



# SMART MATURE RESILIENCE

DESIGN PRINCIPLES FOR THE USE  
OF SOCIAL NETWORKING SERVICES  
TO PROMOTE TRANSDISCIPLINARY COLLABORATION

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## EXECUTIVE SUMMARY

Deliverable 4.2 is the second of four deliveries in Work Package 4 (WP4). The work package runs from month one to month 18 with a deliverable being due each six months. The overall goal is to build a collaborative environment in order to facilitate awareness and engagement among key partner in resilience building. Ultimately, this leads to the development of an integrated Resilience Information Portal, which will be used beyond WP4 for the remainder of the project.

This second deliverable is interlinked with the work in other deliverables. In particular, it provides input for WP5, which took up activities during the work towards D4.2. Similar to D4.1, the deliverable report reflects the twofold nature of WP4: It contains both domain-specific and technologically-driven sections. It makes heavy use of the insights presented in D4.1 but at the same time introduces a host of results from the work of the last six months.

D4.2 compiles design principles for the use of social networking services to promote transdisciplinary collaboration. It does so based on a series of extensive interviews with the CITIES and stakeholders. Interviews were done in a semi-structured fashion and we allowed for open discussion. This enabled us to gain broad insights from the work with the city partners.

To understand challenges in the communication activities of the CITIES, we first needed to understand how they communicate. Thus, core communication activities have been identified for the city partners. Along with these, we have compiled quotes from cities and their stakeholders that hint to a variety of challenges of short-term and long-term communication. In particular, cities need to deal with unintegrated communication tools, information fragmentation (including incompatibility of information), logging incident information, presenting information on complex emergencies, lack of updating what others are doing, lack of direct communication, raising awareness of potential and real threats among the citizens, lack of information variety, unawareness of information reach, contacting relevant people quickly, communicating with hard to reach groups (e.g. people who do not speak local language), human resource updating, lack of interactive communication, long-term involvement, security, information confidentiality, handling of documents marked as protected or confidential, mal-information on social media, and managing social media.

The challenges lead to six design goals for a Resilience Information Portal: Information Sharing (on daily-basis and for emergencies), Establish a Communication Structure, Citizen Involvement and Raising Awareness, Knowledge Sharing (locally, nationally, and on the European level), Information Sovereignty, and Usability. Information Provision (in general, to local stakeholders, and to citizens) is set as an enabling principle especially



for the design goals of Establish a Communication Structure and Citizen Involvement and Raising Awareness. The six goals are extensively motivated and can be directly linked to input from the cities. For each design goal, several design principles could be identified.

While the design goals and principles take an abstract, high-level perspective that allows generalization, actual development activities require a low-level view with an interface to the technological ramifications. Therefore, we present a functional specification. The specification contains a set of criteria for the Resilience Information Portal. They are linked to the design goals and principles and are based on the interview work as well. The functional specification serves as the foundation for the actual development activities (which will lead to D4.4) as well as the ongoing work on design principles (which will lead to D4.3). Consequently, the deliverable report closes with a short look at the onward journey of the work package.



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# 1 INTRODUCTION

Delivery 4.2 is the second of four deliveries in Work Package 4 (WP4). The overall goal is to build a collaborative environment in order to facilitate awareness and engagement among key partners in resilience building. Ultimately, this leads to the development of an integrated communication platform, the *Resilience Information Portal*<sup>1</sup>, which will be used beyond WP4 for the remainder of the project.

This second deliverable compiles *design principles for the use of social networking services to promote transdisciplinary collaboration*. It thereby directly contributes to two of the objectives of WP4<sup>2</sup>:

- The identification of communication and engagement needs of partner CITIES (O4.2).
- Development of a platform (i.e. the portal) that supports information and knowledge sharing (O4.3).

Moreover, this deliverable marks the transition from the theoretical work to practical work with the CITIES<sup>3</sup>. It also provides the necessary preparation for WP4's milestones, which are due six months, after this deliverable is finalized (after month 18 of the project).

Following the assessment of literature and development planning as summarized in D4.1, an interview guideline was designed (see Appendix 8.1). Based on a pre-questionnaire and an interview guideline, the partner CITIES were interviewed. Since interviews were done in a semi-structured fashion and we allowed for open discussion, broad insights could be gained from them. The summary of the analysis of the interviews in synthesis with the results from work with the literature are summarized in this deliverable report.

While the description of the deliverable allowed for a rather broad interpretation, we have decided to present findings in a tightly structured way. This honours the fact that D4.2 is the base not only of D4.3, but serves additional purposes:

- Since work on the fifth Work Package has started already, insights from tool development including from WP4 were and are needed for the kickoff meetings, Webinars, and the further ongoing in it.

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<sup>1</sup> In this report, we use communication platform to describe an information system but Resilience Information Portal to describe the information system that is actually developed as a prototype for WP4 and that CITIES will implement, following the WP's work.

<sup>2</sup> For more details on the WP's objectives and deliverables, please refer to D4.1 (Majchrzak & Sakurai, 2015).

<sup>3</sup> CITIES in caps denoted the seven tier one and tier two cities that are members of the SMR consortium.



- Insights from the interviews are manifold, but they are still not static. The experiences presented herein will need to be shown and discussed with the CITIES, eventually leading to revisions and extensions.
- Development of the Resilience Information Portal needs to be started in parallel to make sure that it is finished in time. Moreover, it will also be needed in WP5. In addition to that, the portal is very valuable for evaluating the design principles since it allows demonstration of findings to CITY stakeholders in a tangible fashion.<sup>4</sup>

Therefore, we have split the analysis work into three parts, of which two are reflected in this report.

Firstly, interviews were analysed in a theory-driven manner with the aim of understanding the abstract findings behind them. This is the most extensive task since it includes in-deep work with the interview transcripts to extract design principles in a narrow sense, as well as to understanding challenges faced by the cities, and goals to be set for the development of the Resilience Information Portal as the appropriate information systems to address the challenges. It also is the task that directly addresses the deliverables goal as defined by the SMR proposal.

Secondly, a functional specification draft is presented. It has become apparent during the interviews that CITIES would not be willing (or, in most cases, even be able and allowed) to install a Resilience Information Portal built from scratch. Replacing existing systems typically is not feasible. Thus, they need concrete advice on how to extend existing systems or how to amend their IT landscape with a portal. While the design principles foster a better understanding of the CITIES' requirements, they are hard to adopt. In contrast, a functional specification document is detailed and very concrete, and comprehensible for people with a basic IT background. Moreover, particularly for amending existing systems it can serve as a blueprint. Thus, the functional specification will serve cities either by supporting them in having their own Resilience Information Portal being developed by a software development contractor, as a draft for extensive own development plans, or "just" as an exemplary "how to" guide.

Thirdly, the prototype of the Resilience Information Portal, which is developed as part of the project, is drafted. While details on the development work are out of scope of this deliverable, the activity is mentioned here nonetheless as it originates from the analysis work required for the deliverable. In fact, the functional specification provides the requirements that are used for development.

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<sup>4</sup> Work on the portal will eventually lead to D4.4. Details on development do not fall into the scope of this deliverable.



Design principles in the narrow sense and functional specification, thus, make up the core of this deliverable. The remainder of the document is structured as follows.

Section 2 provides an overview of context and background of this deliverable. This particularly addresses work that does not belong directly to this document but that either has been a precondition for it or that is strongly affected by it. Due to the complexity of the underlying analysis, we explicate the chosen methods in Section 3. This not only makes our results replicable but should also facilitate a deeper understanding of our findings. Section 4 presents the first set of main findings, namely the communication challenges. The resulting design goals and principles are then extensively discussed in Section 5. Based on these two sections, Section 6 as the third core section provides the initial functional specification of the portal. Finally, in Section 7 a conclusion is drawn.

## 2 CONTEXT AND BACKGROUND

### 2.1 GENERAL

This section introduces context and background of the second deliverable of Work Package 4. Therefore, it explains how it builds on the first deliverable and how it has been developed in relation to the ongoing activities in the other work packages. It also gives an outlook on how the Resilience Information Portal prototype is developed in parallel to the activities that led to the insights captured in this report.

### 2.2 BUILDING ON D4.1

Since WP4 has three successive phases, each leading to one deliverable<sup>5</sup>, D4.2 builds on D4.1. In particular, D4.2 relies on the following results from D4.1:

- It sketched first ideas for the Information Resilience Portal and presented related literature. This has contributed to the foundation for WP4 as a whole.
- The agile development process has been sketched. It illustrates how portal requirements and portal prototype evolve in parallel. The experiences from the interviews have underlined that this process is actually mandated: gaining concrete insights from work with the cities is possible but it takes successive steps to validate what actions, policies, and information system practices of the cities should make it into the functional specification and how design principles relate to them.
- The described interview strategy has been used. It provided the basis for gaining insights in the second phase of WP4.
- The initial set of requirements (which was based on hints from the literature and theoretical considerations) has been informally used to support discussion in interviews were needed.

### 2.3 INTERRELATIONS WITH OTHER WORK PACKAGES

Extending the discussion of interrelations with other work packages as presented in D4.1, D4.2 in particular relates to three other work packages.

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<sup>5</sup> Actually, the third phase has two deliverables. D4.4 is the prototype of the Information Resilience Portal. Since the deliverable type is not a report, it is different in character to D4.1-D4.3.



The work on the preliminary version of the *Resilience Maturity Model* in WP2 (Task 2.6) influences the work in WP4 and is influenced by our work at the same time. The maturity model can be seen as the integrating concept of the SMR project and therefore needs to be honoured in *all* work packages. Since WP4 discusses the information system (IS) usage of cities, it also needs to be reflected in the maturity model. Not only do many resilience-related policies require IS as enabler but also will the Information Resilience Model be required for cities to become more mature.

The strongest interrelations are given with WP5. Work Package 5 contributes to WP4 through the work in the kickoff meetings and webinars and is provided by WP4 with materials in the same time. Until WP4 is finished, work in WP5 and WP4 will go hand in hand, eventually with the WP4 tool (the portal) being “handed over” to WP5.

There are also ties with WP6 in that information system development is an activity that can draw from many standards. Even though these are technological standards, WP4 can draw from DIN’s expertise concerning standardisation and standard usage. Moreover, we have planned to standardize the functional specification as an additional asset that will result from the SMR project.

## 2.4 PARALLEL PORTAL DEVELOPMENT

As already mentioned is the actual development of the portal not part of deliverables 4.1 – 4.3. However, both due to the character of the theory-driven activities in WP4 and the integration with the implementation of tools in WP5, portal development goes along the work described in this deliverable report.

The general process for development has been outlined in D4.1 already. The basic principle is an iterative incremental development process that also follows an evolutionary idea. Design goals and a set of criteria have been derived from the interviews (as described in detail in the remainder of this document). These form the foundation for first development steps. Based on the findings presented in this document, actual functions will be given a closer look with help of the CITIES. Moreover, the first version of the portal can be developed based on these criteria. It will be providing core functionality only and be “bare”. This means that it will not have any content and not offer any city-specific or customized functionality. However, cities will be given the opportunity to work with it and it will be used in the WP5 activities.

The feedback gained in this way will lead to a refinement of goals and criteria, and lead to an increasingly refined set of functions. Any changes to these will be made available to portal development, and can thus be reflected in the prototype. The latter then successively is used, starting a new circle of refinements.



## 3 METHOD

### 3.1 GENERAL CONSIDERATIONS

This section briefly describes the method used to gain the insights given in this report. After discussing general implications, we propose to structure work into challenges, design principles, and functions to reflect the levels of abstraction that can be applied. We then explain how design principles could be derived and how we drafted the functional specification.

The method to gain insights for WP4 had to take into account two particularities of the work package. Firstly, the work package's proceeding has a highly iterative nature with constant exchange with other activities in the project. While the core activities are based on the feedback of the CITIES and the result from WP4 are deliverables, regular feedback from other WPs and general project meetings needs to be taken into account and materials need to be provided to other work packages, most prominently to WP5. Moreover, feedback from the CITIES is gained in several ways such as WP4 interviews, WP4 informal exchange, SMR project meetings, and WP5 activities.

Secondly, WP4 needs to find a balance between concrete and abstract work. The SMR proposal demands design principles to be defined. Principles are always abstract, describe a problem on a very high level, and tend to be intangible for people without prior knowledge of the subject. The Information Resilience Portal on the other hand is an actual technological artefact. Working in a way that leads to both abstract and concrete results needs to be well-tailored. In particular, the methods need to lead to abstract, generalizable result that will provide value beyond the project's lifetime. At the same time, for development and for discussion with the CITIES less abstract representations of the principles are needed. While the description of an information system as well as examples can fulfil this requirement, a sound method needs to ensure that concreteness does not come at the price of missing validity and that abstraction does not come at the price of lost precision.

