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Report on best practices and strategies for innovative self-preparedness and self-protection and the summary of Lessons Learned from case studies

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Document Information

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This report and others are available from the ANYWHERE Project Website at: http://www.anywhere-h2020.eu/

Summary

This document covers the results on gathered best practices and strategies for innovative self-preparedness and self-protection (self-p*) as well as the summary of Lessons Learned from case studies. Lessons Learned from the case studies are transformed into recommendations and best practices in order to support usage of ANYWHERE based services and tools for self-protection and self-preparedness by end users. End users cover stakeholder groups like citizens protecting their health and enterprises targeting business continuity. The results of case studies (D5.2) were interpreted based on preliminary findings of literature studies, i. e., D5.1 documenting the output of studies on ethical, legal and social constraints, communication as well as generic requirements and good practices. Besides deliverables and paper-based representations, all results were implemented in supportive tools. These tools enable intuitive access to knowledge. They are key for sustainable usage beyond the ANYWHERE project. The core platform was entitled “ANYWHERE CIS (Common Information Space)” supporting knowledge exchange among all stakeholder groups. The CIS is flanked by a) the ANYCaRE game, a tool to analyse and illustrate the potential benefits of the implementation of ANYWHERE components and b) the Scenario-Technique tool to simulate scenarios of innovative self-p*.

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1 Introduction

The focus of the deliverable is on “recommendations” in the overall WP5 concept for innovative self-preparedness and self-protection (self-p*) (see “Recommend” in Figure 1). Recommendations should support citizens, enterprises and other organisations to select, to procure and to roll-out appropriate tools and services to enhance self-p*.

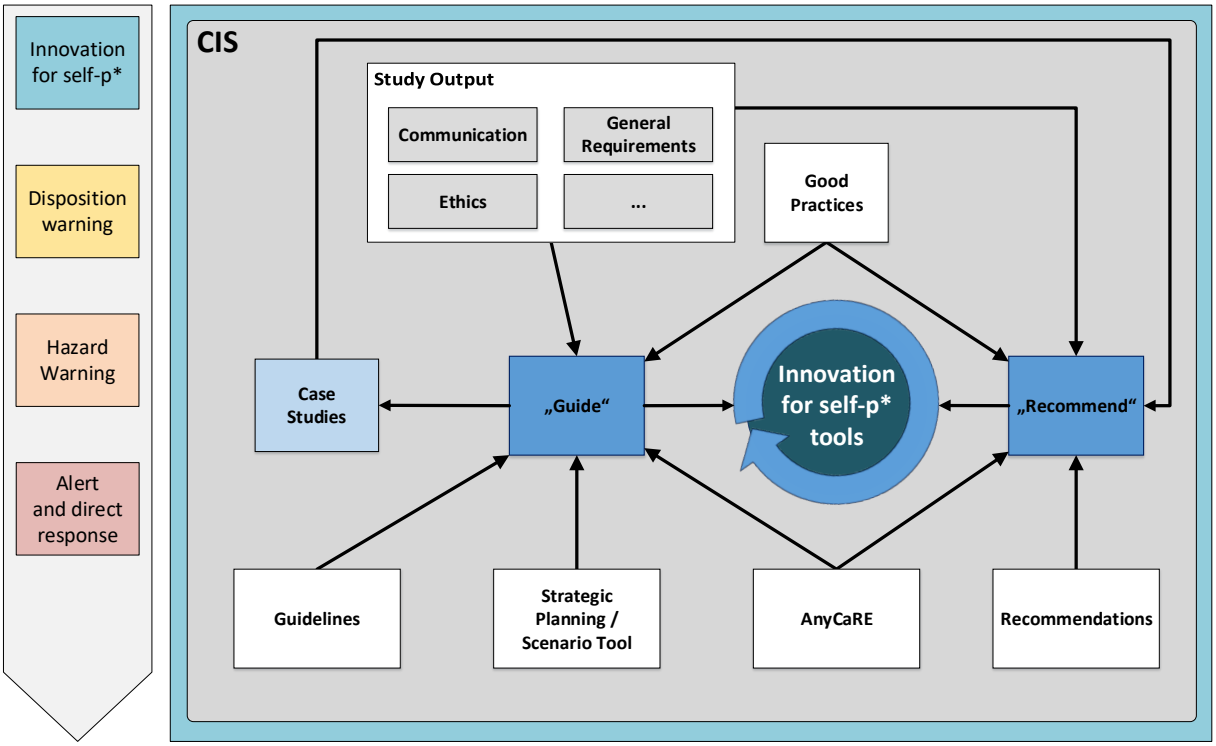


Figure 1 Concept to support innovation for self-p*

1.1 Purpose of the document

While the purpose of activities in WP5 is to enhance innovation for self-p*, the main purpose of this deliverable is to document how the ANYWHERE WP5 team gathers and structures results to make it accessible by and usable as recommendations for citizen, enterprises and emergency services. This document summarises results in terms of

- Methodology for gathering Lessons Learned from case studies
- Lessons Learned from case studies and literature review
- Structuring of Lessons Learned to be included in recommendation targeting citizen, enterprises and emergency services
- Publication of WP5 relevant content in ANYWHERE CIS

1.2 Target audience

The deliverable facilitates collaboration within the wider ANYWHERE community with regard to self-preparedness and self-protection. It was declared to be public. The interviews conducted, which contain internal information, may only be intended for use within the consortium. All chapters include information to allow the audience to engage with the ANYWHERE research results regarding the good practices, recommendations and innovation for self-p* on a general level.

1.3 Structure of the document

With regard to the purpose of the document, studies performed in deliverable D5.1 and expertise from background projects as well as guidelines for service/tool providers (innovators) (see deliverable D5.1) will be regarded in this deliverable. Supportive tools to promote innovation (supportive tools) implementing these guidelines were designed. Draft documentations were included in D5.1, final design and implementation details on the Common Information Space (CIS) can be found in chapter 10 Annex 3. The overall case study design with the tools used in the case studies as well as the data from the case studies are provided in D5.2. Whereas the analysis of the data is part of this deliverable in order to identify best practices and strategies. For this purpose, a case study analysis is carried out on the basis of an interview questionnaire.

The document is structured as follows. First the method for data collection and interpretation is defined (chapter 2). Then Lessons Learned are derived by performing a case study analysis from different perspectives (chapter 3). In addition to the general perspective study output & workshops, business continuity, risk communication and ethical and legal aspects are considered. In chapter 4 recommendations to support self-preparedness and self-protection are deduced. For dissemination and exploitation purposes as well as for the strategy development a revision of the guidelines (deliverable D5.1) and the supportive tools is dealt with in chapter 5. The analysis on the strategies for innovative self-preparedness and self-protection digs down into the market situation and provides an estimation of the business and research impact. It provides links to sustainability perspectives in WP7.

1.4 Remarks on the dissemination level

Following the recommendations included in the Security Scrutiny-Evaluation Report, the current deliverable was revised by the Project Security Committee to avoid any possibility of using the information contained in it for a malevolent exploitation.

2 Methodology for data collection and interpretation

Based on literature research and workshops with experts, case studies were conducted at four different locations. The methodological approach for the implementation and analysis of the case studies as well as the serious gaming approach are presented in this chapter.

Collected Lessons Learned are derived and presented from literature research (study output), workshops and case studies. Case studies are conducted in relation to pilot sites (Figure 2, see. WP6). Recommendations were defined in the following way. First results were derived from case study results, literature research and further additional potential case studies (see world café results). Therefore, a case study approach was developed (See chapter 12 ANNEX 4 Case Study Manual) and provided to all case study leader and further interest groups. The manual includes procedures for conducting case studies and respective templates to align research results.

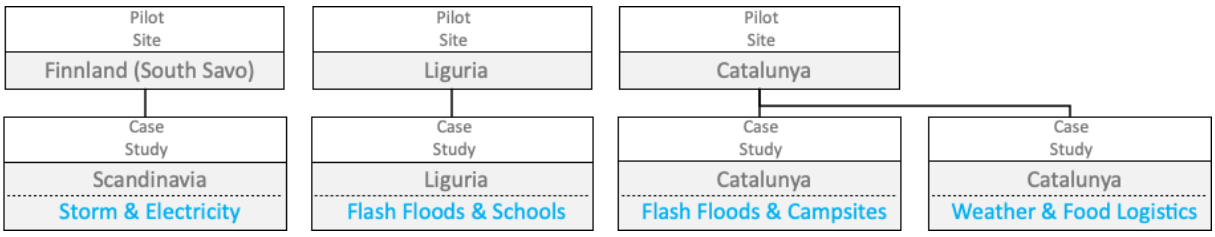


Figure 2 Pilot sites & case studies

In this context, it is of interest to know what positive and negative experiences the users of the ANYWHERE tools have had. It is also interesting to see how companies deal with extreme weather and climate events and how they are aware of the issue of self-protection. Accordingly, the following main questions arise for interviews to be evaluated:

- What experiences have the interviewees had with the topic of self-protection, how is this topic dealt with in their enterprises?
- Does the topic of self-protection play any role at all for the company of the interviewees? If so, to what extent does it play a role?
- What experiences did the interviewees have with the tools of the ANYWHERE project and general tools for self-protection?
- In which areas of self-protection do the interviewees see potential for improvement?

After determining the question of the analysis, the determination of the analysis units can be continued. The individual interviews are defined as the evaluation/context unit, followed by the entire material. Each complete statement of an interviewee on the topics of self-protection, the ANYWHERE product range, experiences with the topic of self-protection and dealing with the topic of self-p* are included.

The decision for an analysis technique is necessary. Analysis techniques include

- summary content analysis,
- explicit content analysis, and
- structuring content analysis.

All three analytical techniques are applied with different objectives for the approach to the material to be analysed. Since the aim of this work is to derive Lessons Learned on the subject of self-protection and the results of the qualitative content analysis should be suitable for this purpose, it must summarise the findings and experiences of the interviewees in as condensed a form as possible, without making compromises with regard to their expressiveness. For this purpose, the analysis technique of the summary is best suited, since it aims to reduce the material without, however, reducing the expressiveness of the material.

The case study approach is based on a method developed by Robert K. Yin (Yin 2014). For ANYWHERE, an adapted procedure was derived to include requirements from the case studies, needs of related tasks and especially the innovation perspective in the consortium to include innovators expertise. The case studies focus on researching the impact of self-p* (incl. tools based on ANYWHERE background) in high impact weather events. The objectives therefore include but are not limited to:

- use of self-p* tools
- procurement of self-p* tools
- self-p* in general

With regard to the overarching questions four research subjects were identified and integrated in all templates and manuals later on.

- to explore what kind of tools, platforms are used to ensure self-p* for citizen or enterprises?
- to understand the way of using self-p*tools by citizen or companies
- to study how information validation is considered especially by tools provided by third party enterprises
- to know what kind of skills or resources are required to use self-p* tools adequate

The case studies are based on the ‘single case study’ approach which allows for exploration of the impact of self-p* tools in extreme weather events of the ANYWHERE scenario. Good and valid results are ensured by employing two different strategies. By using the ‘replication strategy’, in which successive case examples, interviews in the ANYWHERE case, are selected to explore and confirm or disprove the patterns identified in the initial case examples. According to this model, if all or most of the cases provide similar results, there can be substantial support for the development of a preliminary theory that describes the phenomena (Eisenhardt and Eisenhardt 1989). In addition, ‘triangulation’ is used. Multiple methods are used to reach the results for

the ANYWHERE case studies. The first method is observation. The purpose of this method is to observe how tools for self-p* are used by the stakeholders in a real-world situation. Secondly, key stakeholder interviews are interviewed to gather an initial and foundational dataset to give an overview of the case and provide first data to important research questions. The use of two different methods to reach results, improves the validity and reliability of the studies.

In order to facilitate comparability, the *Case Study Manual* was developed in ANYHWERE (See chapter 12 Annex 4). The manual sums up the case study process as a linear yet iterative process, consisting of six phases: (1) planning, (2) design, (3) preparation, (4) collection, (5) analysis, (6) sharing. With clarity and easy communication of the case study procedures in mind, the process is separated into four sub-processes: Scoping, Data Collection, Data Analysis and Good Practices & Recommendations. The simplified process is depicted in Figure 3.

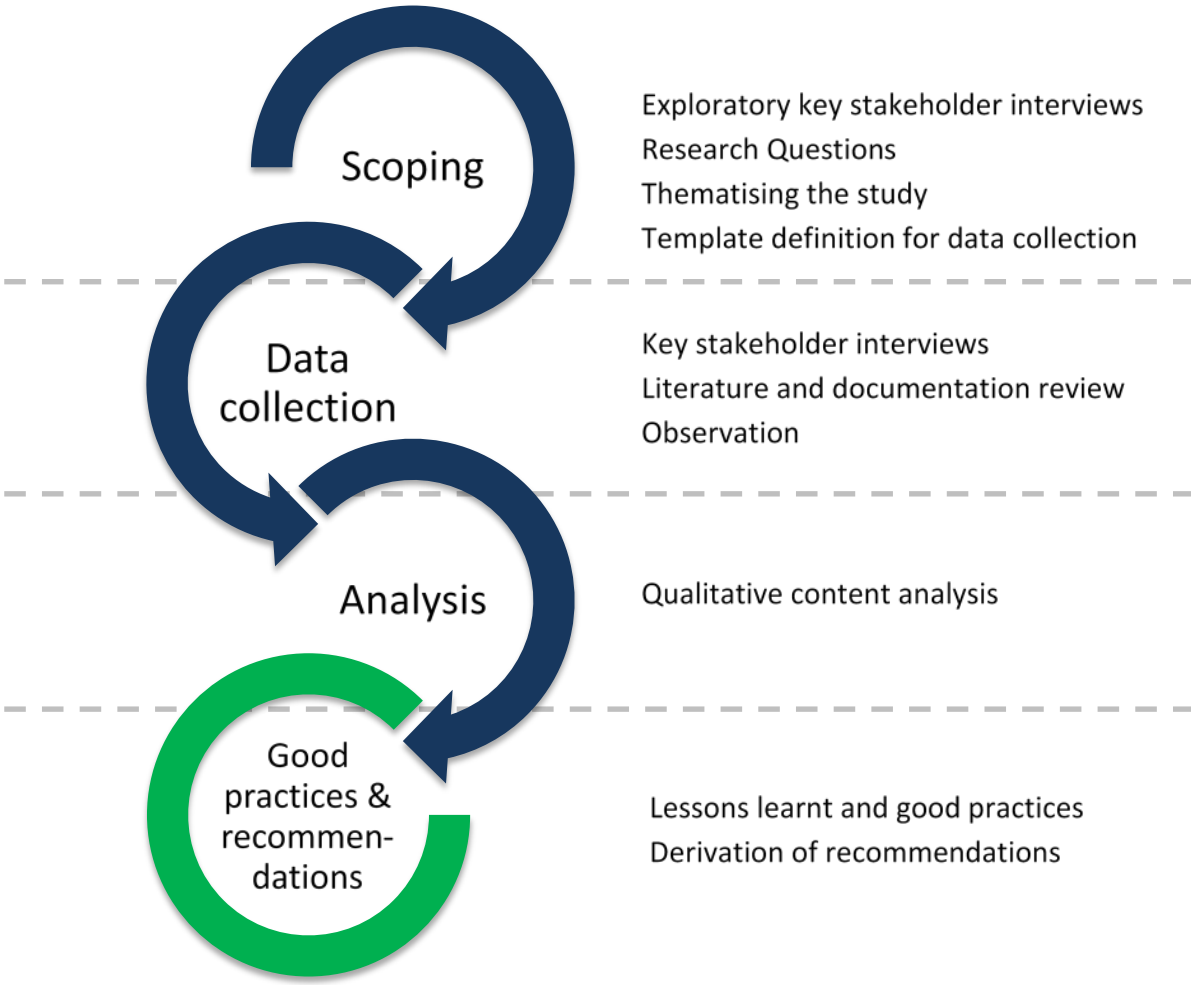


Figure 3 Case study approach

2.1 Scoping & Research questions

One main activity during the scoping phase is the definition of a research questions. The research questions in the ANYWHERE case study manual are based upon the

goals of ANYWHERE and research done during case studies following the tasks and objectives of the WP5 implementation plan. The research questions cover areas ranging from existing and tools currently developed for weather for- and now-casting, organisations using said tools and social media and crowdsourcing involvement.

The overall research question is “What is the impact of self-p* tools in extreme weather events?” The research questions for the cases studies are defined below.

Existing tools, non-anywhere tools for now- and forecasting as well as platforms, technologies and algorithms

- What types of tools, platforms, technologies or algorithms are being used by the main stakeholders?
- What are the strengths and weaknesses of these?
- What is the main gap of these tools?
- For Public Protection and Disaster Relief (PPDR) organisations: How are they integrated into the organizational structure?

ANYWHERE tools for weather now- and forecasting as well as platforms, technologies and algorithms

- What types of tools, platforms, technologies or algorithms are being used by the main stakeholders in ANYWHERE (PPDR, citizens, companies and IT-provider)?
- What are the strengths and weaknesses of these?
- What is ANYWHERE doing better than existing solutions?
- For instance, in order to assess the socio-economic impact.

Organizational structures and integration of ANYHWERE self-p* tools

- How are they integrated into the organizational structure?
- Is there any difference in terms of integration compared to non-ANYWHERE tools?
- What ‘resistance to change’ dynamics in relation to the use of the ANYWHERE tools can be identified and how might these be addressed?
- How does key stakeholder integrate ANYWHERE tools in daily routines?

Staff skills and resources

- What skills are required to help stakeholders to find, interpret and make use of information provided by the ANYWHERE tools?
- What guidance or training would be most useful for them?

Information validation

- How can stakeholders be persuaded that information provided is credible and trustworthy?
- What procedures and tools are used to validate such information efficiently and effectively?
- How can reliability and accuracy be supported, technically?

Social media and crowd sourcing

- Is social media a source to be considered in terms of for- and now casting of high impact weather situations?
- Does your organisation use any tools that support the analysis of social media w.r.t. social media analysis or crowd sourcing? Also with regard to market analysis.
- How can stakeholders be persuaded that information provided via social media from citizens is credible and trustworthy?
- Do the ANYWHERE crowdsourcing solutions provide any indicators to support you?
- What types of information are they most interested in: for example, situational awareness data from citizens or data on the public mood or the emergence of rumours or misinformation?

Moderating citizen communities via social media

- What approaches do you already use to moderate and support volunteer communities using social media?
- What can emergency services do before a disaster to make stronger links with such communities and what can they do to support the preparation, response and recovery operations?

Support of innovation for self-p* by additional ANYWHERE tools

- Can innovation for self-p* be supported by additional tools developed by ANYWHERE partners?
- Does an increases capability for strategic planning support the market uptake of services?
- Do the tools supporting innovation for self-p* support decision making, the quality thereof and the success of the products?
- Is the awareness for potential challenges and chances increases by tools such as the CIS?

Further details can be found in the case study manual (see chapter 12 ANNEX 4).

2.2 Data Collection

In this step, methods will be defined including predefined templates to ensure a consolidated collection of relevant data. In the ANYWHERE case study manual supports the data collection with templates and forms to perform semi-structured interviews and collect data from observation.

2.3 Analysis

The data analysis part of the case studies processes the results of the data collection before and tries to find correlations, causalities, connections and structures within the data. During the data analysis, data collected will be regarded using manual or software assisted qualitative content analysis. This qualitative approach aims to find answers to research questions by searching for indications and evidence.

The final stage of the case study entails integration of the results of the data collection, analysis of the results and producing an individual summary of the case. This is done using triangulation of the evidence collected from the data collection methods applied, to arrive at conclusions.

2.4 Good practices & recommendations

A lesson learnt is knowledge or understanding gained by experience that has a significant impact for an organisation (Milton 2010). The term “Lessons Learned” refers to a method within the framework of systematic knowledge management which is used to identify, develop, use and preserve knowledge (Lehner 2014, 43). Systematic knowledge management is a process that encompasses the identification, acquisition, sharing, evaluation, dissemination and creation of knowledge. This process also includes drawing conclusions from previous mistakes or successes and avoiding negative aspects in the future. (Liebowitz 2006, 43)

The method of Lessons Learned is very well suited to derive recommendations, because with its help positive as well as negative insights and experiences can be recorded in the form of simple sentences or keywords in the final phase of a project in order to prevent forgetting. It is advisable to agree on a certain structure of the Lessons Learned in order to avoid any saving or the loss of experiences and knowledge, as these would otherwise no longer be available to posterity. (Lehner 2014, 202).

This structure can, for example, contain information at the time the Lessons Learned are identified, on the author of the Lessons Learned, a description of the Lessons Learned with the knowledge and experience gained, and potential for improvement.

Therefore, the last phase of the case study process aims to derive and gather outcomes and Lessons Learned based on the data analysis.

2.5 Key Stakeholders

In a next step key stakeholder, which are targeted by the WP5 case studies, will be defined.

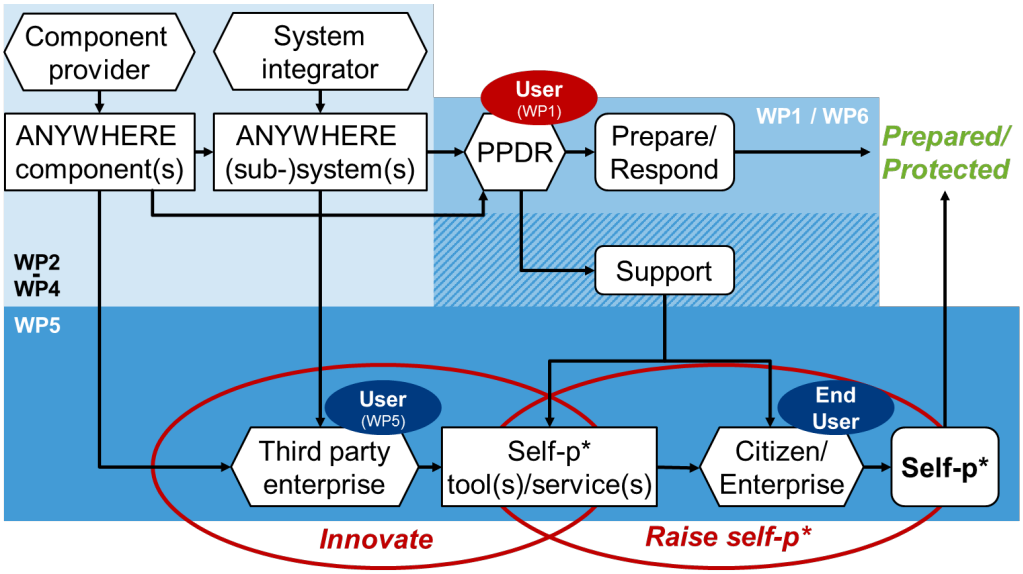


Figure 4 WP5 stakeholder scheme (D5.1)

Already discussed in deliverable D5.1 (see Figure 4) three user groups as key stakeholders can be defined with regard to WP5: Users (in line with WP1), users in the meaning of third-party enterprises (according to the overall aim of WP5) and end users. Users (in line with WP1) can be **PPDR** which use ANYWHERE components for their own application to prepare for high impact weather and to improve the response to these events. From a WP5 perspective, users can also be **third party enterprises (e.g. IT-Provider).** These implement ANYWHERE components (e.g. MH-EWS) or ANYWHERE (sub-) systems (e.g. A4EU) for providing self-p* tools or services to **citizens** or **enterprises**. In contrast du the users (in line with WP1), these users must have a sufficient business model to generate revenues from the tools and services. Citizens or enterprises are considered as end users from a WP5 perspective. Targeting an increase of self-p*, these can either be supported by PPDR or by third-party tools developed by third-party enterprises. Variation of roles of key stakeholder for all three user groups are presented in the Table 1.

Table 1 Key stakeholder groups & roles

Key stakeholder group	Key stakeholder roles
IT-Provider	IT-Providers using ANYWHERE guidelines to create innovative services/tools for self-p* IT-Providers integrating ANYWHERE components into their products Managers who create and adapt business models
PPDR	Decision maker, crisis manager, crisis management team, catastrophe commissioner or officer in charge Publically administrated metrological institutes Technical relief agencies
Enterprises	Responsible persons for critical infrastructures Metrological institutes All enterprises relevant to the ANYWHERE scenarios (to be specified by case study leaders)
Citizens	Affected people like parents, students, pupils, teachers or camper

In addition to the structured implementation of the case studies, further workshops were used to understand the potential for the case studies and pilots in every country and beyond. In the following section, the results and related activities from one workshop will be presented.

3 Lessons Learned

This section deals with the Lessons Learned from the interview results of the ANYWHERE case studies in order to derive Lessons Learned. During the case studies several progress reports, experiences and observations were given. Intermediary results were presented and reflected at all ANYWHERE project meetings, Advisory Board sessions and workshops.

3.1 Findings from case studies

Base on this, questionnaires from the case study manual were used (see chapter 12 ANNEX 4 Case Study Manual) to perform semi-structured interviews to gather Lessons Learned in for self-p*. The case study manual covers the four research subjects, discussed before within following structure:

- INTRODUCTION: Background-Questions to gather information about role and function of the interviewee
- PART1: Organisational structures and facilitators: Questions on what extend self-p* tools are already integrated into daily procedures.
- PART2: Self-p* tools, platforms and technologies in general
- PART3: Self-p* tools – specific ANYWHERE Tool: Questions dedicated to the ANYWHERE tools used in the case study
- PART 4: Information validation
- PART 5: Skills and resources for self-p*
- PART 6: Crowd Sourcing, Social Media, Moderating citizen communities

After the first half of the project duration, the case study manual was updated and enhanced by questions with regard to crowd sourcing and social media.

REMARK: According to ANYWHERE research ethics, raw data from the performed interviews are not included in the deliverable.

3.1.1 Scandinavia: Storm & electricity

During the case study in Finland several workshops and interviews were performed in order to derive Lessons Learned with tools for self-p*. The conducted interviews have covered external partners and end users of the electricity case with the following occupation and responsibilities:

- Transmission engineer, fault control
- Service expert, unit services, customer specialist,
- Control centre expert

The Lessons Learned are summarized in 5 Lessons Learned categories:

Motivation for the subject of self-protection

- Self-protection plays an important role at the company, as the environment is geographically challenging, climate change favours extreme weather events and there are statutory preparedness plans that the company must adhere to.
- Reasons for using self-protection tools are the possibility to create and maintain situational awareness, to inform customers and partners about dangerous situations and to better prepare for situations.

Findings on improvement potentials of the general self-protection and the ANYWHERE components

Potential for improvement in self-p lies in*

- the improvement of cooperation with actors in the critical infrastructure,
- the development of new methods to improve understanding of the relationships between actors,
- the creation of strong links and cooperation between civil protection and energy providers through common tools,
- stronger marketing of crowdsourcing,
- the use of data from distance measurements, energy interruptions and conductor faults, and in displaying faults on maps.

There is potential for improvement in the ANYWHERE components by combining the tools with a terrain database, automatically updating the user interface, improving the zoom properties and operation of the tools, and outputting area-related errors.

Positive and negative experiences with ANYWHERE components

- Positive experiences with ANYWHERE components were made with the map view of the tools, the information quality, the better preparation of the customers,

the higher knowledge and awareness of the situation as well as the good decision support and simplified estimation of resources for coping with the situation.

- Negative experiences with ANYWHERE components have been made with regard to the ambiguity about the correct functioning of the tools, because sometimes incomprehensible values are output, the long update time, the output of estimated values instead of detailed information, the incorrect estimation of the repair time, the reliability and the user interface.

Findings on the usage behaviour of self-protection tools

In the company several ANYWHERE tools, platforms or solutions were used. The summer and winter tool to predict thunderstorms or gust probability predictions (see deliverable D5.2) as well as tools of the platforms A4FIN and A4EU. Other self-protection tools used by the company include the Ilmanet portal for wind gust fractures, probability forecasts for wind gusts, mean wind forecasts, the LUOVA early warning system, a discussion and briefing service for meteorologists as needed, public websites from the Finnish Meteorological Institute and forecasts from Finnish/Norwegian weather authorities. The following findings were derived

- Self-p* tools are used on a daily basis to maintain situational awareness and the risk of harmful weather events occurring.
- Self-p* tools are not used when there is a low risk of harmful weather events occurring.
- The tools wind fractals, weather maps and probability forecasts are used daily in the enterprises involved.

Findings on information sharing within the involved enterprises

- Information on self-protection is shared through websites, social media, own customer publications and all mass channels.
- Information on self-protection is shared with the South Savo Communication Group and cooperating enterprises.

The company uses Facebook and Twitter to disseminate information in dangerous situations and to digitise errors. Customers can also send images of errors and private messages to the company via social networks. The trend is towards digital communication instead of telephone service. In the future, information about social networks will be distributed automatically.

3.1.2 Catalunya: Weather & Food logistics

The case study of Catalonia: Weather & Food logistics has been carried out with the collaboration of the Council of Food Distribution Companies of Catalonia (CEDAC), represented by one of its associates.

In the course of the case study, several meetings were held with the logistics and transport managers of the company. From the analysis of the minutes of these meetings as well as the different work e-mails exchanged during this period, the following Lessons Learned are extracted:

Motivation for the subject of self-protection

- Self-p* tools are essential for the company, since the food logistics sector is affected by any incident affecting the road network and the accessibility to the serviced shops, due to impactful weather or any other type of incident.
- The use of self-p* tools makes it possible to forecast the impacts on the road network and adapting the planned deliveries as far as possible.
- Stakeholders were interested to use self-p* tools if they imply a clear benefit (particularly from the economical point of view) and are adapted to their working methodology.
- Self-p* tools should be easy to use and provide information in a clear and efficient way.

Findings on improvement potentials of the general self-protection and the ANYWHERE components

- It is useful that the self-protection tool translates the forecasts in terms of impact of the weather on the road and circulation conditions, as it facilitates the understanding and analysis of the situation.
- The forecasting horizon must be adapted to the needs of the sector. In the case of perishable products, a two-day horizon is appropriate, as it offers room for manoeuvre to take preventive measures.
- Using the same information as civil protection works is one of the most beneficial points. Working with the same information can help to anticipate and better understand the different preventive measures that might be taken by the authorities.

Findings on the usage behaviour of self-protection tools

- Self-p* tools should be easy to use, practical and intuitive. Including additional information can be unhelpful, making the interpretation of the information more difficult and time-consuming. In the case of logistics platforms, the self-p* tools should consider all transportation modes used in the supply chain. Including the state of the sea to identify the impacts of weather on maritime transportation is seen as an interesting improvement.

Positive and negative experiences with ANYWHERE components

- Since the tool focuses on winter conditions, it is meant to run on a daily base during the winter period (from November to April). The tool is used to adapt the food distribution according to the forecasted impacts on the road conditions, and especially during snow events, to follow the evolution of a given situation.
- The real benefit was on the measurement of the impact, which was used to anticipate the impact on the scheduled routes for the next two days, allowing the route managers to adapt the logistics and delivery.
- It is also used to anticipate episodes that may affect large areas of the territory (and therefore a large number of stores), so that preventive measures can be taken to reduce economic and material losses (e.g. shipping products before the forecasted event, or cancelling the delivery to certain shops).
- The demonstration period of the case study has coincided with a particularly mild winter, with no major snow event outside the mountainous areas, so no major conclusions can be drawn about the interest of the developed tool in this kind of situations.

3.1.3 Catalunya: Flash floods & camp sites

The case study of Catalonia: Flash floods & camp sites has been carried out with camp sites in flood prone areas of Catalunya. During the case study interviews with six representatives of camp sites were performed. In the course of the case study, several meetings were held. Findings form the conducted interviews are presented below.

Motivation for the subject of self-protection

- During the period several hazard may occur on a camp site. In order to be prepared and to protect the citizens on site self-p* need to be increased before, during and after an event.
- A support tool for campsites site operations included flood-info and sensor-data, official warnings and self-p* plans were not available before anywhere.
- Anticipation during flash flood events can be increased substantially using measurements in the headwaters and radar rainfall nowcasting.

Findings on improvement potentials of the general self-protection and the ANYWHERE components

The potential for improvement in self-p lies in*

- The better connection between campers and managers,
- Usage of different sources of data are accessible in a straightforward manner
- Easily include the self-* plans in real situations
- Accelerate the reception of official warnings from the meteorological service

Positive and negative experiences with ANYWHERE components

- Representatives confirmed willing to integrate the tool into their campsite organization structure as it is easy to understand and the aggregation of information from the MHEWS provides a real benefit for all stakeholders.
- The camp site tool with its connection to other ANYWHERE tools and the MHEWS improves the campsite self-protection.
- The information about the steps to follow in case of an event is very valuable

Findings on the usage behaviour of self-protection tools

- Usage was clear and straight forward. Some issue regarding navigational aspects have to be fixed.
- The incorporation of the tool will increase the awareness of flood risks.

- Each participant configured the tool at their own needs successfully.
- Partly participants agreed that the tool will help to carry out more preventive actions.
- Beside the management and the campers, the camp sites workers which are in direct contact with campers will benefit with regard on a knowledge in self-p*
- However, one major challenge to address is to educate the workers adequately. Because of staff rotation a clear concept with regard to the local circumstances needs to be adapted.

3.1.4 Liguria: Flash floods & schools

The Ligurian case study related to flash floods & schools has been developed following a participative approach. The first months of development have been aimed at building-up a team composed by a group of school directors, teachers and parents, representing several schools located in the most flood-prone area of the city of Genoa., civil protection operators and ANYWERE partners.

These representatives participated in several meetings in which the user requirements as well as the aim of the service for schools has been defined in detail, following a participatory approach with the stakeholders that ensure the definition of a service that is compliant with their needs.

Findings form these meting and are presented below.

Motivation for the subject of self-protection

- In the past, also recent (2011, 2014) several flash floods occurred in the urban area and, in some cases, most of the casualties were related to schools. In order to be prepared and to protect the people (especially parents that are try to reach the schools in very risky conditions) clear information on the current situation before, during and after an event is crucial.
- A support tool for parents allow them to have a direct information about the emergency status of the schools in which their children are. Increasing the awareness of the parents about the management of a flood emergency will increase also their confidence in the Civil Protection system and their overall safety. The trigger of this tool is supported by the other tool developed within Anywhere from the site operations included flood-info and sensor-data, official warnings and emergency plans available at the municipality level.

Findings on improvement potentials of the general self-protection and the ANYWHERE components

The potential for improvement in self-p lies in*

- The better connection between schools and emergency managers at municipality level,

- The better connection between schools and parents,
- Easily include the self-* plans in real situations

Positive and negative experiences with ANYWHERE components

- The system has been evaluated as useful by the civil protection operators because it allows know where the critical situations related to schools are.
- The system has been evaluated as useful by parents because it allows to know which is the safety and security situation of the children in case of flood, in each school that is located within the city.
- Representatives of the Municipality of Genoa confirmed the willingness of integrate the tool into their emergency management tools.
- The school tool, in connection with the ANYWHERE MHEWS, helps in improving both the CDG response capacity and the parent's self-protection and awareness.

Findings on the usage behaviour of self-protection tools

- Usage was clear and straightforward based on an app (TELEGRAM) well known by parents. Some issue regarding navigational aspects have to be fixed.
- Incorporate the tool developed in ANYWHERE with the tools already developed in TELEGRAM and use by the Genoa civil protection.
- One major challenge to address is to explain and train the teachers, which are the main actors in providing information related to the children, in using it adequately.

3.2 Case study analysis: Perspective on study outputs and workshops

As stated initially, case studies were performed based on a knowledge base cumulating backgrounds of crisis and emergency management, ethics, law, risk communication, computer science and sociology. One of the aims behind case studies was to contribute to existing, potentially relevant guides and manuals. These were continuously evaluated in parallel to case studies. From the perspective of existing guides and manuals, the results of the case studies lead to the following Lessons Learned.

Since there are documents, guides and recommendations in the literature for various industries, these will be discussed additionally with respect to the work plan as an add-on activity. The existence is not restricted to national level. An association of representatives of the nations around the world have determined rules and guidance relating to the climate protection or the international data and privacy protection. In Europe the EU guidance for a wide variety of topics like product safety or medical devices is available. The Federal Office for Civil Protection and Disaster Relief (BBK)

is the representative for the various authorities and organisations. For example, the agency publishes advises for the storage of goods or rules on how to behave in different crisis situation. Each organization offers rules and guidance for its specific area. There are volunteers in almost all areas. For example, they worked in sports such as football or basketball. But even after a complex disaster such as a terrorist attacks or natural disasters like flooding, they provide help. As a result of the unlimited existence of guidelines and in the event of a disaster or critical situation, a literature research was carried out. In this context, guidance is most relevant for PPDR, enterprises and citizens. Each of these three groups is affected in the event of an incident. The impact of a critical situation is different. PPDR manages the situation and helps those affected. In addition, volunteers support the aid organizations. These volunteers are citizens. The citizens can take on the role of a supporter or affected person. Enterprises play a different role in the event of an accident. They must protect their corporate value. Logistics or transport enterprises do this by observing a time limit. In order to achieve this objective, it may be necessary to change the route in the event of weather conditions or danger to the road. Therefore, the literature offers a lot of documents on guidance relating to different topics like communication, behaviour pattern and rules of conduct.

Table 2 contains an extract of existing guidelines relating to one of the three groups consisting of PPDR, enterprises and citizens.

