SMART MATURE RESILIENCE

A COMMUNICATION PLATFORM THAT FACILITATES DIFFERENT LEVELS OF COMMUNICATION AND ENGAGEMENT AS A SHARED RESOURCE IN THE PROJECT

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EXECUTIVE SUMMARY

Delivery 4.1 is the first 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. While the delivery is the first version of a communication platform, we accompany it with a report that summarizes the activities that were engaged so far, sketches the current plans, and gives an outlook how we intend to build the portal.

WP4 is heavily interlinked with other work packages. It draws from theoretic work (particularly from WP1), makes use of the workshops organized for the other WPs to get feedback on the portal and to conduct interviews, and will provide one of the five tools to be used in WP5. The work in WP4 is twofold: it has a domain-specific and a technological dimension. This is also reflected in the study of literature and related approaches. Besides, WP4 also has some connections to other EU Horizon 2020 projects; these links will be scrutinized in the future.

From the survey of existing approaches, it can be said that we face a problem grounded in the integration of resilience-related situation. Based on the literature review, we recognize infrastructure (and data about it), interface design, and data models as important design factors. It was also confirmed by the partner CITIES that a high number of Web-based systems exist that provide some form of integration of resilience-related information. In particular, some systems even seek to provide a basis for knowledge sharing. However, no information systems described in the literature, observed in actual use, or described by the CITIES closely resemble the objectives set out for WP4 as part of the Smart Mature Resilience (SMR) project.

For the initial set-up of the portal, we face a hen-egg situation: a portal is needed to facilitate discussion with the cities yet the portal needs to be based on the feedback from the cities. We have chosen a bootstrap approach to overcome this challenge by providing an initial set of requirements that we used to design the first prototype. It follows a top-down approach to model the general structure and a bottom-up approach to give one example for a detailed structure. Conceptually, we go for a portal of portals that serves as a gateway to the city portals, and a sophisticated role concept that takes care of access rights and data sovereignty. Technologically, we rely on Web technology and the commercially-graded Content Management System TYPO3.

To achieve our development goals, we have set out for an agile development process. It addresses the incremental and iterative nature in which we intend (and need to) work. In particularly, we will continuously inte-

grate new ideas into the portal to immediately be able to gain feedback from the CITIES. Thereby, we will overcome most of the challenges of a short development time, unclear and possibly contradicting requirements, and a yet-to-be discovered outcome. The process will be fed with the results from a multitude of interviews with CTIY representatives and target groups such as first responders. Most of these will be combined with the various workshops and meetings in the SMR project, starting with the January 2016 workshop in Bristol. Until then, we will also have finalized the guideline for interviews.

We conclude the report with an initial functional specification document, that has been designed as it is done in commercial software development projects. It can be seen as a synopsis our first ideas, findings from the literature, and results from initial work with the CITIES in form of functional and non-functional requirements.

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1 INTRODUCTION

Delivery 4.1 is the first 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.

Setting up a portal requires a sound theoretic foundation. It needs to be based on requirements that have been identified with as much involvement of relevant stakeholders (i.e. users) as possible. Therefore, several objectives have been set:

- A survey of existing approaches (O4.1),
- 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), and
- Providing guidelines for social media integration (O4.4).

These objectives are reflected in the four deliverables:

- A *communication platform* that facilitates different levels of communication and engagement as a shared resource in the project (D4.1).
- *Design principles* for the use of social networking services to promote transdisciplinary collaboration (D4.2).
- *Design principles* for the use of social network services to promote citizen engagement (D4.3).
- A prototype of an integrated *Resilience Information Portal* that provides a coherent framework to support communication and engagement in resilience building activities (D4.4).

D4.3 and D4.4 also directly correspond to the Milestones M4.1 and M4.2 that mark the end of work on WP4 and transition to working with the deliverables of it in the other work packages. The first delivery is the foundation for the fourth deliverable; D4.2 and D4.3 heavily draw from the learning loop in that we will engage CITIES whilst designing the portal.

The first delivery demands a platform as basis for the to-be-developed portal. A portal typically integrates information, processes, and services; in the case of Web portals, the specific focus is on data integration from

various sources. While the aim for a portal is set out, the first deliverable intentionally covers an information sharing platform that can be seen as a step towards building a portal. Particularly the demand for *different levels of communication and engagement* needs to be taken into account since it can refer to levels of confidentiality, user base, rights and roles, and information sovereignty.

As reported by the partner CITIES[1] and also observed in the study of related literature and approaches (see Section 3), a myriad of information systems exist that integrate resilience-related data sources on levels that municipalities have access to. Such data sources include weather reports, static and dynamic infrastructure data, and emergency management systems. However, systems come in all different fashions, embed a great variety of concepts, are non-uniform with regard to technological underpinnings, and – most notably – have a diverse level of integration. Therefore, a main task of WP4 as a whole is to identify *what* kind of portal needs to be built exactly. This comprises of the following questions.

1. Which information should be shared?
2. Who should be the end users?
3. Should all stakeholders have access to all information? Should there be restrictions?
4. What means of communication should be enabled? Should communication be unidirectional or bidirectional?