### 3.2 CHALLENGES, DESIGN PRINCIPLES, AND FUNCTIONS

The process of deriving design principles takes three steps. Firstly, challenges regarding communication activities in each city are defined. Second, stakeholders whom CITIES should collaborate to deal with these challenges are selected by each CITY. Finally, CITIES are asked what (existing) information systems they are using and how they communicate with stakeholders in short-term (emergencies) and in long-term. Challenge definition and stakeholder selection are conducted by a pre-questionnaire provided online. It serves the purpose of get-



ting a rough overview of communication activities in the SMR cities as well as to better understand their challenges. Moreover, it explicitly addresses the question of key stakeholder involvement. This questionnaire was provided to cities early January 2016. A face-to-face interview with CITIES and first responders (stakeholders), who were selected in the pre-questionnaire, was planned afterwards (see Table 1). In these interviews, detailed requirements from the CITIES regarding the portal are discussed. This, however, is a complicated matter for it comprises different topics such as the kind of information to be included in the portal, way of usage of the portal, and intended users.

In total six cities have been interviewed. Twelve stakeholders took part in the interview, leading to 20 sets of interviews in which 33 individual interviewees have participated.

**Table 1: Schedule of face-to-face interviews**

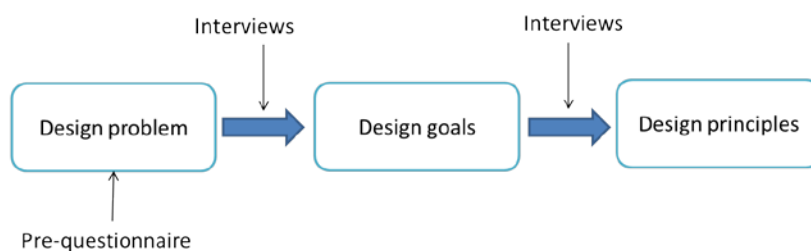
<b>CITIES</b>	<b>Date(s)</b>	<b>City department and stakeholders</b>
Kristiansand	March 1st, 2nd, 9th and April 5th	City council (emergency officer, and Health and social services department), police, fire brigade, county governor, energy utility company
Donostia	March 10th and 16th	City council (technical assistant, health and sustainability department, service for citizen participation, and service for e-Administration), fire brigade
Glasgow	March 7th	City council (Sustainable Glasgow department)
Vejle	March 16th, 29th and April 8th	City council (Chief Resilience Officer, VIFIN), waste water company, <i>Green Tech</i> centre, fire brigade
Bristol	January 26th, 27th and 28th	City council (civil protection, sustainable city team, city highways team, flood risk management, GIS office)
Rome	February 22th, 23th and 25th	City council (natural hazard assessment, social services department and civil protection), regional government, research agency and university

### 3.3 DERIVATION OF DESIGN PRINCIPLES

The process of deriving design principles started with a pre-questionnaire, which was filled out by the CTIES. It consisted of the following five questions:

1. Briefly describe the communication activities<sup>6</sup> (including knowledge sharing) that your city currently undertakes to enhance city resilience.
2. What are the most significant communication challenges that your city currently faces in these activities?
3. Please name relevant stakeholders (police, fire brigade, hospital etc.) with whom you want to collaborate in resilience building activities.
4. Regarding stakeholders, could you kindly name the five most important ones in terms of impact on the cities' resilience?
5. Would it be possible to invite these to the face-to-face interview?

The main purpose of the pre-questionnaire is identifying communication challenges and stakeholders who should be involved in communication activities. Derivation of design principles is conducted based on challenges identified in the pre-questionnaire survey. The process follows the design theory for dynamic complexity (Hanseth et al. 2010). According to this theory, identification of design *problems* should come first since it guides us to design *goals* and *principles* (Figure 1). Design principles in this sense refer to the way of achieving design goals.



**Figure 1: Process of design principle derivation**

Based on the pre-questionnaire results, face-to-face interviews were conducted. These interviews were structured as the follows (Appendix 8.1 shows the full questionnaire):

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<sup>6</sup> activities that require using an information system





1. How do cities and stakeholders share information about risks and resilience (both in emergency and long-term perspective)?
2. How do cities and stakeholders share knowledge and experience to develop a sense of community/learning partnerships around city resilience?
3. What future requirements might the cities and stakeholders want with respect to the possibility of developing a pan-European communication platform?

We also asked CITIES and stakeholders about their usage of information systems regarding question part 1 and 2.

Based on the results of the pre-questionnaire and the face-to-face interviews, six design goals were defined, namely (1) Information Sharing, (2) Establish a Communication Structure, (3) Citizen Involvement and Raising Awareness, (4) Knowledge Sharing, (5) Information Sovereignty, and (6) Usability. Finally, a set of design principles is derived for each design goal.

### 3.4 DRAFTING THE FUNCTIONAL SPECIFICATION

The way towards the functional specification is directly based on the design principles and the interviews. We have chosen the same framing for the specification as already presented in D4.1. Only such elements have been added to the specification that are

- well acknowledged from the interviews, either because they align with existing practices in several cities or stakeholders agree on their usefulness, or
- can be derived as technological preconditions for requirements names in the interviews, principles derived from them, and foundations named in the SMR proposal.

Consequently, the current functional specification is much more concrete than the design principles are; in fact, it allows the development of a “bare” Information Resilience Portal. However, it was impossible to define the very detailed parts of a specification, namely the actual functions and testing scenarios.

Although it can be argued that the functions are the core of a functional contribution, a detailed, well-balanced set of criteria is an important step already. In fact, not taking this step or rushing from criteria to a full set of requirements would likely neglect the *real* requirements of the addressees (the CITIES). Throughout the interviews, we have learned of many potential functions but in this step it would be invalid to state them. Rather, the criteria and sketches of functions as well as examples of what CITIES do or could do will contribute to the



WP5 work as well as WP4's ongoing work with the CITIES. This will lead to a growing set of well-acknowledged functions.

The situation is similar for testing scenarios. In general, there are two ways of fixing testing scenarios. Firstly, scenarios can be designed as typical ways an information system is used and are then based on the list of functional requirements. Secondly, they can be designed in a *test first* manner: users envision how the system should work and test against it, thereby also validating the requirements. Due to the above-mentioned situation with working hand-in-hand with the CITIES towards the functional specification, neither approach is feasible as of now. Rather, we have decided to design the initial testing scenarios based on the SMR workshop in Vejle in May 2015. They will be shared with CITIES in June or July 2016 for evaluation and refinement and eventually be tested against the portal prototype. D4.3 will then contain a full set of testing scenarios for further usage in WP5.

A part of the process of getting concrete functions and testing scenarios is also parallelized with the theoretical work as captured in this deliverable report. For example, cities were asked to provide graphical user interface best practices following the SMR workshop in Vejle in May 2016. These will be used to design the Information Resilience Portal prototype in a way appealing to the cities and user-friendly for their stakeholders and citizens.

### 3.5 USING THE INTERVIEW TRANSCRIPTS

In Sections 4 and 5, we present findings that are based on the interviews. To present these findings, and also to emphasize their origin – the CITIES and their stakeholders – we use quotes from the interviews. All quotes are taken from transcripts. Some of them have been slightly modified for form, carefully ensuring no alteration of context or consent.

While quick slips of language while speaking (e.g. “a” instead of “an”) have been corrected, some language mistakes remain. They have not been corrected due to the risk of altering meaning. It should be noted that neither interviewers nor most of the interviewees are native speakers of the English language.

Furthermore, some quotes have added context put into square brackets. This is done if quotes would otherwise lose their context or sentences would get grammatically clumsy.

In addition to the above alterations, all content that might reveal the identity of the quoted interviewee was removed and replaced by generic terms. For example, a name of a partner city (e.g. Bristol or Vejle) was replaced by *[city]*. This has only been done to the extent required to properly anonymize cities. This is required because the deliverable becomes publicly available while some of the quotes hint to information the CITIESs



might not want to reveal, e.g. because they think they *ought* to be more resilient in a specific regard. For each quote, it is nonetheless given in brackets whether it originates from a city (council) representative or from a city stakeholder.

Where appropriate, phrases in quotes are put in italics. This denotes occurrence of a design goal.

When information is summed up, an arrow (➤) and intended text is used. A correspondent phrase (e.g. “summing up” has been omitted usually for an improved text flow.



## 4 COMMUNICATION CHALLENGES

### 4.1 GENERAL

This and the following Section 5 contain the main contribution of this deliverable report: the design principles. Section 4 first explains communication challenges, which turn to be foundation of design principles.

Firstly, a look at communication activities identified by the pre-questionnaire is presented. Each activity mainly requires using information systems. Secondly, we summarize the main challenges of communication that CIT-IES face.

### 4.2 OVERVIEW OF COMMUNICATION ACTIVITIES

#### 4.2.1 KRISTIANSAND

The city council communicates with internal departments and first responders quite often in daily-basis operations. The regional County Governor Office plays an important role in building network among the regional stakeholders. They frequently have meetings to discuss the latest events and issues concerning societal safety and preparedness. The County Governor Office, the Norwegian Civil Defence and the City of Kristiansand has since 2013 taken initiative to hold an annual societal safety and preparedness conference, at which all relevant regional stakeholders (emergency responders, voluntary organizations, private companies, the regional hospital, students from different universities, several city representatives from a dozen municipalities, and research institutions) has been invited. Kristiansand is reporting, logging and sending information internally through a specific system. This system has the ability to send messages and reports to external stakeholders, but it is not mutual communication. Sending emergency messages to citizens is done with SMS to issue warnings by several departments of the city council, for instance in case of water supply suspension and emergency in schools. However, these warning systems are separately operated by each department and unintegrated. Email is the most useful tool for communicate with stakeholders on daily-basis.

#### 4.2.2 DONOSTIA

The city council is working towards an interdepartmental coordination to share information and knowledge. There is an Emergency Board settled in the city, which uses an information system to integrate related infor-



mation within the city council. This platform mainly focuses on emergency planning and actions. For instance, they share the emergency plans and the different procedures for the emergency situations. A platform to connect city and stakeholders (police, fire brigade, etc.) is also being developed. A SMS service is available to all people including citizens. They promote citizen participation. Web page, twitter and alert sending (by email) are basic channels to facilitate communication with citizens. However, the city concerns these communication channels are merely providing information (i.e. one-way). They seek to facilitate more interactive communication with citizens but have noticed the limitations of human resources to do this. In addition, development of an open data platform is currently on going.

#### 4.2.3 GLASGOW

The city of Glasgow has several frameworks for communication activities, i.e., the *Local Resilience Partnership*, the *Regional resilience partnership*, the *Resilient Glasgow* steering group, and the *Future Cities Initiative*. These involve a wide range of city stakeholders ranging from public, private, third sector and voluntary organizations. In relation to emergency planning, the *Local Resilience Partnership* and *Regional resilience partnership* structure comes into play. At local scale, stakeholders such as Scottish Fire and Rescue, Police Scotland, local municipalities (Glasgow City Council) and the National Health Service (NHS) will meet and discuss, enact and review emergency plans. The city has an electronic portal for emergency responses and there is a special board room available in an event of emergency to communicate with related stakeholders including those on the front line, dealing with emergency incidents. In terms of longer-term city resilience, a new *Resilient Glasgow* steering group deals with wider topics of city resilience. This steering group involves emergency response such as Scottish Fire and Rescue and Police Scotland but also other important city stakeholders, including transport providers, Scottish energy networks and so on. It also includes representation of the private sector business and third sector organizations. Working groups are held in conjunction with this steering group to delve into cross cutting city issues. Internally the city uses various information systems that act as storage databases and log “day to day” incidents or enquiries. The city council and stakeholders also use a central system to register risks and prioritise and prepare for future events as well as reflecting their daily-basis work. These are confidential and restricted to certain participants only. Glasgow recently hosted the *Future Cities Initiative* looking to make the city smarter and safer and more sustainable by opening up city data. This includes a central drive for open data so that all citizens have access to city datasets. Communication with citizens is done via Web sites, Twitter, Facebook, and SMS and email alerts. As a part of the *Future Cities Initiative*, the city created a number of apps for interactive communication with citizens. For instance, citizens can use the My Glasgow App to report incidents, send photographs, get reports back from the city, and know what has happened within the city.



#### 4.2.4 VEJLE

To deliver information on city resilience, the city uses information systems such as the municipality Web site, social media, mails, newspapers, broadcasts, and webinars. In addition, they have traditional meetings, seminars, and conferences to communicate with stakeholders. In January 2016, six municipalities around the region (Billund) started cooperation initiated by the Danish Parliament with purpose of cost reduction. This cooperation framework is named as the Triangle Area Fire. Through this framework, the city communicates with the fire brigade through an internal mobile communication system. SMS is used for sending warning to citizens in case of emergency. Vejle has been using social media (Twitter and Facebook) for around two or three years. The city just started to create a new communication strategy last year. The Chief Resilient Officer takes initiative on this matter. An initial action started to make sure that all municipal information is available on different platforms especially on mobile devices and through social media. The final goal of the strategy is to find out how to involve citizen as a partner of resilience building activities, i.e. to include them in an active part of conversation with the city. A new digital platform based on the strategy will be implemented next year. According to the strategy, this platform connects conventional e-government services and social media more than ever.