Table 2 Documents relating to guidelines for PPDR, Enterprises and citizens

No.	Title	Author	Date	Source	Guideline for
001	Disaster Response: Guidelines for Establishing Effective Collaboration between Mobile Network Operators and Government Agencies	GSMA	2012	https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2013/01/Guidelines-for-Establishing-Effective-Collaboration.pdf	PPDR Operator
002	Global Disaster Alert and Coordination System – Guidelines for the use of GDACS tools and services in emergencies	GDACS	2014	http://www.gdacs.org/Documents/GDACS%20Guidelines%202014_-_FINAL.PDF	PPDR Citizens
003	ELSI Guidance – Effective, efficient and ethical collaborative information management	ELSI	2016	http://isitethical.eu/	PPDR
004	Communications Plan and Media Guidelines	Red Wing	2015	https://www.red-wing.org/media/files/departments/administration/information_technology/2015CommunicationMediaFinalFinal.pdf	Enterprises (Operators)

No.	Title	Author	Date	Source	Guideline for
005	A Practical Guide to Public Information during a Crisis	NATO Civil Preparedness Civil Protection Group	2017	https://www.nato.int/nato_static_fl2014/assets/pdf/pdf_2017_06/20170612_170612-Budapest_Guidelines_en.pdf	PPDR
006	Professional Standards for Protection Work	ICRC	2013	https://www.icrc.org/eng/assets/files/other/icrc-002-0999.pdf	PPDR
007	Emergency Guidelines for Citizens	Mission of the European Union	2013	https://www.eda.admin.ch/content/dam/countries/countries-content/the-republic-of-korea/en/Emergency-guidelines-April-2013_en.pdf	Citizens
008	Guidelines on Cooperation between the United Nations and the Business Sector		2009	http://www.un.org/ar/business/pdf/Guidelines_on_UN_Business_Cooperation.pdf	PPDR Enterprises
009	Towards a Code of Conduct: Guidelines for the Use of SMS in Natural Disasters	GSMA Disaster Response	2013	https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2013/02/Towards-a-Code-of-Conduct-SMS-Guidelines.pdf	Citizens
010	ICCA publishes guidelines on crisis management for associations	ICCA	2015	https://www.iccaworld.org/newsarchives/archivedetails.cfm?id=4914	Enterprises
011	Crisis communication guidelines and response plan	Government of the Republic of Trinidad and Tobago	2011	http://odpm.gov.tt/sites/default/files/Crisis%20Communication%20Guidelines%20and%20Response%20Plan%20DRAFT.pdf	PPDR Citizens
012	Mobile Crisis Intervention – Practice Guidelines	Emergency Services Program	2015	http://www.mass.gov/eohhs/docs/masshealth/cbhi/practice-guidelines-mci.pdf	Citizens
013	Corporate social responsibility – voluntary guidelines	Ministry of Corporate Affairs – Governe	2009	http://www.mca.gov.in/Ministry/latestnews/CSR_Voluntary_Guidelines_24dec2009.pdf	Citizens

No.	Title	Author	Date	Source	Guideline for
		ment of India			
014	Crisis management and communications planning reference guide	The mining association of Canada	2016	http://mining.ca/sites/default/files/documents/Crisis-Management-and-Communications-Planning-Reference-Guide-2016_0.pdf	PPDR
015	A Practical Guide to Public Information during a Crisis (Budapest Guidelines III)	NATO Civil Preparedness Civil Protection Group	2017	https://www.nato.int/nato_static_fl2014/assets/pdf/pdf_2017_06/20170612_170612-Budapest_Guidelines_en.pdf	PPDR
016	Vorsorge im Katastrophenfall	Federal Office of Civil Protection and Disaster Assistance (BBK)	2017	https://www.bbk.bund.de/DE/Ratgeber/VorsorgefuerdenKat-fall/VorsorgefuerdenKat-fall.html	Citizens
017	Business Continuity Planning Guidelines	Texas Department of Information Resources	2004	http://www.epcc.edu/IT/InformationSecurity/Documents/Business_Continuity/Business_Continuity_Planning_Guidelines.pdf	Enterprises
018	Business Continuity Guidelines – Strategies and Responses for Surviving Critical Incidents	Cabinet Office, Government of Japan	2014	http://www.bousai.go.jp/kyoiku/kigyou/pdf/guideline03_en.pdf	Enterprises
019	Ensuring Food Safety in the Aftermath of Natural Disaster	World Health Organisation	2005	http://www.searo.who.int/entity/emergencies/documents/guidelines_for_health_emergency_fsadvice_tsunami.pdf?ua=1	Agencies PPDR Citizens
020	Business Continuity Planning	Federal Financial Institutions Examinat	2003	https://www.fdic.gov/regulations/examinations/supervisory/insights/sisum06/bcp.pdf	Enterprises

No.	Title	Author	Date	Source	Guideline for
		ion Council			
021	Building a Business Continuity Plan – Guidelines for preparation of your plan	AIG Europe	2013	https://www.aig.co.uk/content/dam/aig/emea/united-kingdom/documents/property-insights/business-continuity-planning-guidelines-for-preparation-of-your-plan.pdf	Enterprises

Diverse institutions and organizations offer documents on guidance relating to their specific field of action. Next to this the focus of this material differs. Partially the documents form one organization refers to different topics. For example, a document for disaster management focus on the communication between PPDR and citizens or citizens among each other. Another one deals with behaviour pattern or with the development and implementation of a disaster platform which offers a lot of functions. Next to differences of documents inside one organisation, the content respective to one topic differs also form each organisation. Certainly, documents relating to one topic contains general information that can be found at each other one. Therefore, similar documents on guidance were analysed and general information was summarized. This will be done in the following exemplary. For this purpose, documents on the guidance for the development of platforms like websites generate the base.

In this connection documents have been analysed respective to existing material and common or general information was identified. After the data collection was finished, categories for Lessons Learned were identified. These main LL are:

- Coordination, communication and points of contact
- Technical implementation
- Operational aspects
- Data protection and privacy
- Situational information

The first bullet (coordination, communication and points of contact) covers the choice of the channel, the information that has to published and the possibility of interaction with the users. The channel offers a dialogue, comments or a chat function where topic related chats can be generated. Beside the interaction with different users, channels should offer a range of additional functions. For example, alerts and warnings should be classified relating to the type of incident and coloured by a range of three or four colours that indicate the importance and potential risk for the public. During the technical implementation of functions, the location has to be adapted, next to maps

and satellite images. Another class deals with the operational aspects and especially with the operational environment. This constitutes the initial position. It´s a data collection for each predefined country, like baseline data, operational priorities and security situation. But also, information about potential risk belongs to this class. In case of an occurring incident an information overview with chronological sorted news has to be available for the user. Citizens are also interested in requests and information exchange. In case of requests the status (closed, in process or currently requested) of them is necessary.

The collection of available documents and reports on guidance and the classification of them makes not the demand of completeness. Rather it is an extract of the most common existing ones.

3.3 Case study analysis: Perspective on business continuity

One of the foundations during the project proposal and project setup phase was the fact that Business Continuity Management (BCM) is important for stakeholders. BCM is an important management system for the analysis of risks and preparation for all types of hazards that can influence operational continuity. The previous consideration of the BCM standard is limited above all to the stagnation of the world economy, political unrest and the sovereign debt crisis.

3.3.1 Extended background

There are many models and methods for the implementation and systematization of BCM, which are similar in approach, but differ in detail and can comprise between four and nine phases. They all have in common the elements of risk analysis, solution development, implementation, exercise and maintenance of plans, as well as cultural embedding. Since 2002, the BCM life cycle according to BCI (Hunziker and Meissner 2017, 186 f), which is subdivided into six phases, has prevailed.

The robustness of the business model and its processes is important for operational continuity. Consequently, it must be ensured that the interactions with the company's environment are continued. Because without resources that the company uses, business cannot be kept going (Rössing 2005, 15).

If critical processes are interrupted, damage occurs first. The longer the interruption lasts, the higher the loss, which ultimately endangers the company's existence. It is not important which trigger the event has, because the effect is always the same. The operational continuity is constantly disturbed and in the worst case leads to insolvency (Rössing 2005, 15). The field of risk analysis identifies and evaluates possible dangers that result in the failure of business processes and serves as a basis for decisions on measures to be implemented (Erb 2017, 43). Risk analysis begins with risk identification. While in Business Impact Analysis (BIA), the consequences of a process failure for a company are considered, in risk analysis the possible causes for the failure are considered at process level and resource level.

The holistic view of the company plays an important role here, because the restoration of IT alone does not save a company (Rössing 2005, 17). Possible failure scenarios could be:

- Delivery failure for raw materials, consumables and supplies
- Failure or malfunction of an outsourced sub-process
- Failure of a service provider
- Failure of the external power supply
- absenteeism
- loss of a key person
- Inaccessibility of the premises

Every enterprise differs from other enterprises depending on the sector and type of products and services it offers. They are structured in different ways and have different processes and value chains. For example, a company's activities can be subdivided into design, manufacturing, marketing, delivery and product support. It is therefore difficult to identify generally business-critical processes in a company without examining the company more closely. Michael Porter examines the value chain of a company and its interactions. The value chain divides a company into strategically relevant activities. It consists of nine basic types of activities that are characteristically linked to each other (Porter 2014, 63 ff). The following figure shows a value chain of a company that can be detailed differently depending on the sector. It is divided into two general types, primary and supporting activities. The primary activities deal with the physical manufacture of the product and its sale and transfer to the customer as well as customer service. For each enterprise, the primary activities can be divided into five categories Figure 5. The supporting activities are related to certain primary activities but also support the entire chain (Porter 2014, 67 ff).

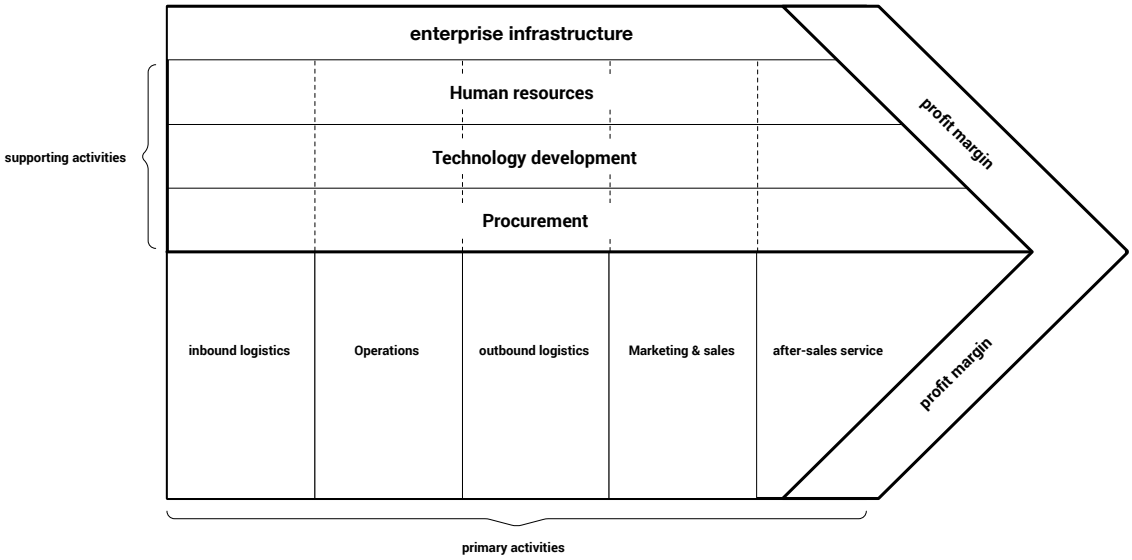


Figure 5 The model of a value chain (Porter 2014)

The longer the failure of a critical activity persists, the more difficult it becomes to ensure operational continuity. Without a well thought-out and tested emergency concept, this is also made more difficult. Due to the many possible extreme weather events, enterprises would have to consider every possible source of disruption and draw up an emergency concept for each. Due to the large number of extreme weather events, many business continuity plans (BCP) would have to be drawn up. This would have the disadvantage that in an emergency the right BCP would have to be found from a large number of suitable ones. This can lead to delays in the introduction of immediate measures. Therefore, not every scenario should be considered individually, and the focus should rely on the impact for the enterprises. Several extreme weather events can thus be combined into one type of failure because they have the same impact on the company. The “power failure” can therefore have different causes. This can happen in the event of a thunderstorm due

to a lightning strike or flood. Nevertheless, the damage management is the same. Possible failure scenarios are shown in Table 3.

Table 3 Failure scenarios

Downtime/ Impact	0-1 days	1-2 days	3-5 days	> 1 week
Personnel shortfall	Black ice, loss of public transport due to storm	Black ice, loss of public transport due to storm	Black ice, loss of public transport due to storm	Injured employees due to fire in the company as a result of prolonged drought or earthquake
Failure/ inaccessibility of premises and resources	Power failure due to storms, damage to buildings or destruction due to fire or water damage as a result of prolonged drought or heavy precipitation, earthquake	Power failure due to thunderstorms, damage to buildings or destruction by fire or water damage as a result of prolonged drought or heavy precipitation, earthquakes, or	Damage to buildings or destruction by fire or water as a result of prolonged drought or heavy precipitation, earthquakes, etc.	damage to buildings or destruction by fire or water as a result of prolonged drought or heavy precipitation, earthquakes.
Failure of process plants	Power failure due to thunderstorms	Power failure due to thunderstorms	Systems are damaged by fire or water damage as a result of prolonged drought or heavy precipitation, earthquakes, water damage, etc.	Systems are damaged by fire or water damage as a result of prolonged drought or heavy precipitation, earthquakes, water damage, etc.
Failure of suppliers	Emergency/crisis with the supplier	Emergency/crisis with the supplier	Emergency/crisis with the supplier	Emergency/crisis with the supplier

For the continuity strategy to be developed, the effects “loss of personnel”, “failure/inaccessibility of operating buildings and resources”, “failure of process plants” and “failure of suppliers” played an important role for in all case studies.

The management of a crisis by an extreme weather event succeeds if the company is prepared for such an event by carrying out a BCM planning process as well as having a running BCM before the occurrence of the disaster. In order for a company to be able

to ensure business continuity in extreme cases, it is crucial to consider all supply chains and stakeholders that play a key role for the company.

In order to ensure business continuity, various planning and analyses must be carried out in advance. Since a complete avoidance of all risks is not only impossible, but also undesirable for economic reasons, a strategy is developed within the scope of this work for a maximum maintenance and restoration of the critical processes of a company during a crisis. In the following chapter, business-critical processes of a logistics company and an energy supply company are identified in order to set up measures for maintaining or quickly restoring the identified processes. An emergency strategy is derived from the objectives and the evaluation of the individual activities of the company. The goal of the company should be to reduce downtime, minimize recovery time and ensure a structured emergency process.

3.3.2 Case study: BCM-Strategy for energy suppliers

An energy supply company is a company which is active in the field of energy supply and can fulfil various functions. A distinction can be made between power generators that operate a power plant to generate electrical energy which is then fed into the power grid. On the other hand, a grid operator, who operates the electricity grids in order to conduct the energy to the customer. Accordingly, enterprises are regarded as energy supply enterprises if they are involved in generation, procurement or transport. They therefore do not have to be directly involved in generation, but can also take over all functions from generation through networks to customer support.

The analysis phase is divided into two phases. In the first phase, the business areas and their dependencies are analyzed to identify the time-critical processes and resources. In the second phase, the location-related threat situations are examined.

The two most important tasks of a utility are power generation and power distribution. For the further procedure, an energy supply company is investigated that also generates its own energy sold by it.

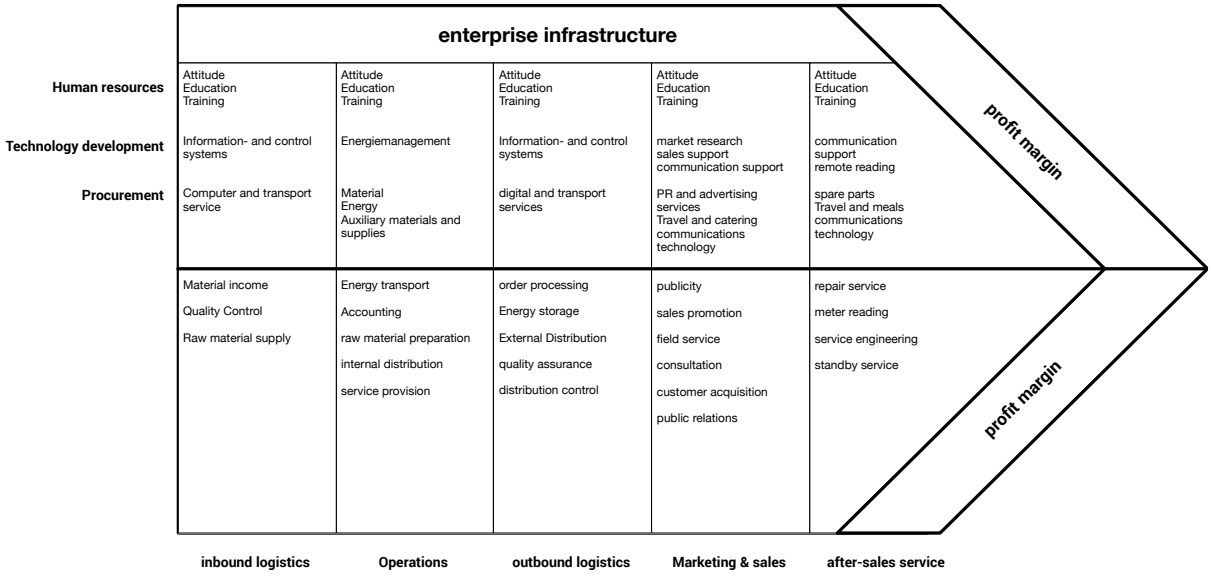


Figure 6 Value Chain of an energy supply enterprise

In WP5 it was determined how critically evaluated processes can be affected in the event of an extreme weather event and how these can be safeguarded or produced as quickly as possible. This will be concretely demonstrated on the basis of an energy supply company. The main objective is to secure the energy supply and generation.

Loss of suppliers

The procurement as supporting activity cannot pursue its function of the procurement of raw materials, auxiliary materials and operating supplies with loss of the supplier of its function. This has influence on nearly all primary activities. If thus a supplier precipitates, concerns above all the procurement. This leads to the fact that the primary activity “input logistics”, “operations” and “output logistics” comes due to the failure of the supporting activity “procurement” sometime to the stop. This would have a high financial damage for the enterprise, if the enterprise cannot be taken up as fast as possible again. In the worst-case scenario, electricity generation and distribution would have to be suspended for a certain period of time. Since it can be assumed that the different suppliers of an energy supply company have different locations and that an extreme weather event is usually local, it is very unlikely that several suppliers will fail at the same time. It is therefore assumed that an important supplier will fail.

Suppliers can fail for various reasons due to an extreme weather event. This means that the event does not have to take place on site at the company. Storms could damage buildings and vehicle fleet, prolonged drought could cause fires or heavy precipitation could cause flooding, temporarily preventing suppliers from performing their delivery activities.

Transport by sea can lead to delivery difficulties due to an increasing number and intensity of storms. River transport may be disturbed by low levels due to prolonged droughts, as navigability may be restricted. This can lead to a shortage of raw materials

if the company is unable to deliver if there is not enough stock in the warehouse. A distinction must be made here between one of several alternative resources or one that has no alternative. For alternatively usable resources, however, this will fail completely if the supplier fails, but the performance can be maintained for a certain period of time by the alternatively usable resources. However, if a resource that cannot be replaced by another resource fails, the performance of the service comes to a standstill. The decisive factor here is how long the supplier is unavailable. A failure of a few days can bridge the company with the stock. If, however, a breakdown of more than one week is to be expected, the warehouse stock may not be sufficient for further performance. Since electricity is difficult to store, often only the required amount of electricity is generated and fed into the distribution network. This means that the distribution of electricity, one of the most important tasks of an energy supply company, is no longer possible. One possible measure is to increase stocks so that a certain amount of time can be bridged in the event of a crisis. This is again not always possible or also economically not meaningful. Therefore, it should already be taken into account when selecting suppliers that the BCM culture is also anchored at the supplier. BCM requirements can be agreed in contracts with suppliers so that they are obliged to implement these requirements. This means that the supplier himself can react quickly to a failure, so that the delivery activity can be resumed quickly. It is also in the supplier's interest to keep downtime as short as possible (Erb 2017, 145). A supplier analysis when assessing new potential suppliers can help to select suitable suppliers in this respect. In this way it is possible to identify problems and possibilities in the supplier relationship at an early stage and to influence the supplier selection accordingly. Since this is only a snapshot when concluding a contract, suppliers should be visited regularly on site to get an idea of the robustness of the supplier. Strategic purchasing should take this threat into account when selecting suppliers. A sustainable procurement strategy can help to bridge the risks for the company in the event of the failure of a supplier by obliging several equal suppliers. So if supplier 1 fails, supplier 2 could still continue to supply. (Büsch 2011, 62)

Failure / inaccessibility of buildings

Building parts or the entire building cannot or must not be used because they have been damaged by flooding due to fire or water damage. This scenario should already be partially covered by a fire protection concept in the company. Workplaces should therefore be set up and operated in such a way that they do not pose a risk to employees at work. This is regulated by the Industrial Safety Ordinance and the Ordinance on Workplaces. According to the provisions of § 10 Para. 1 of the Occupational Safety and Health Act, the employer must take the measures necessary for first aid, fire-fighting and evacuation of employees depending on the type of workplace and activities and the number of employees. In the event of a breakdown of the company building, an alternative location would have to be created for the continuation of operations. The prerequisite is that an alternative location is available. This would have to be available even before the crisis or it would have to be possible to organise it quickly. Another possibility would be a home office for critical processes whose work is not tied to the company's infrastructure. It would have to be ensured

that access to the internal network is available so that work can be continued from home.

A central task here is the facility management of a company, which concentrates on the administration and management of existing buildings. A common solution is the use of so-called “hot sites” to ensure access to business-critical information (Nävy 2006, 12 ff). Frequently, however, premises are required where employees can continue to work in the event of inaccessibility to their workplace. The task of facility management is to find premises for emergencies that are as close as possible to each other. Ideally, this measure should be taken before the acute crisis occurs.

An alternative would be that the dependency of the workplace is not dependent on a central location. In this way, the company can invest in a flexible and mobile workforce so that it can work from anywhere. Because if the work is not dependent on the location, the susceptibility is reduced in the event of a breakdown of company buildings. In the event of flooding or another catastrophe, employees can continue to work from another location as usual.

Personnel shortfall / absence of personal

The absence of personnel can have different reasons. A storm could lead to temporary inability to use public transport due to storm damage. As this is limited to a few days and only affects part of the workforce, it would not have a major impact on business continuity. Nevertheless, it would lead to economic damage if work could not be started for a while. One way to continue working would be to have a home office so that employees who cannot reach their workplace can work from home. It should be ensured that access to the internal network is available.

A loss of several people could occur if the workforce is injured by a fire in the company. One measure could be to deploy employees from less critical processes. To do this, fewer critical activities would have to be reduced or discontinued in order to deploy employees for critical business processes. Here it would be necessary for employees to be trained in advance to work in other departments or to perform new tasks. The employees of the technology development could temporarily stop their actual task so that these can be used for other activities. The failure of a key person with singular or special knowledge with special powers of action, such as members of the management, for example, it is necessary to appoint a deputy who is instructed in the key functions. This should be prepared for the deputy's task through training and education.

3.3.3 Case study: BCM-Strategy for logistics

The creation of logistics services by logistics enterprises can be understood as a service. Their business purpose is the transformation of goods in space and time. Logistics is understood to mean processes, facilities and procedures that directly serve the transfer and storage of objects (Rümenapp 2002).

The dependency of logistics enterprises on major customers can vary. According to a survey by Wittenbrink, the sales share of the largest customer is more than 30% for

many enterprises, which means a high dependency on a few or even only one major customer. Especially here the enterprises are strongly affected in the event that the major customer is temporarily or completely absent. Here a dependence on only a few or one major customer should be avoided or be prepared for the case that the major customer fails (Wittenbrink 2016, 9). Due to the decreasing stock levels due to new logistics concepts, logistics enterprises must be able to guarantee the security of their processes at a high level.

The core processes of a logistics company are transport, transhipment and warehouse processes. Under transport the spatial transformation of goods is understood and the location the temporal change. Transhipment processes are the handling of goods, i.e. the loading and unloading of goods or the sorting of goods in the course of picking goods (Röth 2011, 63 ff). For the further procedure a logistics company is examined, which specialized in truck transport. Figure 7 shows the value chain of a logistics company according to the Porter scheme.

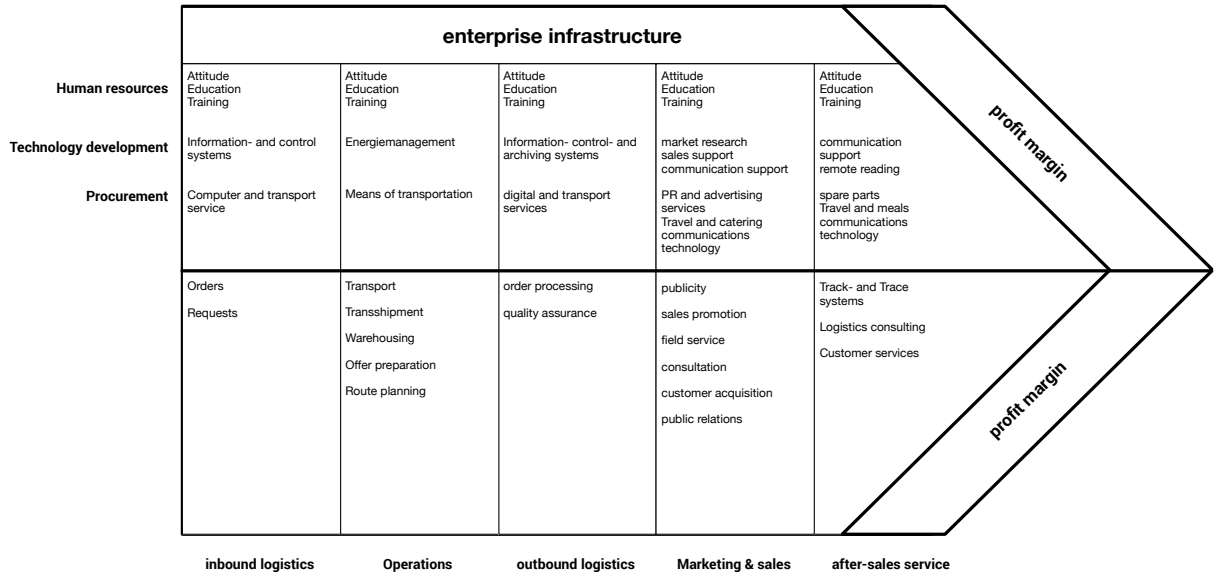


Figure 7 Value Chain for logistic enterprises

Within the scope of this work, measures will be developed how critically evaluated processes can be saved or restored as quickly as possible in the event of an extreme weather event. This is substantiated on the basis of a logistics company.

Absence of personnel

The absence of personnel is very critical for a service company such as a logistics company. Especially in the primary business processes a absence of personnel has a critical effect. The absence of personnel as a result of an extreme weather event would hit the location itself particularly hard, since many employees are employed at one location. Employees who are on transport routes can occasionally be absent, depending on whether they are in the area of the event. However, it is very unlikely that all professional drivers will be absent. This should not have a particular impact on business continuity. However, in order to avoid a breakdown, it is important that they are warned of an extreme weather event at an early stage in order to take an alternative

route. This could be done by a navigation system that is integrated with a weather warning or by other employees who can follow the events with a weather warning and contact the affected drivers in an emergency.

Inbound logistics, operations and outbound logistics employees have a key function for the company's profit. They retrieve and process orders, plan routes and send quotations. If the personnel in these functions were to fail, this would have a critical effect on business continuity, as there would be no new orders and the company would therefore not be able to generate any further revenue. Depending on how the company is positioned, a few days of downtime can be absorbed. The longer the loss of income, the more difficult it will be to continue the business.

If the staff is unavailable because the work location cannot be reached by extreme weather events such as flooding, home office is a good option. Precautions must be taken in advance so that every employee has access to the internal network in order to work from home. Or the company may have another location so that activities can be relocated to other locations. In an emergency, this would have to be coordinated by a responsible person who would consult with the employees.

If the extreme weather event affects the branch itself, for example through a fire, condemned by prolonged drought, the loss of personnel through injury and in the worst-case death could be high. As already explained, employees from less critical processes could be deployed in the critical processes. Another possibility is to transfer critical activities to external service providers or cooperating enterprises when the workload is no longer absorbed by the company's own workforce because the loss of personnel is too high. External personnel from personnel service providers could also be used to absorb the temporary shortage of personnel. The advantage is that customers can continue to be supplied and do not lose confidence in the company.

Failure / inaccessibility of buildings

The measures taken in the event of failure of the building correspond as far as possible to the measures and precautions discussed before.

In the event of an outage of the premises, for example due to damage caused by a storm, it must first be ensured that all employees are evacuated and brought to safety. In order to continue the work nevertheless, an alternative location must be provided. The advantage of a logistics company is that it is an infrastructure-independent company. If all the data is available at another location, the work can be continued there. If the loss of the company building is foreseeable and does not last long, it can also make sense to use hotels and conference centres for cost reasons.

Facility management should therefore ensure that an alternative location is available or contact hotels and conference centres at short notice in the event of a crisis. In order to ensure rapid action in the event of a crisis, lists could be drawn up in advance on which possible hotels and conference centres are listed, which can then be contacted quickly if necessary. In this way, important time can be saved for research during an acute crisis and direct action can be taken.

It is also possible for a logistics company to reduce the dependency of the workplace on the central location so that a breakdown of the company building does not have a major impact. Due to the infrastructure-independent mode of operation, this is even easier here, since only internal network access is required. To do this, the company would have to invest in a flexible and mobile workforce.

Failure of process plants

Computer and communication systems and means of transport (trucks) count as the most important “systems” in order to guarantee the provision of services.

The failure of computer and communication systems would lead to quotations or route planning no longer being able to be prepared and would lead to economic damage. This could happen, for example, if the power fails due to a lightning strike. In this case, emergency power generators could guarantee energy supply independently of the local power grid. In this way, normal operation can be continued for the time being.

A failure of the means of transport would also lead to economic damage, as the provision of services would no longer be possible without means of transport. A scenario in which the majority of the means of transport fails could be a drought-triggered fire that destroys parked means of transport. It should be noted, however, that normally most means of transport are on a transport route to deliver to the customer. So this scenario would only be conceivable on weekends if the company only offered its services on weekdays. In order to counteract the loss of the entire means of transport, it is advisable not to accommodate all of them at one location. In this case, only part of the means of transport would fail.

Should it nevertheless happen that all means of transport fail, it would be conceivable to use means of transport from external providers as long as the insurance matters have not been clarified. Even if the insurance covers the damage, it will take time for the company not to be able to carry out any further orders. This would have the advantage that customers could still be supplied and would have to fall back on competitors. Thus, the existing customers can be held further, the confidence of the customers remains further, and an image damage can be averted. The disadvantage is the high costs that arise from the provision of external means of transport.

Loss of suppliers

A logistics company is not supplied by suppliers, so this would have no influence on business continuity.

However, the loss of a major customer would be a similar scenario and would have a negative impact on the logistics company. If the company's turnover is strongly tied to one or a few customers, the loss would lead to economic damage that could be so high that the company would have to file for bankruptcy. Due to increased efficiency and cost pressure, enterprises reduce their security stocks. As a result, they are also more susceptible to unexpected events. As a consequence, the dependency of the company on sales or earnings losses of other enterprises increases. Accordingly, the goal should be to reduce the dependencies of the most important customers (Huth and Romeike 2015, 210). According to Wittenbrink, 48% of enterprises are more than 30%

dependent on a major customer for their revenue share (Wittenbrink 2016). Here, additional market and sales-related measures are urgently needed to attract new customers.

3.3.4 Case study: BCM-Strategy for camp sites

The number of sites on a campsite can range from an average of 30 sites for smaller facilities to over 400 for larger facilities, depending on the size of the campsite. The number of employees also increases with the size of the site but remains relatively low. Smaller facilities have an average of 3 employees and larger facilities 10. The larger the plant, the more leisure activities are offered which justify the increased personnel expenditure (BTE Tourismus 2019).

Camping sites usually have facilities for personal hygiene and toilets. Facilities such as shopping facilities and restaurants are also part of many campsites and are usually leased out by external service providers. Campsites that manage their own retail trade and gastronomy have a higher staff requirement (BTE Tourismus 2019). If these facilities fail due to storm damage, for example, alternative sanitary facilities must be provided.

Depending on the location and hazard situation, campsites must prepare for possible extreme weather events by taking precautions, as they have always been strongly dependent on the weather. Heavy rainfall in conjunction with storms and thunderstorms increases the risk of injuries and storm damage. People outdoors are then particularly at risk, as it can be assumed that people will be on the camping site in the event of an extreme weather event. For this reason, campsite operators should draw up a concept in advance to ensure the protection of persons in the event of a crisis (VDE e.V. 2019). Depending on national and regional legislation, such preparation may be regulated and permissions for the campsite business activity may depend on it. With time, if campsites are not sufficiently prepared (according to its own particular situation), this may be a legal threat to the business continuity.

Protective areas should be set up to protect against thunderstorms, because not every camper is protected against lightning strikes in his equipment, as for example in a tent. Guests should therefore be informed on arrival where these protected areas are located and be able to identify them so that they can be visited quickly. A notice at the reception or in other places should inform about the correct behaviour in case of storms. Closed cars and caravans or motor homes with an inner metal frame or outer metal skin also provide protection against lightning strikes. If it is not possible for the campsite to provide sufficient protection, it should be sought in the immediate vicinity, such as buildings and vehicles. Here it is necessary for the operator to coordinate with the respective owners. But storms can also be a danger from falling trees (VDE e.V. 2019). Motorhomes or tents do not offer sufficient protection in this case. If there is a danger of falling trees, guests should also go to protective areas.

In order to issue an early warning, the groundskeeper should obtain predictions for the site from the weather service. He informs the responsible attendants of the groups and other guests about the imminent storm. In this way an evacuation can be started early(VDE e.V. 2019).

Most of the farms are leased. Thus the operating result is burdened by the lease costs (BTE Tourismus 2019). If guests leave early due to thunderstorms, this would lead to a loss of earnings. The loss of income must not be too long, otherwise the costs can no longer be covered.

Campsites near water bodies are also exposed to an increased risk of flooding. In the event of flooding, the campsite operator should issue an evacuation order and point out that gas lines outside the vehicle must be closed and electrical connections disconnected. Notices of evacuation plans help with coordination.

In the event of staff absences, clear rules for representation and procedures should be laid down. Regular operational inspections with external and fire brigades can help to identify and eliminate weak points.

Permanent rental accommodation with overnight accommodation on campsites is not so dependent on the weather. Thus, the loss of campers due to bad weather events could be partially compensated by rental accommodation.

A campsite does not have as many facilities that can be destroyed by extreme weather events, so that its operation will be out of order for a longer period of time.

3.3.5 Case study: BCM-Strategy for Schools

In contrast to logistics enterprises or energy supply enterprises, schools are a “non-profit organisation”. The aim of the school as an organisation is education and training. This takes place in the school building, which is equipped with chairs, tables and other resources(Willems 2008, 817). Thus, they do not pursue commercial goals, but rather the transfer of knowledge and skills by teachers to pupils (Lewinski-Reuter and Lüddemann 2010, 272). How important a BCMS is for enterprises has already been explained in the previous chapter. But schools should also think about this in order to maintain security of action in extraordinary situations. Possible scenarios for schools would be “building failure” and “failure of personnel”.

If, for example, the school building is partially or completely destroyed by a storm or flood, the actual function of the educational mission can no longer take place. In order to still be able to provide this service, an alternative building is needed that is equipped with chairs and chairs. For the time being, these resources are sufficient for emergency operation. The construction of containers at the site means that school operations can be resumed at short notice. This interim solution could be used until the school building is restored or a new building erected.

In order to protect the pupils and teachers during extreme weather events, the school director should terminate lessons prematurely due to extreme weather conditions in order to ensure a safe journey home. In order to support the decision to close the school or to end the lessons prematurely, the risk assessment should be obtained from authorities such as the police or fire brigade. Monitoring the weather service can also help.

Crisis management within the school helps to act effectively and efficiently in crises and to return to normal operation as quickly as possible. The crisis team should consist

of the school management and teachers or employees of the school staff. Their task is prevention, intervention during an acute crisis as well as aftercare. The headmaster bears the overall responsibility. In life-threatening incidents, crisis helpers such as the police or fire brigade should be called in (Schodritz 2013, 42 ff).

In the event of a crisis, the superior service authority must be informed so that it can facilitate further support measures (Schodritz 2013, 51).

In the event of a staff shortfall, the school must endeavour to compensate for the shortfall with substitute teachers.

3.4 Case study analysis: Perspective on risk communication aspects

Risk communication has been considered intensively in deliverable D5.1. The ANYCaRE serious games tool (see updated design and implementation in section 5.3) has helped to identify risk communication aspects.

As already reported in deliverable D5.1. the first test of ANYCaRE experiment using the **flood scenario** was conducted during ANYWHERE's 2nd workshop in Helsinki (September, 2017) with 16 players mainly composed of scientists experts in weather-related hazards, developers and modellers, operational forecasters and emergency managers. Since then, based on the feedbacks obtained in Helsinki another game session testing an improved version took place in Grenoble in January 2018 among 8 members of the ANYWHERE project. This improved version of the flood scenario was then used at three other occasions, twice with Grenoble university students (April 2018 and May 2019) and once with 16 experts attending ANYWHERE 3rd workshop in Barcelona. A scientific paper describing the different steps of the game design and implementation as well as the Lessons Learned has been published in *Natural Hazards Earth System Sciences* journal (Terti et al. 2019).

