the aim of the L3 is to share lessons across the CM community throughout Europe the user interface is in English. For the same reason users are encouraged (but are not obliged) to provide their information on events and lessons in English as well.

The L3 contains a set of events and their associated lessons. As depicted in Figure B.1, each event in the repository can contain 0, 1 or more lessons, while each lesson in its turn can be linked to one or more CM functions. Note that a certain CM function can be addressed by different lessons from the same or from other events.

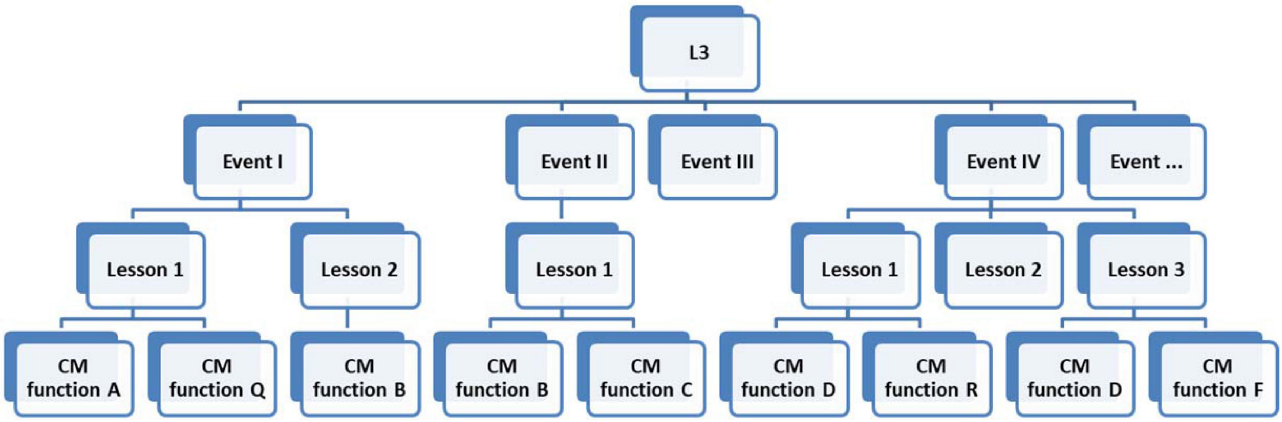

Figure B.1 — L3 structure

B.3 Events, lessons and crisis management functions

An event is described by:

— a summary, including some general data such as type of event (e.g. an incident or an exercise), and the date and place of the event;

— more detailed information on the incident scenario and CM operations, such as the initial incident and cascading events, the (potential) impact, a map of the situation, involved organizations, and an overview of critical CM functions that had to be executed;

— lessons that have been learned from the event.

A lesson consists of two sets of information:

— a description of the observation of positive or negative experiences concerning the applicable CM function during the event. This includes the performance of executing the CM function during the event, which is expressed by the effectiveness (adequacy) of executing the CM function on a 5-point-scale;

— the characterization of a (potential) solution to improve the CM function based on the experiences during the event. This includes a description of the expected performance improvement of the CM function (also expressed on a 5-point-scale) once it will have been implemented. In addition, an indication can be provided of the expected impact reduction by the solution. To this purpose five impact dimensions of UNISDR are used: number of victims, material damage, loss of services, social/economic losses, and environmental degradation.

The L3 includes 24 CM functions to choose from. It concerns the below points.

— Operational CM functions: Alerting (112), Crisis/Risk communication to society, Crowd management, Decontamination, Emergency Health Care, Evacuation & Shelter, Fight/Eliminate incident source (e.g. fire-fighting, stop a leakage), Law enforcement, Provide basic needs to the population, Remove debris, Rescue operations (SAR), and Restore critical services.

— Operations enabling or supporting CM functions: Command, Control and Coordination (C3)/Information management, Detection/Surveillance, International collaboration (incl. home nation support), Logistics/Resource management, Situation assessment, Social media mining, Traffic management, Up-scale/Down-scale of emergency services, and Volunteer management.

— Preparatory CM functions: Education & Training, Planning/Doctrine development, and Risk assessment.

Annex C
(informative)

Examples and templates

C.1 Example baseline

For this example of a baseline the following gap was chosen: "Hard to get the right localization from a caller. Hard to decide on the appropriated vehicle based on the description of the injury given by the caller." The baseline is always specific to one organization. Hence this is only an example.

It is recommended to create a kind of flow chart that depicts the as-is-process in which the gap occurs. Swimming lane diagrammes have proven to be a helpful tool (see Figure C.1):

Here each role (112 caller, call taker/ dispatcher, ambulance) has its own lane that only contains actions (white squares) that are performed by this role. Those actions are ordered by time – starting left and progressing to the right.

Information can be exchanged between roles, which is depicted as blue arrows. The means by which this information are exchanged is represented by a pictogram. Here the CM professional's legacy solutions should be shown, as the current state of the art is depicted.