#### 4.2.5 BRISTOL

Communication activities of the city of Bristol are focused on risk assessment, incident notification, contact list maintenance, incident logging and recording, plan storage, incident management, and warning of and information delivery to the public. The city developed an internal system to report incidents. The city also uses an information sharing portal which the national government developed for emergency communication with stakeholders. Stakeholders are categorized into two parts, i.e., category (A) includes police, fire, ambulance, hospitals, maritime and coastguard agency, national environment agency and local authorities, and category (B) refers to mainly transport and utility providers such as gas, electricity and water. Through the Web-based online portal, they share risk assessments, emergency plans and maps, which visualize critical infrastructure risks and vulnerable people. This system enables the city to connect to the stakeholders, however, it does not provide functions of citizen engagement. Several warning systems are currently in service. For instance, weather warnings are published on the Met Office website (these warnings are open but separately sent to category (A) stakeholders via email). If you live in flood risk area, flood warnings (by text or voice message) are automatically sent to citizens by the Environment Agency, unless they opt out of the system. These warning services are operated separately and are not integrated into a single application. Bristol is a member of the UK Core Cities network, which organizes nine largest cities outside London. Two of the Core Cities working groups bring together representatives from the cities on emergency planning and climate adaptation/city resilience. In addition, they participate in the Local Resilience Forums. It is the forums for multi-agency emergency planning for



category (a) and (B) stakeholders. The forum provides opportunity to come together and plan, train and exercise collaboratively. These cities often come together in daily-basis. Moreover, the city is one of the Rockefeller Foundation's 100 Resilient Cities and received useful information and contacts from this network.

#### 4.2.6 ROME

The city has undertaken its first steps towards a "resilience policy" more than five years ago (during floods in January 2011, a "resilience plan" was already in place to face this emergency). Nevertheless, communication activities are not yet fully implemented. The city currently is working on a communication policy on resilience. The city has official institutional communication channels, internally and with stakeholders in terms of resilience activities. Charity and volunteers associations respond to the coordination of the Civil Protection office by contributing in building social resilience in Rome; however, the city council needs to improve its communication strategy among itself and with these kinds of associations, in particular with regard to planning communication policies. The Civil Protection system in Italy operates in a threefold level. Depending on the seriousness of the emergency, the management of the emergency falls onto the Municipality, Regional Government or National Government. A table of exchanging information among the civil protection department and related stakeholders (fire, police, emergency health care services, transport, power, gas and water supplier, regional soil defence, and other private companies) is set up for emergency management. Volunteer (citizen) associations are included in this table; these associations contact the civil protection department in daily basis. For an emergency management purpose, the civil protection department developed an information system to integrated incident information (accessed only by first responders and the civil protection department). The city uses a Web site, SMS, and email to provide emergency information to citizens. The Web site is widely used for updating information.

### 4.3 COMMUNICATION CHALLENGES

#### 4.3.1 CHALLENGES IDENTIFIED BY EACH CITY

Table 2 shows the main challenges, which arise in each communication activity, as well as stakeholders with whom the CITIES should work together in these. Information in the table was identified by the pre-questionnaire.

Table 2: Communication challenges

CITY	Communication challenges	Relevant stakeholders ( <i>Italics denote top 5 priority</i> )
Kristiansand	<ul style="list-style-type: none"> <li>• Information fragmentation</li> <li>• Not compatible IT system</li> <li>• Information confidentiality</li> </ul>	<i>Fire brigade, police, hospital, civil defence, telecom operator, energy supplier, food security, volunteer organization, county governor, county council, neighbour cities, harbour, meteorological institute</i>
Donostia	<ul style="list-style-type: none"> <li>• One directional communication with citizens and stakeholders</li> <li>• Unintegrated communication tools</li> </ul>	<i>Civil security, fire fighters, local police, citizens, mobility services, health system, energy, construction, ICT and security companies</i>
Glasgow	<ul style="list-style-type: none"> <li>• Information confidentiality</li> <li>• IT availability and compatibility</li> </ul>	Citizens, community groups, transport providers, academics
Vejle	<ul style="list-style-type: none"> <li>• Mal-information on social media</li> </ul>	Fire brigade, waste water authorities, resilience lab Denmark, Chief Resilience Officer (CRO)
Bristol	<ul style="list-style-type: none"> <li>• Contacting relevant people (internal officials) quickly</li> <li>• Communicating with “hard to reach” groups (e.g., people who do not speak English)</li> <li>• Handling protectively marked documents</li> <li>• Presenting information on complex emergencies</li> <li>• Logging incident information</li> <li>• Managing social media</li> </ul>	<i>Police, fire, ambulance, health partners, community groups, environment agency, charity and volunteer sector, social care providers, utility and transport companies, local businesses, neighbouring local authorities, central government</i>
Rome	<ul style="list-style-type: none"> <li>• Raising awareness of potential and real threats among the citizens in terms of all aspects of resilience (social, cultural, demographic, security)</li> </ul>	<i>Civil protection office (city and national level), research institutions, charity and volunteer associations, police, army forces, health centres, Social Services Department of Rome</i>





#### 4.3.2 OTHER QUOTES

Besides the above listed challenges, several other challenges were mentioned during face-to-face interviews. The following quotes illustrate further challenges that cities and stakeholders are facing.

##### **Lack of information variety**

“After the occurrence of an emergency, the information we provide is very limited. We should improve the information we provide, the actions that should be done.” (City)

##### **Lack of updating what other is doing**

“We are not updated on what the police is doing and I do not think the police is updated on what we are doing.” (City)

“During the refugee crisis situations may arise; there are so many activities that overlap but people do not know about them and you try to arrange something, [and] you find someone is doing the same things.” (City stakeholder)

“We are not given what is a good or bad practice.” (City)

“If there is anything that did go wrong, and [then] those existing systems were not available. Do you have a back-up system for communicating?” (City)

##### **Unawareness of information reach**

“We do not know when information is received. For instance, we send SMS but we do not know if these SMS are received.” (City)

“That is potentially more of a challenge how the information comes to the individual. Because it almost implies that they have to know that they want to know about something, to actually subscribe to it, or find out more.” (City)

“It is a challenge in following live situation with all the mobile phones, Facebook and Twitter, and everything because information is going out so fast.” (City)



### **Human resource updating**

“When we have an incident Friday afternoon after 5 pm, who should I call if I want to talk to someone of the top of the organization? We don’t have those specific plans. Every time we just call and hope someone takes the phone.” (City stakeholder)

“Good decision making is about knowing what resources you have, knowing what resources are available, knowing how long that resources are available, knowing how your resources is going to last for the lifetime of the event.” (City)

### **Long-term involvement**

“Another challenge in terms of getting people interested in long-term challenges is to keep them involved.” (City)

“Work towards communication policy in terms of resilience but we need this structure as centre of control to put all together to design proper communication at this moment we have a piece but they are not connected.” (City)

“If we have an accident [...], we do an internal evaluation, what did we learn of that, but we don’t have a formal external information sharing and knowledge sharing about that”. (City)

### **Lack of direct communication**

“An emergency challenge is [...] that we don’t communicate directly” and “we have to contact people via phone and we cannot share information through the internal system so there is some slow communication”. (City stakeholder)

“We have many stakeholders involved in the issues of resilience but in general we don’t communicate with each other. For instance, when we have an emergency, national civil protection gives direction to local level but collaboration is hierarchical and not a cross cutting approach.” (City)

“There is no institutional communication channel with [other] stakeholders ready.” (City stakeholder)



## Security

“Terrorism and things like that are real concern for assets [i.e. resources], so again we [are] keen to have as much asset information freely available [to stakeholders and citizens] as possible, but security needs to be considered.” (City)

*“[Regarding the information system that the city is developing] Confidential data concerning the position of all critical infrastructures is installed.”* (City stakeholder)

### 4.3.3 CONCLUDING REMARKS OF COMMUNICATION CHALLENGES

First of all, cities already have information systems to share information within the organization and related stakeholders. Systems accessed from internal departments are well established in general. The development has been initiated on several levels, i.e., national, regional, and local (different departments inside the city council). Moreover, there have been heterogeneous developments and, in general, an evolving system landscape. This results in unintegrated communication tools and causes information fragmentation. Information related to emergency management complex due to its nature; it tells difficulties of developing one-ideal integrated system to all related players. In this sense, among partner cities, information systems play an important role to store incident information. However, each kind of information is shared through different protocols. As issues are getting more complex (like with the refugee crisis), the number of involved stakeholders increases which causes further information fragmentation and lack of direct communication among cities and stakeholders. As a result, city officials are forced to use several systems to collect information especially in the event of emergency. This can rise complexity even further if additional systems are used to get an overview, but no full integration or at least information update automatization is possible.

While internal communication is supported by several information systems, communication with stakeholders and especially with citizens is a common concern to all cities. Raising awareness of potential issues and threats around resilience is the biggest challenge that cities face. A variety of information should be provided to proper citizen groups (or communities) to raise awareness. However, cities typically lack human resources to cover all tasks surrounding information provision and community identification. Interactive communication between citizens and realization of long-term involvement is desirable. However, there are several hurdles for cities to overcome<sup>7</sup>. Using social media is a popular option to provide information to stakeholders and citizens. Howev-

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<sup>7</sup> This point will be further discussed in the next deliverable (D4.3), where we will also provide proposals to tackle various challenges.



er, quality control of information from citizens is quite hard, and sometimes social media information is considered to be unreliable.

In terms of information around resilience, cities have to deal with - in some cases highly - confidential data, such as datasets on critical infrastructure and vulnerable people. Securing data access and ensuring confidentiality of information are additional challenges when considering communication activities.



## 5 DESIGN GOALS AND PRINCIPLES

### 5.1 BASIS

This section shows design goals and principles. First, a map of problems and design goals is presented. After that, the derived design principles are discussed one at a time. Eventually, the interrelation of the principles is discussed.

Based on the results of the pre-questionnaire and face-to-face interviews, the following communication challenges are identified:

- unintegrated communication tools
- information fragmentation (including incompatibility of information and systems)
- logging incident information
- presenting information on complex emergencies
- lack of updating what others are doing
- lack of direct communication
- raising awareness of potential and real threats among the citizens
- lack of information variety
- unawareness of information reach
- contacting relevant people (internal officials) quickly
- communicating with “hard to reach” groups (e.g. people who do not speak local language)
- human resource updating
- lack of interactive communication
- long-term involvement
- security
- information confidentiality
- handling of documents marked as protected or confidential
- mal-information on social media
- managing social media

These challenges are categorized and linked to design goals (Figure 2). Six design goals and one enabling principle are chronologically dependent each other. Their interrelation will be discussed in Section 5.9.

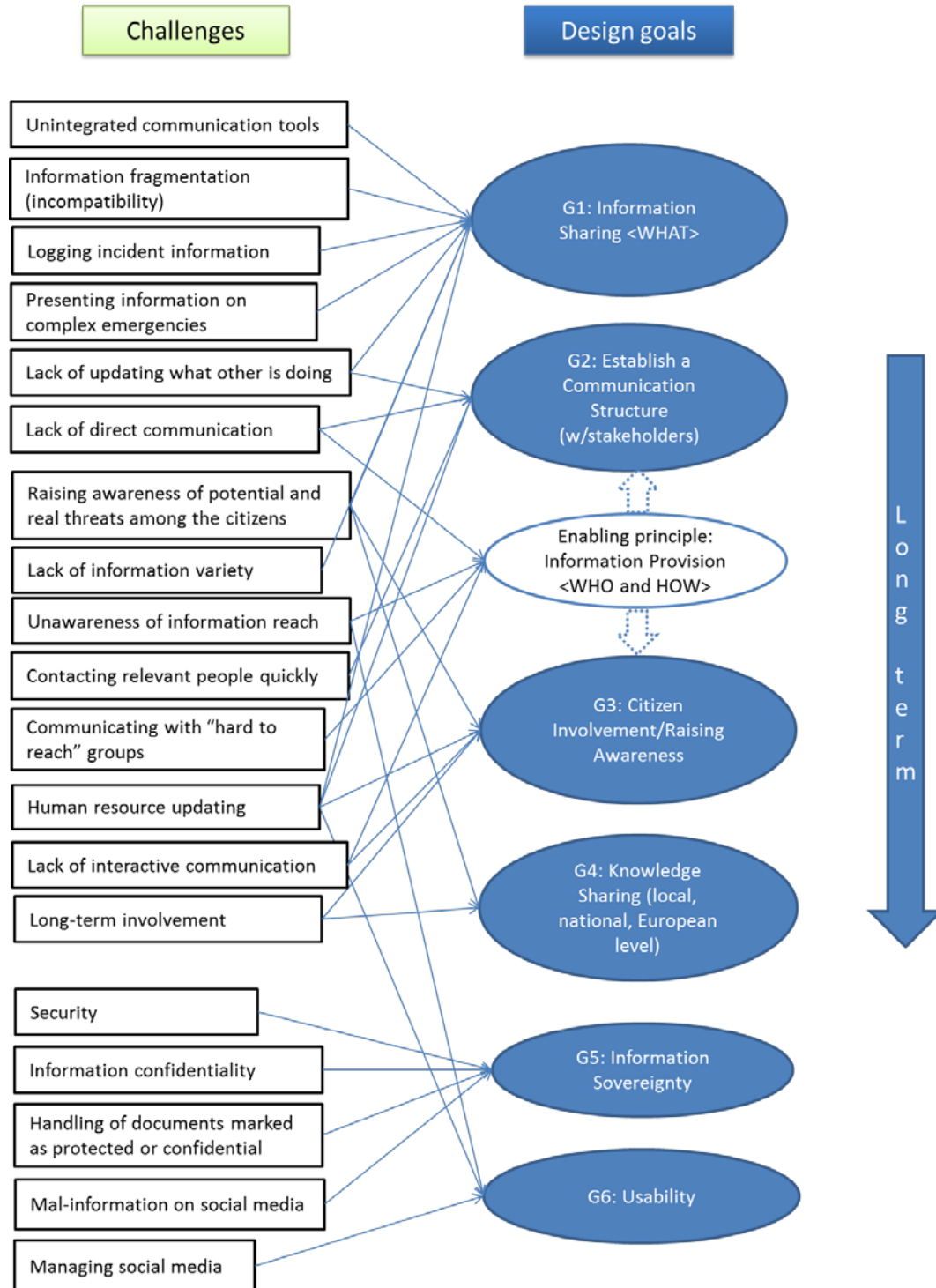


Figure 2: Challenge-goal mapping



The following subsections describe each design goal in detail. When information is summed up, an arrow (➤) and intended text is used.