As a side experiment, the flood scenario game version was also adapted by researchers from UTH Zurich in collaboration with ANYCaRE developers to simulate and test how public information from social media is used in emergency operation centres to make (protective and communicative) decisions. 4 sessions of the game involved a total of 20 participants enrolled in an advanced training course at the University of Geneva, the CERG-C. The CERG-C participants are practitioners or young scientists that work in disaster risk management in various countries worldwide. These experiments and their outcomes are described in details in a scientific paper recently submitted to the *International Journal of Disaster Risk Reduction* (Weyrich, Scolobig, and Patt 2019).

The **strong wind scenario** was played in Mikkeli (Finland) on May 2018 as part of the ANYWHERE pilot site training. The purpose of this game session was to train the Civil protection of the Eastern Finland region, the staff of the external partner, electricity company Järvi-Suomen Energia and the duty forecasters of FMI to learn about ANYWHERE-tools and test their usability through the simulation of a virtual weather crisis. This experiment and its main outcome is also described in details in (Terti et al. 2019) Terti et al. (2019).

Finally, the **multi-hazards cascading event scenario** was tested twice in July 2019 before playing 5 parallel sessions of it during the Finnish EU presidency PROCIV workshop in Helsinki on July 22nd. In total about 80 delegates of the EU participating States actively participated to the game play.

All those game experiments were followed by debriefing sessions were players provided feedbacks on the experiment set-up, the learning outcomes of ANYCaRE and the input data /ANYWHERE-tools presented in the game. The experiments were considered successful since the game was found "to be representative of the reality of crisis management" by players who had the experience of such a situation (for instance PROCIV workshop participants) and "clearly demonstrated the benefit of certain products". The **main Lessons Learned** from those experiments were the following:

- Serious games like ANYCaRE happen to be useful tools to evaluate warning communication, for instance by increasing warning communication literacy and enhancing collaborative capacity (Weyrich, Scolobig, and Patt 2019; Terti et al. 2019);
- The experiments revealed the importance of certain roles in the decision-making chain and taught the significance of co-operation between multiple actors for efficient problem solving (Terti et al. 2019);
- Civil protection practitioners highly rated their ability to apply this learning in their professional environment and they largely proposed the gaming activity as a relevant training tool (Terti et al. 2019)
- Modern impact-based information increase the level of confidence in emergency management decisions (Terti et al. 2019)
- Information from the crowd disseminated on social media leads to better decisions and increases associated confidence levels (Weyrich, Scolobig, and Patt 2019);
- Information from weather spotters, i.e. people trained in meteorology, is more trusted than information from the general public independent of the information quality (Weyrich, Scolobig, and Patt 2019);

Besides its usefulness in analyzing self-p* services/tools in case studies, it was obvious that ANYCaRE serious game seems to have answered a need as it has already received more attention and been used much more than initial expectations. Responding to external demands, further game sessions are already scheduled in September 2019 in the context of the Workshop on extremes and energy transitions held by the JRC at the Ispra site in Italy, as well as in Grenoble INP engineer school and in Météo France forecasting school. Further, experiments may engage either experts or general public to draw more detailed conclusions on the effectiveness of forecast visualisations and delivered warning and emergency messages (i.e., content, structure and format) in terms of comprehension and mobilisation of action; aspects studied through the guidelines proposed in WP5. Players of the game also suggested that it should be made available through ANYWHERE platform and in formats allowing potential users outside of the ANYWHERE project to use it without the intervention of

the initial designers. In this purpose, (Terti et al. 2019) published a scientific paper describing in details the methodological steps needed to design and implement the flood and strong wind scenarios. This paper yet allowed external users to implement an adapted version of the game in order to test the influence of social media information on crisis decision-making (Weyrich, Scolobig, and Patt 2019).

3.5 Case study analysis: Perspective on ethical and legal aspects

The four WP5 case studies (storm induced electricity problems, food supply transportation under snow falls, floods targeting camp sites or schools) provide a framework of good practices to demonstrate ways for dealing with self-p* through the usage of ANYWHERE tools in combination with other systems, platforms and solutions. The analysis of the case studies needs to be undertaken also in light of the important ethical and legal issues that arise with regard to self-p*. Notably, a detailed overview of the (international and EU) legal framework applicable has already been provided in deliverable D1.2, whereas the main ethical, legal and social constraints pertaining to the project and to the case studies have been discussed in deliverable deliverable D5.1. In order to avoid overlapping this section will be concerned with offering an insight into the most relevant ethical and legal aspects, as emerged from the research questions applied to WP5 case studies (see chapter 12 ANNEX 4 Case Study Manual ANYWHERE case study manual).

In ANYWHERE, self-p* includes both preparedness and response measures. Both concepts originate in the increasing recognition of the role that private actors can, and should, play in the event of the face of natural and man-made disasters. The ‘citizen’, in fact, is no longer reckoned as a simply passive beneficiary of the protection bestowed by the State, but is a subject that plays an active role in all the phases of crisis management, from risk mitigation to crisis response. While self-preparedness consists of mechanisms put in place in the pre-disaster phase, including measures and activities that enable different units of analysis—individuals, households, organizations, communities, and societies—to anticipate, respond effectively to, and recover more quickly from the impacts of likely, imminent or current hazard events or conditions; self-protection refers to mechanisms specifically applicable to the response phase.

Broadly speaking, there are two complementary strategies for including self-p* considerations into the mitigation of risks deriving from high impact weather and climate (W&C) events. First, in the pre-crisis phase, information on expected local impacts should be integrated into risk assessment carried out in Multi-Hazard Early Warning System (MH-EWS), and the potentially impacted population should be engaged in collecting this information. Notably, the international instruments, developed in the scope of both climate change adaptation and disaster risk reduction, recognize the need to integrate scientific data on natural hazards and official warnings with local knowledge and vulnerability impact assessments.

The second way self-p* may contribute to enhance protection from high impact W&C events is through information exchange between private groups or individuals during a crisis. On the one hand, public authorities responsible for risk and crisis management

play a central role for information validation and distribution. On the other hand, there is the idea that more dispersed information sharing would also facilitate self-p*. In this case, however, the potential for self-p* interfering with the single official voice principle (SOVP) remains an important concern (Venier and Capone 2019), that has been addressed at length in deliverable D5.1. SOVP is defined as the need to identify a single speaker, e.g. an authority who is officially and solely responsible for providing information during a disaster/emergency/crisis, or for coordinating public announcement (Clarke et al. 2006, 160).

It has been suggested (IFRC 2013, 21) that technological innovations are improving disaster management in all of its phases, including mitigation, preparedness, response and recovery, and have the potential for even greater positive impact. In consideration of the aims of ANYWHERE, it is important to focus on the technological component for disaster early warning and response, stressing the ethical and legal issues that have been taken into account, also in relation to the case studies, in order to align ANYWHERE self-p* technological solutions to the highest European ethical and legal standards. As noted by Miller and Selgelid, while ethical considerations and legal considerations are obviously related, they are not the same thing:

> *there is, of course, a close relationship between the moral and the legal. For instance, typically criminal laws, such as the laws against murder, assault and theft, 'track' or follow antecedent moral principles; there is a law against murder, for example, precisely because we regard murder as morally wrong. Nevertheless, the moral and legal are conceptually distinct* (Miller and Selgelid 2008, 14).

In general terms, while ethical norms result from the philosophical inquiry into what is good and right and the outcomes of this inquiry may vary depending on the approach adopted, legal norms refer to rules of binding character (i.e. they are enforceable), created by an appropriate authority and whose official interpretation is provided by the judiciary system. As is well known, research projects funded at the EU level must comply both with European ethical principles and values, as established in the EU Treaty (article 2) and in the Charter of Fundamental Rights of the European Union (CFREU), as well as with the legislation applicable at the national, EU and international level. Ethical and legal considerations are also related to the analysis of changes brought by technologies impacting on society in both positive and negative terms. Consistently with the research questions for the case studies listed in the present Report as well as in the Case Study Manual, the main ethical and legal challenges in ICT deployment in emergency situations that have been addressed during WP5 are: i) crowdsourcing, social media and data mining, ii) digital divide (and the potential for discrimination). Both these aspects will be discussed below, first by providing a general introduction and second by analysing the main issues that each of them triggers and their relevance to the four case studies.

3.5.1 Crowdsourcing, social media and data mining

The so-called digital voluntarism is based on techniques such as crowdsourcing and on the collection of data shared through social media. In consideration of the huge

amount of data collected, there is also the need to develop extremely sophisticate data analysis techniques. These three elements need to be considered in turn, seeking to highlight the main ethical and legal issues that may arise from the development and deployment of these technologies in crisis situations.

Crowdsourcing is the process of obtaining services, ideas, or content by soliciting contributions from a large group of people. On the basis of a review of proposed definitions available in scientific literature, a comprehensive definition of crowdsourcing has been recently proposed as follows:

Crowdsourcing is a type of participative online activity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task. The undertaking of the task, of variable complexity and modularity, and in which the crowd should participate bringing their work, money, knowledge and/or experience, always entails mutual benefit. The user will receive the satisfaction of a given type of need, be it economic, social recognition, self-esteem, or the development of individual skills, while the crowdsourcer will obtain and utilize to their advantage that what the user has brought to the venture, whose form will depend on the type of activity undertaken (Estellés-Arolas and González-Ladrón-De-Guevara 2012, 5).

This definition is composed of different elements, including the identification of a crowd and of a 'crowd-sourcer', the existence of a task with a clear goal and recompenses, and the fact that this participative task is performed online. In emergency situations, crowdsourcing describes a method of information collection that utilizes data received from volunteers to enable stakeholders to participate in disaster response through online forums, such as wikis and crisis mapping (Narvaez 2012). Since the 2011 Libya crisis and the 2013 Typhoon Haiyan in the Philippines, the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) is increasingly activating networks of volunteers to crowd-source the collection and analysis of crisis data. A recent trend since the 2010 Haiti earthquake has been also the development of emergency response information tools directly by IT companies, such as for instance Google's units devoted to information access in disaster settings (i.e. Google Crisis Response and Google Person Finder) or Facebook Safety Check.

This raises broad and complex questions related to the fact that private non-profit and for profit organizations are substituting public authorities in their risk and crisis communication role. The advantages in using crowdsourcing in disaster relief operations refer to the fact that crowd-sourced data, collected almost immediately after a disaster, are instantly increasing situational awareness. Using this information, relief organizations can coordinate resource distribution and make better decisions based on their analysis (Gao, Barbier, and Goolsby 2011). The benefits of crowdsourcing in these contexts is not limited to supporting relief organizations but include also giving an opportunity to affected people to send their requests for help and to receive information, and to digital humanitarians to become an active part of the relief effort.

The crowd-sourced data can be collected from a variety of sources, but by large the most common one is through 'social media'. The term refers to internet-based

applications that enable people to communicate and share resources and information. Examples of social media include blogs, discussion forums, chat rooms, wikis, YouTube Channels, LinkedIn, Facebook, and Twitter. Social media are increasingly used in emergencies. (Vihalemm, Kiisel, and Harro-Loit 2012) for instance found that social media can help citizens receive, understand and cope emotionally with warning messages. (Alexander 2014, 717) has outlined seven roles of social media in disaster management, including

- a listening function (i.e. passively collecting information from ordinary people whose voices are more difficulty heard in traditional disaster management),
- a monitoring function (aiming at evaluating the seriousness of the situation and at stimulating self-protection behaviors),
- integration into emergency plans (i.e. issuing warnings and requests for collaboration),
- crowdsourcing and collaborative development,
- creating social cohesion and promoting therapeutic initiatives,
- the furtherance of causes (including for instance soliciting donations),
- and finally as a research tool to explore social dynamics towards risk and fear.

Some researchers even suggest that 'disaster response may be the ideal environment for "proving the worth" of social media as a serious knowledge management platform' (Yates and Paquette 2011).

Along with the exponential increase in the volume and speed of data collected through online channels, also comes the need to make sense of 'big data', particularly in emergency settings where correct information can save lives. To this end, digital volunteerism and human intelligence are supported by big data analytics. These refer to a range of tools and methodologies that use advanced computing techniques to automatically process largely passively generated data, for example those resulting from the use of mobile phones or social networks, in order to gain insights for decision-making purposes. Among these tools, data mining is particularly promising: it refers to the computational process of discovering interesting and useful patterns and relationships in large volumes of data (data sets). It combines tools from artificial intelligence, statistics and database management (Salvi 2012, 20).

Main issues

Associated with the tremendous potential of crowdsourcing, social media and big data analytics, new technologies raise some concerns that have become to be discussed only in very recent times, and this is particularly true in the emergency management field. One of the most delicate issues probably remains the validation of data: with messages potentially 'going viral', there is a great risk for rumor propagation and the dissemination of false or misleading information. For instance, in the crisis mapping field, it has been suggested that the characteristics of uncertainty and requirements of large amounts of manual manipulation for data validation and interpretation still hinder

Volunteering Geographic Information (VGI) applications in disaster scenarios (Hung, Kalantari, and Rajabifard 2016, 37–40). In his analysis of the perceptions of emergency management professionals on VGI, Haworth found that while perceived opportunities include improved communication, acquisition of diverse local information, and increased community engagement in disaster management, identified challenges relate to data management, misinformation, and liability concerns (Haworth 2016, 189). Nonetheless, current research also suggests that harmful and inaccurate rumors are not particularly enhanced by the use of social media, at least no more than what happens in traditional media: the reason is that with mass participation the false rumors that do begin to circulate are easily corrected by other people. In this respect, (Flanagin and Metzger 2008, 10) go even further by arguing that the wisdom of crowds through the use of social computing tools effectively substitutes for the weight of the credibility and authority in traditional institutions.

In addition to the wisdom of the crowd, relying on the wisdom of data mining may be another strategy for data validation and management. The ethical issues surrounding automatic data processing are so vast and complex that cannot be dealt in detail in this report; what is important to note here is that 'with big data come big responsibilities' (Boyd and Crawford 2012). With specific reference to automatic data processing tools making use of algorithms to make sense of big data, it is also relevant to note that human choices are usually implied in the development of algorithms, which are inescapably value-laden and therefore almost always include an ethical component. In their analysis of the 'ethics of algorithms' academic debate, (Mittelstadt et al. 2016) have pointed out both epistemic and normative ethical concerns and proposed some paths for future research.

As a final remark, it is also worth considering whether citizens have any obligation to avoid generating confusion and spreading rumors, also through social media, both before and during an emergency. This is particularly relevant in consideration of the increasing important role played by the different channels at their disposal, and the rapidity of online information sharing. The obligation of not alarming the population unnecessarily is obviously incumbent on public authorities, but it is also, to some extent at least, valid in the private realm. For instance, in Italy a provision of the Penal Code (Article 658 on 'Procurato Allarme presso l'Autorità') establishes an offence for any person who transmits a warning to a public authority about a non-existent calamity. Similarly in Spanish Law the offence of disturbing public order ('Delito de Desorden Publico'), can be committed also when knowingly giving a false alarm or simulating a situation of danger which triggers the intervention of public authorities (Article 561 of the Spanish Penal Code). Spreading false alarm is also punished under the Norwegian Penal Code, Section 187, with a penalty of a fine or imprisonment for a term not exceeding six months. Instead Finland – which is at the forefront of the fight against fake news and it is investing a lot of efforts in educating the population – has not embedded in its criminal code any provision dealing with the spread of false information during an emergency.

A further important concern raised by crowdsourcing, social media and big data relates to the need to identify credible standards for protection of personal data in the online realm. In emergency situations, personal data may be of particular sensitive nature

(i.e., medical data), collected without the consent – or, in some cases, even without knowledge – from the affected individual. As a result, it is trivial to observe that new technologies are having a deep impact upon all basic data protection principles such as data minimization, purpose identification and data subject consent and control.

Relevance to the case studies

The information provided by the partners in charge of the case studies gives an account of how crowdsourcing, social media and data mining have been addressed in practice. The Scandinavian case study (Storm and Electricity) – aiming at reducing storm-driven impacts on electricity transmission grids – has showed that information on self-protection is increasingly shared through websites, social media, own customer publications and all mass channels.

The case study leaders specify how self-p* information is shared. In particular on the one hand information on self-protection is shared through websites, social media, own customer publications and all mass channels. On the other hand information on self-protection is shared with the South Savo Communication Group and cooperating enterprises. The company uses Facebook and Twitter as main channels to disseminate information in dangerous situations and to digitise errors. Customers can also send images of errors and private messages to the company via social networks. The main caveat to take into consideration, in line with the general overview provided above, concerns the reliability of the information spread through the social media and the other channels. In fact, there is a steady need to validate said information and to update it also in situations of emergency, when, according to the interviewees conducted, the employees are too busy to do that, but costumers still rely on it.

With regard to the second case study, i.e. Weather and Food logistics, the goal, as clearly explained in deliverable D5.2, was to enhance self-p* of distribution companies during severe weather events in ANYWHERE by providing a set of tools for the advanced forecasting of the traffic conditions and the simulation of weather-based transport scenarios at different scales, from regional to urban. The main ethical/legal aspect arising has been the usage and analysis of different types of data. In fact, by cross-correlating the weather forecasts (such as level of snow, precipitation, etc.) and a representative model of the road network, the service is able to estimate the extension of the affected area and the impact on the circulation conditions, which are then translated into the impact on the network capacity. The outcomes are high-resolution forecasts of the road and circulation conditions, and indications for logistics-related companies (i.e. food distribution) useful to find or choose the best route (i.e. alternative road, multimodal path) between two locations. The testing period of the relevant tools, and the users' feedback, did not reveal criticalities in relation to the compatibility of the system with the current ethical and legal standards.

Concerning the third case study, i.e. Flash floods and camp sites in Catalonia, a web-based tool called A4CAMPSITE has been developed. It is an Early Warning System for floods that integrates in a single place all the flood-related information: real time sensor data, official warnings and self-protection actions. Like in the previous case study, the main issue to consider from a legal and ethical perspective is not the

collection of data from social media, but rather the use and processing of different types of real-time data obtained from sensors, ANYWHERE products and official notices. Each of these products has at all times assigned a warning level (0, 1 or 2) based on previously configured thresholds. Then the level of the campsite warning is defined as the maximum levels of warning for all products. The level of the campsite warning is continuously updated, since it is recalculated every time new data is available. Notably, the Water Agency of Catalonia – in line with Directive 2007/60/EC on the assessment and management of flood risks which requires States to establish flood risk management plans focused on prevention, protection and preparedness – has issued a list of basic criteria that Early Warning systems should comply with and the one developed for the case study under scrutiny does meet all the relevant requirements, which cover also the kind of data that can be used.

In relation to the fourth case study, which, as is well known, concerns the flash floods and schools in Liguria, the tool A4Schools, based on TELEGRAM, has been developed to improve and speed-up the communications between schools, emergency managers and parents. The procedure starts when the civil protection communicates to the schools (head teachers and teachers) the situation of Alarm, or another specific code defined, for which specific instructions related to the safety of people within the schools have to be followed (phase 1). During phase 2, the teachers responsible for each specific school acknowledge that the message of Alarm has been correctly received, by providing a specific feedback within the TELEGRAM bot. The civil protection receives the feedback message from each school in the municipality area while the head-teachers receive information from the schools they are responsible of. Once the children/students have reached the safety positions defined in the internal security plans, the teachers responsible for each specific school provide a feedback through TELEGRAM to both civil protection and head-teachers (phase 3). In phase 4 the parents, that subscribed to the specific schools they are interested in, receive a message reporting that 1) their children are safe and cared by the school people and 2) take self-protection measures and do not go to the schools until the Alarm is ceased. The teachers, therefore, represents the main actors expected to provide, through the TELEGRAM App, information related to the children, whereas the parents are merely the recipients of direct information about the emergency status of the schools in which their kids are. No particular criticalities concerning legal and ethical aspects have emerged during the testing phase and according to the users' feedback, however, given the centrality of the role of teachers and the special protection to which children should be entitled in situations of emergency, outreach activities and training are essential to guarantee that the tool is used in compliance with existing standards.

3.5.2 Digital Divide

Digital divide is usually said to refer to two gaps, i.e. the unequal access to and different possibilities of use of ICTs. While the first aspect refers to the gap between those who have access to ICTs and those who have not (e.g. distinction between urban and rural areas, developed and developing countries), the second gap refers in differences in the use of ICTs. What is particularly important to stress is that digital divide is a dynamic concept, which evolves along with the rapid advances in digital technologies: these

create not only new opportunities, but also new risks of exclusion for those groups who do not embrace them. Some researchers have also emphasized that digital divide will exist as long as other inequalities persists in our societies (Van Dijk 2012). ICTs offer the possibility of unprecedented progress in many areas of society, including in situations of emergency, but they also reflect, and, at times reinforce, social, economic, and other disparities. Notably, a human rights approach to globalization and the digital divide begins with determining how to bridge the overall gap between the rich and poor and addressing existing contradictions between the rights and freedoms guaranteed on paper and the accessibility of those rights and freedoms in practice. In fact, the Universal Declaration of Human Rights and Article 19 of the International Covenant on Civil and Political Rights (ICCPR) proclaim the freedom of everyone, without discrimination, to enjoy access to information, including through the use of ICTs.

According to (Floridi 2002, 40), digital divide 'is the source of many of the ethical problems emerging from the evolution of the information society'. Indeed, in order to utilize many everyday services and to fully participate the benefits of today's society, it is key not only having access to ICT but also having the requisite skills, abilities and motivation to use the technology. In fact, as it is widely shared '[d]igital inclusion is fast becoming a prerequisite for social inclusion' (Arstein-Kerslake 2017, 49).

Main Issues

In Europe, the digital divide has been substantially reduced over the last decade, but still some important gaps remain, with varying degrees across Member States. According to Eurostat, about half of the less educated and the elderly do not use Internet regularly, and about 58 million EU citizens have never used it at all (EUROSTAT 2016). Current research suggests that there is unequal distribution and use of social media technologies and applications within societies, for example along the lines of class, gender, race, age, disability, and skills. Thus, while social media can, on the one hand, lead to a democratization of voices, attention has to be paid to how this 'democratization' is socio-technically structured.

In the emergency management field, digital divide may imply that the most vulnerable segments of the society – who are likely to be disproportionally affected by a disaster – may also be potentially excluded from the benefits of using technologies. Vulnerable groups include older generations having grown up in a pre-Internet era, less educated people, marginalized groups and less (digitally covered) countries or regions in the EU. The widespread use of social media in disasters, thus, raises the question as to how to address discriminatory practices based on the digital divide. One recommendation on how to address this challenge may be to foresee empowering programmes and training for those who risk to be excluded. The european commision recommends for policies 'in areas where society places obligations on citizens or where access to essential services are predicated on ICT use' – therefore including emergency management – mechanisms unrelated to ICT have to be established in the short to medium term (Salvi 2012, 10).

Relevance to the case studies

As mentioned above, the digital divide can only be overcome by filling the relevant gaps, i.e. unequal access to and different possibilities of use of ICTs. Across the world many different initiatives have been undertaken in several countries with a view to closing the digital divide that exists between different sectors of society, e.g. due to issues relating to age, socio-economic status, geographic location and disability.

In relation to the ANYWHERE case studies the digital divide has been duly taken into account as each case study has strived to fill the gap and make access to ICTs easier and more inclusive.

With regard to the Storm & electricity case study the trend registered by the case study leaders is that there is a propensity for digital communication instead of telephone service. Furthermore, in the future, it is envisaged that information about social networks will be distributed automatically.

Concerning the second case study, i.e. Weather & Food logistics, the ANYWHERE tool is used to adapt the food distribution according to the forecasted impacts on the road conditions, and especially in the course of winter (during snow events), to follow the evolution of a given situation. The tool is particularly useful in relation to the second digital divide's gap – i.e. the differences in the use of ICTs – because the self-protection tool translates the forecasts in terms of impact of the weather on the road and circulation conditions. The tool, thus, facilitates the understanding and analysis of the situation and it adapts to the specific needs of the sector.

With respect to the third case study, i.e. Flash floods & camp sites, the ANYWHERE tool contribute to bridging the information gap between the camp management, the campers and the camp sites workers. As a result, a broader and diversified number of actors are provided with the same updates and insights thus leveling accessibility and enhancing the knowledge on self-p*.

Finally, with reference to the fourth case study, i.e. Flash floods & schools, significant efforts have been put in place in order to increase the approachability of the tool A4Schools. A user manual (in Italian), has been provided to explain both how to install TELEGRAM for the most common systems used by the smartphones as well as how to subscribe to the specific TELEGRAM bot "scuoleBOT" used. It is possible to subscribe as a parent, a teacher, a head teacher or a service provider (although this last option has not been activated yet). The subscription as parents is open and can be done by anyone interested in the service for one or more schools. On the contrary the subscriptions as head teachers or teachers work only if the mobile phone number who is requesting the access has been registered as the reference number for one school (in case of a teacher) or more schools (in case of a head teacher).

4 Deduced Recommendations

Based on the feedback received during the case studies, various LL were created. The recommendations are derived in this section, taking ethical issues (see section 3.5) into account. Besides the already described guidelines for IT-provider (documented in deliverable D5.1) further recommendations mainly targeting citizens, PPDR (emergency services) and enterprises will be considered. To ensure an easy access to the recommendations a continuous use of the Common information Space (CIS) is used to publish and update the findings and results. Further details on the design and development of the CIS is available in

4.1 Derived recommendations from the Lessons Learned

The results from the deduction to receive recommendations for the different stakeholders are listed below:

Table 4 Recommendations from the Lessons Learned

Nr.	Recommendation	Description	Addressed stakeholder
1	Motivate for the subject of self-p*	As self-p* plays an important role for the preparedness and protection of employees, customers and citizens	all
2	Develop a clear strategy on self-p*	Depending on the identified risk factors, a clear strategy will help to implement a self-p* plan. The strategy needs to be communicated to all involved stakeholders with regard to their needs. Workers need to be educated.	
3	Use available tools to support self-p*	All case studies reported that the tools associated to the MHEWS were providing valuable support on different tiers.	
4	Self-p* tools should be built on trustworthy relations between actors	In a crisis situation, citizens and stakeholders are exposed to various information sources and quality. Self-p* tools are efficient when built on sustained trustworthy communications between actors.	
5	Self-p* tools should ensure a quick and appropriate understanding of the threat situation	Message contents need to be precise (specially with respect to the threat and potential impacts' timing and location), consistent and easily understandable.	
6	The obligation of not alarming the population unnecessarily is not only incumbent on public authorities, but it is also, to some extent at least, valid in the private realm. Therefore self-p* tools that rely on crowd-sourcing need to take into account the importance of vetting information.	The possibility for private individuals to contribute to feeding information in case of emergency is becoming an essential feature of our reality, as such it cannot, and should not, arbitrarily removed or constrained. Nonetheless, there is a need to balance crowd-sourcing with methods and systems to check and validate the information that do not stem from official sources, or at least to promptly react to its diffusion when it can endanger the population.	
7	In order to levelling accessibility and enhancing the knowledge of self-p* tools, it is important to provide outreach activities and training to all the relevant stakeholders.	As the civilian population (as well as end users and private stakeholders in general) increasingly relies on self-p* tools, the mere possibility to use them is not sufficient to guarantee that they are properly employed. The growing tendency towards a proactive approach during emergency situations must be constantly informed by adequate training and outreach activities.	

5 Revision of Guidelines and supportive tools

Based on the overall WP5 research approach IT-provider were taken into account with guidelines supporting the development of self-p* tools. Mainly results were presented in deliverable D5.1 of ANYWHERE project and therefore not described in detail here.

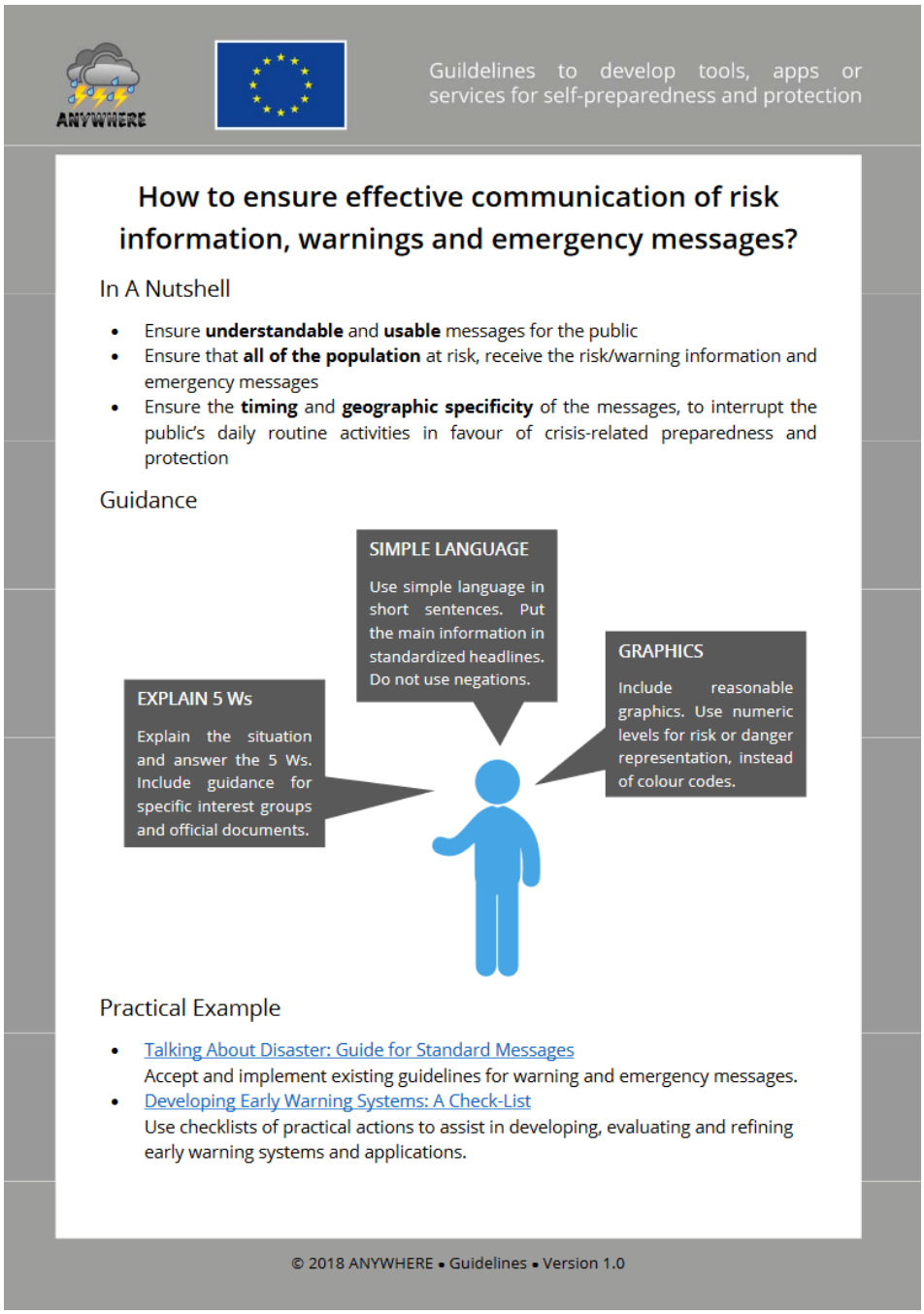


Figure 8 Example for a short version guideline

With regard to received end user feedback, short versions of the guidelines were derived and firstly provided to project stakeholders at the Barcelona workshop. The aim was to highlight visibility and comprehensiveness of the existing ANYWHERE

guidelines. An example of a short version is given in the Figure 8. Elements of the short version are based on the guidelines template provided in deliverable D5.1. In chapter 9 ANNEX 1 Guidelines: Short Versions all “short” Guidelines developed.

Several supportive tools were developed and used in the context of WP5. The CIS was developed for the publication and dissemination of results regarding self-p*, the Scenario-Tool was developed to for strategic planning using scenario technology. ANYCaRE supports all involved stakeholders and train high impact weather related scenarios. These supportive tools implement recommendations and guidelines into services easy to use in decision making processes.

The following paragraphs summarize updates performed after initial designs of these tools in deliverable D5.1.

5.1 Common Information Space

The ANYWHERE Common Information Space was designed to support cooperative work, active construction and negotiation of shared objects by the members of a Common Information Space. Implementation details that are not available in deliverable D5.1 can be found in the chapter 11 Annex 3.

Recommendation targeting citizens are based on official / government sources from various European countries. Currently 25 references were taken into account to derive conclusions from the numerous recommendations in high impact weather events. The most significant considered recommendations are published under https://cis-anywhere.eu/recommendations-citizens/#existing_recommendations.Represented countries are

- Austria
- France
- Germany
- Italy
- Portugal
- Spain
- Switzerland

Independent from the country recommendations are mainly scenario-depended. Thus, recommendation differ if the event is flood or drought. Due to that fact recommendations were clustered in relation to defined scenarios. Considered scenarios are: flood, thunder storm, wild fire, strong winds, droughts, snow, avalanches, cold waves, and heatwaves.

All recommendations are included as scenario-based checklist in the ANWHERE CIS, see following Figure 9.

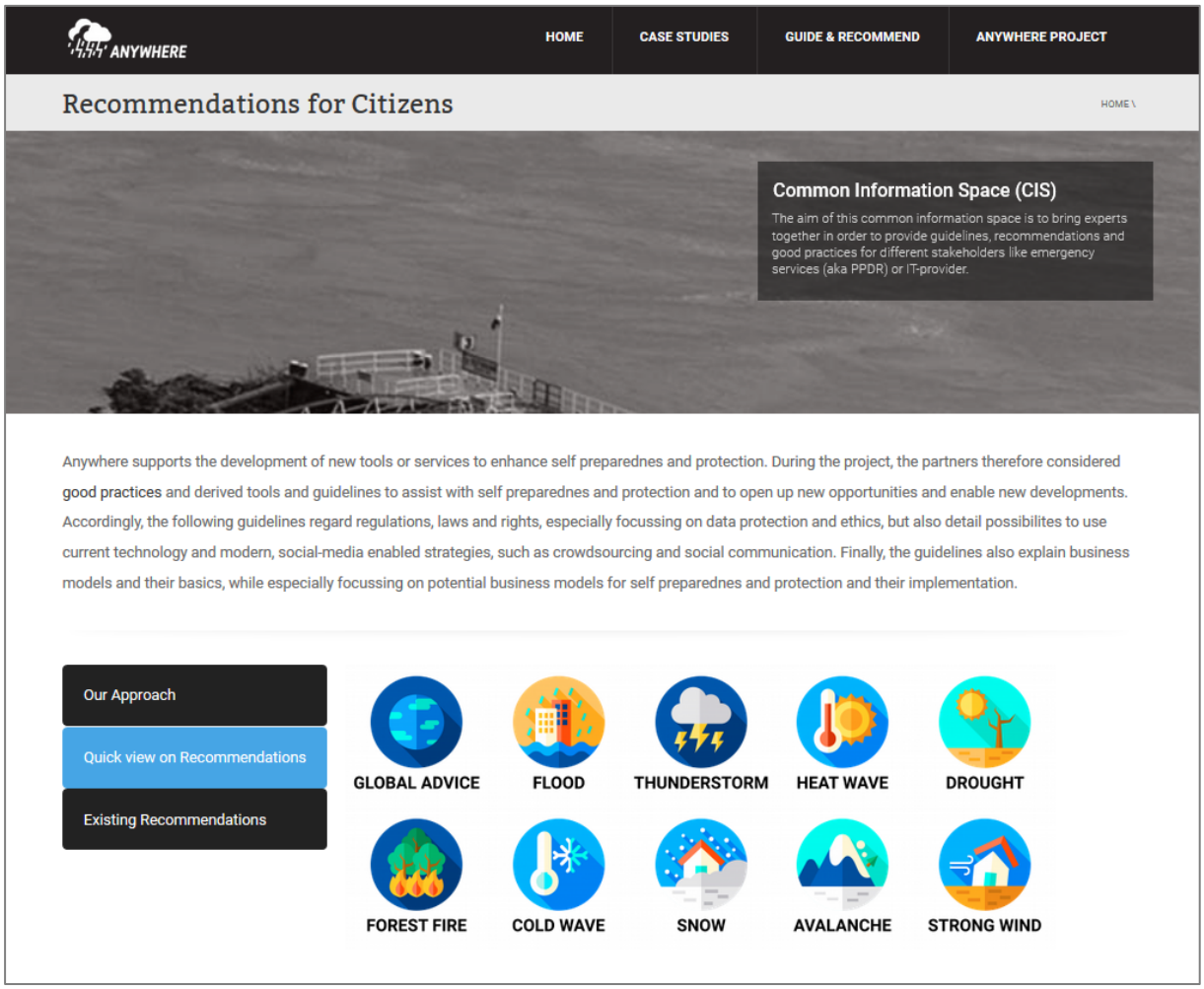


Figure 9 Scenario driven self-p* recommendations

In each of the scenarios specific recommendations are collected. The structure of the recommendation is quite similar. First some general information in relation to the disaster type are provided. Subsequently main advices to remember are visible. And last the concrete recommendations are listed. Here, the checklists are grouped in correlation to the timing phases. There are recommendations before, during and after an event occur. Categories like personal advices or spatial recommendation will support citizens to better identify relevant topics. The recommendations targeting floods are illustrated below.