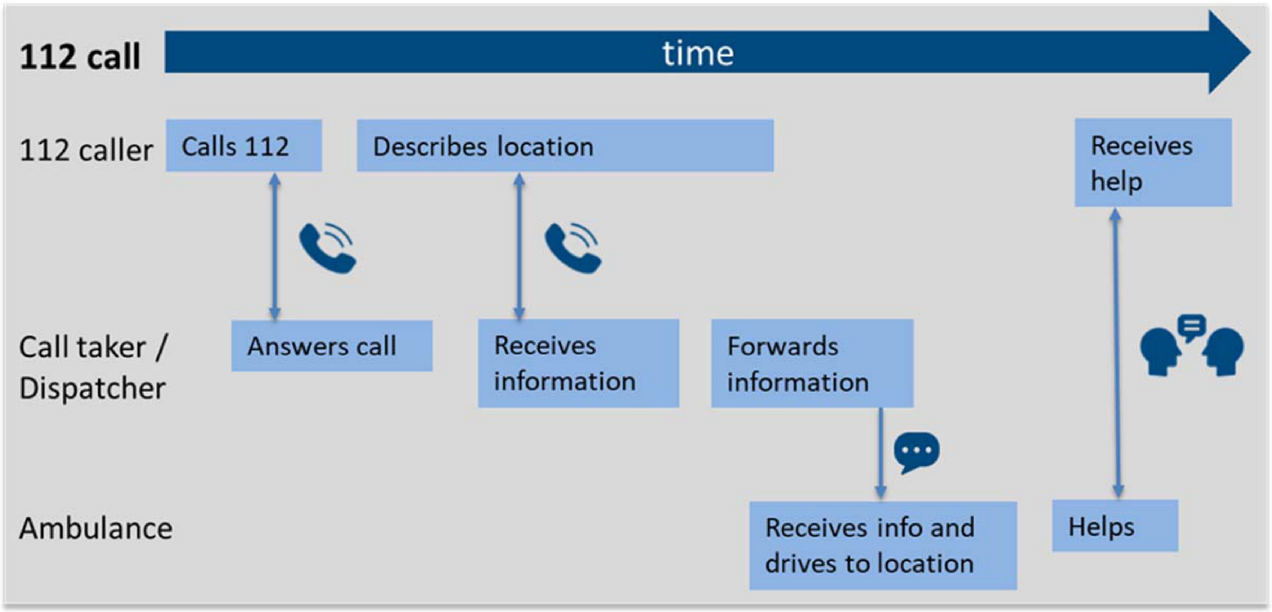

Figure C.1 — Example baseline

C.2 Example innovation-line

For this example of an innovation-line the solution of an app which sends the GPS location as soon as the caller uses it to call 112 was chosen. Another functionality is that the caller can send pictures of injuries to the call taker.

The innovation-line should depict the foreseen changes in the process, the roles, the equipment, the information exchanges and the means to exchange them. It should be based on the related baseline.

Hence swimming lanes are also used in Figure C.2 the same way as described in Figure C.1.