## 5.2 DESIGN GOAL 1: INFORMATION SHARING

### 5.2.1 INFORMATION SHARING IN GENERAL

The focus of this principle is communication and information sharing in general, which refers to daily-basis and emergency communication. Its scope is local; sometimes information is shared nationally through a national information system. The overall objective of communication, which was derived from CITY's statement, is the following:

- Cities need the ability to understand the capability of neighbours and of other agencies.
- Moreover, they need the ability to locate resources and find out where both equipment and people (who can support your emergency response) might be.

Corresponding challenges to the design goal of Information Sharing are mainly unintegrated communication tools and information fragmentation (including incompatibility of information and systems). Each city has existing information sharing tools (systems). However, they often do not speak to each other: hardly any integration is typically given. One reason is the confidentiality of the information. The following is a quote on this issue:

“The issue around the emergency response is that it's quite confidential, it's sensitive information that they're discussing, so the information isn't freely available to other city stakeholders. Obviously due to the kind of sensitive nature, only certain organizations get to use it. Therefore, it is not necessarily a kind of social information for everyone. It really is about keeping it to those who need to know and need to respond.” (City)

In terms of information sharing, we identified the important question from interviews as:

- WHAT information should be shared?
- WHO should be involved?
- HOW should that information be delivered?

This section mainly deals with the <WHAT> question in daily-basis and emergency. <WHO> and <HOW> questions are discussed in the enabling principle (Section 5.4).



## 5.2.2 INFORMATION SHARING: DAILY-BASIS COMMUNICATION

- Daily-basis communication with stakeholders is based on issues and events. Cities share risk assessments, emergency plans and complaints through internal software, Web sites, and face-to-face communication.

The following quotes (words with *Italic style* refer to findings to the topics in each section) describe how cities communicate in daily-basis practice.

“In terms of how they [city and stakeholders] communicate information – they literally sit around the table and they will have structured conversations. They also, I suppose, *share minutes and documents*.”

I suppose internally there are a number of systems that we use to collate either the information around *enforcement issues*, around complaints. We use a system, which employs data base of logging *incidents or enquiries or complaints*.” (City)

“The city council departments have an internal network where they share *the emergency plans* and *the different procedures* that they have defined for these emergency situations. By using this platform, all the city council departments are aware when some protocols are activated. They also use this platform to prepare *new plans* or coordinate internal activities regarding emergency preparation.” (City)

“Face-to-face forums gives us the opportunity to tell others *what they and we do*.” (City stakeholder)

“[Our city] intended to develop more efficient methods to communicate *what the social services of [our city] do*.”

We established a Web page and it shares information to other department to tell *what we are doing*.” (City)

In terms of future communication, cities and stakeholders wish for the following possibilities:

- <A> For future preparation, resource capabilities, project information, problems, progress, future plans, list of stakeholders, and profile of involved citizens are required.
- <B> When reporting activity information, statistical analysis tools are desired.
- <C> Creating a database of people and of critical infrastructure, of which municipalities should take care, is desirable. However, data should be protected in a *special* way when it is going to be shared.

Keeping information updated to reflect the current resources and situation is one of corresponding communication challenges of this design goal. A communication platform can support this function.





Supportive statements are:

<A>

“A dedicated portal would allow people to identify both *needs and requirements, and capabilities of resources* would be lovely.

See [project], *what their problems was, how they approach the problem, what they did*, to be able to have some sort of database.” (City)

“It is nice to get what the municipality is *actually doing, the progress, what the plan is*.” (City)

“I would like to have a database with updated information and participation of the public. Ideally, this platform would allow to create *lists of interested stakeholders* and to provide them with information they need to know. For instance, this database would allow to *organize data as well as to identify those citizens* that have been involved in a project and would like to know more and receive *news about the project*.” (City)

“The municipality was asked to develop an information system to make different stakeholders of the social assistance system to talk together regarding *the problems of the people* whom we take care of.

Homeless people office with immigration office, we connect them together to share information of *people that municipality as in charge to help to them* to solve problems.” (City)

<B>

“When we go out to visit companies, we put all data in about each visit, but the problem with that is you can’t make any proper *statistics* about it.” (City stakeholder)

<C>

“I would like to have a database through which different departments of the City Council can exchange information. Often we have problems to share data of people between departments of the City Council because of *data protection laws*.” (City)

“A big issue of sharing information on vulnerable people is that it is personal information, and it is potential sensitive information, so we have very *special protection legislation*.” (City)



### 5.2.3 INFORMATION SHARING: EMERGENCY COMMUNICATION

This category focuses on situations of emergency. Information for emergency management is complex by their nature, and how to share this complex information is one of the communication challenges. This section mainly looks at how cities currently share this kind of information in the event of an emergency.

Summary of findings:

- **<A>** Cities collect weather related data for disaster preparation and responses. Rain, (river) water level, snow, frost, cold and hot temperatures, winds and flood forecasting should be shared properly.
- **<B>** Information sharing is carried out mainly by alerts and warnings, showing the affected area, and uploading photos. However, consideration of password protection is necessary.
- **<C>** Reporting detail information about the accident, how they responded to the certain event (and what the impact of the event is) and how they would respond in the future is desirable to be explicit.

Supportive statements are:

**<A>**

“We have an automated warning system, an *environmental automated warning* system where people within a defined area are warned if a certain event is coming and may affect them, so that is fairly well established. We have also alarms set to each of those so if certain intensively rainfall is experienced, it will trigger our alarms and send us text or send us an email to let us know.” (City)

“In the [European state] we have a system of severe whether warning which issues information about *rainfall, snow, frost, cold temperature, hot temperature, high winds*, and in addition to that we have a flood forecasting centre which issues *flood forecasting statements*.” (City)

“There is an application for the mobile phone in which you can get information on the *water level*. That information serves citizens to feel that they are secure and that the situation is controlled.” (City)

“So we also collect data about *how is the weather going to be*. From this we can judge what is going to happen.” (City stakeholder)

**<A+B>**

“We share information from our *rain gages, water level monitoring* within environmental agencies so the information from those is all put on to our Web site which is password protected.” (City)



“Civil protection has their own system that allows communicating with citizens in an emergency situation. For instance, in case of heavy rain they know *the most likely areas that can suffer floods* and they can send SMS or emails to warn about the *level of rivers* or to recommend to take some prevention measures.” (City)

“(With using [My name of a city] app) you can report *incidents of environmental incivility*; I suppose you would call it. You can take *photographs*, you can *tag*.” (City)

<C>

“If we had an incident in [our city], we will have various government department demanding information about *how we were responding* and *what the impact was*.” (City)

“So even on smaller scale if there is a weather incident, they (internal system) reflect on that and think: actually, well, *how did we respond to it and would we respond differently the next time*.” (City)

“From the stakeholders, we will need information about *the amount of the accident* and what do that mean, what kind of consequences can this turn out to be for the city.” (City)

“If power goes down it is important to know about *the critical functions in the area*, situation for instance *people who needs some instruments* which requires power or hospital or something like that.” (City stakeholder)

Reflecting how cities share information and what is desirable for future activities, important principles can be derived. Firstly, cities and all related stakeholders should have common objectives; they need to consider for which purpose they want to share information. After the common objective is settled, an information system can be integrated. As illustrated above, integration of all related information is unrealistic; however, to make connections clear among information, systems and people it is useful when cities collect information. A function, which is keeping information updated, is required for the communication platform. One possible solution is making a situation diary within the platform.

## 5.3 DESIGN GOAL 2: ESTABLISH A COMMUNICATION STRUCTURE

We are looking at the structure of communication both on a daily basis and for emergencies, for cities and their stakeholders. Stakeholders in this section mainly refer to local stakeholders who are identified in Table 2 (p. 24). Contacting relevant people as quickly as possible is a major concern for cities in an emergency situation. For doing so, establishing a communication structure in daily-basis operations becomes an important goal.



Summary of findings:

- **<A>** A structured channel mainly for daily-basis communication is set up based on cities' strategy or regional as well as national level initiative. Its coordination is often done face-to-face.
- **<B>** Creation of contact lists as well as organizing workshops and conferences are the popular means to establish a communication structure.

What cities tried to do for establishing structure is:

**<A>**

"We've been the ones facilitating *a number of workshops, working groups, steering groups*, over the last few years focusing on resilience. The City set up *the Operation Centre* in the event of emergency which all the key stakeholders would have seen when they were around.

The City has *a person who focuses on the engagement and coordination* of a number of different kinds of stakeholder groups who all feed into various different elements of resilience and facilitating how we get information out of those groups.

This is all pretty much *face-to-face coordination*." (City)

"Our main task is actually to find out how do we mobilize such a partnership so that we make all these stakeholders actually come together on a common solution which everyone can see that they can benefit from." (City)

**<B>**

"We have a short *internal meeting every week, ½ h – 1h*, to update ourselves about everything going on in crisis management, and a *meeting once a month* with participants from each sector in the municipality. We communicate normally *two or four times a week* in different matters. We also have the warning list [i.e. a contact list of relevant resources and their phone numbers], where to call". (City)

"Daily-basis communication takes four levels. The first is municipal level. The second is on regional level with bosses [i.e. leaders]. On daily basis we have regular *yearly exercises meeting*. The third one is something called communication advisors forum for same stakeholders. The fourth forum is also on regional level but not bosses." (City stakeholder)

"The City Council has a *list* with the contacts of relevant companies that may need to be contacted." (City)



“I created a *contact list* for municipalities, two county councils, police, hospital, power, telecom, road, civil defence and fire. In each organization, contact list of Mayor, head of admin, civil protection/coordinator, municipal planning, and doctors are described. Collected information is name, mobile phone and email address. We are in the very central of establishing this daily relationship.” (City stakeholder)

A communication platform will support creating a communication structure in the following way:

“It would be interesting to have a portal with not the target group of citizens but with a *target group of technology companies, of researchers, of advisors to the city*. So there in one place, in one platform, could see what the infrastructure due to resilience is. [We want to know] Who is in charge of what, where the pipes are, how big they are, how much energy comes in, from where and what, who the contact persons are at your organization, the municipality and the electricity company.” (City)

“It could be interesting to find out who is communicating with whom if something breaks down”. (City stakeholder)

Since it is already identified as a communication challenge, there are some issues around human resources as follows:

“One of the biggest current challenges is really around resourcing, and having the resources to actually communicate. And potentially it relies a little bit on the individual taking upon themselves to go to the Web site or go to their Twitter account and find out more”. (City)

“A big problem every time you make plans, and you make contingency planning, the problem is the paper updating, with the proper phone numbers and functions on persons.” (City stakeholder)

In this sense, we propose visualization of live communication as well as resource capability as design principles for achieving the *Establish a Communication Structure* goal.

## 5.4 ENABLING PRINCIPLE: INFORMATION PROVISION

### 5.4.1 INFORMATION PROVISION IN GENERAL

The enabling principle named *information provision* covers the following two questions:

- WHO should be involved?
- HOW should that information be delivered?



The WHO question mainly refers to local stakeholders as discussed in the previous section. Information provision affects both design goals 2 and 3. Since it became clear that the means and process of involving local stakeholders and citizens are quite different, this section discusses information provision to local stakeholders and citizens separately.