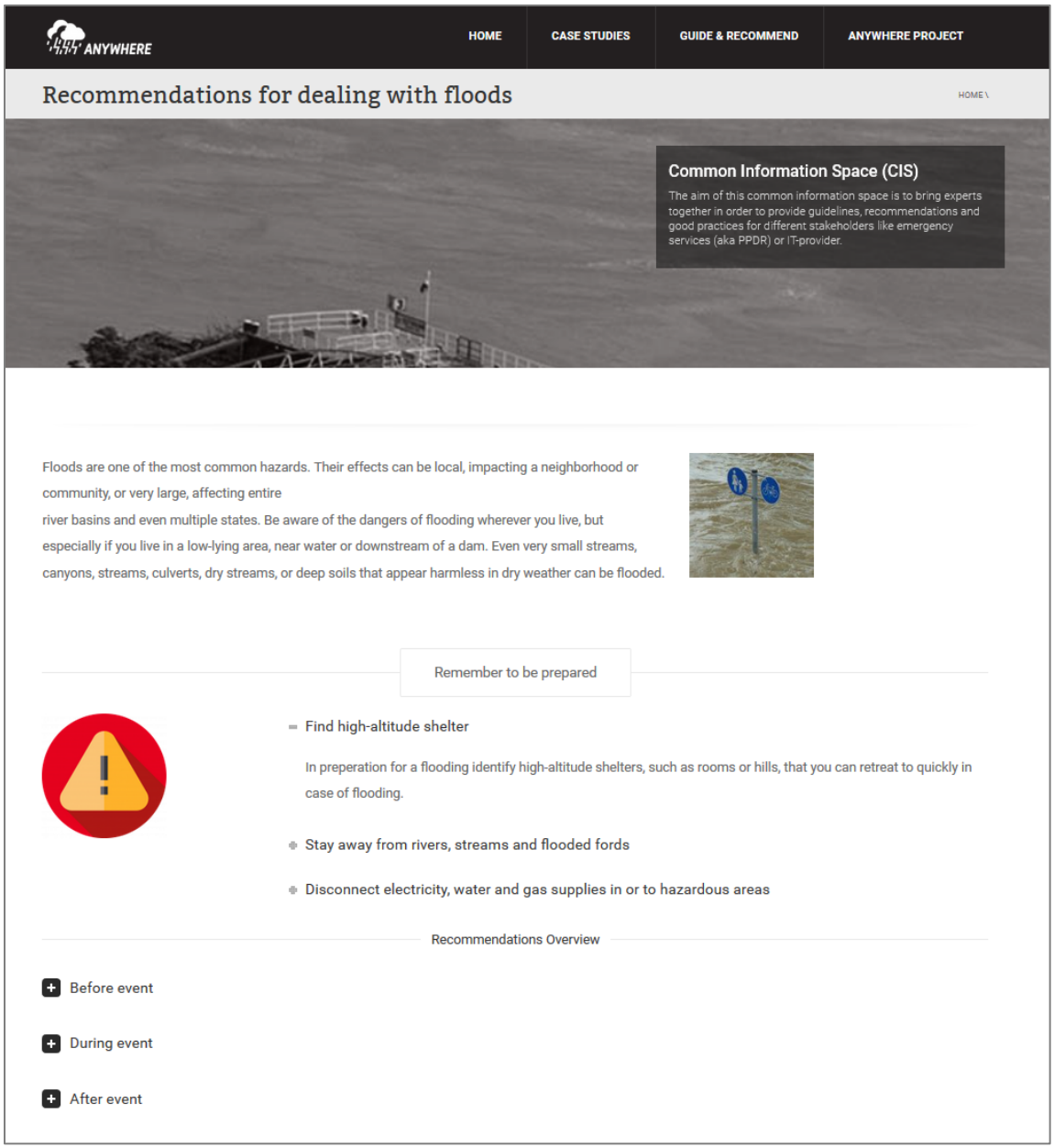


Figure 10 Self-p* recommendation targeting flood

Since the beginning of the project, the CIS has been continuously further developed. The final structure is shown in Figure 19. The CIS is connected to various ANYWHERE subsystems. In addition to the ANYWHERE Catalogue, there is a connection to WP7 and the scenario tool developed within the framework of WP5.

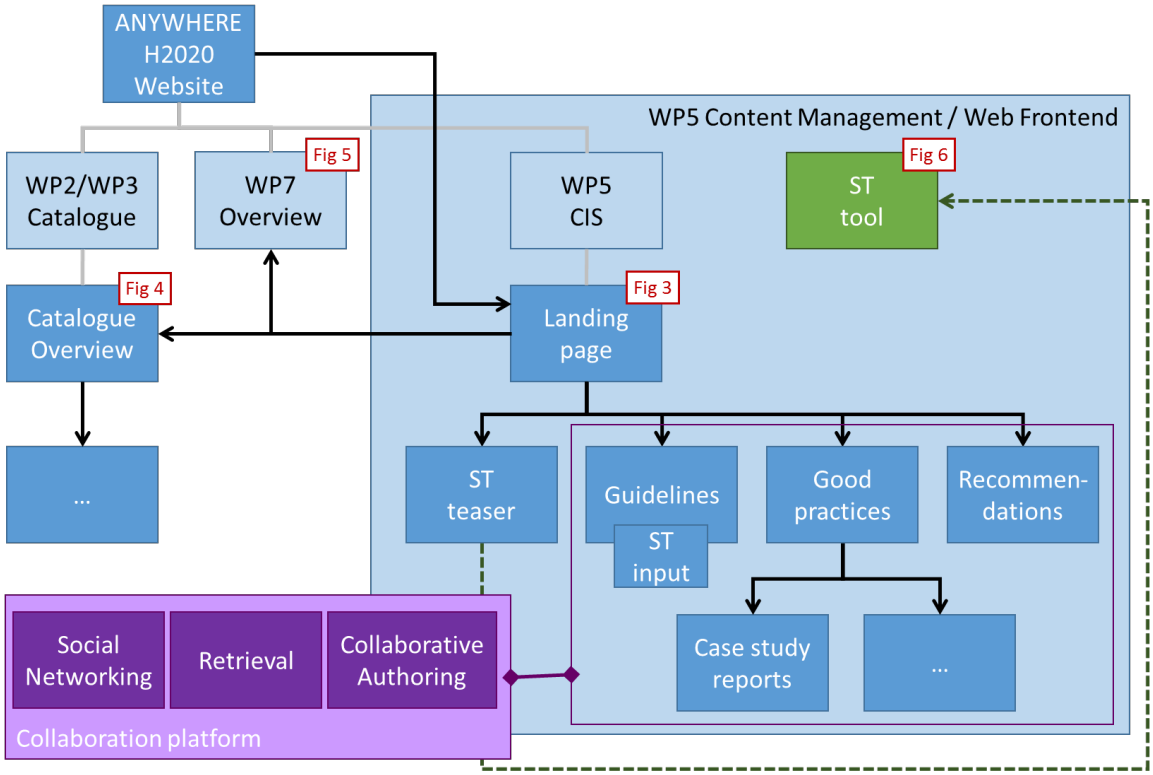


Figure 11 Structure for the Common Information Space

Since the submission of deliverable D5.1 a major revision of the user front-end has been implemented. Furthermore, information on the Case-Studies and the short versions of the guidelines, deduced recommendations and good practices were published via the CIS.

Examples of the rework are shown in shown in Figure 12 to Figure 14 . At the same time major navigation issues were removed.

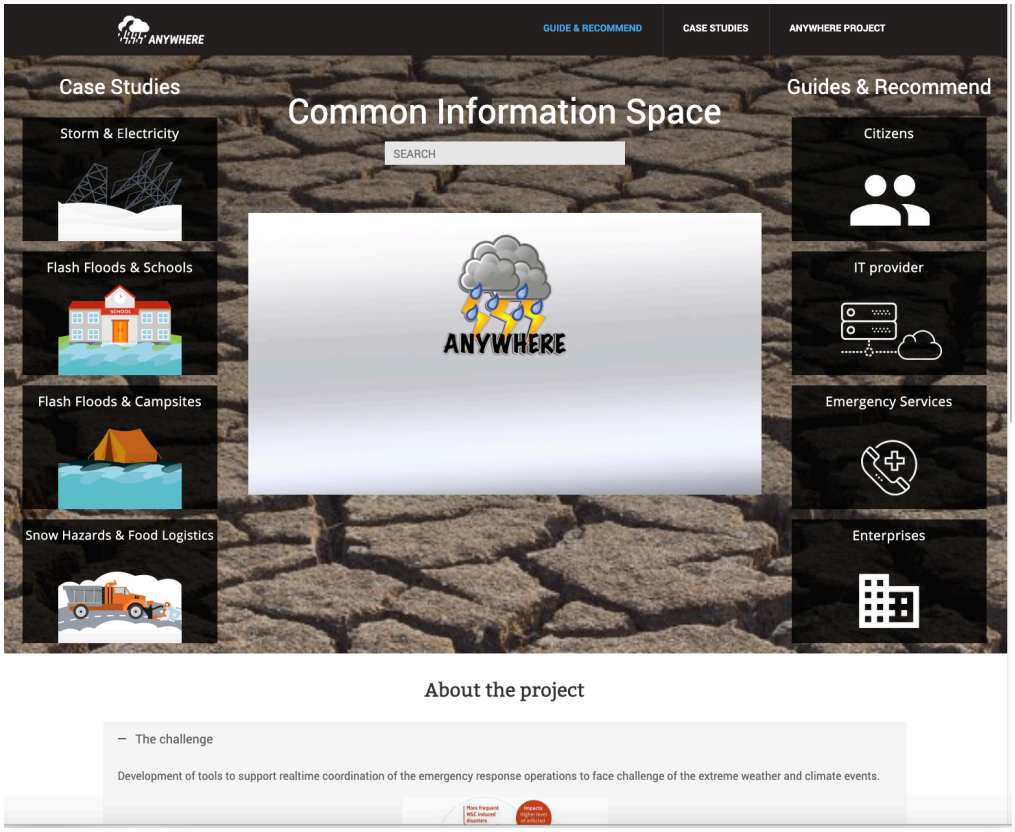


Figure 12 ANYWHERE CIS Front Page, rework. V2 – (1/2)

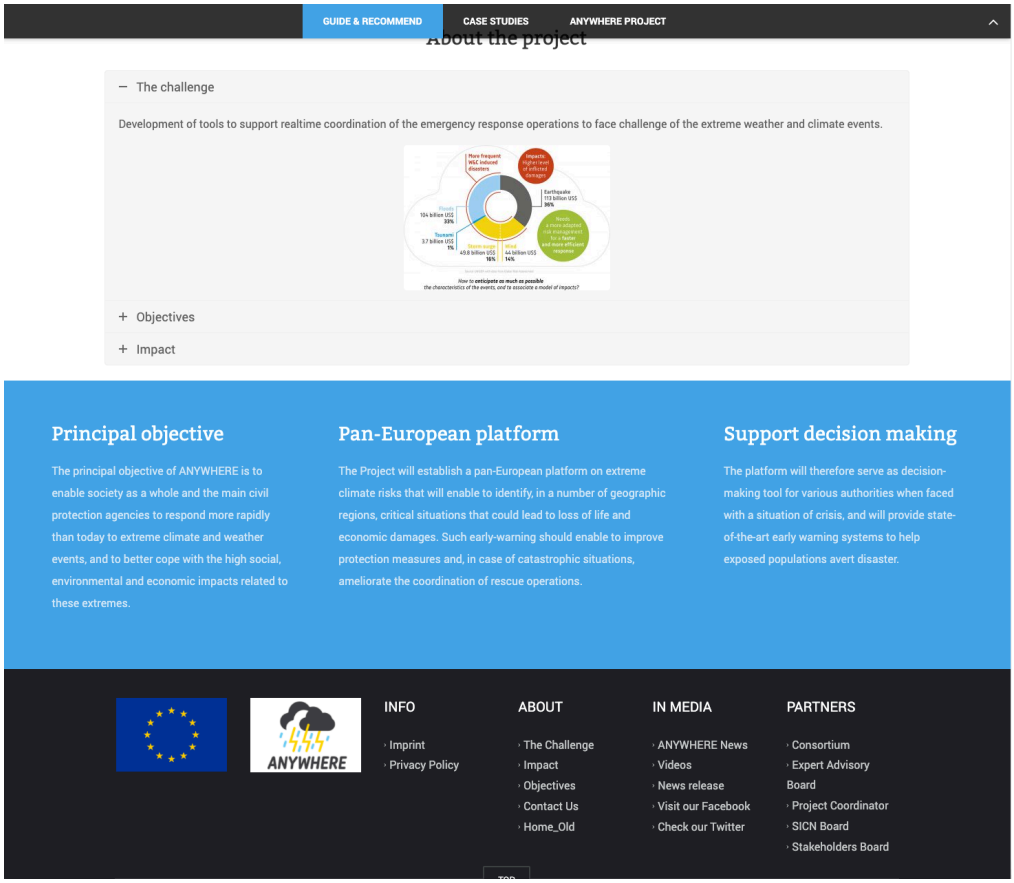


Figure 13 ANYWHERE CIS Front Page, rework. V2 – (2/2)

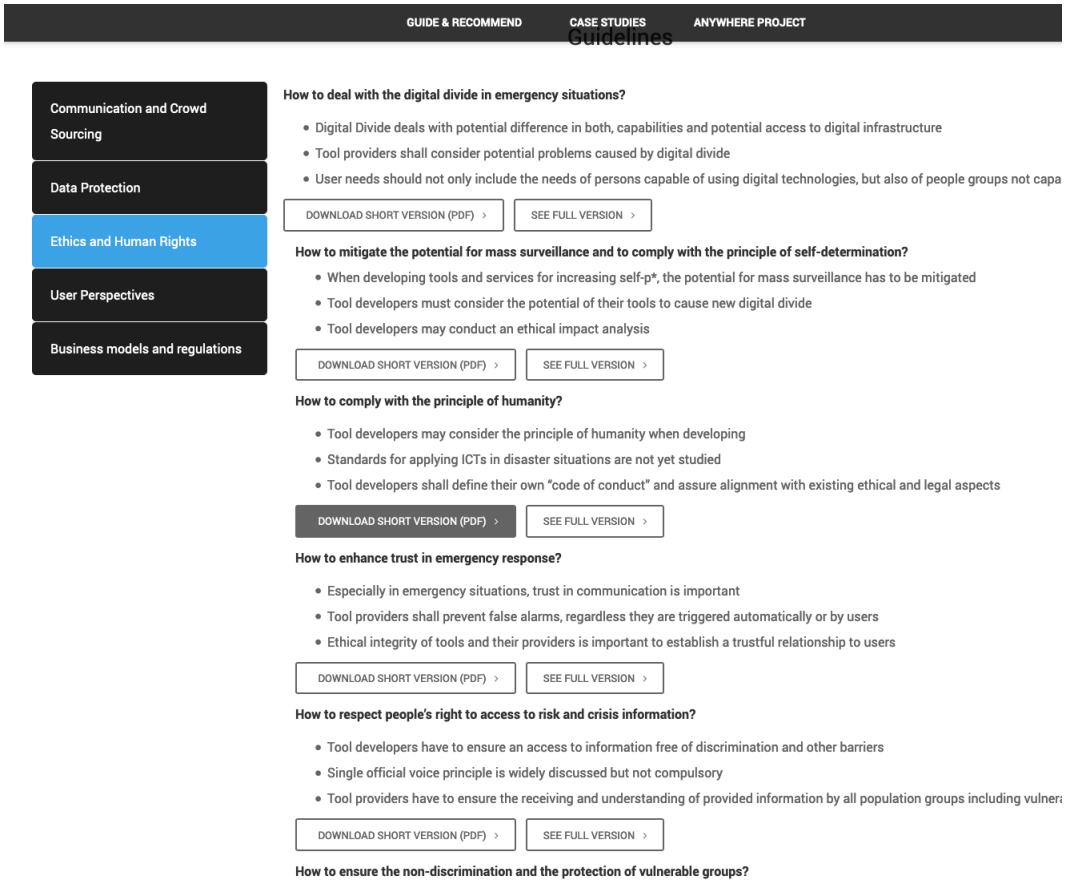


Figure 14 ANYWHERE CIS Short Version of Guidelines

5.2 Scenario-Technique tool

As outlined in deliverable D5.1, the ANYWHERE Scenario-Technique tool was made available to the project partners. The Scenario-Technique tool was provided to enhance the capability for strategic planning in third-party enterprises. Due to the nature of an innovation action, project results are commercialized after the end of the project. To be able to transfer the ANYWHERE results (such as the A4* platforms and the MH-EWS) into commercial applications, enterprises have to be able to identify the strategic gap between technological feasibility, market situation and consumer demand. Though the technological feasibility was proven by the case study applications, market situation and consumer demand are difficult to predict. One method for strategic foresight is Scenario-Technique: third-party enterprises can, guided by the ANYWHERE Scenario-Technique tool, anticipate future market scenarios. These include both, the future market situation and customer demand and the underlying influence factors. Looking at the customer demand for self-preparedness and self-protection tools, the future demand for innovative services is directly influenced by the individual threat of extreme weather and climate events. Hereby, enterprises are able to identify the strategic gap between technological feasibility, market situation and customer demand. Consequently, the success rate of innovations can be improved by strategic foresight and adapted market uptake strategies for innovative tools.

The underlying process model of Scenario-Technique is shown in Figure 15 below.

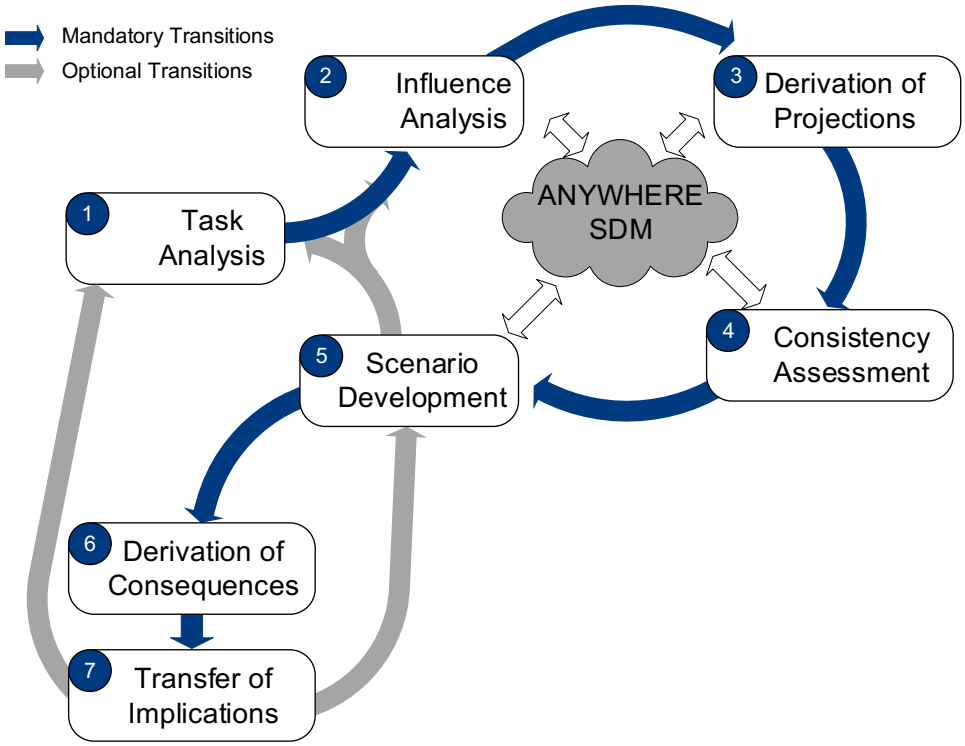


Figure 15 ANYWHERE scenario process model (D5.1)

The process steps are described in detail in deliverable D5.1. Two major deficits to the supporting algorithms were identified:

- Consistency assessment (process step 4) is a rather time-consuming process step. The high effort required reduces the usability of the ANYWHERE scenario tool. The issue was addressed by developing and implementing a method for semi-automatized consistency assessment (see section 5.2.1);
- Scenario development (process step 5) is, due to algorithmic deficits, rather time consuming. Therefore, a novel algorithm was implemented (see section 5.2.2).

5.2.1 Development of a method for semi-automatized consistency assessment

To address the first deficit, a novel method for semi-automatized consistency assessment was developed. Hereby, only parts of the consistency values have to be assessed by the user. The rest is semi-automatically completed on the basis of an analysis of the consistency values already assessed by the user (Dönitz 2009). Basis for the semi-automatized consistency assessment are sub-matrices indicated in Figure 16 below.

Influence Factor	Projections		1A	1B	2A	2B	2C	3A	3B		nA	nB	nC
Influence Factor 1	…	1A											
	…	1B											
Influence Factor 2	…	2A											
	…	2B											
	…	2C											
Influence Factor 3	…	3A											
	…	3B											
Influence Factor n	…	nA											
	…	nB											
	…	nC											

Figure 16 Sub-matrices in the consistency matrix

All consistency values are therefore classified in consistency types derived from empirical investigations within the self-p* context. Based on the identified consistency types (k_{ij}), of each sub-matrix a deterministic rule set was derived. The intention of such a rule set was to classify missing consistency types based on the triangular relations of influence factors within the consistency matrix. An example for the triangular relations is given in Figure 17 below.

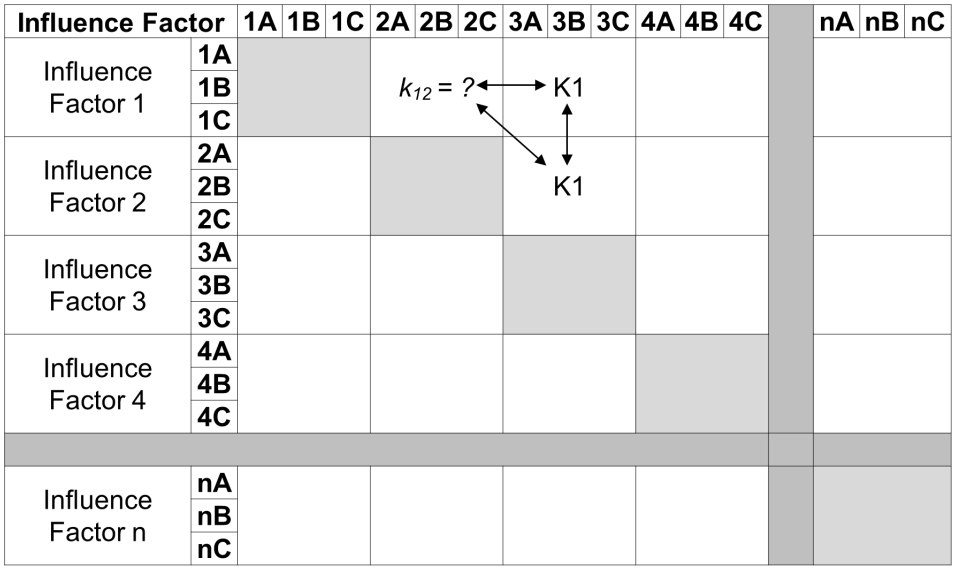


Figure 17 Semi-automatized consistency assessment based on triangular relations

The consistency values assessing the consistency values for influence factor 1 in relation to influence factor 2 are missing. The missing type k_{12} can be estimated by looking at the triangular relation between influence factors 1-3 and 3-2. Hereby, the consistency type can be identified semi-automatically based on a rule set identified in an empirical study. The values of the submatrix can be re-generated based on another rule set for the re-generation of matrix values from the consistency type. The approach was validated by a case study from the ANYWHERE context carried out by post-graduate students. The task was the derivation of scenarios for an innovative service supporting self-preparedness and self-protection based on ANYWHERE services. Given a pre-filling of the consistency matrix of 25%, 45,27% of the remaining consistency values could be correctly assessed semi-automatically.

5.2.2 Implementation of an efficient algorithm for scenario development

To increase the second deficit – clustering performance – a novel clustering algorithm was developed. Based on a branch-and-bound logics, scenarios with a high number of inconsistencies can be identified more early in the scenario development process. As the process of scenario developments aims at the identification of scenarios with a high consistency, the novel algorithm allows the exclusion of inconsistent scenarios at an early point of scenario development. Hereby, the overall efficiency of this process step could be improved.

5.3 ANYCaRE serious game

ANYCaRE (ANYwhere Crisis and Risk Experiment) is a serious game that engages participants in the decision-making process at different levels of the weather-related emergency system (from hazard detection to citizen response). The focus of the experiment is a tabletop or pen-and-paper role-playing game (PnP) for adults in which participants act out their role through speech while sitting in a comfortable setting

(Grouling 2010). The PnP game is structured in progressive simulations in which ANYWHERE improved multi-model outputs, including information on (i) impact assessments and maps and (ii) live data on exposure and vulnerability derived from social media and crowdsourcing (called "impact-based vulnerability information" hereafter), are presented as new decision-support tools for the players to act in the context of a virtual emergency operation center. The simulations are built based on the hypotheses that dynamic real-time impact information (e.g. potentially affected population and critical infrastructure, economic damage) can support emergency services to

1. spatially and temporally locate critical spots for intervention and, therefore, better allocate available re- sources to protect lives and livelihoods;
2. communicate more targeted warnings and emergency guidance messages to help the public understanding of how certain hazards may affect their lives, livelihoods and properties, leading to appropriate self-preparedness and self-protective actions.

An important advantage of the simulation approach is its dynamic nature that allows participants to experiment with real-time decisions and experience potential changes in the outcome over time (Pasin and Giroux 2011). By first providing the players with hazard-forecast information alone and then adding impact-based forecasts at each round of the game, it allows them to progressively integrate the use of impact- based model outputs and reflect on the usefulness of such information in supporting the collective emergency decision-making process. This "learning by doing" process – a fundamental principle in experiential learning theory (Kolb 1984) – has the privilege of taking place in an informal setting with- out real consequences.

With respect to crisis and disaster risk management, (Van Ruijven 2011; Di Loreto, Mora, and Divitini 2012; Alharthi et al. 2018; Solinska-Nowak et al. 2018), proposed reviews of serious games and simulations, specifically looking at the challenges of using serious games for research and assessing their effectiveness in soft-skills training. If the ANYCaRE game falls in the most common category of *face-to-face multi-player experience with lively interactions between players*, it is one of the few role-playing game dealing with early warning systems (EWSs) and allowing to test new forecasting products (Solinska-Nowak et al. 2018).

It is hypothesised that the methodological approach adopted in ANYCaRE allows the following:

- Argumentation on weather crisis management should be collaborative (Huang et al. 2010). Dialectic reflection on weather uncertainties and challenges helps participants to form their situational awareness and build a common strategy to solve problems of safety during extreme weather events. Therefore, the experiment facilitates collaboration and coordination between participants who may have distinct fields of expertise and/or belong to different national or local institutions across Europe.
- Training of decision-making skills for emergency management is needed (Linehan, Lawson, and Doughty 2009). Through progressive simulations the

players are expected to get more and more familiar with good practices in emergency management. Serious games are recognised in the literature as useful tools for training since they offer an environment in which trainees can experience demands of emergency management under stress before the real crisis (Crichton, Flin, and Rattray 2000). The reception of new data as the game progresses makes the player cultivate soft skills such as communication and understand- ing of auxiliary or inconsistent information in a limited time frame (Linehan, Lawson, and Doughty 2009).

- Relevant behaviours for emergency response are fostered (Meesters and Van De Walle 2013). A safe playing environment in which participants act out given roles (sometimes very different from their duties in daily life) permits them to gain a deeper understanding of the weather-related risks and decision-making complexities (Rebolledo-Mendez et al. 2009). During the experiment the player can realise conflicting requests arising in times of weather crisis and reconsider the relevance of specific (self-) protective actions.
- Through all of these aspects, ANYCaRE enables research teams to perform evaluation measures. Stakeholders are engaged in a realistic situation perceiving realistic stress. Using the ANYWHERE platform through self-p* services and tools, use cases can be observed in (non-)participatory observations. ANYCaRE scenarios are designed in a way that allows combination of PPDR usages and self-p* actions.

5.3.1 Conceptual framework and playing rules

The roles to be played and the potential decisions and actions to be chosen by the players in ANYCaRE are predefined based on qualitative evidence gathered during ANYWHERE sites visits and European workshops that took place in March and April 2017 (see deliverable D1.2) and in previous research (Ruin 2007). In particular, the game was designed in order to be adapted or easily adaptable to most European countries' warning and emergency decision-making contexts. Examples of warning systems were provided by ANYWHERE pilot sites in Switzerland (Canton of Bern), Spain (Catalonia), Italy (Liguria), Finland (South Savo) and France (Corsica). Commonalities of these systems were identified and used to simulate realistically the dynamics of the warning and response processes starting with the detection of a potential weather-related threat and ending with decisions related to the coordination of the emergency response. In times of emergency, actors with complementary competencies are gathered (at the administrative level of concern: local, regional or national in the case of a state emergency), either physically or remotely, to take decisions on how to best manage the crisis to ensure people's safety. Generally, those emergency operation centres (EOCs) include representatives of civil services as weather/hazard experts, police, firefighters and rescue forces, representatives of municipalities, and infrastructure experts from public or private companies (road, telecommunication, energy suppliers). A representative of the highest authority concerned will act as the leader of the group to organise the discussion and finalise the emergency decisions. The centre functions as the kernel of information, by receiving, checking and sharing information with operational teams as well as deciding

upon complex emergency actions that need a holistic view of the situation, coordinating efforts and communicating with the public.

Based on this type of crisis management organisation widely used in Europe, the ANYCaRE game proposes that decisions should be taken in the context of a simulated EOC gathering in the same room or a choice of the actors cited above. A panel of role descriptions that are distributed among the players (randomly or based on their real-life expertise) describes the tasks and responsibilities that each player has to contribute to the collective decision finalised by the group leader. Some roles, such as the ones of the forecasters or the one of the group leader, may be distributed carefully as they require either strong expertise or leadership.

The role of the emergency management group is to keep the population safe by coordinating protective actions when the normal course of daily activities is under the threat or severely perturbed by an adverse event. Crisis situations are dominated by uncertainty and the multiplication of wicked problems to be solved under time pressure. As a group the players are requested (i) to evaluate the weather-related situation and potential threat based on weather forecast information and their own assessment of the level of exposure, potentially supported by impact-based and crowdsourced information, (ii) to select, from a pre-established list, protective actions (if any) and four communication options that can be taken to best inform the targeted public about those decisions. The proposed list of actions depends on the storyline and the purpose of playing and can be easily adapted to different scenarios to be played by different audiences.

Several rounds (up to 3 or 4) of decision-making are played successively to simulate the progression of the hazard from its early detection to its landfall. By using multiple rounds, we allow the players to experience evolving hydro-meteorological facets and test different decision-support tools, which give more and more accurate information, as the event occurrence gets closer. The repetition of the decision-making process over several rounds also helps the players to get better at managing their roles and learn from practice. Nevertheless, based on the dynamic and predictability of the simulated event, the pace of succession of the hazard and/or risk information and decisions to be made in the game can vary to represent a few hours to a few days in real life.

At the beginning of the simulation, only weather and/or hydrological model-based forecasts are available for the coming hours or days. The level of uncertainty is still high. Round after round, more precise information including impact-based information is provided to reflect the decrease in uncertainty and the potential imminence of the event occurrence. With this information, specifically distributed to each role with respect to its own responsibilities, the players first need to interpret and share their specific knowledge before envisaging and deciding upon solutions to use against the potential threat they identified. Based on their collective evaluation of the situation, they have a certain time to choose between 3 types of decisions: (i) stay aware and monitor the situation, (ii) take actions in the context of a warning phase and activate the EOC to take precautionary measures, (iii) activate the emergency plan and proceed to specific safety measures. To reflect the time pressure that real-life EOCs always face,

the players are given a limited time in which to provide responses to each trial and the game moderator is in charge of pressing the group to obtain their decision in time.

5.3.2 ANYCaRE scenarios

Flood scenario

The initial implementation of ANYCaRE started with a flood/flash flood scenario taking place on a virtual territory composed of 3 distinct areas characterised by various susceptibility to flooding, as well as elements at stake (urban and residential areas, campsite, schools, main bridge, a fall festival gathering locals and tourists) (Figure 16a).

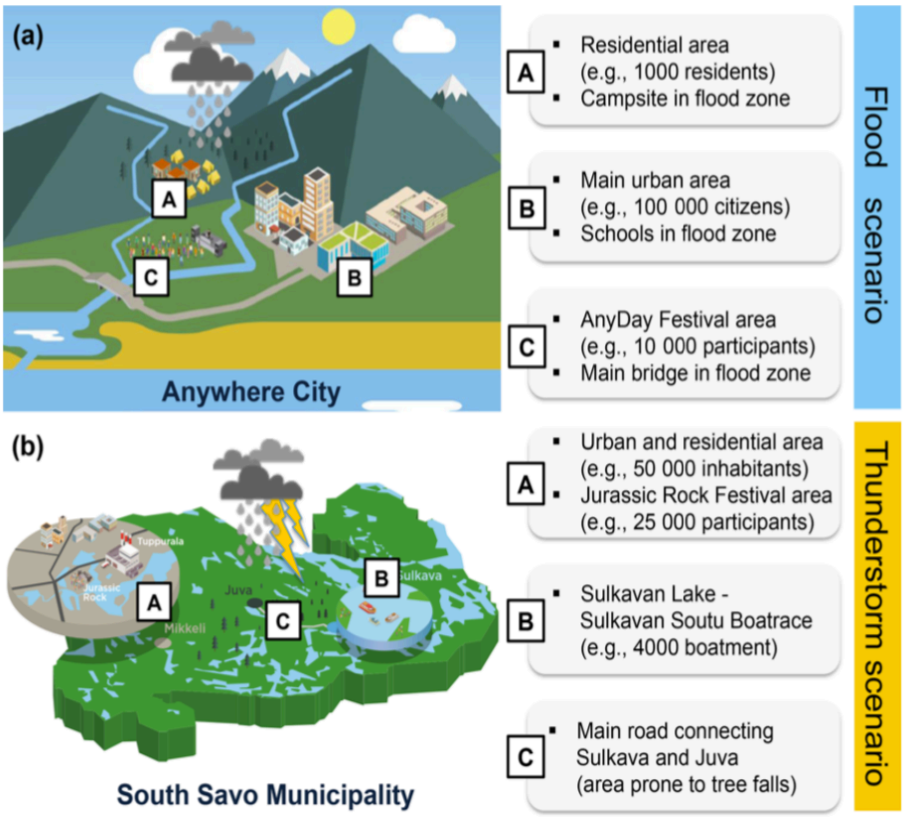


Figure 16: Presentation and brief description of the territory considered in the storyline of ANYCaRE for the (a) flood scenario and (b) strong- wind scenario (Terti et al., 2019).

The game takes place at the beginning of autumn and starts on a Monday, 5 days before the AnyDay festival takes place on the border of the main river. The peak of the festival is planned for Saturday, when visitors are expected to reach numbers of 10 000.

Each player is given a specific sub-role to act as representative of one of the following institutions: (i) hydro-meteorological services, which interpret the hazard model outputs and communicate warnings if needed; (ii) first responder services, which deal with the

possible evacuation of residences, schools, campsites and public events; (iii) the municipality, which makes decisions related to the every- day (e.g. anticipation of school pick-up time, cancellation of school-related transport) or recreational events (i.e. AnyDay festival) in the city; (iv) road services, which manage road closures and the maintenance of the main bridge road in case of a flood emergency.

The flood scenario is running on 3 rounds (1 round by day from Wednesday to Friday, the day preceding the festival). Each round is divided in two trials, the first one where only traditional existing hydro-meteorological forecasts are provided and the second one where new impact-based information tools developed by ANYWHERE are additionally provided. In each trial, collective decisions are to be taken and reported as well as an evaluation of the level of confidence in the chosen decisions (Figure 18a).

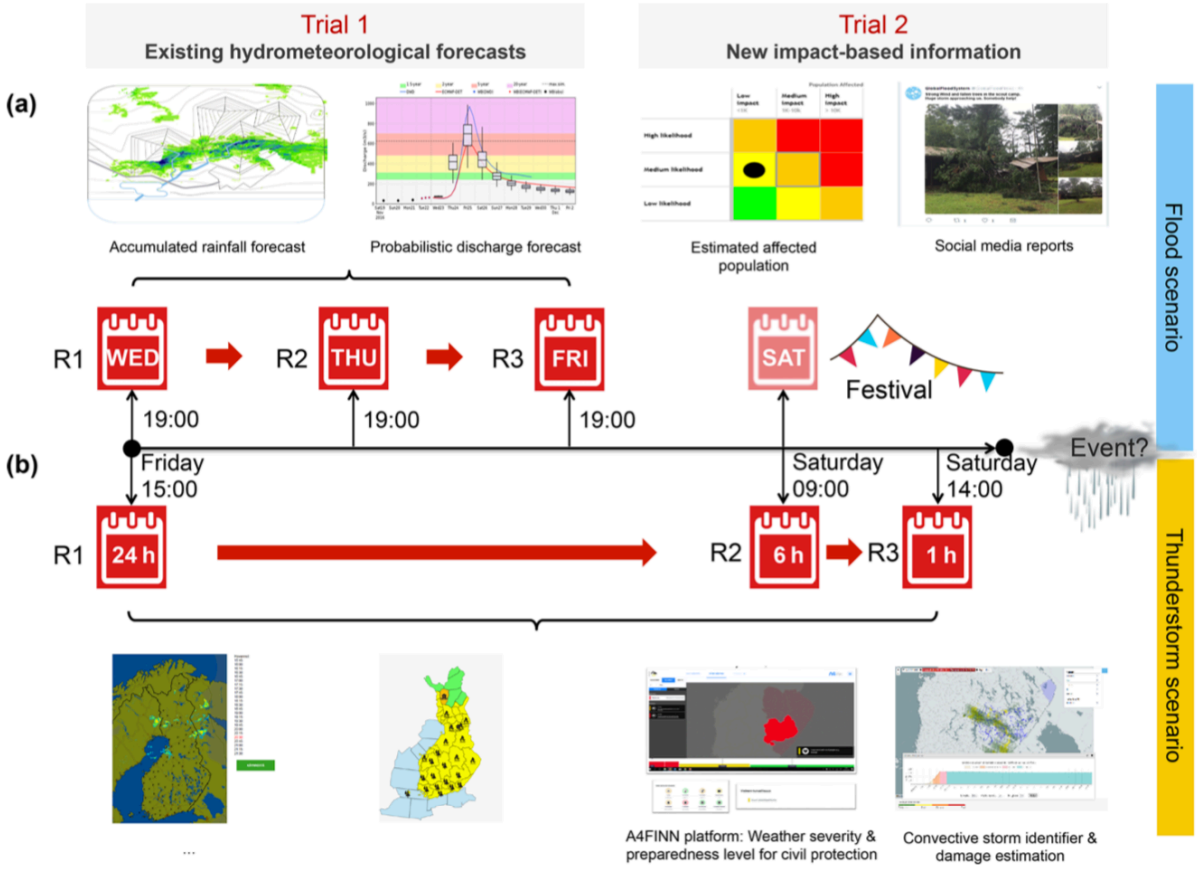


Figure 18 Schematic illustration of the gaming timeline. Each of the three game rounds (R1–R3) played in the experiments corresponds to a daily or hourly time step before the festivals that, according to the storylines, are held on Saturday. In the second trial of each round, the players receive additional decision-support tools including high-resolution forecasts and impact-based vulnerability inputs (Terti et al. 2019)

Strong wind scenario

The strong-wind scenario was built based on the structure of the flood scenario with necessary adjustments. The experiment was originally designed for a combined training day of Finish civil protection services, meteorologists and electricity company

employees in the South Savo municipality. Therefore, the territory and the game roles were selected as representative of the study area. The South Savo municipality has a special landscape with (i) dense forest areas, (ii) power lines above the ground that are vulnerable to strong winds and falling trees, (iii) lake areas attracting numerous boatmen during the summer, and (iv) the urban areas of Mikkeli and Juva (Figure 18b). As in the initial flood scenario 3 distinct areas with specific exposure and vulnerability characteristics composed the virtual territory under concern.