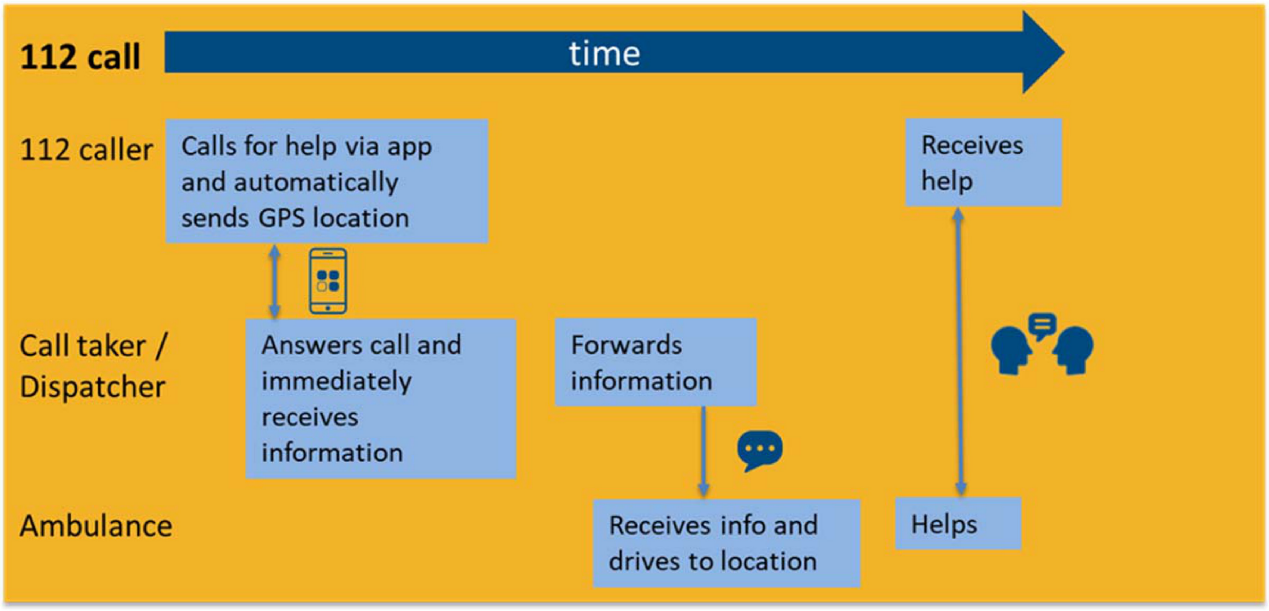

Figure C.2 — Example innovation-line

The comparison of the base- and innovation lines, depicted in the Figure C.3, allow for the clarification of the “gap-process“ by answering which tasks, roles, equipment, information exchanges are involved in gap process. In consequence, the trial stakeholders have a common ground to discuss the starting point including the gap, the visualisation of the changes introduced by the innovative solutions. Finally, the identification of relevant metrics and KPIs is supported through the depiction of the respective objectives and interrelations involved in both the base- and innovation lines.

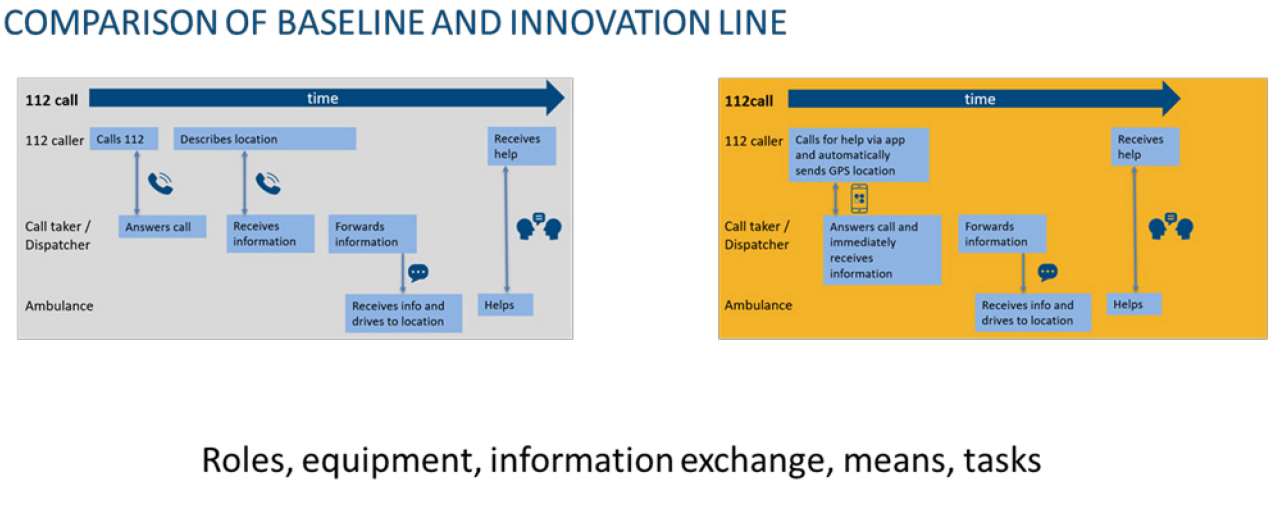

Figure C.3 — Comparison of baseline and innovation-line

C.3 Guidelines on trial questions

Here is a list of criteria for formulating good trial questions. A trial question:

1) needs to be a question:

2) needs to address a distinct gap;

3) needs to cover one of the three dimensions of trials (trial dimension, crisis management dimension, solution dimension);

4) must not be scenario-driven;

5) needs to be answered and measurable by the trial;

6) needs to be understood and approved by all trial stakeholders;

7) can be organized in a multi-level hierarchical structure;

8) must be simple, but not easy to answer.

C.4 Data collection plan template

Data collection plan			
Define what to measure:			
Measure:	Type of measure:		Operational definition:
Name of parameter or condition to be measured:	X or Y attribute or discrete data, product or process data:		Clear definition of the measurement defined in such a way as to achieve repeatable results from multiple observers:
Define how to measure:			Define who will do it:
Measurement or test method:	Data tags needed to stratify the data:	Data collection method:	Person(s) assigned:
Visual inspection or automated test? Test instruments are defined. Procedures for data collection are defined.	Data tags are defined for the measure. Such as: time, date, location, tester, line, costumer, buyer, operator, etc.	Manual? Spreadsheet? Computer based? etc.	State who has the responsibility:

Sample Plan			
What?	Where?	When?	How many?
What data is being collected:	Location for data collection:	How often the data is collected:	The number of data points collected per sample:

Bibliography

[1] ISO 9241, *Ergonomics of human-system interaction – Part 11: Usability: Definitions and concepts*

[2] ISO/TR 18317, *Intelligent transport systems – Pre-emption of ITS communication networks for disaster and emergency communication – Use case scenarios*

[3] ISO 22398, *Societal security – Guidelines for exercises*

[4] CEN/TS 17091, *Crisis management – Guidance for developing a strategic capability*

[5] ISO 22300, *Security and resilience – Vocabulary*

[6] Project Responder 5, Homeland Security, Science and Technology, August 2017

[7] Doran G.T. There's a S.M.A.R.T. way to write management's goals and objectives". Manage. Rev. 1981, 70 (11) pp. 35–36