#### 5.4.2 INFORMATION PROVISION: TO LOCAL STAKEHOLDERS

- Communication with cities and local stakeholders is done by email, phone, SMS, and face-to-face. Sometimes interactions among them are not as intensive as desired.

“We do the ‘normal’ communication like *E-Mail, phone, direct meetings* as no platform or common communication systems at the moment. So it is mostly the traditional phone or personal meetings.” (City stakeholder)

“We have no Web-based system to communicate with people outside the department. We use *telephone* that is the most useful tool to communicate and of course *email and face-to-face meetings*.” (City stakeholder)

“Reporting to external is not formalization, now we use email.” (City stakeholder)

“If the emergency occurs, if we get warnings that emergent weather is coming, we have a plan whom to warn in the list in emergency system. This warning will go to all the municipality depending on what area is affected but we can issue the warning to all 30 municipalities in the region; normally, we issue this warning to police, road authority, telecom, and energy supplier. To fire, hospital, and civil defence we use a closed information system which sends message via *email or SMS*.” (City stakeholder)

“We want to warn the city, but do have quite a lot of people we have to warn, and we do have to find out what actually happens here, and the communication with the city is quite low on that list because we have so many things we have to do in the first place, but they need to get the information a bit earlier, so we do miss to have a communication form in the early phase. It is difficult to find a way to early enough to share information with the city in a written way so it is much easier to take *a phone* and explain what is happening .... or use *Twitter*.” (City stakeholder)

“There are a lot of situations that could be shared on *Web site*. And we use *Facebook* but there is empty room between decision makers. We established quite good communication system for *internal* but no system exists to outsiders.” (City stakeholder)

There is a gap between cities and stakeholders in terms of emergency communication. Stakeholders prioritize to respond in the field so reporting comes later. Information sharing systems already have been developed;



however, using phone and email is the fastest and easiest way in an emergency, also according to the following quote:

“These kinds of systems are well developed, however, a problem is pointed out as sharing situational information between cities and stakeholders takes time. From stakeholder’s perspective, they have to prioritize dealing with the situation, so that sharing situational information with the city is not on the top list.” (City stakeholder)

However, information systems to support this kind of communication are developed in some cities as follows:

- An information system is developed in some cities. The development initiate might be led by the national governments or by the cities itself. The system supports reporting, sending alert messages and emails, and creating virtual discussion space.

“We are developing a *platform* for the Civil Protection department to make easier the communication with all the city stakeholders. The civil protection department will be able to select the stakeholders that need to be warned and send them *an email*. In an emergency situation, they have an internal network where the different departments can share *alert messages*.”

We use *an application of the email* that allows creating working groups so that all stakeholders involved can received the information shared in the groups. In our case, we share information with the press cabinet of the City Council and then they are in charge of contacting the media.” (City)

“In the terms of within the emergency responder’s communities, there has been a central government developed *information-sharing portal* already. Internally, we have *reporting systems*, certainly connected with incidents.” (City)

“[Regarding internal info management software] you can create areas called *project spaces*, so if you have, for example, water issues across the city council, you can *create a project space* around that and give permissions to certain people across the city council to put documents so that they can share documents in one secure area. We use that as well.” (City)

### 5.4.3 INFORMATION PROVISION: TO CITIZENS

- The typical ways for providing information to citizens are phone, email, SMS, Web-page, and posters. Social media is getting more popular for communicating with citizens. However, it is often a one-way communication.



Supportive statements are:

“We have a rather big capacity to reaching out. We can immediately set up a *public telephone*.” (City)

“There’s a number of different systems whereby you can sign up for information to come to your personal, whether be it a *phone or an email* address to give you advice on what to do.

The emergency services have also well-defined methods of communicating with citizens. They all use *Web pages* with updates. *Print, radio and the traditional media*, will play quite a big role as well.” (City)

“We use *the media* to inform. It is important channel. If the incidence is severe, we will contact the media pro-actively.” (City stakeholder)

“The City Council provides a *SMS* service for anyone interested. Citizens and companies can register in this system and they will receive direct information on disaster risks and alerts.” (City stakeholder)

“We have a system when it comes to water and waste, if there is a break we can warn [i.e. notify] the people that have a *mobile phone* and live in the area, they don’t have to be there, so we have a semi *SMS warning system*. And schools also have [this], all the parents have put their phone number into a system at the school, so they can give [i.e. send out] information to the parents about something [typically problematic] happening.” (City)

“During floods, so we push that on all different platforms that are available, *Twitter, Facebook, the city Web site*, etc., so that is working pretty well.” (City)

“We have a commercial system to send a *SMS* to a specific area if something brakes down. That is a kind of warning. We tell the municipality *press officer* what we were doing, how things were, and then she make the messages on *social media* and put it on the municipality’s home page and so on.” (City stakeholder)

“In our department, we do not have any procedure or timetable to communicate information. We usually develop *posters* and hand them in the *neighbourhood associations* to publish information about meetings. Once we tried to create and maintain a *blog* to publish information but it did not work well. Updating the blog required resources and time that we were not able to provide.” (City)

As indicated in the last quote, keeping information updated requires resources. In addition to this, when they deliver information to citizens, sometimes it is not clear whom they should approach as indicated the following statements:





“In terms of water resilience, particularly in terms of heavy rainfall, surface water that may be spread across the city. We do not really have any communication tools at the moment because we haven’t identified the relevant groups that communication should go to. We use social media pages and networks that they have to give a kind of weather warning, but that is not fantastically effective. So part of the work we are doing at the moment is to identify the groups around the city that we can engage with so we could have them on a communication tool.” (City)

“When I am going to warn people, for instance of flooding, we cannot warn the whole municipality. We are trying to get sharper on the specific areas by measuring data in the rivers and so on, and heavy rain.” (City stakeholder)

“Giving information on *the Web site* you reach only 10% of the population.” (City)

In this section, one enabling principle named *Information provision* is proposed. The focus is on <WHO>, and on <HOW> should information be shared. Discussions relate to design goal 2 (Establish a Communication Structure) and 3 (Citizen Involvement and Raising Awareness). Towards future citizen involvement, identification of communication groups is an issue. In addition, information reaching is a further issue. Social media like Twitter and Facebook is used but it is not clear who receives message.

## 5.5 DESIGN GOAL 3: CITIZEN INVOLVEMENT AND RAISING AWARENESS

At the early stage of the SMR maturity model, information flows are observed only from cities to citizens (one-directional). As cities achieve a higher level of maturity, citizen involvement is becoming a main goal. In this sense, the position of citizens changes as follows:

- <A> The relationship of cities and citizens change. Citizens turn to be a partner for creating value rather than service recipients.
- <B> Cities are seeking the way to realize interactive communication with citizens.

The finding comes from the following statement:

<A>

“We have been looking at the citizen as a recipient of municipal information, and only recently we started to use social media, so we only have around two or three years of experience, and that was something on a dif-



ferent level. In the new communication strategy, we are looking into how we can make *citizens become a more active part of the conversation.*” (City)

“We have also come to the understanding that there is no one [i.e. single] problem, one [single] organization, so when it comes to climate change, flooding, or when it comes to increased social complexity, it is not something that municipal organization can solve alone, it requires a lot of collaboration and different kind of collaboration with citizens.

What we are focusing on right now, it also relates to what we talked about earlier, in the shift in the relation between the citizen and the municipal organization. We used to have an approach before that was delivery of services. That means also that delivery of information was the main part of organizing the city’s information systems.” (City)

As issues are getting more complex, cities are required to assign more officials as well as involve stakeholders. Since cities originally have limitation of human resources, mobilizing citizen’s capability and creating long-term relationships is important in building city resilience. However, finding ways of involving citizens is a future issue for almost all cities.

<B>

“What the information system that we are currently using doesn’t give us is *the ability to engage with the public.* Potentially there’s so many challenges about getting information to community groups and citizens about how they can participate in their community, how they can start to come on board individually or as a resilient community.” (City)

“What I guess a portal could do is to offer the ability to people to build on these warnings [i.e. to utilize them] so if the portal exists and the warnings come out then it *offers the ability to make connection to other people* in their local area.” (City)

“We do not have a communication platform today to involve the citizens. If you are developing a new city, that is typically happening by how much buildings and what infrastructure [we should develop], but the citizens need to be involved.” (City stakeholder)

“The ability to communicate with the public, which is another thing that I touch on, which is functionality that, not just one way, to actually *interactive capabilities*, I just think is a massively useful function.” (City)



“We use twitter to inform citizens about meetings and to give information on the results of the meetings. But *we do not respond to twitter received from citizens*. So far, the city council Web page is useful to provide information to the citizens but *they do not receive much information from the citizens*. It would be convenient to be able to answer citizens’ questions in a quick way.” (City)

So far, cities are seeking the way to realize interactive communication with citizens. In some cities, an application that enables citizens to report or upload photographs is developed as indicated in the following statements.

“(Using [MyCity] app) *you can report* through that. I suppose it is very interactive. We will also give you a *report back* to see that your complaints have been logged. And also let you know what’s happened with it. So it’s quite an interactive way of communicating with citizens around those sort of issues.” (City)

“I know the municipality has a system just for that, where the citizens can, as they see a road that is damaged, a hole in the road, *take a picture and upload that to the municipality*. They immediately get the information and I think it is relatively popular where people feel they can give something back. It might be that it takes three months before something started but they feel that they are on the boat. There have been very positive reactions to that app”. (City stakeholder)

To sum up:

In this sense, the design goal of Citizen Involvement and Raising Awareness can be supported by the following two principles: co-creation of value and growing social capital. Along with the relationship change with citizens, cities head to create value together with them. We consider interactive communication among them is necessary to support co-creation of value. To achieve this, cities have to mobilize citizen’s capability. Mobilization of citizen’s capability is also important to overcome human resource (internal officials) limitation of cities. Therefore, growing social capital among citizens during daily-basis operations turns to be important. The communication platform can provide the means to realize these principles. Further discussions on how these principles can be implemented will come in the next deliverable (D.4.3), particularly also with addressing social media inclusion.



## 5.6 DESIGN GOAL 4: KNOWLEDGE SHARING

### 5.6.1 BASICS

This section looks at knowledge sharing. The possible scopes are local, national, and European (or even global). All related players such as cities, stakeholders and citizens are involved in this process. The aim of knowledge sharing is building a community (or communities) with a long-term perspective.

- Long-term communication for building resilience community is less structured than that on daily-basis or in emergency communication.

“The internal first response is quite well established, the community resilience is less so.” (City)

“In terms of chronic stresses, the reflection part, the learning part is definitely not formalised. If it happens, it happens slightly more *ad-hoc*. You will probably find some of the city institutions, for example the third sector forum that supports voluntary and community groups. They will disseminate information that will help groups to progress.” (City)

“In terms of community building there are less things [i.e. fewer issues] than emergency.” (City stakeholder)

What cities currently are doing in terms of knowledge sharing is summarized as follows. Implications for future activities are included.

- **<A>** Exercises, evaluation and conferences are the means to provide opportunities for knowledge sharing to the local community. The aim is sharing experiences, risks and best practices. However, they are not supported by communication tools.
- **<B>** The educational perspective should be included in knowledge sharing.
- **<C>** For getting a broader level of knowledge sharing, a higher level of trust should be built among the partners.

In the following subsections, various attempts to share knowledge are illustrated. We thereby distinguish by scope.



## 5.6.2 LOCAL LEVEL

<A>

“When we have an *exercise*, it can be a table top or a full-scale exercise. We will evaluate what is happening, we will work with putting up the exercise, that gives a lot of information and knowledge sharing, and we do the exercise and we will do an *evaluation* after.

The best thing is *the conference* once a year hosted by county governor office, Civil defence and the City. Participants are one-third from the first responders, one-third from the municipalities, and one-third from the private sector. That is a very good event to talk about *experiences*.

If we have an accident like the one at the school, we do an internal *evaluation* on *what we learned of it, but we don't have formalised external information and knowledge sharing about that.*” (City)

“The different departments of the city council participate in a meeting to learn after the occurrence of a disaster. Also, meetings are arranged with affected citizens and neighbourhoods in order to receive information, feedback and complains.” (City)

“We have an *exercise* once a year, training them, so we do have communication several times a year between all of the part of the rescue, but not as a portal. Evaluation of the past event was disseminated by email.” (City stakeholder)

“[Our city] has for many years done [means: worked] to tell children from second to fourth grade about avoid fire and what you can do at home, smoke alarms and so on.