The players of the strong-wind scenario act as (i) meteorologists, who interpret the NWP model information to the customers and issue warnings (and the corresponding meteorological bulletin); (ii) civil protection services, which make decisions for possible evacuation of public events (e.g. Jurassic Rock festival); (iii) electricity companies, which manage the maintenance of electricity distribution to the customers considering the related economic constraints. The electricity company representatives are especially challenged to divide their resources effectively in order to fix potential power cuts as quickly as possible and ensure the electricity supply in the area. Similarly to the flood scenario, the biggest challenge for the players refers to the protection of the festival planned for Saturday.

The timeline in the strong-wind simulations is 24 h before the public events. Given the rapid development tendency, the small size and the short life cycle of convective storms, the forecast time is among the shortest lead times in weather phenomena, making forecasting a real challenge. Therefore, each round is chosen to be in terms of hours prior to the event (i.e. round 1 – 24h, round 2 – 6h, round 3 – 1h ahead) in the ANYCaRE game (Figure 18b). From meteorological perspective, the scenario imitates the so-called “Asta” strong-wind event that happened in 2010 and caused financial losses of over EUR 20 million (Astola et al. 2014). As for the flood scenario each round was composed of 2 trials to allow players to compare the existing tools to the new impact tools. In this scenario, new ANYWHERE tools include the A4FINN, a product developed for the municipality of South Savo, combining relevant weather parameters and a map product to show the automatic, suggested preparedness level of the civil protection services.

Multi-hazards (Nat-tech) hybrid threat and cascading event scenario

In the context of the 2019 Finnish EU presidency, a new and more complex scenario was built with the objective of raising discussions on the different ways Member States are strengthening their capacity and resilience to respond to a variety of emerging threats and on the cross-cutting and cross-sectoral forms of cooperation required to respond to CBRN (Chemical, Biological, Radiological and Nuclear) and hybrid threats.

Based on the experience of the previous scenarios and the opportunity offered by the Finnish EU presidency PROCIV (Working Party on Civil Protection) workshop, the ANYCaRE game developers in collaboration with the Finnish EU presidency team elaborated a multi-hazards hybrid scenario involving extreme weather events (flooding and strong winds) which have cascading effects resulting in an extended power outage, explosion and fire at the chemical plant triggering a release of chemicals and radioactive substances. The accident also causes intense discussions on social media

with disinformation and rumours spreading. Some of the activity seems organized with malicious intent (possible hybrid influencing) and aimed at weakening the trust in authorities.

The scenario takes place somewhere in Europe, on the border of two countries, Alfa and Bravo. The area is geographically prone to flooding. The Lima river flows on the border of country Alfa and country Bravo. County Alfa's territory includes a major and densely populated urban area as well as a chemical plant, located in flood prone zone, using significant quantities of dangerous substances. On the other side of the bordering river, a smaller city and its drinking water treatment plant stand in Country Bravo.

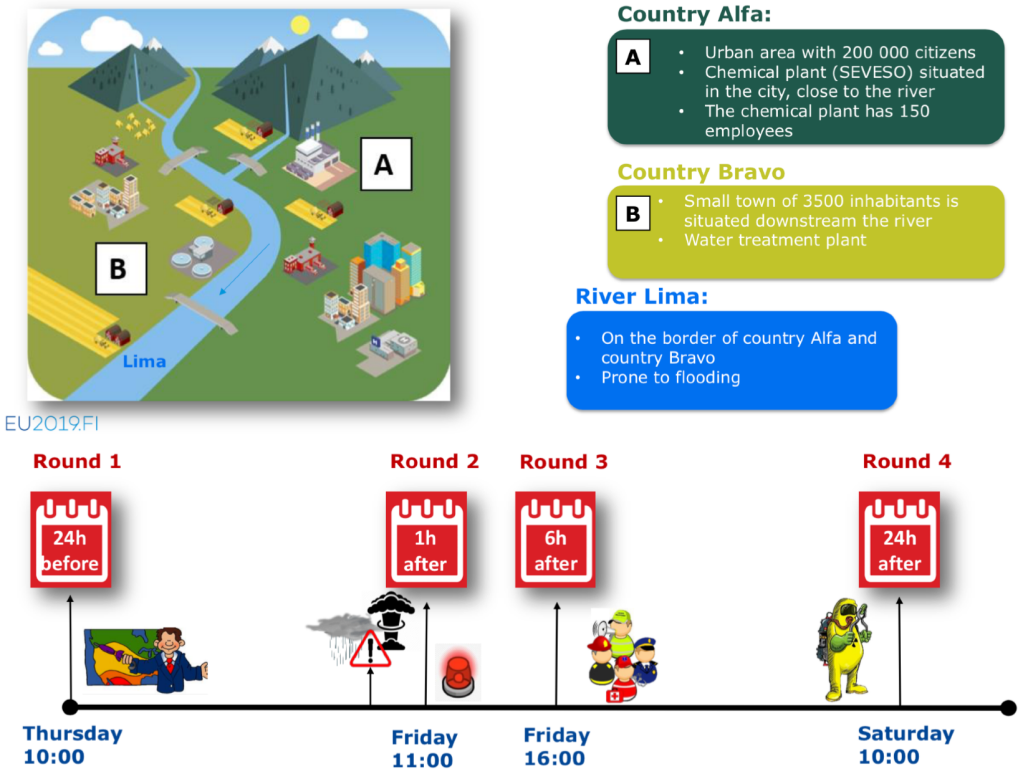


Figure 19 Schematic illustration of the territory of the multi-hazards cascading event scenario and gaming timeline (rounds 1 to 4).

The players of this multi-hazards and cross-border scenario act either as: (i) hydro-meteorological services, which interpret the hazard model outputs and communicate warnings if needed; (ii) local/regional civil protection of country Alfa who are responsible for monitoring, assessing and responding to the local situation and communicating about it to national authorities; (ii) National civil protection authorities of country Alfa and Bravo in charge of cross-sectoral cooperation between national authorities and potentially requesting assistance or activating the European Union Civil Protection Mechanism; (iii) one group leader to organise briefings of the situation at each round and facilitate the decision-making process under time constraint.

The timeline starts on a Thursday, 24 hours before the forecasted extreme weather (heavy rain and strong winds) event. Round 2 begins Friday at 11am, 1 hour after the

explosion in the chemical plant. Round 3 happens 6 hours after the accident and round 4 comes 24 hours later. Because the PROCIV workshop's objectives was to trigger discussions on cross-sectoral cooperation and EU Civil protection mechanism to deal with CBRN and hybrid threats, 4 rounds were needed to install such a complex and cascading scenario which in turn only allowed for one trial by round.

6 Strategies for innovative self-preparedness and self-protection

In this section, strategies for innovative self-preparedness and self-protection are outlined. Within section 6.1 an outline of potential business models is given. In section 6.2, an exemplary strategy for self-preparedness and self-protection from a railroad operator is presented.

6.1 Potential business models for innovative self-preparedness and self-protection

To enhance the potential of innovative self-preparedness and self-protection services and tools offered by third-party enterprises, the services/tools need to be based on an adequate business model. Gassmann et al. (2013) identified 55 generic business model patterns proven to be successful in many branches. These business model patterns were analyzed in relation to their applicability to the field of innovation in self-preparedness and self-protection, results in form of twelve most-promising business model patterns are given in Table 5 below.

Table 5 Business model patterns for innovative self-preparedness and self-protection

Business model pattern	Description	Potential for innovation in self-preparedness and self-protection
Add-on	An existing product is enhanced/augmented by additional services.	Third-party enterprises can enhance existing services by offering self-preparedness and self-protection tools based on ANYWHERE tools. An example can be the augmentation of autonomous driving or routing.
Cross-Selling	The products of an enterprise are enhanced by complementary tools and services.	Third-party enterprises can enhance existing products by complementary services based on ANYWHERE tools. This business model pattern is not suitable for start-ups.
Crowd-Sourcing	Data and tools are gathered from a mass of participating users.	Third-party enterprises can combine ANYWHERE data with other crowd-sourced data to generate customer value.
Freemium	In addition to a free-of-charge basic version, a chargeable premium version with enhanced services is offered.	Any self-preparation and self-protection tool can be offered free of charge in a basic version. A limited number of user updating to a premium version is generating the required value. An example could be enhanced apps with metrological forecast for special target groups.
Guaranteed availability	The product provider guarantees the availability of a service/product.	The availability of a service is guaranteed by a third-party enterprise. Examples could be routing services, logistics of the availability of a product under certain meteorological conditions.
Ingredient Branding	Within a product, components are branded. These components are an independent part of the products value proposition.	Third-party enterprises could license ANYWHERE components and improve the value proposition by outlining the ANYWHERE-branded components implemented in the product.
Layer Player	Here, an enterprise is just focused on providing single parts of the value chain.	Third-party enterprises can create products for other parts of the value chain based on ANYWHERE tools, e.g. an innovative meteorological extension to logistics distribution services.
Leverage Customer Data	Customer data is collected and analysed to generate an added value.	Third-party enterprises may gather customer data, combine it with ANYWHERE tools and thereby generate innovative services for self-preparedness and self-protection.
Pay per use	Payment for the product/service is only due to the usage of the product.	Third-party enterprises may only charge users for their products once an emergency situation occurs. This may enhance the number of users, bur require advanced strategic planning due to high uncertainty about the occurrence of events.

Business model pattern	Description	Potential for innovation in self-preparedness and self-protection
Pay what you want	Users are obliged to pay an amount of money they can determine.	Third-party enterprises may only charge users for their products an amount of money defined by the user. This may enhance the number of users, bur require advanced strategic planning due to high uncertainty about the occurrence of events and the willingness to pay.
Performance-based contracting	The price is not defined by the physical value, but the customer benefit.	Third-party enterprises may outline the benefit of the ANYWHERE integration for the end user. The revenue will then be related to the actual usage of the self-preparedness and self-protection tools.
Solution provider	An enterprise is just focused on providing the solution to a specific problem along the value chain.	Third-party enterprises can just focus on problems related to high-impact weather. An example can be specific tools for forecasting of high-impact weather in relation to the value chain (e.g. logistics services).

6.2 Additional case: Strategy for innovative self-p* for a railway operator

A potential market was identified in the area of railway operations. This was indicated both by initial testings in the Finnish case study (see section 3.1.1) and in Germany. A key player in the German railway operation is “Die Deutsche Bahn AG” (DB), as a train service provider as well as the operator and owner of railnetwork. There are two main drivers for companies in this market related to high impact weather events: damaged resources and less passengers, especially in connection with business travels. Figures acquired for the German market indicate that 40% of passengers could not leave or continue travels due to extreme weather events (see Figure 20), information about weather events is rated as “important” or at least “rather important” by 90% of passengers (see Figure 21). Information about extreme weather and strikes has to be provided beforehand by travel business agencies; the business portal of DB is one of the top six portals to book business travels.

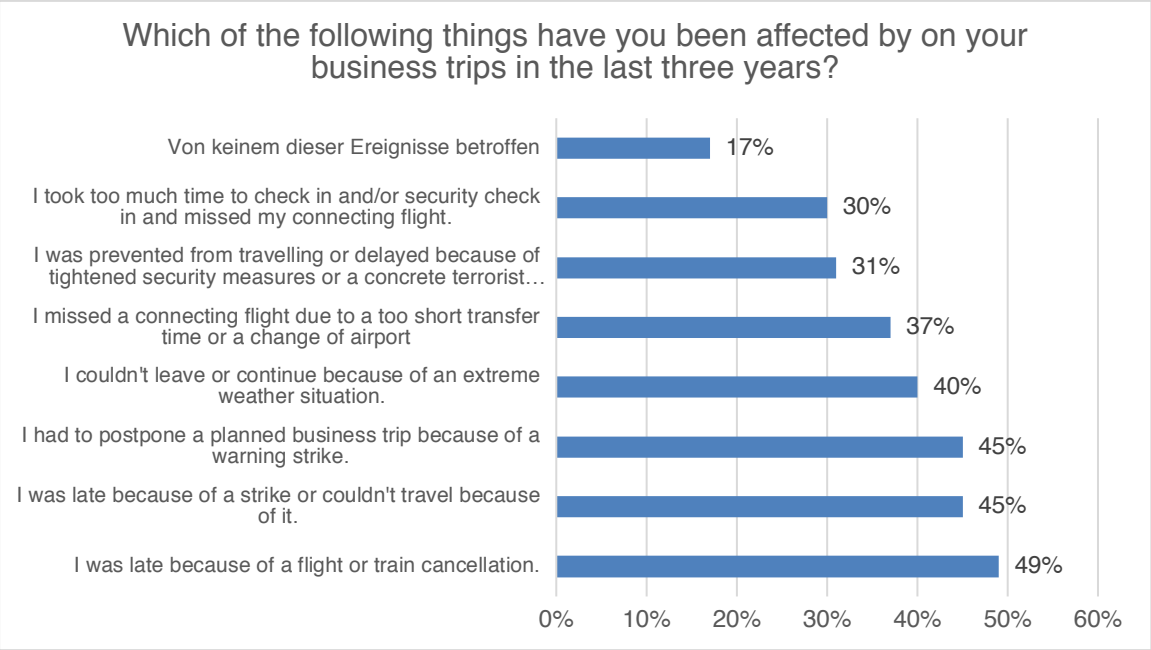


Figure 20: Effects on business trips in the past three years

The importance of an adequate strategy to react to high impact weather on business travellers will only increase in the future, as rail travel for business travel is seen as the fastest growing industry in business travel out of rental car, hotel, flight and rail travel and as of 2018 about 10 billion euros has been spent on business travels with rail services in Germany per year with growing tendencies.

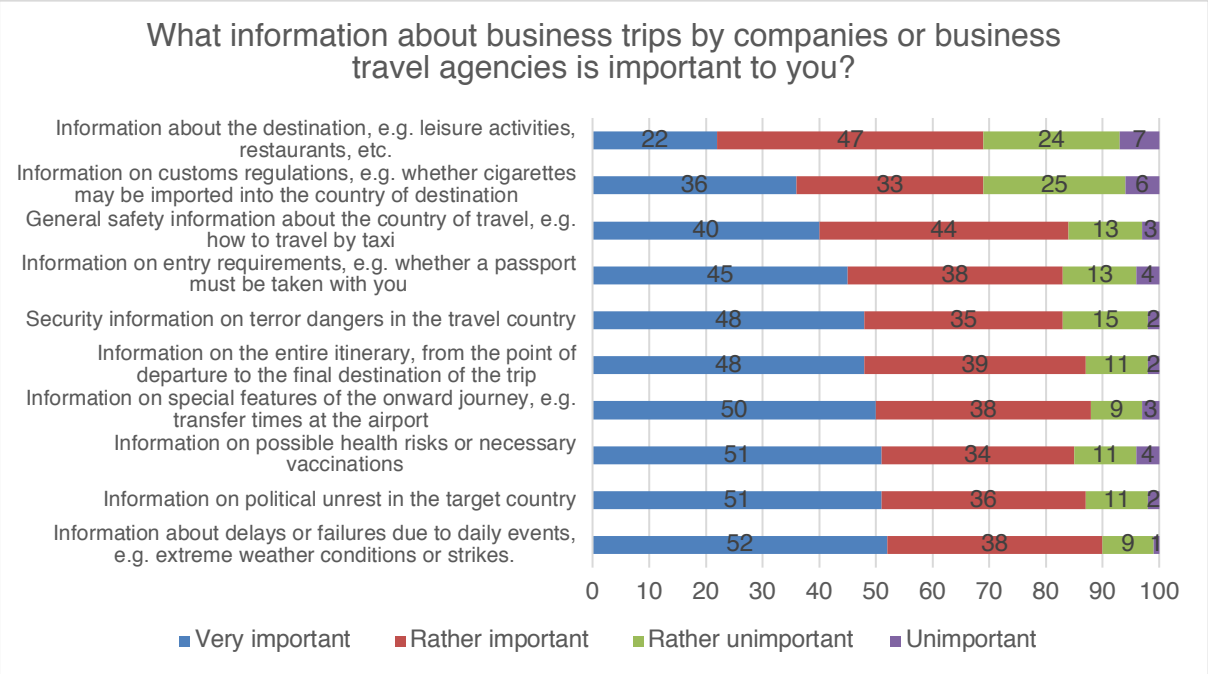


Figure 21: Most important information to business travellers

In conclusion, provision of information about high impact weather impacting business travels and preventive measures to reduce delays and cancelations by extreme weather for rail services is an interesting market.

Following DB numbers, tardiness is a big concern as roughly a quarter of the long distance transport is late (over 6 minutes). As shown in Figure 22, 31% of the delays are caused by infrastructure issues.

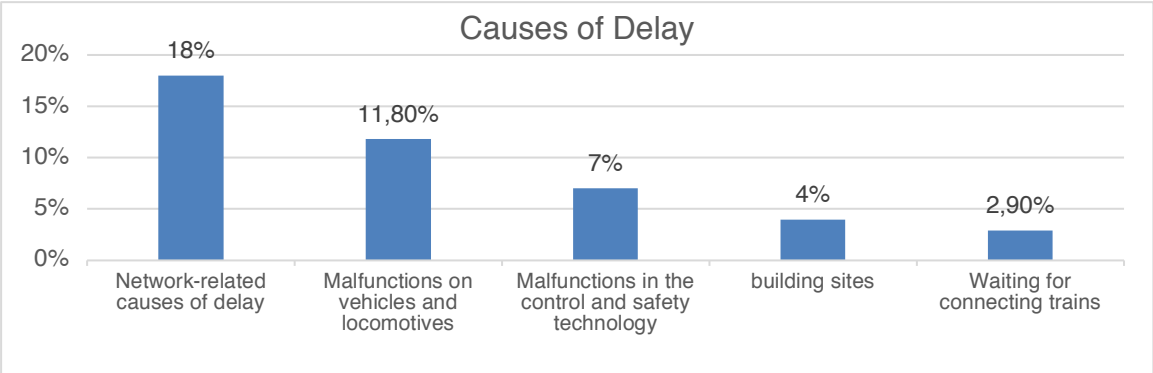


Figure 22: Causes of delay of the Deutsche Bahn AG for long distance transport

DB identifies external and internal factors for these delays and list in their annual tardiness report extreme weather conditions as the first external factor for delays. These extreme weather conditions can be trees, fallen on tracks, or destroyed catenary wire and signals.

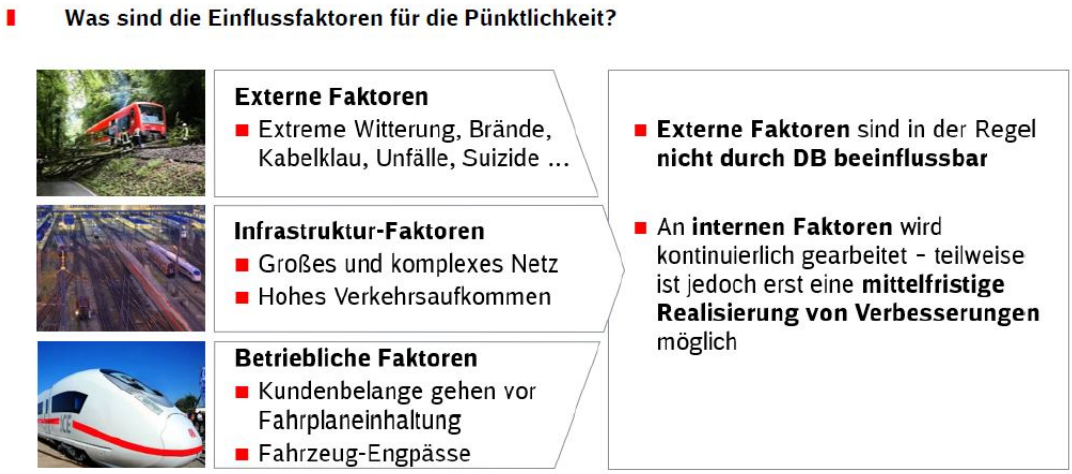


Figure 23: Causes of delay as of Deutsche Bahn

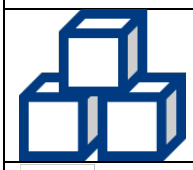
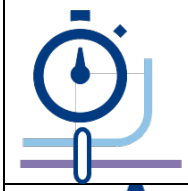
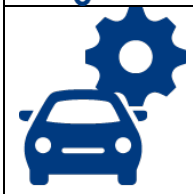
DB has taken several steps to reduce the risks of such delays and cancelations. In the action plan: Adaptation of the German Adaptation Strategy to Climate Change, for example falling trees on tracks as a result of high impact weather have been identified as a consequence of climate change. In the strategy by the German government in response to climate change, out of the 13 steps, actively taken by the government, seven are in context with DB. As a consequence, direct investments have been taken for the securement of the tracks against branches as well as information services for better reactions to extreme weather. From 2013 until 2018, 625 Million € were invested

in vegetation measures and additionally the pilot project „Fiber Optic Sensing" was started, which implements an advanced object detection for trains. This shows the awareness and willingness to react to high impact weather by DB.

6.3 Potential cases with different partners

Promising innovation fields were identified by means of creativity techniques and systematic analysis of branches based on section 6.1. Through the network of the chair of Product Creation, the results of WP5 were mentioned and discussed with different partners. For each partner a potential ANYWHERE based service/tool is presented in the following table. The enterprises reach from small and medium sized companies up to international companies.

Table 6: Potential partners and applications

	Company	Potential service
	Logistics/supply chain software	Software solution provider for logistics management and logistics consulting → Implementation of services in own platform
	Sugar industry	Europe's second largest sugar manufacturer → Forecasting for crop spoilage
	Agricultural machinery	Europe's largest agricultural machinery manufacturer → Forecasting of best harvest time
	Transport information service	Leading transport Information provider, i.e. network planning and end-user apps → Integration of services in planning applications
	Automotive supplier	Leading German engineering company; solution provider for automotive industry → Integration of services in mobility products
	Fire-service vehicles/equipment	World's top three largest manufacturers of fire-service vehicles and firefighting equipment → Integration of services in fire fighting products

	Automotive engineering	One of the world's largest independent development partners to the automotive industry → Integration of services into autonomous driving solution

In corporation with EDAG (see line “automotive engineering” in Table 6) a weeklong workshop was held to develop services, based on the possibilities for autonomous driving and mobility. During that workshop, six different ideas and concepts were developed, as for example the tailoring of the EDAG city bot (Figure 24) to service in preparation and during high impact weather.

Figure 24: EDAG City Bot

As a result of the workshop, two ideas were selected to be further discussed and pursued. One promising idea is to implement high impact weather information to adapt the routing. As a business model, the Add-On business model pattern was selected. A graphic Business model canvas is displayed in Figure 25. The idea is to adapt the routing, calculated by the navigational system, with regards to impacts as severe weather predictions as well as air pollution or temperature and rain. The resulting value proposition is a more energy and resource efficient as well as a save way to a desired location. Therefore, the relationship to the customer is a personal, reliant on mouth to mouth word. The customers are primarily companies in the automotive sector, either manufacturing automobiles or supplying certain components as the navigational system. As mentioned, the revenue streams, resulting from the business model are based on licence, add-on and access, while the cost results from the use of the ANYWHERE platform and the maintenance and development of the software, which also represents the key activities. As partnerships with the costumers and end-users already exist, the most important new key partner are the stakeholders of the

ANYWHERE platform. Lastly, the key resources are knowledge about the integration of components and software in automotive development projects.

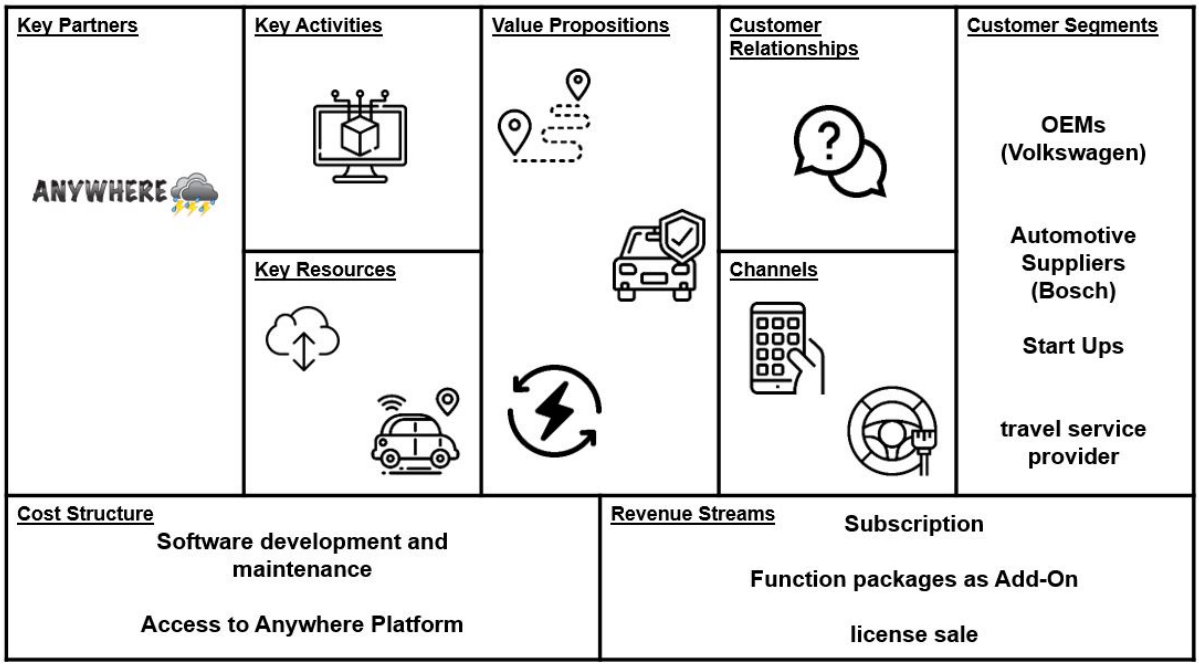


Figure 25: Business Model Canvas

7 Summary and outlook

In this report, best practices and strategies for innovative self-preparedness and self-protection (self-P*) were developed on the basis of the research carried out in WP5. The deliverable is focused on uptake by end users. Final chapters include revisions of guidelines and tools designed to support creation and implementation of self-p* services and tools

To this end, case studies were performed in WP5 and accompanied within the framework of an iterative approach. Within the frame of each case study, observations and interviews were conducted to collect experiences. Across case studies, key stakeholder interviews were conducted with responsible case study leaders. The aim here was to obtain Lessons Learned based on the interviews conducted with regard to self-p* and the tools used at the case studies. With the help of the Lessons Learned, ten key best practices were derived. These best practices represent a continuously expandable framework and must be reviewed and extended at regular intervals, e.g. due to technological developments. In the analysis of the case studies, different perspectives were considered. The first perspective was on summarising the results of the workshops and studies carried out within the framework of the project. The second perspective was on aspects of business continuity with a focus on self-p*. Since risk communication as well as ethical and legal aspects play an important role for self-p*, the perspectives “risk communication aspects” and “ethical and legal aspects” were researched.

New cases were identified in fields like automotive industry with regard to autonomous driving, agriculture in sugar fabrication and fire equipment OEMs. Companies were approached and specific application concepts developed.

On the basis of the feedback received in the case studies as well as on the gathered findings from WP5, WP4 and WP7, the supportive apps and guidelines within the framework of WP5 were expanded in the following way:

- The guidelines already presented in deliverable D5.1 were revised on the basis of the Lessons Learned and extended by short guidelines for a quick overview.
- The CIS was extended by further features (authoring, versioning etc.) to support interaction with stakeholders. Usability was improved on the basis of feedback and the guidelines were integrated into the CIS platform.
- The ANYCARE serious game was continuously advanced and analysed in the context of case studies. In addition to the improvement of the flood scenario, ANYCARE was extended by multi-hazards (Nat-tech) hybrid threat and cascading event scenarios.

The practical and marketable tools for self-p* were extended by strategies for innovative self-preparedness and self-protection. In addition to an evaluation of the market situation, a business impact and a research impact analysis were carried out.

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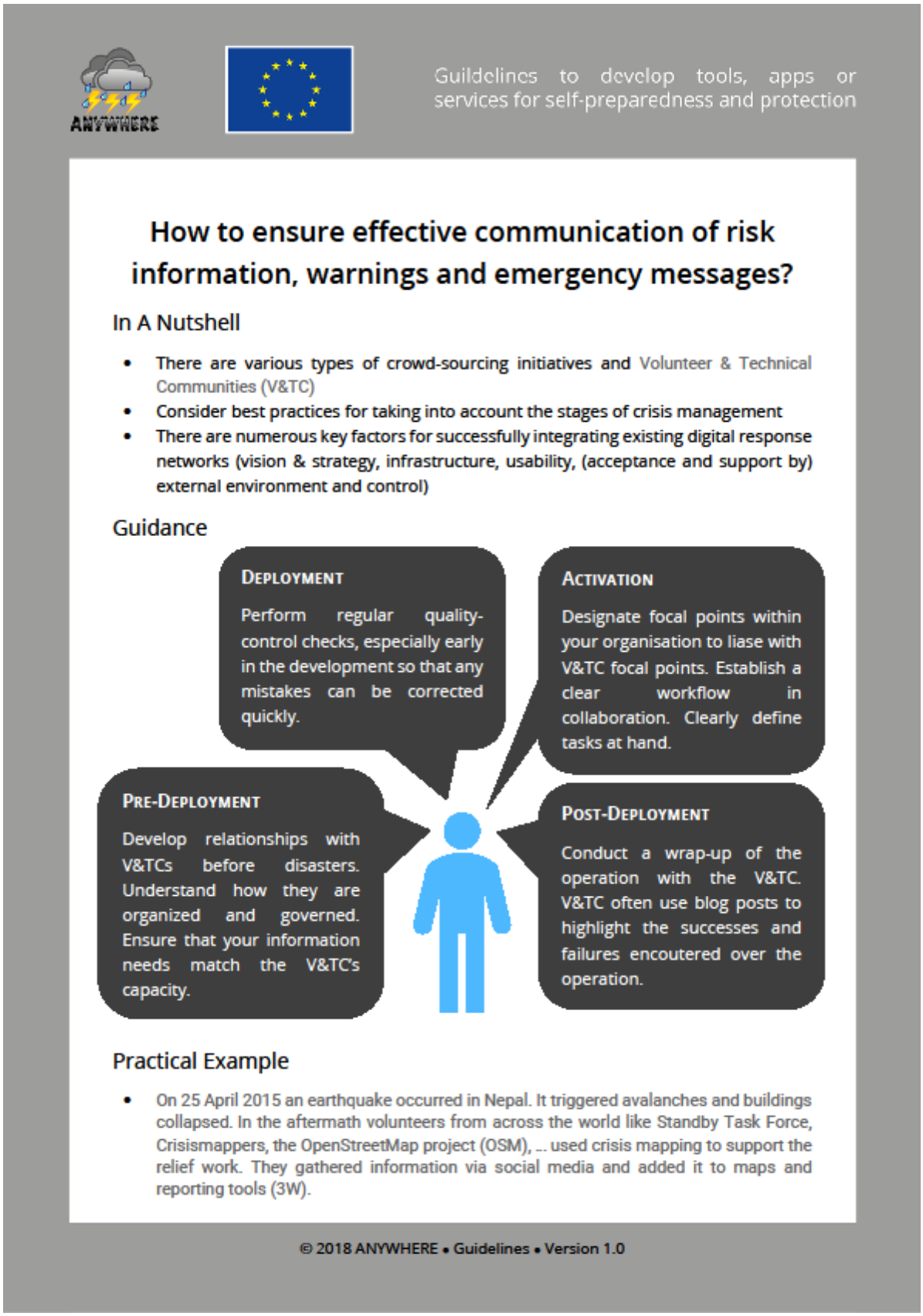
9 ANNEX 1 Guidelines: Short Versions



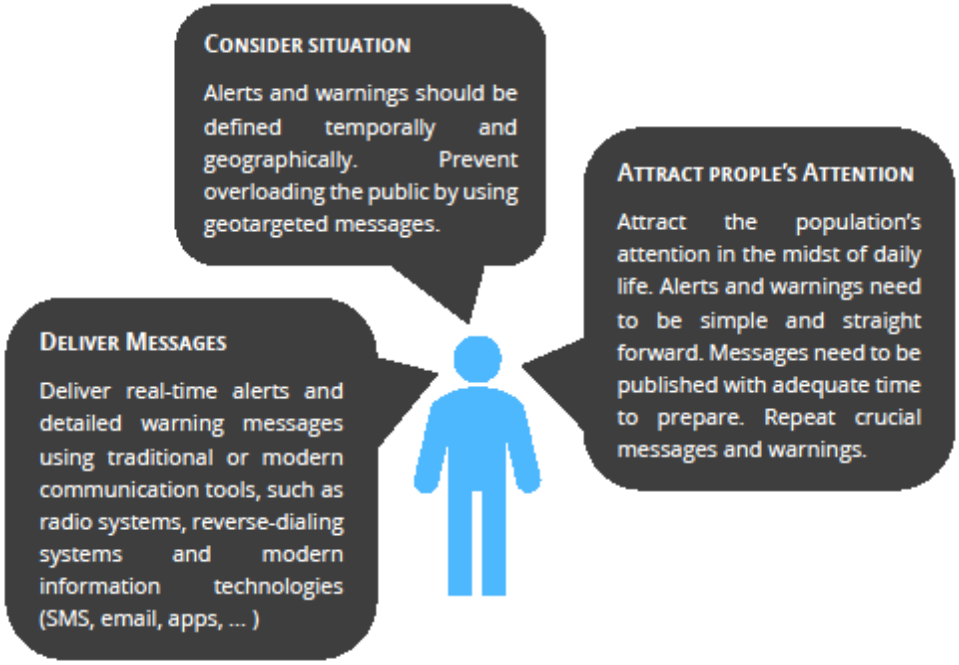
Guidelines to develop tools, apps or services for self-preparedness and protection

How to identify the most relevant timing to deliver emergency messages?

In A Nutshell

- Attract the population's attention during daily life
- Consider the location/situation of recipients
- Ensure the timing and geographic specificity of the messages

Guidance



Practical Example

- **"Guardly"**: Launching Guardly activates its location detection capabilities, transmitting real-time GPS location and indoor positioning within buildings (for select enterprise customers), while providing two-way communication with private security, 911 authorities and safety groups (http://www.guardly.com/technology/mobile-safety-apps.html)
- **"Disaster Alert"**: The mobile application from Pacific Disaster Center's World Disaster Alerts "Disaster Alert" provides mobile access to multi-hazard monitoring of and early warning for natural disasters around the globe (https://index.co/company/disasteraware).

Guidelines to develop tools, apps or services for self-preparedness and protection

How to promote interaction between authorities and the public?

In A Nutshell

- Interactive two-way communication is a key component of effective risk and crisis communication
- Interactive communication during the crisis/response phase is interrelated to the use of social media

Guidance

INFORMATION OF THE PUBLIC

Increase the public's risk awareness for hazards. Explanation of the structure of the illustrations (e.g., colour codes, maps legends). Guidance on specific actions to be taken by individuals in certain situations. Advise for self-protective activities.

COLLECTION OF FEEDBACKS

Perception and knowledge on hazards. Understanding and reliance on the current warning system and the existing emergency services. Self-preparedness and self-protection activities being currently adopted by individuals. Ground facts enhancing situational awareness.

Practical Example

- "STOP DISASTERS!": The United Nation's International Strategy for Disaster Reduction (UN/ISDR) developed a disaster simulation game for children between 9-16 years old (although anyone can play) with the goal to increase their risk awareness and subsequently the probability to survive during disasters.
- Australian Alert SA: The Alert SA Website and Mobile App gather information shared from multiple sources in various social media and map them across South Australia.

Guidelines to develop tools, apps or services for self-preparedness and protection

How to design a successful crowdsourcing initiative?

In A Nutshell

- Collect basic information about the DRN (needs, solutions, risks and benefits) and comply to humanitarian and legal principles
- Set up the network hub
- Success factors are vision & strategy, infrastructure, usability, external environment and control

Guidance

BASIC INFORMATION

Identify the NEED about the problem to solve, the SOLUTION, the risks and benefits associated with creating a DRN and compare them with the benefits, the resources needed for the establishment of a DRN in terms of time, resources, and skills for the short and for the long term.

NETWORK HUB

First thing to be done is to establish and sustain a Network Hub. It is responsible for developing the larger DRN. It must be able to administer, sustain and promote the DRN.

VOLUNTEER AND TECHNICAL COMMUNITIES

The DRN should consist of an eclectic blend of individuals, organizations and networks from V&TCs, local responders and the community.

Practical Example

- The biggest attempt to use the social media in the crisis management was the activation of the Digital Humanitarian Network by the United Nations OCHA in response to Typhoon Yolanda (November 2014).
- During the Balkan floods in 2014with more than 60 people losing their lives and over 3 billion Euro damage, Serbian government was developing the system during the ongoing flood crisis. Government created system for monitoring social media and reports submitted via SMS and emails.

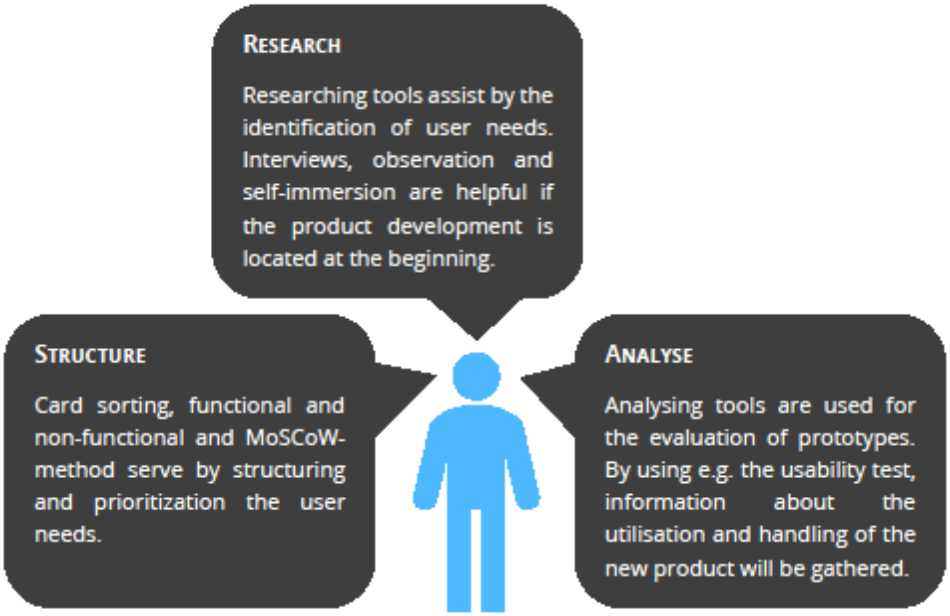
Guidelines to develop tools, apps or services for self-preparedness and protection

How to identify customer needs/ market demands?

In A Nutshell

- Make a detailed analysis of requirements and the customer's needs
- Use proven methods to understand and analyse the user

Guidance



Practical Example

- The aftermath of hurricane Katrina 2006 also concerned people with disabilities. The emergency management plan not include people with disabilities. Later on, an evaluation of the problems and needs of the target group (people with disabilities) during the hurricane had to be done. The result was the Emergency Management Reform. This small example shows special needs of a target group and modifications in emergency management. A transfer in terms of customer / user –driven design is possible.

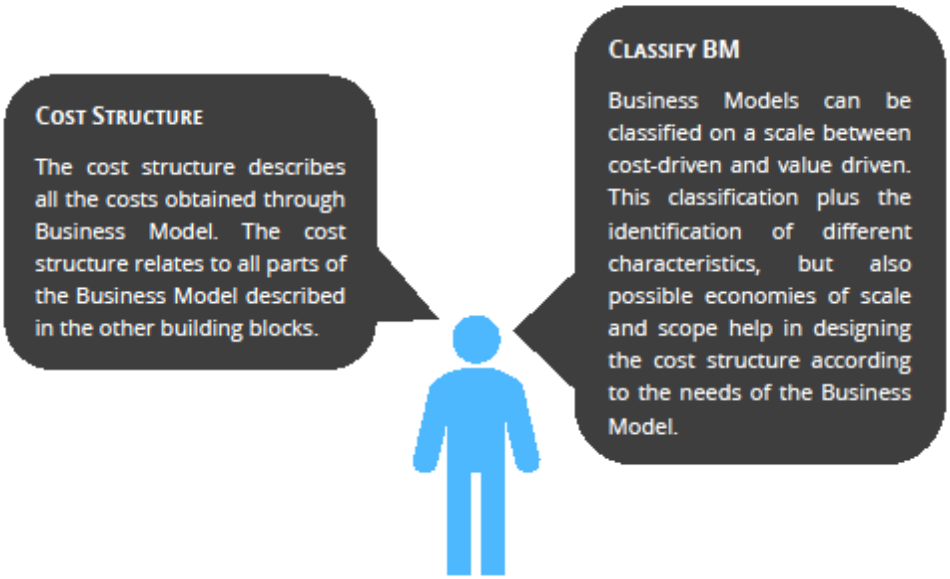
Guidelines to develop tools, apps or services for self-preparedness and protection

How to build a cost structure suitable for the Business Model?

In A Nutshell

- Specify all costs indispensable for the business model
- Osterwalder's Business Model Canvas can be used to define the cost structure
- The cost structure defines the required costs for all assets, activities and partners required to deliver the value specified by the value proposition

Guidance



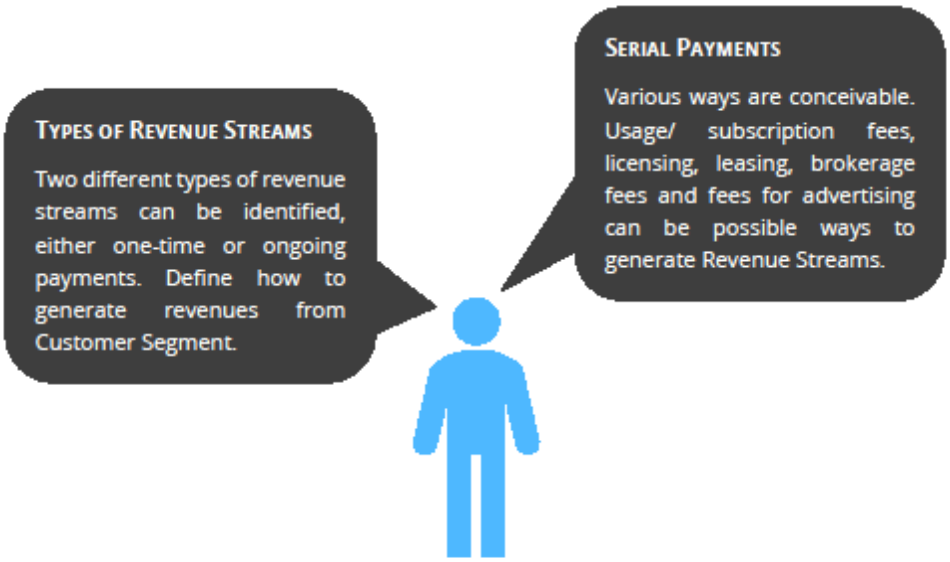
Guidelines to develop tools, apps or services for self-preparedness and protection

How to define revenue streams for a Business Model to capture value?

In A Nutshell

- According to Osterwalder, revenue streams are the fundamental definition of how an organization can capture the value it delivers by fulfilling its value proposition
- Use Osterwalder's Business Model Canvas to define revenue streams
- Sharpen the definition with the questions in the BMC building blocks

Guidance



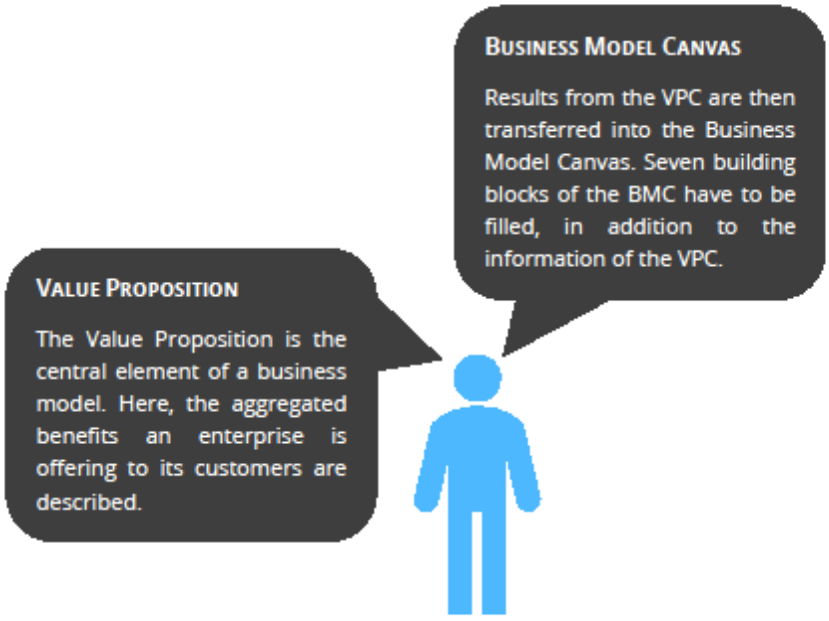
Guidelines to develop tools, apps or services for self-preparedness and protection

How to develop Business Models for innovative products based on ANYWHERE components?

In A Nutshell

- Use the value proposition as the initial starting point for business model development
- Apply Value Proposition Canvas by Osterwalder

Guidance



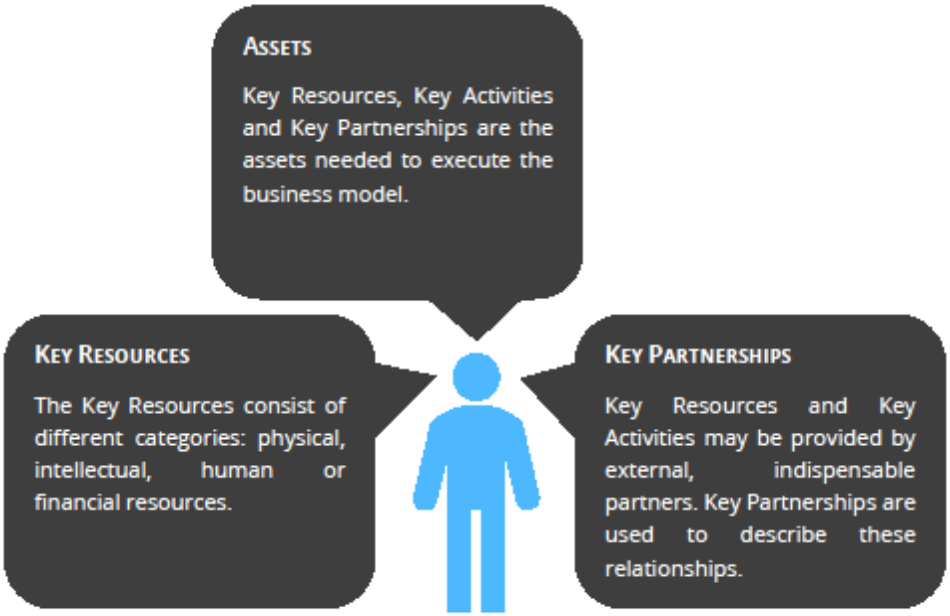
Guidelines to develop tools, apps or services for self-preparedness and protection

How to specify Key Resources, Activities and Partners for a Business Model?

In A Nutshell

- Assets, actions and partners required to deliver the value to the customer have to be defined
- The assets, actions and partners can either be internal or external to the company offering the value proposition
- Use Osterwalder's Business Model canvas to define the assets

Guidance



Guidelines to develop tools, apps or services for self-preparedness and protection

How to use other business models or business model patterns for developing a Business Model?

In A Nutshell

- Apply Gassmann's Business Modell Patterns for inspiration or the development of new business models
- As a tool developer, adapt or modify these patterns for your services or tools
- Business model pattern cards can be used as a workshop tool
- Use the principles of confrontation or similarity for applying the Business Model Navigator

Guidance

SIMILARITY PRINCIPLE

The principle starts with the current BM and searches for similar industries. If these are found, the Business Models are selected from the pattern cards. Then the patterns are analysed from the most similar towards the least.

CONFRONTATION PRINCIPLE

This principle starts with the comparison with the most contradicting BM. Due to the contradiction, the current BM is challenged and new ideas besides existing ones should be encouraged.

10 ANNEX 2 Recommendations for citizens

Recommendation targeting citizens are based on official / government sources from various European countries. Currently 25 references were taken into account to derive conclusions from the numerous recommendations in high impact weather events. The most significant considered recommendations are published under https://cis-anywhere.eu/recommendations-citizens/#existing_recommendations.Represented countries are highlighted in the following Figure.

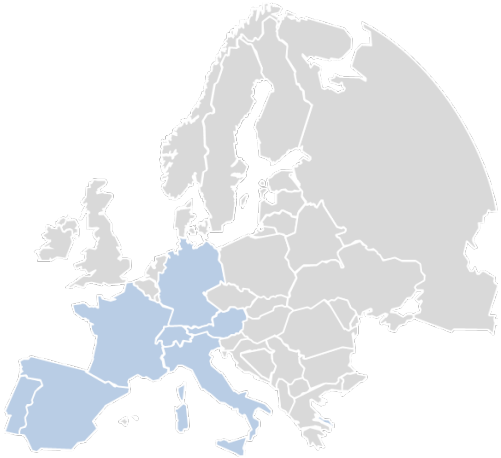


Figure 26 Sources used from blue marked countries

Independent from the country recommendations are mainly scenario-depended. Thus, recommendation differ if the event is flood or drought. Due to that fact recommendations were clustered in relation to defined scenarios. Considered scenarios are: flood, thunder storm, wild fire, strong winds, droughts, snow, avalanches, cold waves, and heatwaves.

All recommendations are included as scenario-based checklist in the ANWHERE CIS, see following Figure 27.

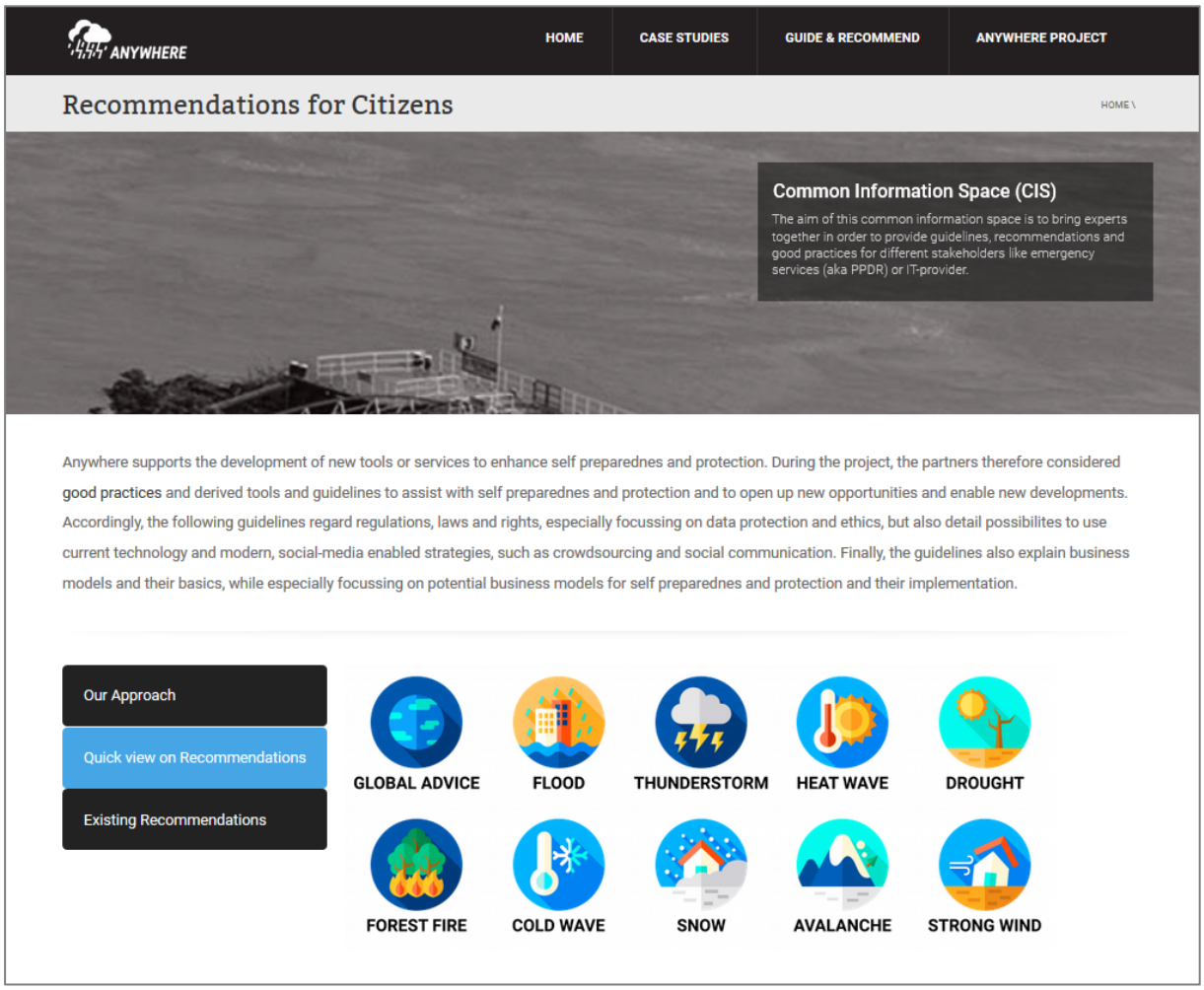


Figure 27 Scenario driven self-p* recommendations

In each of the scenarios specific recommendations are collected. The structure of the recommendation is quite similar. First some general information in relation to the disaster type are provided. Subsequently main advices to remember are visible. And last the concrete recommendations are listed. Here, the checklists are grouped in correlation to the timing phases. There are recommendations before, during and after an event occur. Categories like personal advices or spatial recommendation will support citizens to better identify relevant topics. The recommendations targeting floods are illustrated below (Figure 28).

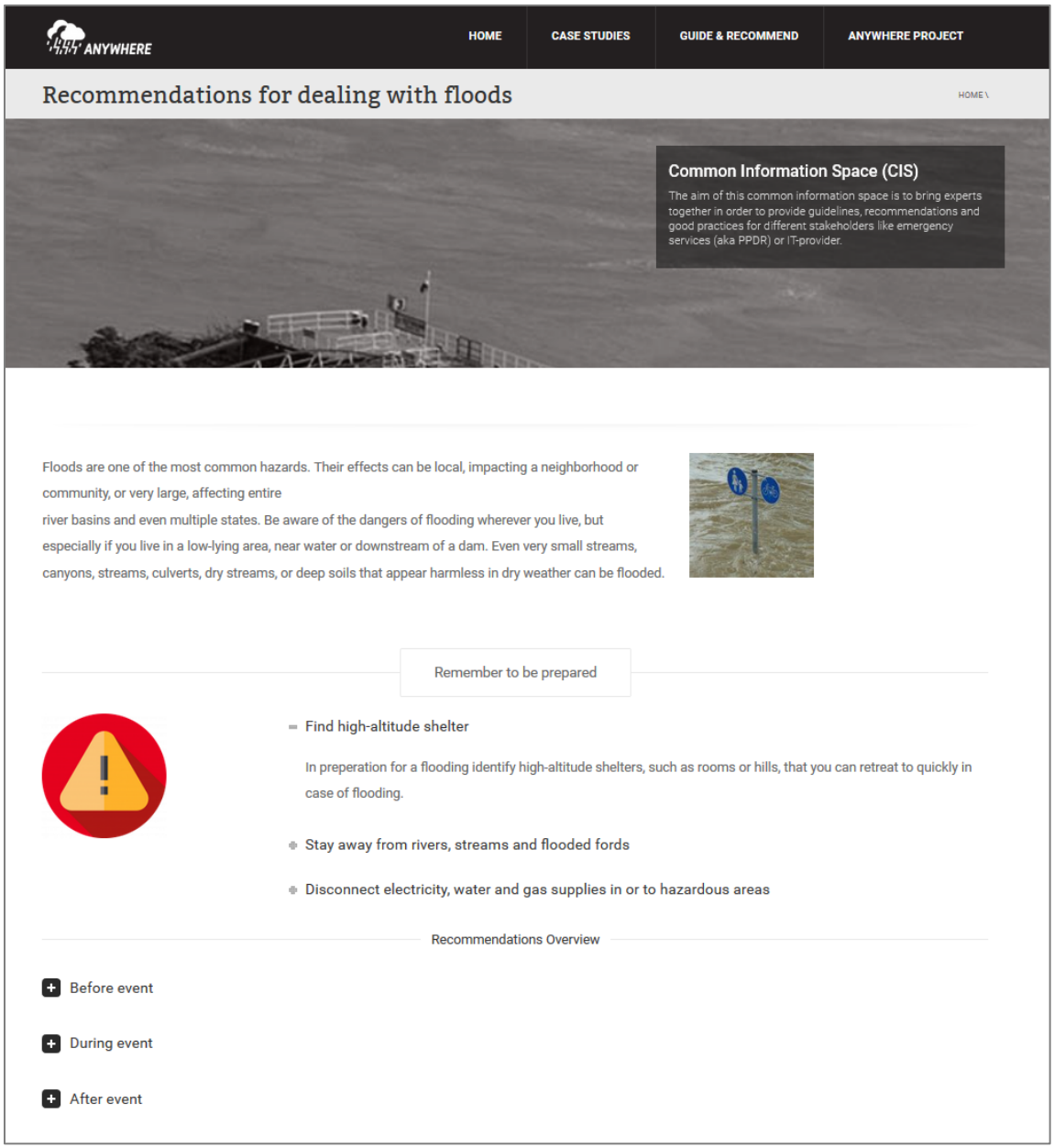


Figure 28 Self-p* recommendation targeting flood

11 ANNEX 3 Implementation Details on the supportive Tools

11.1 Common Information Space

A common information space is not only the provision of a shared database, it is moreover cooperative work, active construction and negotiation of shared objects by the members of a common information space. (Schmidt and Bannon, 1992, p 20)

In terms of ANYWHERE especially the WP5 team use the common information space to discuss, present and reflect results and work done in the WP.

11.1.1 Requirements & Use Cases

This section will provide an overview about the overall approach for creating the ANYWHERE common information space and therefore includes related requirements and use cases. The used template to declare the relevant use cases for the Anywhere CIS and further presents the conducted use cases. For the description of use cases two perspectives were taken into account:

- First the authors of CIS content
- And subsequent the visitors of CIS content

In a next step the way for documenting the use cases will be presented. For the descriptions of use cases the template from (Denger, Paech, and Benz 2012). The already existing template considers following topics:

- Use case name,
- Actors,
- Intent,
- Precondition,
- Flow of events,
- Exceptions,
- Rules,
- Quality constrains,
- Monitored environmental variables,
- Controlled environmental variables and
- Post conditions.

This template was adapted and reduced to needs of the ANYWHERE project and is documented in the table below

Table 7 Use-Case Template

Use Case Name	Brief description. Usually a paragraph or less.
Actor	A list of the Actors who is involved in that use case
Aim of the actor	Describe the trigger why the actor initiate that use case
Precondition	List of any conditions that must be true, before the use case can be started.
Flow of Action	List of actions that the user wants to do with the system and responses of the system
Post-condition	Condition that must be true after the use cases

Basic definitions

The following table provide an overview about defined roles and general terms to better understand use cases and requirements.

User roles	
Manager	Is defined by the WP5 leader.
Authors	Are defined by the manager. Initially all WP5 members are authors. The list of authors can be extended by the manager. Anywhere partners can suggest additional authors to the manager.
Consortium member	Has read-access to all guidelines (incl. draft versions), recommendations (incl. draft versions) and good practices
Visitor	Has read-access to published guidelines / recommendations / good practices. Visitors could be IT-Provider, enterprises, citizen or PPDR. All have different perspectives on guidelines and recommendations and require role-based access to the provided information
General terms	
Guideline	“Guidelines” that help developers and integrators to create new tools and services (resp. extend existing ones) for self-p* based on ANYWHERE products with high business impact
DRAFT Guideline	A draft guideline is not publically available.
Recommendation	“Recommendations” that help citizens, enterprises and other organisations to select, to procure and to roll-out appropriate tools and services as part of preparedness activities
DRAFT Recommendation	A draft recommendation is not publically available.
Good Practice	“Good practices” which provide practical, case related knowledge about technologically supported self-p* targeting offering, procurement and use of tools and services.
Tag	Used to categories documents / guidelines / recommendations. Tags can be added by authors and visitors.

Space	A space is defined by set of tags. Only administrators can associate tags to spaces.

Uses Cases – CIS (Authors & Manager)

Use Case	Provide new DRAFT guideline / DRAFT recommendation / Good Practice
Actor	Authors (WP5 partner)
Aim of the actor	Author likes to provide a new guideline / recommendation / good practice
Precondition	1. Author is logged into the CIS 2. Access rights are given to respective Authors 3. Draft guidelines / Draft recommendation / Good Practice is ready for provision
Flow of Action	1. Navigate to CIS 2. Select “upload new guideline” / “upload new recommendation”, “upload new good practice” 3. Select at least one predefined tag to categories the guideline / recommendation / good practice a. OPTIONAL: Define new tags. 4. OPTIONAL: Define status of guideline / recommendation / good practice as [ready for publication, internal draft, minor changes]
Post-condition	1. New DRAFT guideline / recommendation / good practice is provided 2. OPTIONAL: If author marked the DRAFT guideline / DRAFT recommendation to be published, the manager will be informed to initiate the quality assurance process

Use Case	Edit DRAFT guideline / DRAFT recommendation / Good practice
Actor	Authors (WP5 partner)
Aim of the actor	Author likes to edit an existing guideline / recommendation / good practice
Precondition	1. Author is logged in 2. Access rights are given to respective authors 3. Draft guidelines / Draft recommendation / Good practice is already existing
Flow of Action	1. Navigate to CIS 2. Select “edit/replace guideline” / “edit/replace recommendation”, / “edit/replace good practice” 3. Edit guideline / replace guideline / edit recommendation / replace recommendation / edit good practice / replace good practice by uploading a new version a. OPTIONAL: Online collaborative editing of the document

	4. Modify tags. a. OPTIONAL: Define new tags. 5. OPTIONAL: Define status of guideline / recommendation / good practice as [ready for publication, internal draft, minor changes]
Post-condition	1. New DRAFT guideline / DRAFT recommendation / good practice is provided 2. OPTIONAL: If author marked the DRAFT guideline / DRAFT recommendation to be published, the manager will be informed to initiate the quality assurance process

Use Case	Initiate & perform QA process
Actor	Manager
Aim of the actor	Manager wants to ensure the quality of guidelines / recommendation / good practice
Precondition	1. Manager is logged in 2. Access rights are given to respective manager 3. Draft guidelines / Draft recommendations / good practices marked as to be published exists
Flow of Action	1. Access guideline / recommendations / good practices and initiate & perform QA process 2. Inform author about the result of the QA process
Post-condition	1. QA process was performed 2. [OPTIONAL] Publish guideline / recommendation if QA was not rejected.

Uses Cases – CIS (Visitors)

Use Case	Access and Search existing guidelines / recommendation / good practice
Actor	Visitor
Aim of the actor	Visitor wants to access/download guidelines / recommendation / good practice
Precondition	Guidelines / recommendation / good practice is publically available
Flow of Action	1. Visit *cis.anywhere-h2020.eu* 2. Access guideline / recommendation / good practice by navigating to existing spaces OR using the free-text / tag based search engine.
Post-condition	Actor could access / download guidelines / recommendation / good practice

Use Case	Commenting guidelines / recommendation / good practice
Actor	Visitor

Aim of the actor	Visitor wants to provide feedback on a guideline / recommendation / good practice
Precondition	Guidelines/ recommendation / good practice is publically available
Flow of Action	1. Visit *cis.anywhere-h2020.eu* 2. Access guideline/ recommendation / good practice by navigating to existing spaces OR using the free-text / tag based search engine. 3. Use contact form to provide feedback
Post-condition	Manager and Author will be informed about feedback

11.1.2 Derivation of Requirements

Template

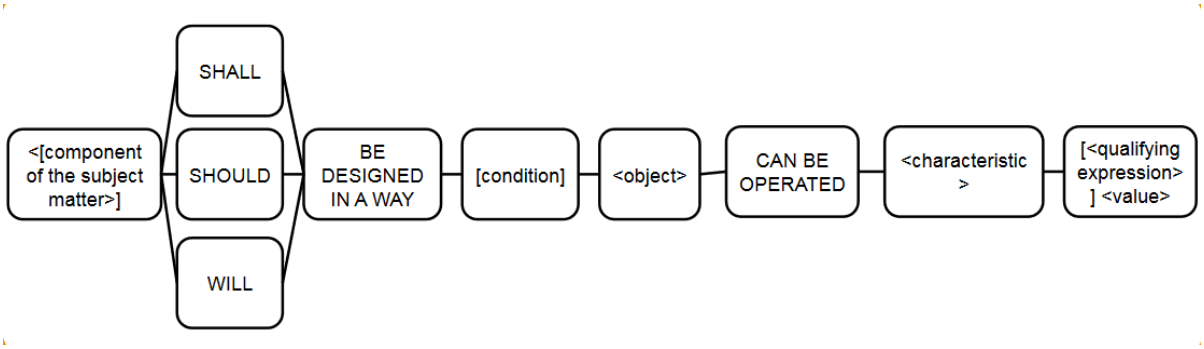


Figure 29 Template Rupp and Pohl (Klaus Pohl 2011)

<Number>	<Title of the requirement>	<Classification: Shall/Should/Will>
Description:	The description should follow the template above	
Reason:	Reason and background information for the requirement	
Relation:	Relation to other requirements	
Additional Information:	If needed additional information to understand the requirement	
Author:	Author of the requirement	<Version>

Requirements

01	Rights Management	WILL
Description:	The ANYWHERE CIS will be designed in a way that permits it to be operated with different user roles.	

Reason:	The ANYWHERE CIS needs to provide a user rights management system that differentiates between visitors (including IT-Provider, enterprises, citizen, PPDR), authors and managers and grants each role its corresponding access and permissions.	
Relation:		
Additional Information:	Roles: 1. Visitor 2. Author 3. Manager	
Author:	UPB	1.0

02	Full-text Search	SHOULD
Description:	The ANYWHERE CIS should be designed in a way that enables the visitor to use a search on the guidelines / recommendation / good practice.	
Reason:	A full-text search enables the user to find information in guidelines / recommendation / good practice, especially not knowing the specific name of the needed guideline / recommendation / good practice.	
Relation:		
Additional Information:		
Author:	UPB	1.0

03	Editing	WILL
Description:	The ANYWHERE CIS will be designed in a way that enables the editing of the guidelines / recommendation / good practice.	
Reason:	The CIS shall allow authors and users to collaboratively work on the guidelines / recommendation / good practice.	
Relation:		
Additional Information:		
Author:	UPB	1.0

04	Versioning	SHOULD
Description:	The ANYWHERE CIS should be designed in a way that supports the versioning of the draft guidelines / draft recommendation / good practice.	
Reason:		

Relation:	03	
Additional Information:		
Author:	UPB	1.0

05	Interaction	WILL
Description:	The ANYWHERE CIS will be designed in a way that it supports user interactions with the guidelines / recommendation / good practice in form of *liking* and *sharing*.	
Reason:	06	
Relation:		
Additional Information:		
Author:	UPB	1.0

06	Comments	SHOULD
Description:	The ANYWHERE CIS should be designed in a way that enables the users and visitors to comment on guidelines / recommendation / good practice.	
Reason:	Comments of visitors are feedback for the guideline authors and can be used in future revisions of a guideline.	
Relation:	05	
Additional Information:		
Author:	UPB	1.0

07	Traceability	SHOULD
Description:	The ANYWHERE CIS should be designed in a way that it enables the tracing of changes and other interactions with the guidelines/ recommendation / good practice.	
Reason:		
Relation:	03, 04, 05, 06	
Additional Information:		
Author:	UPB	1.0

08	User-centred Design	WILL

Description:	The ANYWHERE CIS will be designed in a way that enables the user (visitor, manager and author) to sort and filter the guidelines / recommendation / good practice according to the user's needs.	
Reason:		
Relation:		
Additional Information:		
Author:	UPB	1.0

09	Quality Assurance	WILL
Description:	The ANYWHERE CIS will be designed in a way that it automatically initiates a quality assurance process for a given guideline / recommendation / good practice upon the author's decision to publish it.	
Reason:	To ensure a constantly high quality of the guidelines / recommendation / good practice, a quality assurance process needs to be provided. Upon the author's decision to publish a guideline / recommendation / good practice, the manager needs to be informed automatically that a QA process is to be initiated. The guideline / recommendation / good practice may only be published upon completion of this process and the manager's decision.	
Relation:		
Additional Information:		
Author:	UPB	1.0

10	Publication of guidelines	WILL
Description:	The ANYWHERE CIS will enable the manager to easily publish new guidelines / recommendation / good practice.	
Reason:	The ANYWHERE CIS will grow over the project period and even beyond. Based on comments from external parties new or adapted guidelines / recommendation / good practice will be developed and need to be published.	
Relation:		
Additional Information:		
Author:	UPB	1.0

11	role-driven access to guidelines / recommendation / good practice	WILL
Description:	The ANYWHERE CIS will enable access to guidelines / recommendation / good practice based on the visitor´s background	
Reason:		
Relation:		
Additional Information:		
Author:	UPB	1.0

11.1.3 CIS Structure

The first published version of the CIS will be presented in this section. During the design of the CIS we identified, that the structure of the CIS is very important for the stakeholders we're targeting. A sitemap was created to provide to structure the CIS as a Sitemap presented below. This diagram contains all the information concerning which site leads to which sub-site, and which site contains information and / or links towards a given topic. The colour of a field marks the layer within the context, blue means top-level, orange is a subcategory and the grey ones are the different topics one can navigate to without leaving the subcategory.

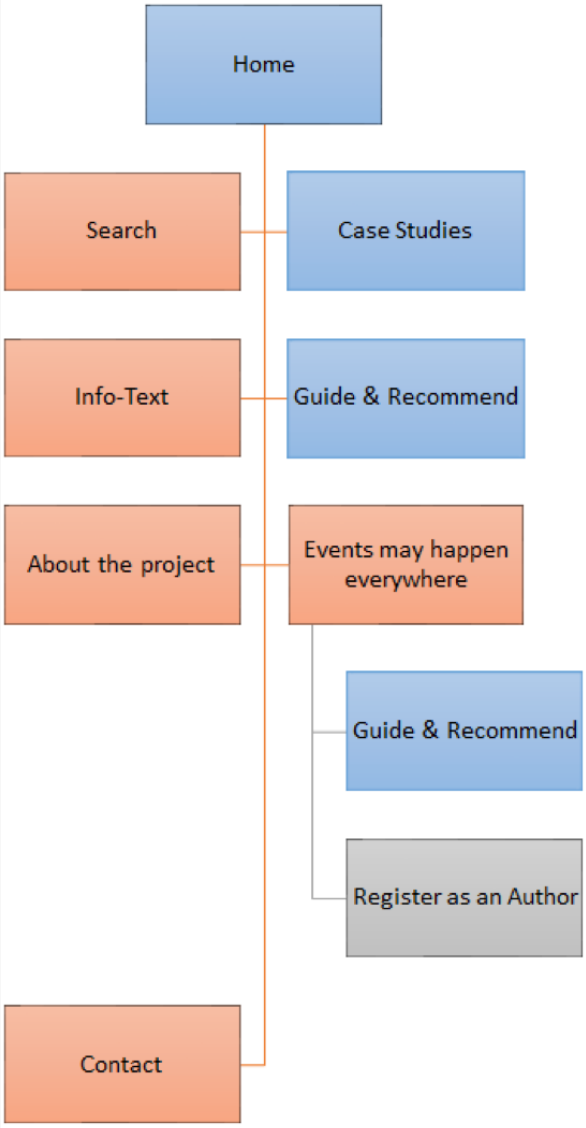


Figure 30 Sitemap 1/2

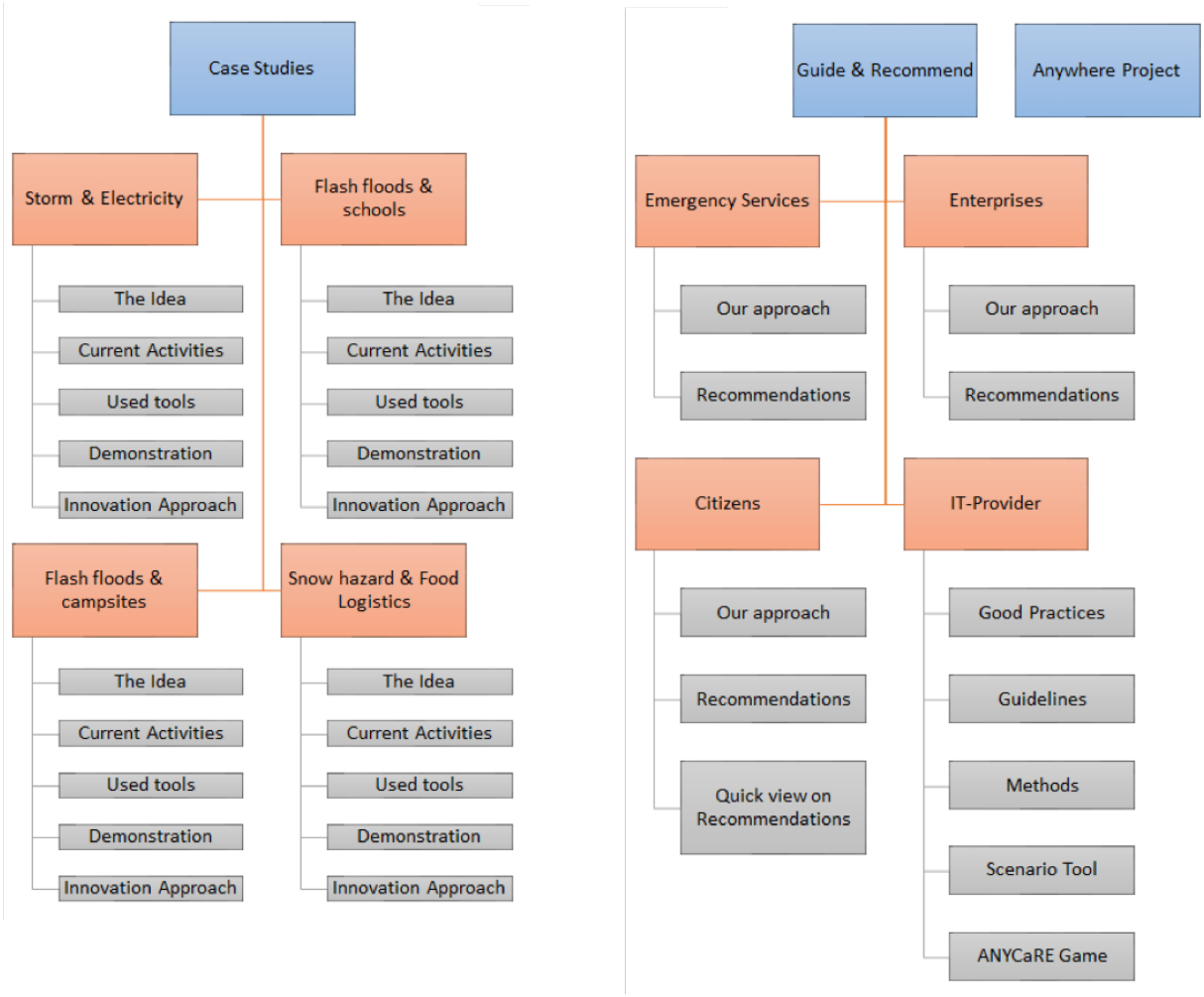


Figure 31 Sitemap 2/2

11.1.4 Implementation insights – V1

Based on the sitemap and structure the first version of ANYWHERE CIS was implemented and hosted at https://cis-anyhwere.eu. The CIS provides useful information regarding self-p* for all stakeholders (see section 2.5). Below some example pages are considered in more detail. All recommendations and results from the Lessons Learned and the locations were published in the ANYWHERE CIS. Below some example are given how the CIS was implemented considering the derived requirements and use cases (see section 11.1.1).