We are sharing *best practices* with the citizens. We put *experiences from universities* on our Web site. We are having some conferences, some workshops.” (City stakeholder)

“It is important for us that the shift towards more digital society is taken place and is done in an inclusive way. So we collaborate with different organization that make sure that senior citizen learn the necessary skills, but also with our social housing companies. We collaborate with them on *workshops*, on data *workshops*, to make sure that new immigrants also learn how to use the public information systems.” (City)



<B>

“If there are other *interesting studies* that are ongoing that some of the other universities are doing. It might also be of use as well. It will be nice to share it with *other’s experience*. It could be interesting to have a section that is *education-based*, that would be with teaching resources.” (City)

### 5.6.3 NATIONAL LEVEL

<A>

“In Britain there is a good form called “*Knowledge Hub*” which is for local government and anybody in the government can formally account and start discussions and that is really good for *discussion problems* that we all facing across the country, and *exchange ideas* and how we approach those problems.” (City)

“We use incident from other cities, from other countries, we talk about them and we learn from them, and that could also be done on a citizen level.” (City stakeholder)

“People at the Centre of the Population Health will probably spend a lot of time trying to *analyse the indicators* and share that knowledge through *a series of reports* on their Web site.” (City)

<A+B>

“The Norwegian government has its own National Emergency Planning College. Here you can get information and educate people, but they don’t include various stakeholders.” (City)

<B>

“[Concerning the information system the city uses.] They do *assess* against after the circumstances and look for learning, particularly where things could have been quicker or smarter or what could be done better in the future.” (City)

### 5.6.4 EUROPEAN LEVEL

<A>

“It might be able to identify *best practice* about how people get around these problems and how there is more sharing of information, that would be good. Having that connection between our European partners would be extremely valuable. It was very interesting because a *laud* of possibilities of using some kind of portal as a *resource sharing* facilities.” (City)



"[About flooding] We looked toward [other city], done a really a great work on that part, actually when there is a massive flooding in [other city], it attracts people to the waterfront. They look at the water and they experience how the water is running, and the same thing in Rotterdam which they also created some fantastic solutions in which flooding and water is part of the experience of living in the city. And that shift from a negative risk that we don't believe in, a cost oriented discourse to a much more attractive, positive, let's move forward, let's develop our city, but let's make flood protection an integrated part of city development. That is the shift that we have been pushing for during this strategy process." (City)

<C>

"The 100 Resilience cities is a very good model in which you have key persons in the cities that you will invest in building a relationship between them.

What is very imperative in terms of knowledge sharing is that you have *a trust*, you have interaction, and you also have interest in other people. So that you feel an empathy or a sympathy for the city. Knowing people from other cities and actually visiting their cities and hearing about their challenges is something that I think make you more to knowledge sharing." (City)

### 5.6.5 INTERMEDIATE SUMMARY OF FINDINGS

Through all three levels of Knowledge Sharing, the communication platform gains the possibility to enable cities to do the following:

- The platform could support learning, simulating, and building a solution storage.

Supportive statements are:

"It could be interesting having a tool, a 3D vision playing with resilience tools and how to get the reaction of 'I am sitting in department A in the city' but if I am doing 'this' something is happening 'here', which could damage in another way. Showing that they are linked together. That could be very interesting.

We are trying to find funding for making a *resilient house* and in the resilient house there should be *education* and inspiration about new resilience, *share best practices and ideas* about technologies, ways of doing it and that should be open to the citizens of the city." (City stakeholder)

"To share *experience* and make them easily accessible is useful. For instance, to establish a kind of storage solution.



Exercise is useful to keep updated. Systems can be useful if it involved these things.” (City stakeholder)

“What a portal would give us is the ability to *develop a shared picture of the risk* that we face, a shared picture of what it might affect us in [City], particularly geographical location and then of course the ability to share plans and arrangement we have in place to manage these risks.” (City)

Reflecting what cities are doing, and what they wish in terms of knowledge sharing, online learning and building a resilience library are the proposed design principles for the development of the communication platform.

## 5.6.6 POTENTIAL PROBLEMS

### 5.6.6.1 General

Knowledge sharing is a frontier field for all cities, which means it has enough room to be improved. Consequently, many possibilities can be discussed as illustrated in the prior subsections. However, through the interviews, the following three points came up as potential problems.

- Potential problems for further knowledge sharing are discussed in three categories, namely resources, language, and motivation.

### 5.6.6.2 Resources

“What the portal also allows is, moving on to the public conversation as well, is a way to *organize civilian capabilities and resources*, so you have the opportunity to both chair and understand the risk with your population.” (City)

“I think the difficult part is ‘oh, I have to find the document, I have to upload them somewhere, I have to make sure they are translated, I have to tell somebody that I share this’, so a lot of hard work actually to share knowledge. And this is also where the network of 100 RC’s staff actually play a very vital role because they sometime knock me on the shoulder and saying ‘well, you should look on what they doing in [this city] or [that city], it is very similar to what you are talking about here’.

I think the 100 RC has really done a lot of good working in creating a knowledge sharing community. But the challenge is, that is very expensive because they really put a lot of money into this. So let’s say we didn’t have all the Rockefeller fund money, then what would we do. So I think that’s where also maybe the European commission could play an active role, especially for European cities, doing something similar or in the future and also after the 100RC.” (City)





#### 5.6.6.3 Language

“Another one is very simple, that is translation services. Because when we collaborate internationally, we as the only [Language] speaking city, I have no chance to share actually what we work with, because it is all in [Language]. And in our municipality we don’t have a tradition for writing in English, that means we have a lot of protocols and plans and strategies and a lot of things that we could share, but it is not possible.” (City)

#### 5.6.6.4 Motivation

“We got login, you can start conversations, it is forums, and I think none of us have become active participant in it because you generally default to email, it is kind alike.” (City)

These problems are operational issues and not solved by an information system (at least not directly), however, we should notice these as future considerations.

## 5.7 DESIGN GOAL 5: INFORMATION SOVEREIGNTY

So far, four design goals and supplemental principles for the communication platform are illustrated. These goals can be achieved chronologically, in other words, they are corresponding to each maturity level.

In the following sections, two remaining design goals are explained. These goals are more technology-oriented while the other four goals focus on operational aspects. Moreover, while the first four goals have a functional appeal in that they can be connected to policies, actions, and information system functionality, the remaining two rather focus on qualitative aspects.

The fifth design goal is named *Information Sovereignty* and deals with communication challenges of security, information confidentiality, handling protectively marked documents, and mal-information on social media. Since information related to resilience is naturally sensitive, and might be exploited by terrorist activity and cyber-attacks, considering information sovereignty within the platform is necessary. Additionally, erroneous or even situation-dependably superfluous information should neither burden stakeholders nor citizens.

Summary of findings:

- <A> Securing information accuracy is an important issue especially when thinking of social media usage.
- <B> Making resilience related information open to the public should be considered very carefully. In some cases, laws prohibit dissemination of these data.



<A>

“You could say that in an emergency it would be nice to involve people, using social media. But I think there is a problem. You have not verified this information. Someone could go in, do something and tell wrong information. We need validated information.” (City)

<A+B>

“The ideal platform should provide transmit security and provide real information (e.g. images).” (City)

<B>

“The need to ensure that the community know what risk they face, as much as possible, versus insurance. So you have to be very careful when disseminating information that you don’t causes problem for people getting insurance.” (City)

“One is a kind of data around infrastructure like water supply system, energy supply system, telecom systems tends to be quite difficult to get out to the public because it is critical infrastructure, it is attractive to people that might want to harm UK with terrorist attack, that kind of information is quite well regarded and we know it is difficult to publish information of this kind.” (City)

“There is a generic risk as well which is cyber-security. It is one of the area the council and the whole of [Country], security infrastructures, is increasing aware of. Any kind of collaborative activities in terms of information technologies is scrutinized quite carefully now.” (City)

“I suppose the issue around the emergency response is that it’s quite confidential, it’s sensitive information that they’re discussing, so the information isn’t freely available to other city stakeholders.

Obviously due to the kind of its sensitive nature, only certain organizations get to use it. It is not necessarily a kind of social information for everyone. It really is about keeping it to those who need to know and need to respond.” (City)

“That also means that we have to engage more with citizens and maybe also making them aware of the risks, but it is very sensitive.” (City)

“(Regarding the information system they are developing) The architecture of DB has been designed to be secure and penetration test is produced in order to see to calculate your security level. Is it a sort of protocol they will give you score in principle it should prevent 99% of unauthorized access?” (City stakeholder)



Based on the interview result, information sovereignty can be achieved by securing information quality, role-based authorization, and penetration testing of the communication platform. These are proposed as design principles.

## 5.8 DESIGN GOAL 6: USABILITY

The last design goal is *Usability*. The main topics are publicity and information filtering.

- **<A>** The way of reaching people including those who do not access to the Internet should be considered.
- **<B>** The ways (and possibilities) of filtering information affects the usability of the platform.

### **<A>**

“There are certainly communities that maybe need more support or more engagement around resilience than others. And there’s other communities that tend to have less access to the Internet. And that’s an issue because increasingly as a council we are moving more online. Our consultation hubs, both the existing hubs are very much online now. And it’s how you let the citizens access it –it’s a big issue for us.” (City)

“A critical thing about a portal is how many know the portal and how many [will] use it. Will I find valid information? There is always a critical point that [whether] people knows about, that is always a critical challenge. There could be links from the diverse pages (pointing to the other two interviewees) to the portal and back.” (City)

### **<B>**

“We are involved in the initiative called ‘Compact of Mayors’\* with other cities. We have a platform to share information, but the information that can be shared in this platform with other cities is very limited and needs to pass through many filters in order to be published. To obtain more specific and detailed information we directly communicate through emails. Ideally this new platform should have a general section and a more private section where information that can be shared does not need to pass filters.” (City)

Regarding publicity, the communication platform cannot deal with it directly. Nevertheless, improving “easy to use” functions becomes foundation of the attractive communication platform.



## 5.9 INTERRELATIONS OF PRINCIPLES

Six design goals are set to approach the cities' communication challenges. Each design goal is interdependent and its dependency is described chronologically. Since the design goal is discussed in the very abstract level, we need to consider a design principle that guides us how to achieve these goals. Table 3 shows all design goals and principles. Each goal and principle (in *Italics*) is explained in the following.

First, we need to *share information* and provide it. Daily-basis exchange and emergency communication have different characteristics described as findings. However, the common requirements to daily-basis and emergency communication are (1) *setting a shared objective*, (2) *integrating information, systems and people*, and (3) *logging a situational diary*. Setting objectives is useful to understand reasons for the need to share information and with whom we should share it. Based on the objective, links between information, systems, and people can be designed. Besides that, in terms of information sharing, logging a situational diary is useful to prepare future sharing occasions. Ideally, this diary should have a standard format to transit to later sharing smoothly. In this phase, information flow is one direction and interactions are not necessary.

While setting objectives and links among information, systems, and people, a *communication structure* mainly with stakeholders is going to be established. A structured communication channel often is set by someone's initiative. *Visualization of live communication*, considering who is contacting whom with which matter both in daily-basis and emergency situations, will help to build this channel. The important input from the interviews is considered with resource allocation. We also need to *visualization of resource capability* in establishing a communication structure.

After building a structured communication channel with stakeholders, the goal moves to the more interactive part. *Citizen involvement and raising awareness* is becoming the prevalent issue. More detailed discussion will be provided with the upcoming deliverable 4.3. However, findings guide us to recognize the importance of *co-creating value with citizens* and *growing social capital among citizens*. The communication platform should employ functions to support these principles. In this phase, the information flow is dynamic and we see interactive communication among cities and citizens.

At the same time of the trial of citizen involvement, *knowledge sharing* among cities, stakeholders and citizens starts to happen. Knowledge sharing can be organized in three levels, i.e., local, national and European (including the global perspective). *Online-learning* opportunities are useful to support knowledge sharing. In addition, a *resilience library* that keeps best practices, experiences and excises is desirable to make visible the knowledge.



When the level of knowledge sharing is getting higher, the high level of trust is required. When transmitting knowledge to different countries, language issues need to be overcome.

Apart from these design goals and principles, *Information Sovereignty* and *Usability* should be considered as foundation of the communication platform. Since cities are facing threats like misinformation on social media, information disclosure, and cyber-attacks, *information quality and role-based authorization* should be secured through the communication platform. Additionally, *penetration testing* is advisable. In addition, from a user-perspective, encouraging people to use the platform should be considered (*publicity*). From the cities' perspective, the number of steps to upload information should be minimized (how to *filter* information). Additionally, they should be encouraged to keep information updated all the time.