Front Page

All main areas can be accessed on the start page. In addition to a search function, the areas Guidelines Recommendations and Good Practices as well as the info area for the case studies are highlighted.

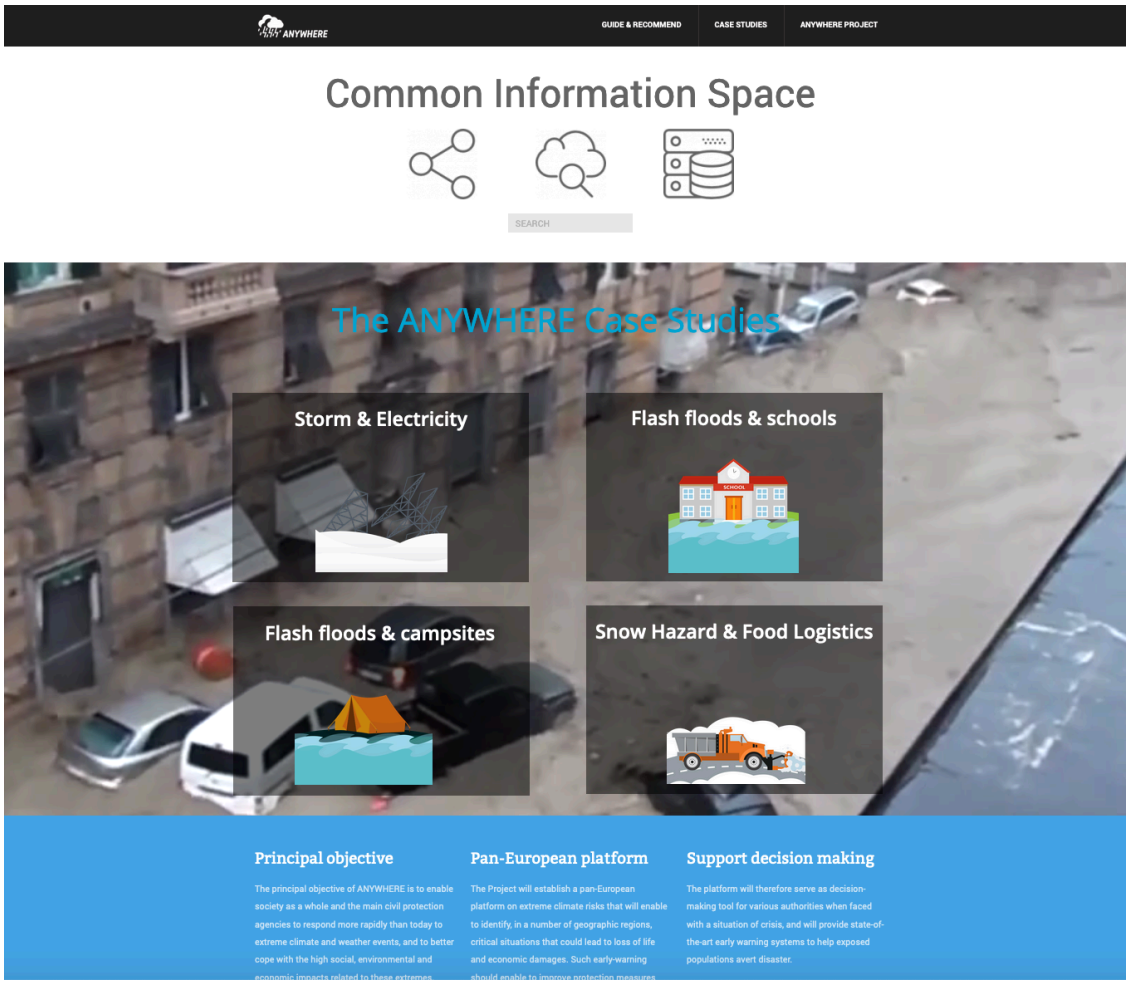


Figure 32 CIS Front Page - Initial Version (1/2)

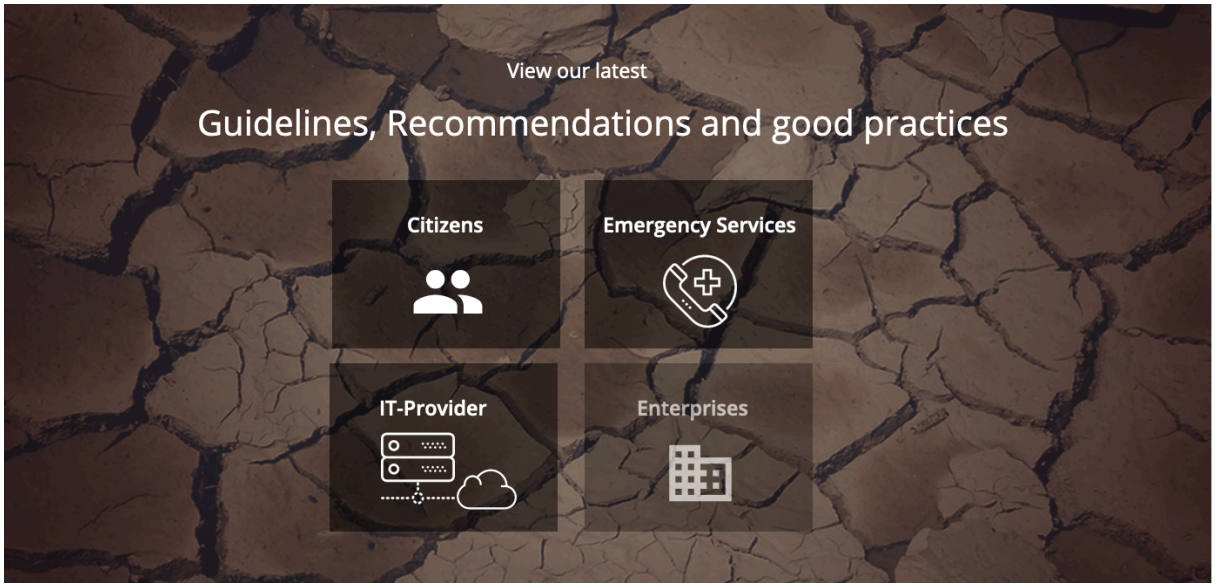


Figure 33 Front Page - Initial Version (2/2)

Sub-Page: Case Studies

From the case studies section, interested parties can track initial information on the case studies conducted in ANYHWERE as well as current activities.

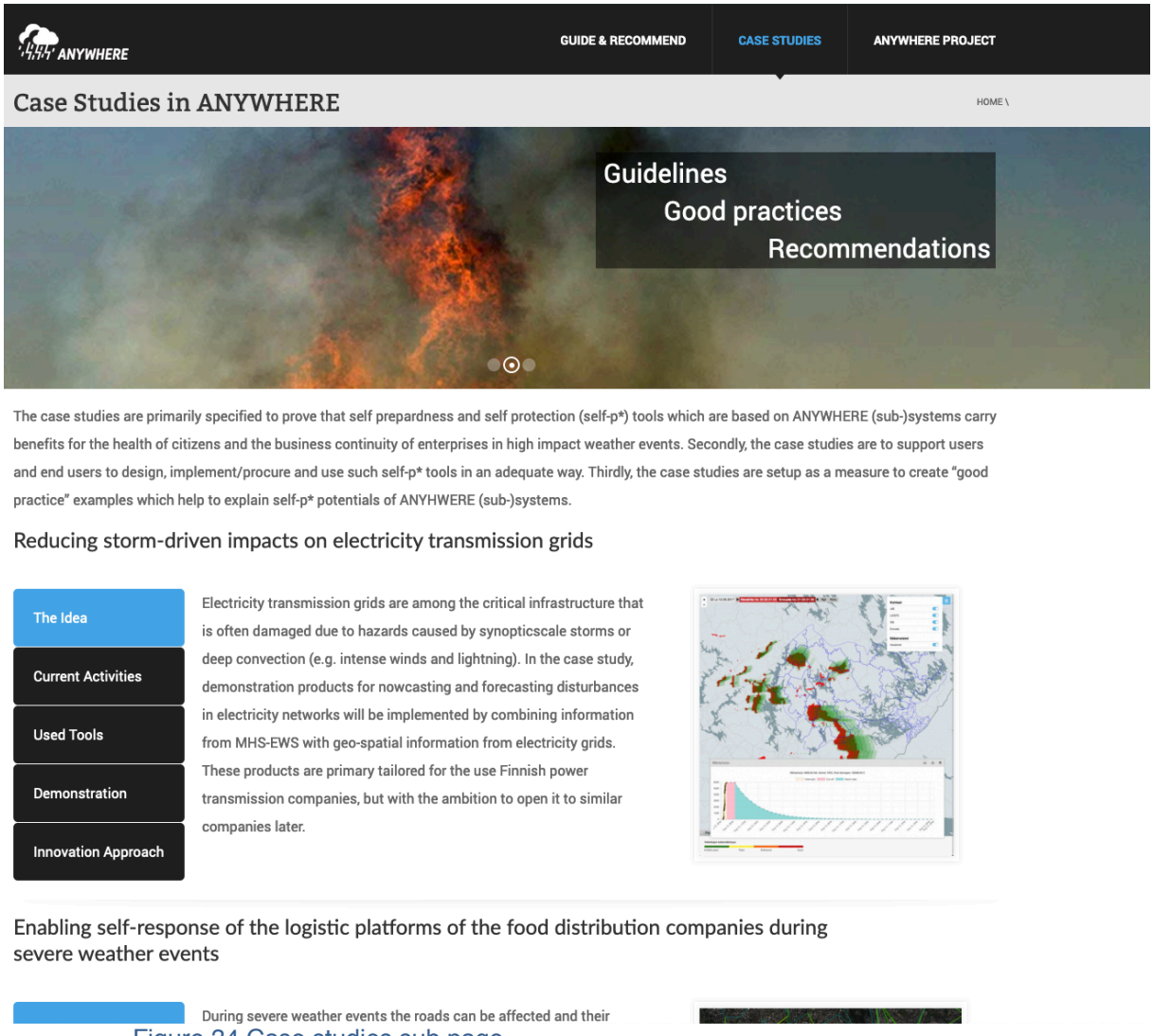


Figure 34 Case studies sub page

Sub-Page: Guidelines / Recommendations

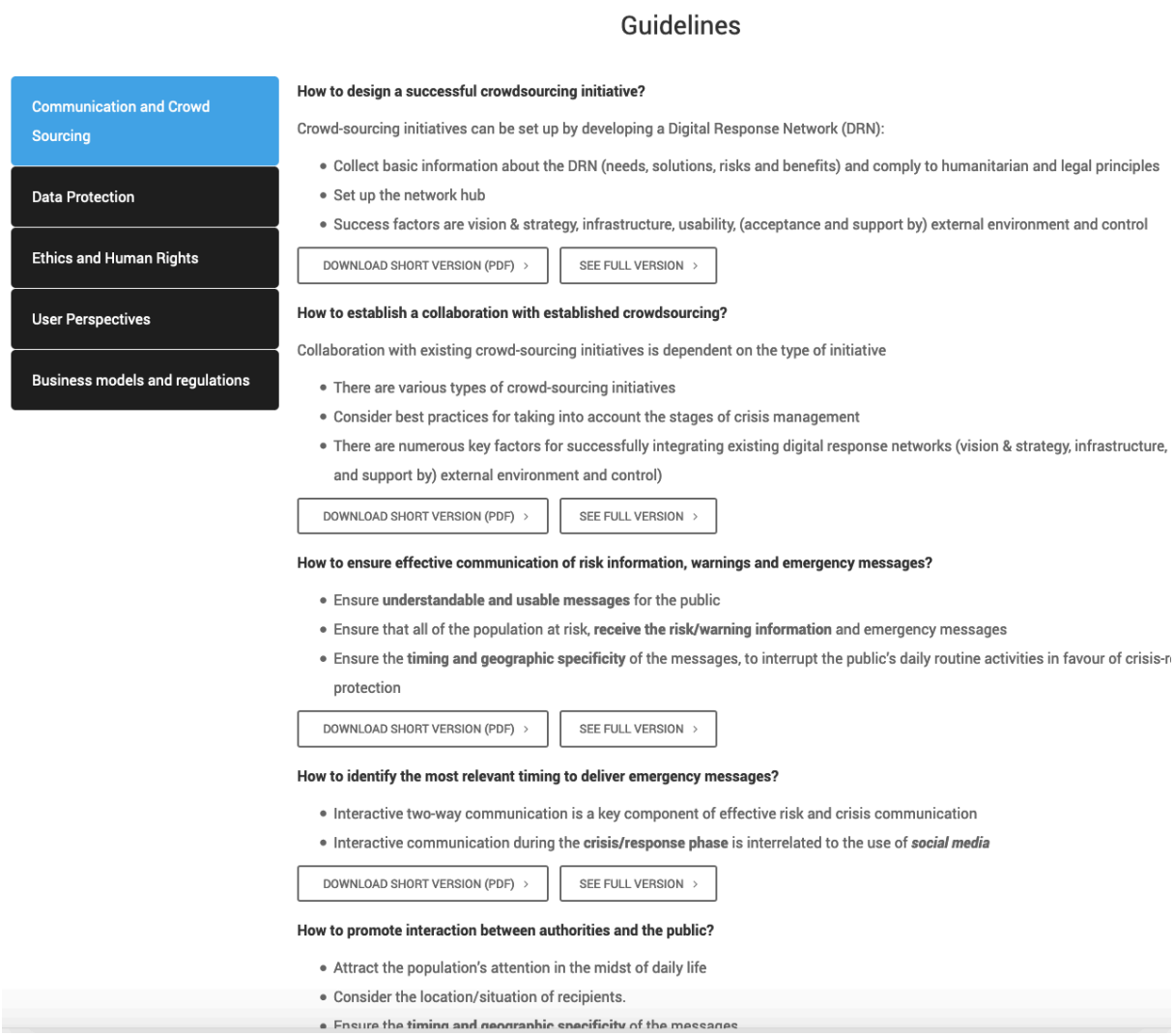


Figure 35 Implementation of Guidelines for IT-Provider

Sub-Page: Authoring Backend

The author backend was designed to work together on new guidelines and recommendations for action with the help of bundled collaboration functions. New experts have to undergo a simple registration process and have access to the author network afterwards. This enables the establishment of a structured process for publishing new content as well as collaborating and sharing content.

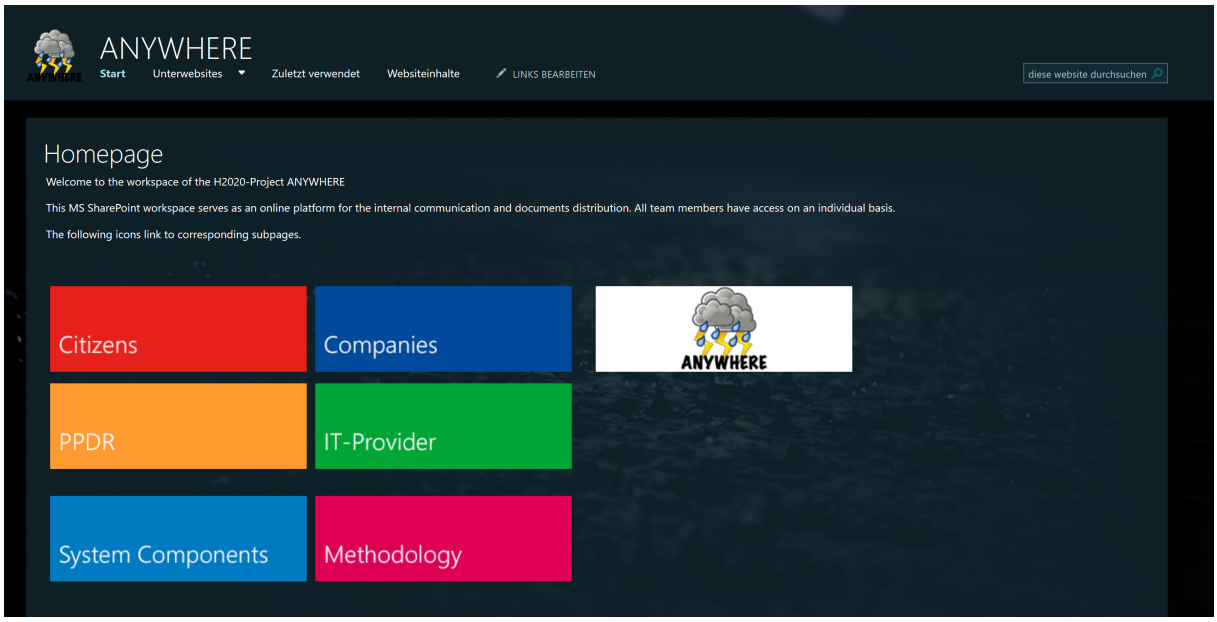


Figure 36 Layout for CIS Front page for the authoring part

11.1.5 Usability Analysis and test

Minor issues

During the project various usability tests were carried out for the CIS in order to improve the user experience and to make available information easier to find. Overall, tests were conducted with stakeholders of the case studies. During the tests many small problems appeared which could be fixed in the final version of the ANYHWERE CIS. Those were mainly navigation issues, problems with the search function and misleading buttons.

Some mutual exclusive statements like disruptiveness of the video on the front page or the style of the icons used in the CIS were mentioned by the testers as well. The main page video showcased very mixed results, some wanted to skip through various parts of it, pause it, watch it again, interact with it to get more and precise information from it, others wanted to get rid of it entirely since it blocked content they wanted to see, was too bright and flashy and overall unnecessary. The combination of the animation of the picture fading into the background video emphasises this emotion and should be addressed, certainly without removing the video. When rearranging the main page, a solution that fits both sides expectations should be found.

Like for the common statements those will be targeted in the final version with a less disruptive video and a flatter design style icon will be considered.

Major issue

One major criticism was given on the scroll length at the front page. As this user did not recognise some important part on the first visit of the ANYHWERE CIS. In the literature this is already discussed as a known problem. The average scroll length of a user in Nielson's Studies was 1.3 sites (Nielsen and Loranger 2006) applying that on the current site would leave a perspective like depicted. A text of what ANYWHERE is about, four pictures, all leading to the same site, and a search bar. It wastes a lot of space with overly huge pictures, quite a lot of space for the eye to rest (which by itself is not bad, just not in this amount) and loses track of its own priorities by giving everything far too much space.

The front page is where both the AYNWERE logo in the top left leads to, as well as the HOME button and even the GUIDES & RECOMMEND – albeit the later jumps beyond the 2.3 mark and directly scrolls down to the guidelines. It is the vital hub of the Website, yet it focuses not on structure and guidance, but on pictures, videos and bright colours. According to Nielson, a front page should (Nielsen and Loranger 2006):

- Tell you where you are
- Educate about the advantages the usage of your side can bring
- Display what is new
- Show your options and where to find what is important to you

This issue will be covered by a major redesign of the front page. No further major issues were identified.

Figure 37 Complete front page - Discovery issue

11.1.6 Implementation insights – V2

The most important change should be the front page, it being the first impression and will influence whether the user will stay or leave the page. The style of the page and the front page worked very well to impress the users, to keep them entertained and, for those who were receptive to it, even reason enough to feel entertained – yet the downside of loading times, temporarily inaccessible content and scrolling must be addressed.

The changes should aim to retain the positive feeling while removing the downsides. An attempt would be to shift all content to the top of the page, reduce the place every segment occupies. As a rough estimate, the 1.3 pages range should be considered the maximum, while the front page without any scrolling should already enable to access every content or at least showcase it. If there is a need to shift content back certain elements, content should be sorted corresponding to abilities of the user.

Considering V1 of the front page (see Figure 32 and Figure 33) the white bar at the very top can be removed entirely, the “Common Information space, if needed at all, can be shifted to the Menu bar on the top left side. The four pictures of the case studies can still be used, while the video should be shifted to a different part of the page. If the case studies would be moved to the left half, the guidelines and recommendations could equivalently occupy the right half of the screen.

The blue border should be just above the website footer and reworked if possible. It is important to describe the concept, and those who read it were well informed in their consecutive decisions, yet the similarities to the website footer currently work to its disadvantage.

Due to the shift of the guidelines to the top, the removal of the “About the project” tab (it was rarely used and felt out of place entirely, probably it can be contained at another place in the future) as well as the following border which scrolls back up a bit, the wall of text naturally jumps to the bottom of the page. This removes that argument and breaks down the new design of the front page.

Guidelines, recommendations and good practises were made available to all considered stakeholders in comparable formats trough the ANYWHERE CIS. For citizens, recommendations for 10 different high impact weather events were prepared. (See Figure 27). For PPDR (emergency services), further existing recommendations were made available via the ANYWHERE CIS on the basis of the findings in the case studies.

The CIS was developed as an interactive, living system, which will be distributed by the project partner UPB even after the end of the project for the purpose of marketing and dissemination. Through access to a broad network of experts, the platform is continuously developed further.

The rework is shown in shown in Figure 38 and Figure 39. At the same time major navigation issues were removed.

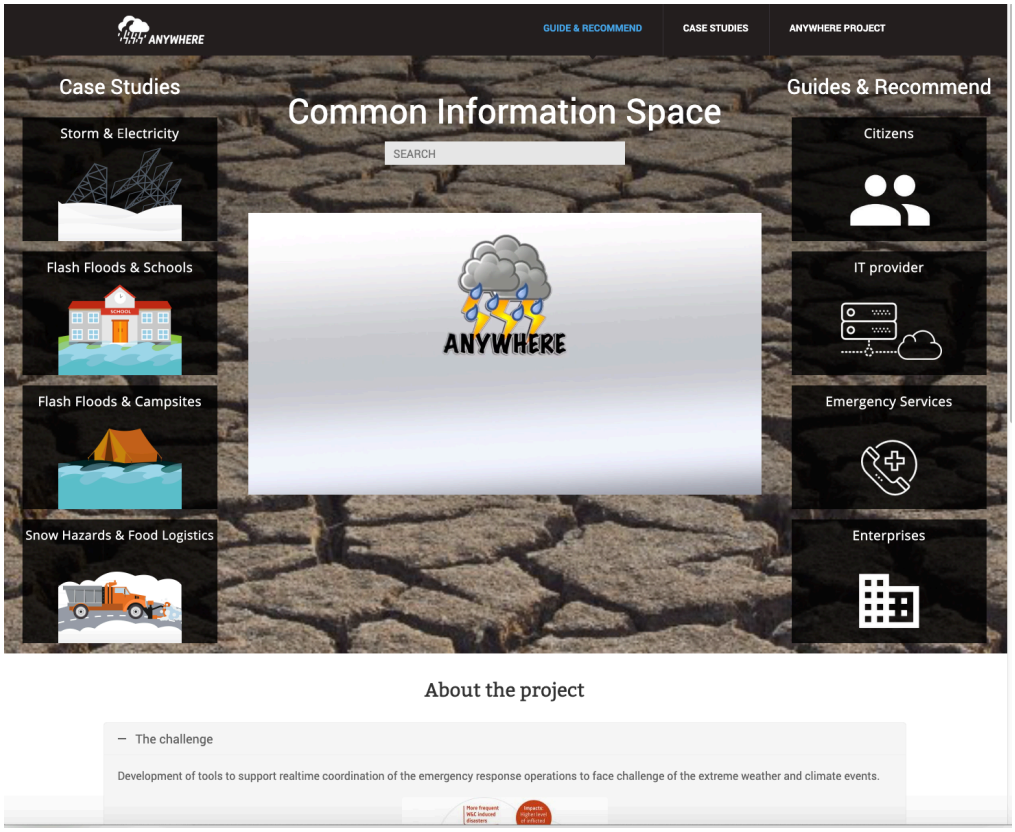


Figure 38 ANYWHERE CIS Front Page, rework. V2 – (1/2)

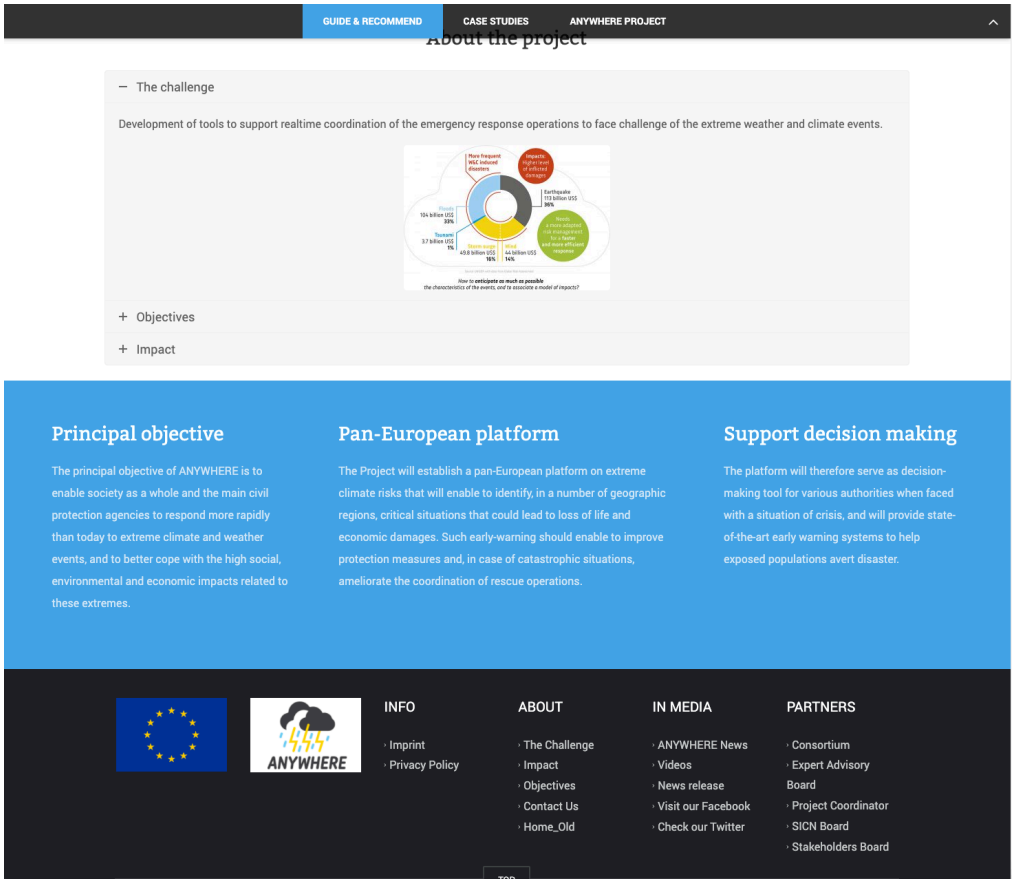


Figure 39 ANYWHERE CIS Front Page, rework. V2 – (2/2)

12 ANNEX 4 Case Study Manual

Project Number 700099
Call: H2020-DRS-01-2015

Project Title:

ANYWHERE

EnhANcing emergencY management and response to extreme WeatHER and climate Events

Subject:

Case Study Manual

Dissemination Level: CO

Delivery date: **24th January 2018**
Month: **Month 20**
Organisation name of lead contractor for this document: **UPB**
Responsible authors: **Matthias Habdank, Christina Schäfer and Nikolai Rodehutskors**

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Table of Contents

1 Objectives and methodology of visiting ANYWHERE case studies

The WP5 case studies are primarily specified to prove that self-p* tools which are based on ANYWHERE (sub-)systems carry benefits for the health of citizens and the business continuity of enterprises in high impact weather events. Secondly, the case studies are part of the formative evaluation of guidelines and recommendations (including the ANYCaRE game and the Scenario Technique tool) created in WP5 to support users and end users to design, implement/procure and use such self-p* tools in an adequate way. Thirdly, the case studies are setup as a measure to create "good practice" examples which help to explain self-p* potentials of ANYHWERE (sub-)systems.

The ANYWHERE WP5 team will follow a single case study approach adopted from (Yin, 2013) but also emphasise a replication strategy. Therefore, a successive comparing of cases to confirm or disprove common pattern of self-p* is overall objective.
For that purpose, four research subjects were identified and integrated in all templates and manuals later on.

1. To explore what kind of tools, platforms are used to ensure self-p* for citizen or companies
2. To understand the way of using self-p*tools by citizen or companies
3. To study how information validation is considered especially by tools provided by third party enterprises
4. To know what kind of skills or resources are required to use self-p* tools adequate
5. To what extend is the innovation of new services bases on ANYWHERE supported by tools provided (CIS, Guidelines, Scenario Tool, …)

The case studies are based on the 'single case study' approach (Yin, 2013) which allows for exploration of the impact of self-p* tools in extreme weather events of the ANYWHERE scenario. Good and valid results are ensured by employing two different strategies. By using the 'replication strategy', in which successive case examples, interviews in the ANYWHERE case, are selected to explore and confirm or disprove the patterns identified in the initial case examples. According to this model, if all or most of the cases provide similar results, there can be substantial support for the development of a preliminary theory that describes the phenomena (Eisenhardt, 1989). In addition, 'triangulation' is applied. (Yin, 2013) For the application of triangulation, two or more methods need two be used to reach the results for the ANYWHERE case studies. The first method is observation. The purpose of this method is to observe how self-p* (tools) is used by key stakeholders in a real-world situation. Secondly, key stakeholder interviews are interviewed to gather an initial and foundational dataset to give an overview of the case and provide first data to important research questions. The use of two different methods to reach results, improves the validity and reliability of the studies.

1.1 Key stakeholder

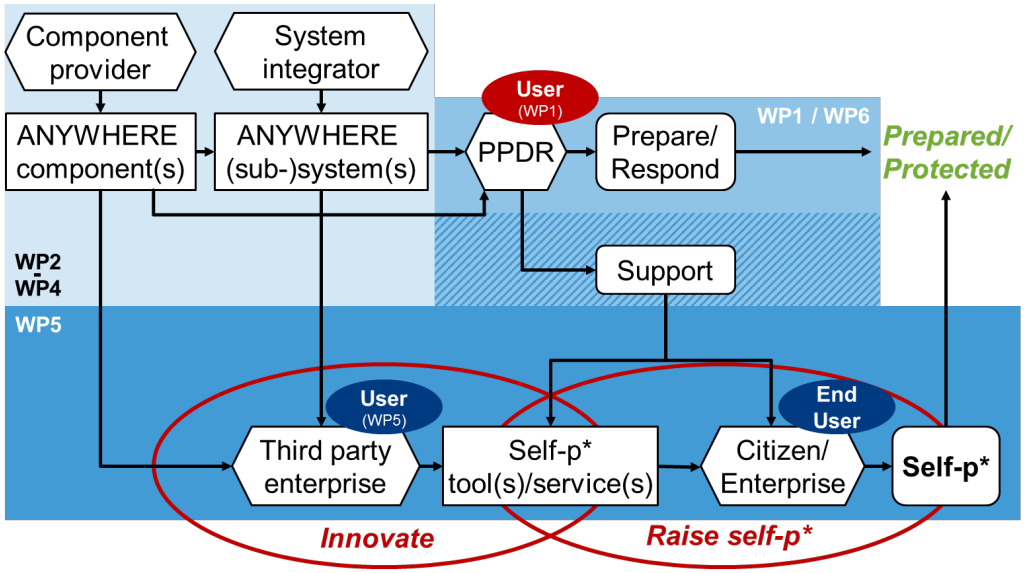

Figure 1 WP5 stakeholder scheme [D5.1]

Already discussed in D5.1 three user groups as key stakeholders can be defined with regard to WP5: Users (in line with WP1), users in the meaning of third party enterprises (according to the overall aim of WP5) and end users. Users (in line with WP1) can be **PPDR** which use ANYWHERE components for their own application to prepare for high impact weather and to improve the response to these events. From a WP5 perspective, users are **third party enterprises (e.g. IT-Provider)**. These implement ANYWHERE components (connecting to the MH-EWS) or ANYWHERE (sub-) systems (e.g. A4EU) for providing self-p* tools or services to **citizens** or **enterprises**. In contrast to users in line with WP1, these users must have a sufficient business model to generate revenues from the tools and services. Citizens or enterprises are - from a WP5 perspective - considered as end users. Targeting an increase of self-p*, these can either be supported by PPDR or by third-party tools developed by third-party enterprises. Variation of roles of key stakeholder for all three user groups are presented in the following.

Table I Key stakeholder groups & roles

Key stakeholder group	Key stakeholder roles
Service/tool Provider	IT-Provider using anywhere guidelines to create innovative tools for self-p* Manager who adept and create business models (scenario tool?) Developers implementing self-p* tools IT-Provider integrating ANYWHERE components into their products
PPDR	Decision maker, crisis manager, crisis management team, catastrophe commissioner or officer in charge Technical relief agencies
Enterprises	Responsible persons/organisations for critical infrastructures All enterprises that have an interest to self-p* due to economic considerations, legal obligations etc. (represented in case studies by camp site operators, food companies, energy transmission grid operators and schools management)
Citizens	Affected people like parents, students, pupils, teachers or campers

1.2 Methodology

The methodology that makes up the foundation for this case study template is based on the work by Robert K. Yin (Yin, 2013). Yin sums up the case study process as a linear yet iterative process, consisting of six phases: (1) planning, (2) design, (3) preparation, (4) collection, (5) analysis, (6) sharing. Regarded more abstractly, while the phases 4 through 6 represent the practical execution of the study, the first three phases are the foundation for the case. The process that Yin suggests and that finds broad application in case study research is adopted and adjusted for ANYWHERE. The process with the customized layout is detailed in Figure 2.
Regarding the planning, design and implementation of the case study, several steps have already been taken during the proposal phase of the project. Thus, the locations (pilot sites), goals, used tools and other foundations for the case study are known, while other points, e.g. the methodology, are still to be finalized.
This case study manual is part of the first three phases and lines out the procedures that make up the ANYWHERE case studies.