**Table 3: Design goals and principles**

#	Principle	Criteria (see Section 6.2)
1	INFORMATION SHARING <WHAT>	A01, A02, A03, A05, A06, A07, A08, A11, A12, B01, B04, B08, B09
	1-1 Shared objective	A09, A10, B05, B16
	1-2 Integration of information, system and people	A15, A19, B06
	1-3 Situation diary	
2	ESTABLISH A COMMUNICATION STRUCTURE (with stakeholders)	A01, A02, A03, A04, A05, A06, A07, A08, A13, A15, A19, B08, B09, B16, B17
	2-1 Visualization of live communication	
	2-2 Visualization of resource capability	B01, B18
3	CITIZEN INVOLVEMENT AND RAISING AWARENESS	A08, B14
	3-1 Co-creation value	A15
	3-2 Grow social capital	B11
4	KNOWLEDGE SHARING (local, national, European)	A01, A02, A03, A05, A06, A11, A12, A14, B03, B08, B09
	4-1 Online learning	B11
	4-2 Resilience library	B05
5	INFORMATION SOVEREIGNTY	
	5-1 Information quality	A07, A09, B06, B11, B15
	5-2 Role based Authorization	A08, A10, A11, A12, A14, B09
	5-3 Penetration test	A18
6	USABILITY	A16, A17, A19, B03, B07, B10, B11, B12
	6-1 Publicity	A15
	6-2 Information filtering	B01

## 6 FUNCTIONAL SPECIFICATION

### 6.1 INTRODUCTION

This section presents the functional specification based on the identified design principles. The presentation follows that of an industry-inspired functional specification document. The scheme adheres to the proposal for a functional specification document by Balzert (2009, Cha. 20.3) and builds on the initial set of requirements proposed in the first deliverable. It takes as input both the work presented in Sections 4 and 0 and the transcripts of interviews directly. The functional specification is to be considered volatile, since it will recurrently be updated until a first stable state will be reached with D4.3. For D4.3 it is intended to additionally follow the IEEE 29148-2011<sup>8</sup> standard. It is similar in structure but even more extensive regarding suggestion of practices. Thereby, it will be possible to standardize the specification of the Resilience Information Portal: The here presented functional specification will be offered to be formally standardized within the SMR project based on the to be extended, revised and evaluated version that will be included in D4.3.

Since the functional specification serves both the basis for portal prototype development and as a result from the project, a distinction is required for some requirements. These are denoted by “For the SMR project:” and “After the SMR project:”, respectively.

Please note that comments that would typically not be found in a functional specification but are here needed for context are put in *italics*. Moreover, please note that this introductory subsection is not part of the functional specification but rather the introduction to how it is represented here.

### 6.2 AIMS

#### 6.2.1 PURPOSE

Aims set the main goals and profound criteria for the portal software. For integration with the design principles presented in Section 5, please refer to Table 3 (page 53). While the product definition encompasses all design principles, for each requirement (MUST) and each recommendation (SHOULD) the applicable design principles are given in brackets. For example, (1-3, 4-2, 6) means that the principles *INFORMATION SHARING AND PROVI-*

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<sup>8</sup> “Systems and software engineering – Life cycle processes – Requirements engineering”, 2011.



*SION* <WHAT, WHO, HOW> and *KNOWLEDGE SHARING* (local, national, European (and global)) are applicable with their characteristics *Situation diary* and *Resilience library*, as well as the principle *USABILITY*.

Distinguishing between MUST and SHOULD follows industry practices. For D4.3 we will extend this categorization by distinguishing aims by the maturity stages, i.e. there will be five categories denoting for which level of maturity a certain criterion is required to be fulfilled.

### 6.2.2 PRODUCT DEFINITION

The aim is to build a Resilience Information Portal. It will serve as a collaborative environment to facilitate awareness and engagement among key partner in resilience building activities. The portal will particularly serve two purposes:

- Support communication within the city, between the city and its stakeholders, and between the city and its citizens. In addition, the integration of social networking services should be supported.
- Enable knowledge sharing as a long-term communication activity. Similarly to short-term communication support, the city, its stakeholder, and citizens should be included.

### 6.2.3 MUST CRITERIA

- A01: The portal must be a publicly available Web application. (1, 2, 4)
  - Note: It should be a fully cloud-based information system.
- A02: The portal must provide the basic functionality of Web applications, most importantly page retrieval. (1, 2, 4)
- A03: The portal must provide functionality to embed static content as well as dynamic content. In particular, it must be possible to have Newsfeeds, Weblogs, Wiki pages, and Forums. (1, 2, 4)
- A04: Contact lists need to be enabled as a special form of technically static, yet frequently updated content. (2)
- A05: The portal must provide the functionality to provide existing dynamic content, both by inlining existing Web sites and by integration (and automatically) updating data from XML-based sources. (1, 2, 4)
- A06: Extended functionality must be provided to compose pages. Page editing must be supported by WYSIWYG tools. (1, 2, 4)
  - Note: Easy editing tools do not require programming or design knowledge but can be used similar to basic Word processing software.
- A07: It must be possible to present complex information. (1, 2, 5-1)



- Note: This requires adequate formatting capabilities as well as the possibility to cross-link information.
  - Note: This includes the possibility to log incident information.
- A08: Users must be able to register for portal usage and log in. (1, 2, 3, 5-2)
- A09: An adaptive role management must be realized. (1-1, 5-2)
  - Note: This is particularly needed to distinguish between city personnel, stakeholders, and citizens.
- A10: It needs to be possible to flag documents as sensitive. Access to such documents must go along with the role management. (1-1, 5-2)
- A11: Logged-in users with respective rights must be able to edit pages. (1, 4, 5.2)
  - Note: This includes the upload of documents.
- A12: Administrators or users with rights for sub-areas of the portal must be able to generate new pages as well as to remove pages from the portal. (1, 4, 5-2)
- A13: Based on the role concept the portal must facilitate bidirectional communication flows. In particular, feedback from citizens must be a core concern. (2, 4, 5-2)
- A14: On top of the role-concept, the portal must provide an “emergency mode” in which the homepage shows the for the particular thread most relevant information. (1, 2, 4, 5-2)
- A15: Social media integration must be provided. In particular, news posting must be linkable to Facebook and LinkedIn. Moreover, unidirectional integration of Twitter is required. (1-2, 2, 3-2, 6-1)
- A16: Accessibility standards<sup>9</sup> as outlined by W3C must be followed. If applicable, national laws must be followed. (6)
- A17: A search functionality must be provided that allows to sort information. (6)
- A18: The portal must provide adequate security. (5-3)
  - Note: This includes adherence to well acknowledged standards as well as good common security practices.
- A19: The portal must provide a basic integration of a Web-based corporate video conference tool<sup>10</sup>. (1-2, 2, 6)
- For the SMR project: Mockups and Mashups must be enabled to simulate and demonstrate functionality a fully implemented city portal would take. (1-2, 2-1, 2-2, 3, 4)
  - Note: This functionality should be realizable with the above listed criteria.

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<sup>9</sup> <http://www.w3.org/standards/webdesign/accessibility>

<sup>10</sup> E.g. WebEx.





#### 6.2.4 MAY CRITERIA

- B01: Logged in users should be able to customize pages that are set to be customizable. In particular, the home page should be customizable. (1, 2-2, 6-2)
- B03: Mobile device support should be pursued by designing the portal in a responsive fashion. (6)
- B04: Frequently Asked Questions (FAQ) pages should be provided. (1, 4)
- B05: Tools for interactively measuring the resilience maturity level of a city should be provided. (1-1, 4-2)
  - Note: This mandates integration with the other tools developed in the SMR project.
- B06: The portal should provide a reminder-functionality for updating pages. It should be configurable by everyone with editing rights for a page to define whom to remind as well as the reminder interval. (1-2, 5-1)
- B07: The user interface (UI) should be designed according to international usability standards that have been implemented as European standards (EN ISO 9241-161<sup>11</sup>, EN ISO 9241-112<sup>12</sup>, EN ISO 9241-125<sup>13</sup>). (6)
- B08: Static pages should provide the means to structure information. (1, 2, 4)
- B09: It should be possible to change roles and rights in this case. (1, 2, 4, 5-2)
  - Example: Provide people who are normally not eligible but require this information in case of emergencies with information of a certain level of confidentiality.
- B10: National guidelines should be observed. (6)
- B11: The portal should support multiple languages. (3-1, 4-1, 5-1, 6)
  - Note: Moreover, the portal may include translation services. (6)
  - Note: If cities have more than one official language, the portal must have multi-language capabilities. (1, 6)
- B12: The portal should be well performing. (6)
- B13: The portal should be scalable. (not directly related to principles)
- B14: Feeding Twitter posting back to the portal would be a reasonable addition. (3)

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<sup>11</sup> “Ergonomics of human-system interaction” - Part 161: “Guidance on visual user-interface elements”, 2014-06-06.

<sup>12</sup> “Ergonomics of human-system interaction” - Part 112: “Principles for the presentation of information”, 2015-07-24.

<sup>13</sup> “Ergonomics of human-system interaction” - Part 125: “Guidance on visual presentation of information”, 2016-05-13.



- B15: A backend functionality that scans for redundant information would be a beneficial addition. (5-1)
- B16: If possible, better coupling with video telephony and video conferencing tools should be enabled. In particular, extended bidirectional information exchange is desired. (1-1, 2)
- B17: An advanced portal may include access to workflow management systems and even dynamically adjust to workflow handling in cases of emergencies. (2)
- B18: The portal's dynamic content may reflect resource allocation done in other systems in real-time and adjust dynamic pages' content accordingly. (2-2)
- B19: In extension of A19, additional integration of a basic video telephony tool should be provided.
  - Note: The integration needs not be extensive, but starting video conferences from the portal and submission of basic information to these tools is required. (1-2, 2, 6)

#### 6.2.5 NEED NOT AND MUST NOT CRITERIA

- C01: The portal is specific to the SMR project, even though it should yield generalizable insights.
- C02: The portal is not needed to be optimized for architecture and performance.
- C03: The original idea of a *portal of portals* will not be realized. While CITIES will form a resilience backbone, a close integration of their information systems is out of scope. A portal of portals would pose more challenges than offer benefits. It also would be hard to maintain.

## 6.3 USAGE

### 6.3.1 PURPOSE

The usage scope describes the basic condition of provisioning the portal software.

### 6.3.2 AREAS OF APPLICATION

For the SMR project: The portal will be used as the Resilience Information Portal as defined in WP4 of the SMR project. It will then be used in WP5 until the end of the project.

After the SMR project: The portal will be used as the Resilience Information Portal of a city.



### 6.3.3 TARGET GROUPS

For the SMR project: The portal will be used by the seven partner CITIES of the SMR project as well as by the academic partners of the project. Target groups are the municipalities and their emergency managers, civil protection units, first responders (police, health care, fire fighters), critical infrastructure providers, and citizens (stakeholder and citizens in the usual wording). A possible extension to further target groups needs to be expected.

After the SMR project: The portal is used by a city and provides services also to the city's stakeholders and its citizens.

### 6.3.4 STAKEHOLDERS

For the SMR project: Stakeholders are the consortium members of the SMR EU project, along with stakeholders that are relevant for them. This in particular includes all resilient-related stakeholders of the CITIES. For further details, please refer to the concept of CITY in the SMR proposal.

After the SMR project: A city, its main stakeholders in terms of resilience-related activities, its citizens. Possibly, other cities are stakeholders if they exchange information with the city or even collaborate on the topic of urban resilience.

### 6.3.5 OPERATION CONDITIONS

For the SMR project: The portal will be up and running until the end of the SMR EU project (i.e. May 2018). Usage of the prototype after the project is currently not intended since CITIES plan to implement their own portals.

After the SMR project: Upon initial installation and setup, the portal will run indefinitely. Regular maintenance and extension must be expected. The portal needs to be hosted in a way that allows continuous service, even in unexpected conditions such as disasters.

## 6.4 TECHNICAL PRODUCT ENVIRONMENT

### 6.4.1 PURPOSE

The technical product environment describes preconditions for successfully running and accessing the portal software.



#### 6.4.2 SOFTWARE

- A current, up-to-date Web browser for clients.
- For the server:
  - For the SMR project: Google Web Toolkit (GWT)
  - After the SMR project: An appropriate technology for Enterprise Web Applications.

#### 6.4.3 HARDWARE

There are no specific hardware requirements. On the server side, any hardware that supports the required backend software suffices. On the client side, any hardware that can be used to run a modern Web browser suffices. This in particular includes mobile devices such as smartphones and tablets. Since the initial performance requirements are low but the portal will be scalable, no suggestions are proposed at this point. After the SMR project, scalable and reliable hardware will be very important.

#### 6.4.4 INTERFACES

For the SMR project: No interfaces to existing systems will be realized.

After the SMR project: Existing information systems should be integrated with the platform. The level of integration as well as the systems to integrate at all are to be determined by the respective city.

#### 6.4.5 HOSTING

For the SMR project: There are no specific hosting requirements.

After the SMR project: Hosting outside of the city's area is desirable. The infrastructure must allow scalability and reliability. In case of emergencies that have effect on the whole city, access for the portal should still be possible. A multi-location hosting in the fashion of a highly available distributed system is recommended.

### 6.5 FUNCTIONS

*As discussed in Section 3.4, no concrete functions will be given as part of D4.2.*



## 6.6 DATA

The portal will be saving all data for its content but for externally linked content. The portal will keep a user's database including the user right management and the role management. In general, portal data is highly city-specific and will, therefore, only be sketched here.

The pages of the portal are organized hierarchically.

Users are described by surname, name, email-address, affiliation (optional), municipality, and password.

Roles are described by role name. Roles are organized hierarchically.

Roles are linked to pages to denote access rights. For this purpose, a Boolean denoting read rights, a Boolean denoting write rights, a Boolean denoting administrative rights, and a Boolean denoting the right to grant rights to others are used.