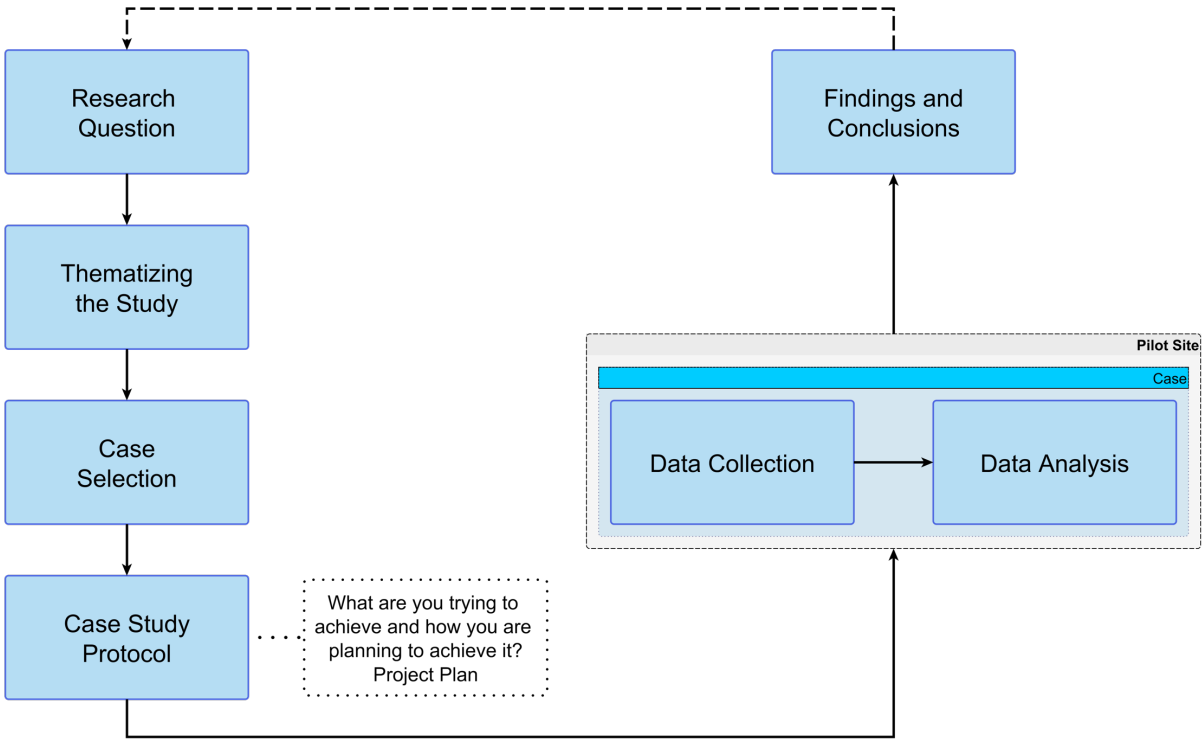

Figure 2 Case Study Procedure adopted from (Yin, 2013)

Using a customized approach based on the work by Yin, the ANYWHERE case study approach follows the single case study design and is to be regarded as a potentially continuous and repetitive process, with the possibility to adjust or redesign components of the case study based on outcomes of the case study. Figure 2 describes the complete case study process in detail. With clarity and easy communication of the case study procedures in mind, the process is separated into three sub-processes: Scoping, Data Collection, Data Analysis and Good Practices & Recommendations. The simplified process is depicted in Figure 3. These are outlined in the following sections and the corresponding methods and material are presented in the following chapters.

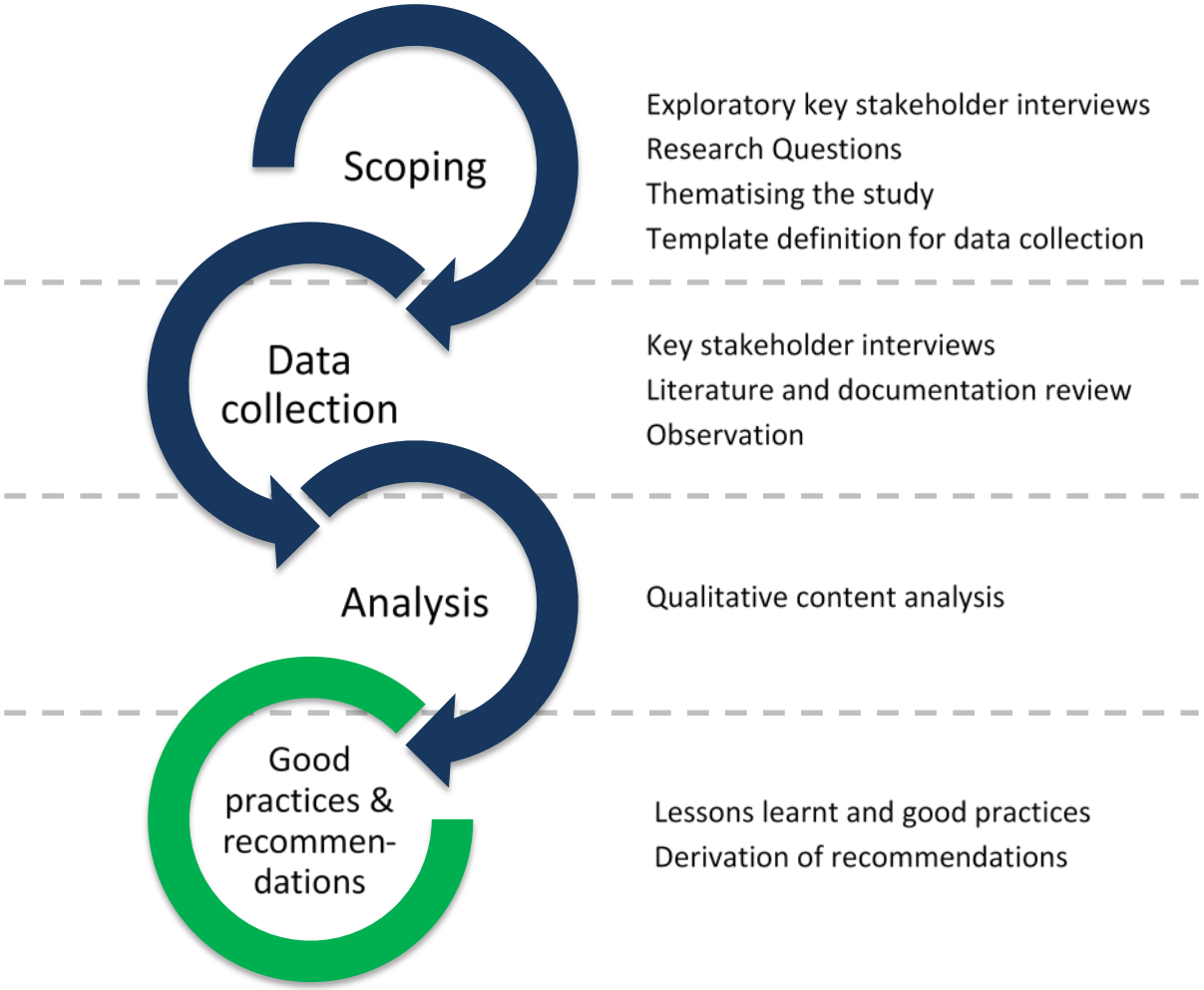

Figure 3 Case study methodology design

1.2.1 Scoping

Based on the research questions formulated in section 2.1 of this document, the study commences. The research questions are based upon the goals of ANYWHERE and research done during case studies following the tasks and objectives of the WP5 implementation plan[1]. The research questions cover areas ranging from existing and tools currently developed for weather for- and now-casting, organisations using said tools and social media and crowdsourcing involvement.

Founded on the research questions, the general theme of the study is set: "Is there a perception of positive impact induced by ANYWHERE based self-p* tools in high impact weather events for citizens and enterprises?". This generalised, and highly abstract research question is the prevailing theme of the ANYWHERE case studies. And is vital to put the case studies into the correct context. (Benbasat, Goldstein and Mead, 1987; Yin, 2013)

Both, theme and research questions lead up the section of cases to study. In ANYWHERE four cases are regarded in separate studies. Each of the cases provide insight into the use of tools and technology under certain extreme and hazardous conditions:

1. Storm and Electricity (Scandinavia)

[1] WP5 implementation plan v103 from 12.12.2017

2. Flash floods and Campsites (Catalunya)
3. Flash floods and Schools (Liguria)
4. Weather and Food logistics (Catalunya)

Following the definition of the studies topics and the cases that need to be regarded, a case study protocol is developed. The case study protocol, or in the ANYWHERE case, the general ANYWHERE Case Study Approach Manual records the goals of the case studies and details the means of achieving them. It is a standardized agenda for the conductors of the case studies and provides an overview of the case study project. It therefore offers background information on the study, the issues that need studying as well as methods for the investigators. This contains checklists, questions and frameworks.

The pilot sites serve as the scene for the case studies. These sites thematise the studies and provide the locational and background setting for the cases. In ANYWHERE, four pilot sites are given, of which three host case studies (see Figure 4). The fourth pilot site in Switzerland could be utilized to test approaches used in the other case studies as well as gaining additional information from a different perspective.

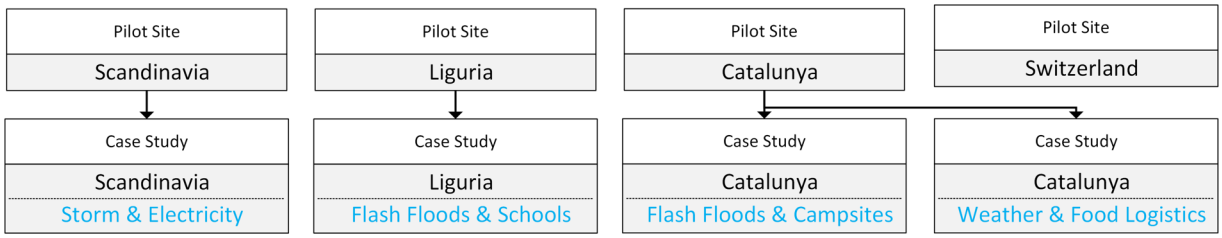

Figure 4 Pilot & Case studies and sites

1.2.2 Data Collection

Following the feasibility test, the practical part of the main case study commences. It consists of data collection and analysis.

There are four different possibilities to collect case study data in ANYWHERE.

Option 1: Key Stakeholder Interviews

Key stakeholders in ANYWHERE are IT-Providers, PPDR, Companies and Citizens. Interviews with each group are conducted to gather an initial and foundational dataset to give an overview of the case and provide first data to important research questions. They also gather further information on contacts and data sources for use in subsequent research activities.

Option 2: Observations

Observations gather information on how social media is used by emergency services in a real-world situation. The 'Observation' method and tool should only be used in cases where a) there is an opportunity to carry out an on-site visit to observe how, for example, social media is used in real practice by an emergency service and b) observation will add significant value to the data collected.

Option 3: Sensor and User Dialogue data

Input will follow

OPTION 4: ONLINE QUESTIONNAIRE

Online questionnaires enable a short and location-independent reply to questions and could reach a more participants. For realising the online questionnaire the EU survey platform was used. Current version is visible at:

https://ec.europa.eu/eusurvey/runner/anywhere_cs_short

1.2.3 Data Analysis & Integration

During the data analysis, data collected will be regarded using manual or software assisted qualitative content analysis. This qualitative approach aims to find answers to research questions by searching for indications and evidence.
The final stage of the case study entails integration of the results of the data collection, analysis of the results and producing an individual summary of the case. This is done using triangulation of the evidence collected from the data collection methods applied, to arrive at conclusions.
The results of the data triangulation will be integrated in two stages for each case. First, each case example will have its own individual summary, set out in a Case Study Report. Second, to enable cross-comparison of cases, each case example should be summarised in a common Case Summary template.

1.2.4 Good Practices & Recommendations

Using a generalized template, Lessons Learned, experiences, indications and evidence that are collected during each case study, are recorded. The submitted templates are used for the derivation of good practices and recommendations targeting stakeholders later in the project.

1.2.5 Overall Case Study Design

The following table provide an overall view of all phases of the case study, related objectives and used methods in the different phases.

Table 2 Case Study design

Scoping		
Activity	**Objectives**	**Methods and Tools**
Exploratory Key stakeholder interviews	To contact key stakeholders and 'gatekeepers'. To collect and analyse preliminary information on research questions.	Telephone/Skype interview (semi-structured)
Definition and refinement of research questions	To be in line with the overall research subject key research questions are pre-defined by the DoA and should be detailed and agreed through the WP5 team.	Workshop, e.g. WP5 Meeting in Grenoble 24th January 2018
Thematising the study including context, roles and interviewee	To be in line with the overall research subject key research questions are pre-defined by the DoA and should be detailed and agreed through the WP5 team.	Workshop, e.g. WP5 Meeting in Grenoble 24th January 2018
Definition of templates for data collection	Provided through this manual	
Data collection		
Activity	**Objectives**	**Methods and Tools**
Literature and Documentation review	Collect content from key documentation of the case	Desktop study
Key stakeholder interviews	Collect data on experiences and knowledge of key stakeholder	Key stakeholder Interview template
Observation	Observe the use of self-p* tools and concepts	Observation template
Online Questionnaire	Short and situation-based replies	Questionnaire template
Sensor data		
Analysis		
Activity	**Objectives**	**Methods and Tools**
Qualitative content analysis	To analyse the data from the documentation review	Case summary template
First setup of Lessons Learned and good practices	To analyse the data from key stakeholder interviews and observation	Case summary template
Good Practices & Recommendations		
Activity	**Objectives**	**Methods and Tools**
Definition of Lessons Learned	Extract key insights of the case studies	Lessons Learned template
Derivation of Recommendation for citizen and companies	Provide valuable advice to citizen and companies	

1.3 Check-List for conducting case studies in ANYWHERE

For each case study a common set of activates need to be carried out before. This checklist should support case study leaders to prepare case studies. Please use the checklist shown in Table 3 to check on the progress.

Table 3 Checklist before performing a case study

Case Study Name:	
Actions	**Status/Comments**
1. Please assess any potential ethical issues that have to be addressed using the deliverables D1.2 on ethical, legal and environmental implications.	
2. Identify available existing contacts and data that is needed to perform the case study	
3. Identify key contacts representing the involved key stakeholders for preliminary interviews.	
4. Contact key stakeholder(s) and explain study objectives. Ask what data/materials are available and arrange for it to be sent/accessed.	
5. Establish whether site visit appropriate and possible for Observation and when, and what data collection can be carried out on site.	
6. Establish how access to users and other key stakeholders can be arranged. Establish how interviews can be delivered.	
7. Note any relevant problems that need to be addressed.	
8. Arrange interview with key stakeholder(s) - face to face; phone; e-mail.	
9. Record relevant data on logistics on Logistics Work Sheet.	
10. Record any useful material emerging from interview on Outputs Notes.	
11. IF RELEVANT Plan site/Observation visit. Record details on Work Sheet.	
12. Carry out site/Observation visit	
13. Carry out data analysis	
14. Carry out data integration and record results in Case Study Summary Template	

2 Scoping

Based on the gained Lessons Learned, best practices and recommendations to support self-p* of citizens, companies, PPDR and IT-Provider will be derived.

2.1 Research questions

Overall research question is “What is the impact of self-p* tools in extreme weather events”. Following the hypothesis specified in section 1 the research questions for the cases studies are defined below.

- **Existing tools, non-anywhere tools for now- and forecasting as well as platforms, technologies and algorithms**
  - What types of tools, platforms, technologies or algorithms are being used by the main stakeholders?
  - What are the strengths and weaknesses of these?
  - What is the main gap of these tools?
  - For PPDR: How are they integrated into the organizational structure?
- **ANYWHERE tools for weather now- and forecasting as well as platforms, technologies and algorithms**
  - What types of tools, platforms, technologies or algorithms are being used by the main stakeholders in ANYWHERE (PPDR, citizens, companies and IT-provider)?
  - What are the strengths and weaknesses of these?
  - What is ANYWHERE doing better than existing solutions?
    - For instance, in order to assess the socio-economic impact.
- **Organizational structures and integration of ANYHWERE self-p* tools**
  - How are they integrated into the organizational structure?
    - Is there any difference in terms of integration compared to non-ANYWHERE tools?
  - What ‘resistance to change’ dynamics in relation to the use of the ANYWHERE tools can be identified and how might these be addressed?
  - How does key stakeholder integrate ANYWHERE tools in daily routines?
- **Staff skills and resources**
  - What skills are required to help stakeholders to find, interpret and make use of information provided by the ANYWHERE tools?
  - What guidance or training would be most useful for them?
- **Information validation**
  - How can stakeholders be persuaded that information provided is credible and trustworthy?
  - What procedures and tools are used to validate such information efficiently and effectively?
  - How can reliability and accuracy be supported, technically?
- **Social media and crowd sourcing**
  - Is social media a source to be considered in terms of for- and now casting of high impact weather situations?

- Does your organisation use any tools that support the analysis of social media w.r.t. social media analysis or crowd sourcing? Also with regard to market analysis.
- How can stakeholders be persuaded that information provided via social media from citizens is credible and trustworthy?
  - Do the ANYWHERE crowdsourcing solutions provide any indicators to support you?
- What types of information are they most interested in: for example, situational awareness data from citizens or data on the public mood or the emergence of rumours or misinformation?
- **Moderating citizen communities via social media**
  - What approaches do you already use to moderate and support volunteer communities using social media?
  - What can emergency services do before a disaster to make stronger links with such communities and what can they do to support the preparation, response and recovery operations?

- **Support of innovation for self-p* by additional ANYWHERE tools**
  - Can innovation for self-p* be supported by additional tools developed by ANYWHERE partners?
  - Does an increases capability for strategic planning support the market uptake of services?
  - Do the tools supporting innovation for self-p* support decision making, the quality thereof and the success of the products?
  - Is the awareness for potential challenges and chances increases by tools such as the CIS ?

3 Data Collection

To carry out the next steps, this section details the afore mentioned methods used for data collection during the ANYWHERE case studies. To ensure internal validity of the case studies, the tool of triangulation is used in different steps of the case studies. Triangulation is a social sciences tool that describes the use of different sources or methods to regard the same problem. This changes the perspective of the problem and aids in identifying the correct influencing variables for a hypothesis. In this case two different methods are used for data collects, thus enabling ANYWHERE to regard the research questions from distinct angles.

3.1 Key stakeholder interviews

The main objectives of the key stakeholder interviews are:

- to get first information about the respective case study
- to gain data especially targeting the defined research questions based on the scoping process
- to gather further information various data sources or contacts useful for documentation review and qualitative content analysis

The template defined in section 3.1.1 supports semi-structured interviews. This enables the interviewer to shape questions if necessary and focus on Interviewee experiences and background. Due to that procedure the key stakeholder interview template fits to all kind of key stakeholder. The defined four research subjects (see section 1) are covered within the template and allow questions for all relevant topics.
Each part of the template includes two kinds of questions:

- First, main question derived from the research questions during the scoping process
- Further, all supplementary or clarifying questions which allow the interviewer to tailor the question to the respective Interviewee and to support the understanding of the questions by the interviewee

The key stakeholder interview process is as follows:

- The interviewer should predefine the category of the key stakeholder (IT-Provider, PPDR, citizen or enterprises)
- The interview should begin with an explanation of the project's objectives and how the interview will be carried out.
- The interviewer goes through the questions shown in the respective Template. The responses can either be recorded – having obtained the interviewee's permission – or the responses can be taken down in written (note) form.
- The interviewer should summarise the key results of the interview using the Case Study Summary Template (Table 7).

3.1.1 Template

The key stakeholder interview templates are provided below and should be used as a guideline for performing key stakeholder interviews in a semi-structured way with respect to the different types of stakeholder.

Table 4 Guideline for key stakeholder interview (category: Citizen or Enterprises, Emergency Services)

Name of case study:	

Interviewer details	
Date of interview:	
Interviewer name:	
Name of organisation:	
How interview carried out (skype; phone; e-mail; face to face):	

Interviewee details	
Interviewee name:	
Name of organisation:	
Interviewee contact data (e-mail, etc.):	
Role of interviewee in the case study:	

Questionnaire	
Background questions	
1. Can you briefly describe your organisation (size, locations, structure)?	
2. What role/function does self-p* currently play in your organisation? (Which roles deal with self-p*? How is information shared with others (citizens, companies, PPDR, IT-Provider, organisations responsible for critical infrastructures)?	
Part 1: Self-p* tools, platforms and technologies	
1. How does your organisation access/analyse weather data w.r.t. forecasting and now-casting?	
2. What specific platforms, tools or methodologies do you use? (Why these? What is the main benefit?)	
3. Which ANYWHERE tools, components, and algorithms do you use?	
4. When are self-p* tools used? (every day or only before/during emergencies)	
5. Who uses them?	
6. For what specific purposes are, they used (warning, evacuation, awareness…)?	
7. Other questions asked (e.g. supplementary or clarifying questions)	

Part 2: Organisational structures and facilitators	
8. In what ways and to what extent are self-p* tools integrated into daily procedures or organisational structures?	
9. Other questions asked (e.g. supplementary or clarifying questions)	
Part 3: Information validation	
10. Have you experienced any problems with the level and quality of data generated in emergencies in the past? (Prompts: what kind of problems?)	
11. Other questions asked (e.g. supplementary or clarifying questions)	
Part 4: Skills and resources for self-p*	
12. What skills are required to help stakeholders to use self-p* tools? (Prompts: financial; technological; organisational; technical competences)?	
13. Other questions asked (e.g. supplementary or clarifying questions)	
Part 5: Crowd Sourcing, Social Media, Moderating citizen communities	
14. Do you use social media or crowdsourcing in any way to help you being self-prepared or protected in high impact weather events? (Prompts: what kinds of social media communities are involved? What roles do they play?)	
15. Does social media play any role organizational structures and systems?	
16. Other questions asked (e.g. supplementary or clarifying questions)	
Contacts and data sources	
17. Could you suggest any sources of data that would help us to better understand self-p* for high impact weather events?	
18. Could you suggest any people who could help us in this case study?	

Table 5 Guideline for key stakeholder interview (category: IT-Provider)

Name of case study:	

Interviewer details	
Date of interview:	
Interviewer name:	
Name of organisation:	
How interview carried out (skype; phone; e-mail; face to face):	

Interviewee details	
Interviewee name:	

Name of organisation:	
Interviewee contact data (e-mail, etc.):	
Role of interviewee in the case study:	

Questionnaire	
Background questions	
1. Can you briefly describe your organisation (size, locations, structure)?	
2. What role/function does self-p* currently play in your organisation? (Which roles deal with self-p*? How is information shared with others (citizens, companies, PPDR, IT-Provider, organisations responsible for critical infrastructures)?	
3. Part 1: Self-p* tools, platforms and technologies	
4. How does your organisation access/analyse weather data w.r.t. forecasting and now-casting?	
5. What specific platforms, tools or methodologies do you use? (Why these? What is the main benefit?)	
6. Which ANYWHERE tools, components, and algorithms do you use?	
7. When are self-p* tools used? (every day or only before/during emergencies)	
8. Who uses them?	
9. For what specific purposes are, they used (warning, evacuation, awareness…)?	
10. Other questions asked (e.g. supplementary or clarifying questions)	
11. Part 2: Information validation	
12. Have you experienced any problems with the level and quality of data in the past? (Prompts: what kind of problems?)	
13. Other questions asked (e.g. supplementary or clarifying questions)	
14. **Part 3: Skills and resources for self-p***	
15. What are skills required to develop self-p* tools based on ANYWHERE components?	
16. What skills are required to help stakeholders to use self-p* tools? (Prompts: financial; technological; organisational; technical competences)?	
17. Other questions asked (e.g. supplementary or clarifying questions)	
18. Part 4: Crowd Sourcing, Social Media	
19. Does social media play any role in your tool or service? If yes: which?	

20. Other questions asked (e.g. supplementary or clarifying questions)	
21. Part 5: Underlying business model	
22. Can you please briefly describe the customer segment targeted with your service? Which are main users?	
23. Please describe the value proposition of your tool/service briefly.	
24. Is there any revenue stream generated by your tool/service? Please also consider non-monetary revenue streams (such as data,…)	
25. Other questions asked (e.g. supplementary or clarifying questions)	
26. Part 6: Innovation support	
27. Did you apply any of the innovation support tools provided by the consortium (CIS; guidelines, scenario tool)? If yes, which?	
28. Did these support uptake of information, decisions, or the market uptake? If yes, in which way?	
29. If used: Did the scenario tool improve the strategic planning, the market uptake or the foresight of potential future developments concerning your tool/service? If yes: Which and in which way?	
30. If used: Did the underlying catalogue of influence factors help to initially develop the scenarios? Were the influence factors clear and comprehensible?	
31. If used: How many of the generic influence factors were relevant? How many tailored influence factors were added by yourself? If applicable: How can the generic influence factors and their selection be improved?	
32. If used: Were selection processes and rules transparent and comprehensible?	
33. If used: Was the process of scenario derivation transparent and comprehensible? If not, which improvements were desirable from your point of view?	
34. If used: Were you satisfied with the results gained from the scenario tool? If not, why?	
35. If used: Are there any improvements, you would suggest for the scenario tool? Which?	
36. Other questions asked (e.g. supplementary or clarifying questions)	
37. Contacts and data sources	

38. Could you suggest any sources of data that would help us to better understand self-p* for high impact weather events?	
39. Could you suggest any people who could help us in this case study?	

3.2 Observation

The purpose is to observe how self-p* tools are used in a real-world situation**.** The ANYWHERE case studies allow on-site visits and add significant value to the data collection process.
First the degree of **participation** in a respective situation or training activity need to be answered. Main issue with a high involvement is the distance to observe and record the ongoing situation in an adequate and valid way. In the case of non-participant observation, the researcher is never directly involved in the action but observes from outside. In participant observations the researcher collects data under study. (Sekaran and Bougie, 2013) It means watching the activities or situation from inside by taking part in the group to be observed. Hence researcher can better understand the views of participants than an outsider but in the same time decrease objectivity. In non-participant observation the researcher gives a detached and unbiased view about the participants and has the time to produce adequate records. In case of a direct, non-participant observation two different strategies exists:

- **Reactive** – A reactive observation indicates that participants know that someone is currently observing the situation. In this case the potential of changing the behaviour due to the attendance of an observer need to be considered. (Crowther and Lancaster, 2008)
- **Non-reactive** – Non-reactive observation involves serious ethical questions because the study of participants is taken without their awareness.

In addition, the **indirect observation** is a method, which allows researcher to observe outcome of behaviour rather than observing the behaviour itself. (Bajpai, 2011) Sometimes a researcher is unable to observe persons directly, so an indirect observation can be conducted though the analysis of internal organizational documents or other recordings. (Bailey, 2008)In this case methods of content analysis are useful and are further described in section 19.

3.2.1 Template

The Observation Template provided below (Table 6) sets out the procedure for Observation. The template provides a guideline for carrying out structured observation in the field visit site, using a classic observational analysis approach.

Table 6 Observation Template

Location of the observation:		**Visit carried out by:**
Start time:	**End time:**	**Total time:**
1. Environment		
Brief description of the environment in which the observation is carried out		
What is going on?		
Who is doing what?		
How is the self-p* tool integrated in the environment?		
Other observations		
2. Participants		
How many people are present during the observation?		
What are their roles?		
How do they use self-p* tools?		
Other observations on		
3. Activities and interactions		
What formal/structured activities take place?		
What informal interactions can be observed?		
Other observations		
4. Critical Incidents		
Describe any 'critical incidents' you observed (e.g. stress situations) and a possible connection to self-p*		
What caused these incidents?		
How were the 'critical incidents' handled?		
Other observations		
5. Self-P* Tool		
What kind of Self-P* tolls are used during the observation?		
How are they used?		
Who is using them? For what purpose?		
Are there any problems that can be observed?		
Other observations		
6. Social Media		
What kinds of social media/social media tools are used?		
How are they used?		
Who is using them and for what purposes?		
Other observations		

4 Data Analysis

The data analysis part of the case studies processes the results of the data collection before and tries to find correlations, causalities, connections and structures within the data. In the end of the Analysis, the data is integrated, leading to case study summaries and reports.

4.1 Analysis

Data collected using the methods described above will be analysed using qualitative content analysis. In a nutshell, content analysis of this material is aimed at scanning the material to find evidence and indications that will enable us to answer the research questions. Additionally, the result of the qualitative content analysis may give a situational report on the status of implementation and integration of self-p* in the context of the ANYWHERE scenario. The qualitative content analysis can be done manually, or software assisted, using regular text editors or specialised content analysis software, such as NVivo.

This can be done in two ways – manually, or software assisted (either using 'Microsoft Word', or other text editors and then searching the text for key words or using a specialist content analysis software package like NVivo). The manual approach uses a method based on 'reduction'(Creswell and Poth, 1998). In practice, this requires:

- A first reading of the item being analysed, during which examples of answers to the research questions and the ANYWHERE topics are searched. In addition, topics suggested by the stakeholder interviews may be searched.
- Marking essential points and issues making a note of the substantive points and questions that arise during the reading process regarding to these topics and identifiable constructs that define these issues and questions.
- Returning to the notes made of the reading, and the list of constructs identified and clustering together those that are similar, to make a 'master list' of key constructs.
- Re-reading the item and analysing it more systematically to find examples of the list of constructs, and recording in the case analysis template descriptors of examples of each construct that can be identified in the text.

The evidence gathered from the data collection methods, will be analysed using 'triangulation', which commonly refers to the use of multiple methods to gather data, see section 3.

Triangulation, in this case not of methods but of data originating from different sources and methods, is used to balance the different biases of the different approaches and their results. In this approach, data for the triangulation originates from documents, observations and stakeholder interviews. In addition to the different data sources considered, different social positions are regarded, especially for data originating from interviews. The triangulation leads to the fining of correlations, causalities, connections and structures within the data, which represent the evidence and indications that are needed to answer ANYWHERE's research questions.

Also, triangulation is not the only strategy applied when it comes to the data analysis. The replication strategy is used to identify consistent patterns and uncover themes that can be either new or divergent. In this approach, the replication strategy is adapted to regard

multiple interviews as multiple cases and topics, structures and causalities are searched in these.

The theory of change is essentially a comprehensive description and illustration of how and why a desired change can be expected in a context. It focuses on mapping or "filling" what is a "lost intermediate point" between what a programme of change or an initiative (activities or interventions) does and how it leads to the achievement of the desired objectives. This is done primarily by identifying the desired long-term objectives and, based on these objectives, we work to identify all the conditions (outcomes) that need to be present (and how they are causally related) to achieve the objectives All are included in a scoreboard.

After completion of this step, the Theory of Change is applied. The result of the triangulation is evidence and indications mostly in form of current situations, future goals. For example, the current and potential and targeted future use of weather now- and forecasting tools, or social media in extreme weather scenarios. This leaves a gap between the current situation and the future, that is planned to be achieved. The Theory of Change describes the way in between these situations and the steps that need to be taken to achieve the goals in the end. This happens by regarding all identifiable conditions and potential outcomes and their causal relation. With the current situation, the goal and the steps between them identified, the Theory of Change helps to verify or disprove assumptions made in ANYWHERE.

4.2 Integration

The final stage of the case study entails integration of the results of the data collection, analysis of the results and producing an individual summary of the case.

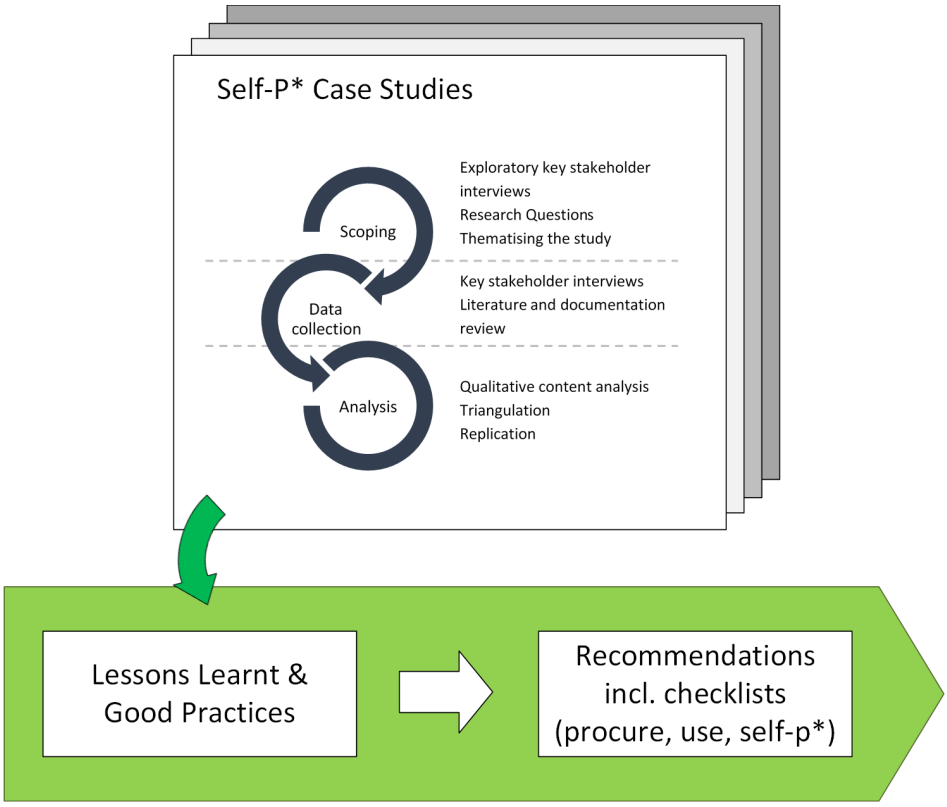

Figure 5 ANYWHERE case study integration process

The results of the data analysis, including the results of the data triangulation, will be integrated in two stages for each case. Firstly, each case example will have its own individual summary, set out in a Case Study Report. This should include:

- the main key messages from the observations and interviews
- the main findings from data triangulation and replication strategy
- the results of the analysis.

Secondly, to enable cross-comparison of cases, each case example should be summarised in a common Case Summary template (Table 7). This summary template will provide a synthesis and synopsis of the key results for each case, closely following the six key research themes investigated in the case studies.

These summaries will then provide input to a final round of data integration. This round will apply an item analysis procedure (Haney *et al.*, 1998) involving the following steps:

- Two or more researchers independently scan the completed Case Analysis Summary templates. They each cluster and aggregate the set of themes and constructs identified for each individual case
- The researchers then compare their results and reconcile any differences that show up on their initial lists.
- The lists are then integrated to produce a set of key overall findings from the case studies, which feed into an ANYWHERE Case Study Report, outlining the main results of the case study and cross-case analysis.

The Case Summary Template – Table 7 below - provides a framework for analysis and synthesis of the data gathered through the data collection methods. Use the template to provide evidence for your summary, including any data gathered and quotations from key stakeholders to illustrate your conclusions.

Using this approach, ANYWHERE can find good practices for the ANYWHERE scenarios. These good practices are finally transferred into recommendations, such as guidelines and checklists for different topics.

Note: The Case Study Summary template shown in Table 7 below is intended to provide an overall summary of each individual case example. This will enable us to compare the different cases against each other and to produce an overall integration of the case study analysis**.**

4.3 Template

Table 7 Case Summary Template

Case study Name		
Summary compiled by		**Date compiled:**
Part 1: Self-p* tools, platforms and technologies		
Sub-question	**Conclusions**	**Evidence to support conclusions (including data source, e.g. KI interview; document analysis)**
How does your organisation access/analyse weather data w.r.t. forecasting and now-casting?		
What specific platforms, tools or methodologies do you use? (Why these? What is the main benefit?)		
Which ANYWHERE tools, components, and algorithms do you use?		
When are self-p* tools used? (every day or only before/during emergencies)		
Who uses them?		
For what specific purposes are, they used (warning, evacuation, awareness…)?		
Other questions asked (e.g. supplementary or clarifying questions)		
Part 2: Organisational structures and facilitators		
Sub-question	**Conclusions**	**Evidence to support conclusions (including data source, e.g. interview; document analysis)**
In what ways and to what extent are self-p* tools integrated into daily procedures or organisational structures?		
Other questions asked (e.g. supplementary or clarifying questions)		
Part 3: Information validation		
Sub-question	**Conclusions**	**Evidence to support conclusions (including data source, e.g. KI interview; document analysis)**
Have you experienced any problems with the level and quality of social media data generated in emergencies in the past? (Prompts: what kind of problems?)		

Other questions asked (e.g. supplementary or clarifying questions)		
Part 4: Skills and resources for self-p*		
Sub-question	**Conclusions**	**Evidence to support conclusions (including data source, e.g. KI interview; document analysis)**
What skills are required to help stakeholders to use self-p* tools? (Prompts: financial; technological; organisational; technical competences)?		
Other questions asked (e.g. supplementary or clarifying questions)		
Part 5: Crowd Sourcing, Social Media, Moderating citizen communities		
Sub-question	**Conclusions**	**Evidence to support conclusions (including data source, e.g. KI interview; document analysis)**
Do you use social media or crowdsourcing in any way to help you being self-prepared or protected in high impact weather events? (Prompts: what kinds of social media communities are involved? What roles do they play?)		
Does social media play any role organizational structures and systems?		
Other questions asked (e.g. supplementary or clarifying questions)		
Part 6: Innovation support		
Did you apply any of the innovation support tools provided by the consortium (CIS; guidelines, scenario tool)? If yes, which?		
Did these support uptake of information, decisions, or the market uptake? If yes, in which way?		
Other questions asked (e.g. supplementary or clarifying questions)		

5 Good practices & recommendations

A lesson learnt is knowledge or understanding gained by experience that has a significant impact for an organisation (Milton, 2010). To bring all experiences together available throughout the ANYWHERE case studies, this section provides a template in order to collect Lessons Learned. Please use this template as a journal in any case new experiences are gained. If one information (e.g. activity decomposition) is associated with a good practice or in worst case with a problem, please mark that connection.
The different lesson learnt tables will be used for the derivation of good practices and recommendations targeting citizens or companies later on in the project.

Case Study Name	Lessons Learned author details			Involved parties and target group for Lessons Learned			Lessons Learned backgroud questions			Experiences		Improvments / Suggestions	Case study close out		Feedback
	Date when lesson learnt was identified	Name of the author	Name of organisation	Which persons / organisations are involved?	What kind of roles do they have?	Who would be the target group for this Lessons Learned (developers, users, PPDR)?	Specify the name of the Lessons Learned	Please describe the subject or information for understanding this Lessons Learned. (E.g. Issue escalation)	Please describe the situation learnt from	What are the positive effects / results?	Which results / experiences are not as good as provided?	List areas of potential improvements along with high-impact improvements	List the three biggest successes from the case study	List other successes that the team would like to highlight	Please describe your general feedback

Table 8 Lessons Learned Template

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