## 6.7 PERFORMANCE

- All pages of the portal must be provided without noticeable delay (i.e. less than 500 milliseconds). This particularly concerns pages with personalized dynamic content, such as the portal home page. The reaction characteristics for frontend users should at any time be perceived as seamless.
- Performance, particularly regard to reaction times, need to follow the EN ISO 9241 standard series<sup>14</sup>.
- Loading the backend editor for users that edit content should be done within three seconds.
- Posting content should be done within five seconds.
- Search questions should be completed within five seconds.
- Backend management task should not impose major delays.
- Where applicable, technology such as AJAX should be used to partially update views rather than imposing page reloads.
- The portal must not impose unusually high server load. (In other words: it should be efficient.)

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<sup>14</sup> "Ergonomics of human-system interaction" with several applicable parts.



## 6.8 USER INTERFACE

For the SMR project: The aesthetic aspects of the user Interface design, in general, will follow the SMR project Web site's design "SMR :: Home". In addition to this, portal-like features are included in the design. Besides that, there are no specific requirements. However, adherence to EN ISO 9241-151<sup>15</sup> and -161 should be given.

After the SMR project: The portal's design is up to the implementing city. It should follow the corporate design of the city. Full integration with a municipal Web site and adherence to that design is an option.

## 6.9 QUALITY REQUIREMENTS

- **Extensibility:** the portal needs to be extensible both with regard to content and to functionality. Function extension in the form of plug-ins should be supported. In particular, extended usage on mobile devices should be possible to be added.
  - Note: The portal might be used for a longer timespan than initially expected.
- **Maintainability:** The portal must be highly maintainable. It must allow for further development, customization and adaptation.
  - Note: This aligns with the possibility for a lifespan that well exceeds a few years.
- **Robustness:** The typical robustness of well-tested Web applications should be achieved, i.e. there should be no obvious flaws, and the system should react graceful to improper usage. No particularly high level of robustness is required, though.
  - Note: This explicitly addresses software robustness, not the availability of the portal. The latter is also considered robustness but here mentioned along with Hosting (Section 6.4.5), i.e. the robustness of the system of portal, hardware, and communication infrastructure.
  - Note: Robustness will also be reached by following the before mentioned EN ISO 9241 standards series.
- **Resilience:** After a crash of the server, the portal should resume operation with the last stable state before the crash. No particular resilience is required.
- **Compatibility:** With relying on current Web technology, extreme compatibility on the client side is given. Compatibility on the server side relies on the used products (see Technical Product Environment above).

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<sup>15</sup> "Ergonomics of human-system interaction" – Part 151: "Guidance on World Wide Web user interfaces", 2008.



- Note: Compatibility to existing software systems is determined by the desired level of integration.
- Portability: No particular portability must be achieved.
- Usability: The portal should respect EN ISO 26800 and the EN ISO 9241 human-system interaction series. The system should be effective, efficient, and satisfactory for the specified users to achieve specified goals within the specified context of use. Its functions should be easy to understand and to learn. Basic editing functionality needs to be understandable even to technological laymen. To avoid a digital divide, basic usage should be possible even for people with hardly any computer experience.
- Accessibility: The portal should be as accessible to people with disabilities as possible.
  - Note: In this regard, EN ISO 9241-171 needs to be followed.
  - Note: In general, adhering to the latest standards in HTML and CSS as well as to best practices in interface design should support accessibility.
- Documentation: A brief handbook for users with editing rights must be provided. For frontend users, the portal should be intuitive enough to make a handbook superfluous. Where needed, explanations should be put onto pages directly.
- Security: ISO/IEC 29115<sup>16</sup> and ISO/IEC 27034<sup>17</sup> should be considered. The portal must not be harmful to the users' computers. The underlying software should be updateable to ensure that potential security wholes are closed. The authentication and authorization mechanisms must employ best practices to prevent breaches.
  - Note: Higher levels of security are mandated if the portal provides access to sensitive or confidential information (even if it resides in integrated systems).

Besides the here mentioned requirements, honouring ISO/IEC 25000<sup>18</sup> is recommended.

## 6.10 ADDITIONAL NON-FUNCTIONAL REQUIREMENTS

- The portal must be scalable. Actual scalability must take into account the number of potential users in a city as well as prospective city growth. Moreover, it should scale seamlessly with a high number of parallel user requests.

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<sup>16</sup> "Information technology – Security techniques – Entity authentication assurance framework", 2013-04-01.

<sup>17</sup> "Information technology – Security techniques – Application security", 2011-11-21.

<sup>18</sup> "Software engineering – Software product Quality Requirements and Evaluation (SQuaRE) – Guide to SQuaRE, Common Industry Format (CIF) for usability: User needs report", 2013-08-30.



- EU regulations and national laws regarding public (Web) services need to be respected. This particularly concerns accessibility, privacy, and security.

## 6.11 GLOSSARY

*Due to the high number of specific terms that revolve around urban resilience, a glossary will be provided with the final version of this functional specification as given in D4.3. Since work on the terms is ongoing in several other work packages, it is not included here.*

## 6.12 TEST CASES AND TESTING SCENARIOS

Test scenarios and test cases enable the assessment of the portal software. In particular, they provide the means for checking adherence of the actual software to this functional specification.

### 6.12.1 TESTING SCENARIOS

*As discussed in Section 3.4, no testing scenarios will be given as part of D4.2.*

### 6.12.2 TEST CASES

*Without testing scenarios, there is no rationale in providing test cases already.*

### 6.12.3 SECURITY

The security of the application might be evaluated according to ISO/IEC 15408<sup>19</sup>. CITIES are urged to consider additional audits in accordance with their regulations and practices for IT security.

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<sup>19</sup> “Information technology – Security techniques – Evaluation criteria for IT security”, 2015-08-27.





## 7 SUMMARY AND CONCLUSIONS

### 7.1 CONCLUSIONS

In this section, we present a summary and conclusions of our work that led to this deliverable. We then sketch the onward journey towards deliverable 4.3 and 4.4.

This document represents the second deliverable of Work Package 4. Building on the first deliverable, we have conducted extensive reviews. The results from these reviews are the basis for this deliverable. To provide discussable and utilizable information, we have divided our work into analysis and derivation of design principles, proposal of a functional specification, and prototypic portal development. The first two of this are included in this document.

The design goals are Information Sharing, Establish a Communication Structure, Citizen Involvement and Raising Awareness, Knowledge Sharing, Information Sovereignty, and Usability. While the interviews went into different directions and had varying emphasis, the topics that lead to the design principles had much consensus. In fact, even though examples were different each time and the interviews took many different paths, in the end cities face similar challenges when it comes to communicate and share knowledge in order to become more resilient. International standards as existing to the mentioned design goals and principles are referred to in the derived functional specification.

### 7.2 THE ONWARD JOURNEY

The ongoing work will be threefold.

Firstly, we will revise and extend the design principles based on the work with the cities. The findings presenting in this deliverable report will be used in Work Package 5 activities. Moreover, they will form the basis of further discussion with the cities. We will scrutinize what cities think about the suggested actions, how cities perceive challenges and goals named by other cities but not by them, and whether our proposals will lead to new ideas from the cities.

Secondly, this document will be the foundation for the third deliverable. D4.3, however, will be no mere revised D4.2 – for this, the first part of our ongoing work would suffice. Rather, social media inclusion will be the driving force of extension. While social media has already been mentioned in some of the interviews, it will now get focus (as also demanded in the SMR proposal).



Thirdly, development work on the portal prototype will continue. This will lead to further insights considering the producibility of some of the rather vague requirements. Furthermore, it will provide a testbed and demonstration tool that will facilitate discussion with the CITIES. Thereby, it will stimulate the work on design principles and requirements.

## 8 APPENDIX

### 8.1 GUIDELINE FOR FACE-TO-FACE INTERVIEWS

This guideline is used to support the interview process of Task 4.2.

#### Purpose

The purpose of this interview is to identify communication and engagement needs related to resilience building activities in partner cities. Results of the analysis will be embedded into design principles for an integrated Resilience Information Portal<sup>20</sup>. Moreover, the actual portal will be designed based on the interview results.

#### Research question

How can the resilience of cities be improved with information and knowledge sharing with the help of information systems?

Sub-question 1) What kind of information systems are used by cities in practice, and who are the respective users / target audiences?

Sub-question 2) What is the purpose of that system (what is the problem the system solved)?

Sub-question 3) Which functionalities, technologies and privacy protection features should be employed by a future communication platform?

Sub-question 4) What are general design requirements (*principles*) for a resilience information portal?

#### Preparation

A pre-interview questionnaire which has a purpose of getting a rough overview of existing systems will be completed. It is expected to be sent back to an interviewer at least one week before the interview date. The pre-interview questionnaire will be sent to only city officials (not to other stakeholder, who could take part in the interview).

The questionnaire for the face-to-face interview will be sent to city officials before the interview.

#### Recording

Interviews will be audio recorded. Kindly ask for permission to record the interview. If the interviewees have doubts, explain the merits of recording and assure confidentiality.

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<sup>20</sup> Work Package 4 is concerned with the development of a Resilience Information Portal. It will serve as a communication, collaboration and integration platform for the whole SMR project. The portal will be used by CITIES, first responders, emergency managers, and, eventually, citizens. It will not only serve as a starting point for Work Package 5 (which starts in 2016) but also be available to the participating cities beyond the time of the SMR project.



### **Language**

Primary language for the interview is English. However, if interviewees are more comfortable with their local language, the interview may be conducted in the local language. The result is transcribed and translated into English afterwards (this only applies to Donostia and TECNUN).

### **Business cards**

Business cards from all interviewees shall be collected and sent to CIEM.

### **Interview duration**

Maximum 3 hours is expected for the face-to-face interview. Complementary questions might follow via Skype or e-mail.

### **Interviewee**

We expect to do the focus group interviews with city managers and other relevant stakeholders. Stakeholders will be selected by the city. Preferable number of people (besides one or two city managers) in one interview is less than five. We should discuss a solution when the number of stakeholders is over five.

### **Report**

Interviewers (CIEM, Strathclyde and TECNUN) develop a full interview transcript in English. Please send it to Mihoko Sakurai at CIEM ([mihoko.sakurai@uia.no](mailto:mihoko.sakurai@uia.no)) [by a city-specific date]. An interview report will be created by CIEM. If necessary, complementary questions might follow via Skype or e-mail. Then interviewees will be asked to review the report once it has been finished.

The report is going to be used for an academic research but confidentially should be assured according to the ethical guidelines of the SMR project.

### **Types of Questions**

The questionnaire consists of three parts, (i) general information, (ii) current systems, and (iii) future requirements. When we ask about current systems, preferably answers should be based on current status. In the future requirements part, we expect to have interviewees' opinions (this might be subjective), even though factual or argumentative support is desired. This part should be described in detail.

### **Contact person**

If you have any questions, please contact Mihoko Sakurai ([mihoko.sakurai@uia.no](mailto:mihoko.sakurai@uia.no)).



## 8.2 QUESTIONNAIRE FOR FACE-TO-FACE INTERVIEWS

Main object of this interview is to derive design principles to develop a resilience engagement and communication tool to integrate the wider public in community resilience, including public-private cooperation.

### General information

Name, agency, title, years of experience and contact information of respondents  
Role of each agency towards building city resilience

### General question on Communication

1. How do you communicate with related stakeholders regularly?
2. What are challenges both in short-term communication (emergency) and long-term communication (community building)?

### Information Sharing – Current Systems

3. Which information should be shared in communication activities of question No. 1...
  - 3.1 Within your organization?
  - 3.2 Between the city and stakeholders?
  - 3.3 With citizens?
  - 3.4 What is the most important information or sources for your organization to make decisions in these activities?
4. What kind of information systems are used to support the above activities (Wikis, blogs, Web-based communication tools etc.)?
  - 4.1 What are name of the system, introduced year, and Web site address (if applicable)?
    - 4.1-Sub-Q: How about using social media?
  - 4.2 What is a main objective of the system (what are problems that the system solved)?

(the following 4.3 through 4.8 can be answered only if it is applicable)

- 4.3 How was the system implemented (vendor-provided or developed by yourselves)?



4.4 Who are using the system? How frequent is it?

4.5 How does Information flow between the city and stakeholders through the system?

4.6 Who maintains or updates information (at the same time, how to dispose unneeded information)? Is the same person responsible for updating all the content? Or does each stakeholder in charge of updating the information related to his/her expertise?

4.7 Is it possible to customize the system by yourselves?

4.8 What changes (both of positive and negative) did the system bring to you?

### **Information Sharing – Future Requirements**

5. Which kind of functions do you require to the future communication platform...

5.1 In communication activities of Question 1?

5.2 In general?

6. Is there any specific technology you would like to use for future activities?

### **Knowledge Sharing**

7. Do you have specific methods to share knowledge which other stakeholders have gained through their daily operations and experiences in an emergency?

\*The following question applies only for the city\*

8. How do you share information with other cities (inside or/and outside of your country) and work for developing a disaster management plan or procedures?



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