These questions extend the questions given in the proposal. They originate from the synthesis of literature review and analysis of existing platforms. Answering them requires extensive work with the CITIES, in line with the DoW. However, in this deliverable, we need to solve a "chicken-and-egg problem: without an existing portal or prototypical demo, it is hard to engage CITIES and to discuss concrete solutions. However, without input from the CITIES construction of a portal is likely to be an intellectual game without *actual* relevance to the partners. Consequently, a first platform has been set up that will be used as the basis for discussion with the stakeholders (see Section 3.1). We chose an exploratory approach with limited functionality, yet providing a tangible structure supporting discussion[2]. The design and the architecture are flexible and we envision several extensions such as an advanced information sovereignty concept and semi-automatic integration of data sources. Thus, the work in the following months will be characterized by an iterative and incremental approach

[1] CITIES are the cities that are participating in the SMR project, i.e. Bristol, Donostia/San Sebastian, Glasgow, Kristiansand, Riga, Rome and Vejle.

[2] In the early discussion with CITIES – particularly with Kristiansand and Rome – it became clear that they are eager to observe, probably even try out new solutions. Merely discussing theoretical possibilities is undesired and might even demotivate them. Thus, having means of demonstration and exemplification cannot be judge to be too valuable.

that draws from a *build and evaluate* methodology typical in information systems research (cf. Hevner et al., 2004). Starting with the very initial platform, it will be extended towards the fully-fletched Resilience Information Portal in small steps and constant consultation with the partners. Changes implemented after conferring with one CITY will be shown by the others and thereby be discussed before becoming part of the *stable* portal base. By following this approach, WP4 will eventually deliver a generic portal not only useful within the project but also for the partner CITIES. With proper inclusion of their ideas and wishes, we are confident they will make the portal a standard of their resilience strategy. Moreover, the modularity process will facilitate abstraction and generalization, thus enabling an easy uptake and customization by other European cities. Thereby, we will be able to provide guidelines that should prove useful well beyond the SMR project.

This document serves three purposes. Firstly, it is a description of activities conducted so far in the construction of the platform. Secondly, it provides an in-detail process description that motivates the producibility of our approach. Thirdly, it will also serve us as a guideline and work description and thereby act as a handbook to the proposal regarding WP4's activities.

Contrasting e.g. WP1, in WP4, the analysis of existing literature and related approaches does not lead to a deliverable. Nevertheless, we have included brief aspects in this document since the analysis backs up our initial set of requirements.

The remainder of this document is structured as follows. Section 2 introduces the context and background by discussing the relationship with the other work packaged and technological implications. It then presents a look at related literature and actual approaches. Section 3 sketches the status of the platform, and explains how it acts as the first step towards the portal. Based on the work than has been done already, we then move to the current activities. Section 4 sketches an agile development process that will enable the development of the Resilience Information Portal. In Section 5, we explicate the planning of interviews and additional exchange with the CITIE partners towards the end of WP4. The results from our work so far and our planning merge to the initial set of requirements presented in Section 6. Finally, we summarize and draw a conclusion in Section 7.

2 CONTEXT AND BACKGROUND

This section briefly explains the context of the deliverable and highlights technological considerations.

2.1 INTERRELATIONS WITH OTHER WORK PACKAGES

While the general relationship between Work Package 4 and the other WPs is sketched on p. 22 of the SMR proposal, we will here shed light onto the actual interrelation regarding portal development (cf. also with the figure provided on p. 22 of the proposal).

In WP1 ("Survey of resilience approaches"), extensive literature work has been conducted along with an analysis of existing approaches to urban resilience. We have been in close exchange with the WP1 team[3] to learn from these approaches. In particular we have exchanged findings whether – and how – information systems with a wiki, weblog, or portal character have been described in the scrutinized literature. Similarly, we have shared standard-related information with WP6 ("Standardization") whenever applicable. While these exchanges do not necessarily appear in the deliverables, they enrich the work nonetheless.

There is close exchange with WP2 ("Requirements gathering") regarding general CITY requirements. While WP2 targets risks and their mitigation, their different kinds lead to information needs. Therefore, findings from WP2 are highly relevant in WP4. Moreover, since WP2 is responsible for conducting a series of workshops that we use for interviews and further exchange, we are working hand-in-hand with WP2. The first WP2 workshop, which was held October 2015 in Riga, was used to start the design of the interview guidelines and also employed heavily for the exchange on first ideas for the portal with several of the CITIES' representatives. In particular, we sat together with representatives from Kristiansand and Rome to get insights on their current information systems usage. These meetings were not part of the planned interviews but used for preparation. More details are given in Section 2.5.

Since WP3 ("Development of Resilience Tools") is starting in month 13, there is no exchange besides the mid-term planning so far. This will be changed in the course of the next year.

WP5 ("Development, Implementation and Validation of a Resilience Management Guideline") will soon start with its work. We have been in constant exchange with the WP5 team since the project start. We now plan to

[3] In fact, WPs 1 and 4 share some members, which made exchange and joint learning even more productive since we have not only full access to intermediate findings but even contribute to them.

use WP5 meetings for interviews. Naturally, exchange will even intensify from month 8 (February 2016) on, particularly considering that our work is a precondition for the ongoing work in WP5 in the later project.

Since ICLEI is leading WP7 ("Dissemination & Exploitation") and developed the project's Web site, we closely cooperate on the level of technology choices. Moreover, since the portal *is* dissemination in a way, we will intensify the joint work.

While D4.1 is mainly a precondition within WP4, it will also be relevant to WP3 (due to their work on tools) and to WP5, in which work is started well before work in WP4 is concluded.

2.2 COLLABORATION WITH OTHER EU PROJECTS

Not only the SMR project addresses topics of urban resilience in the context of the EU Horizon 2020 programme. Thus, we will seek collaboration with other projects.

In particular, we have agreed on an exchange of ideas – and, possibly, results or even artefacts – with the DARWIN ("DARWIN") project that runs parallel with the SMR project shares some of its aims. Since the DARWIN project has activities that are complementary to work in the SMR project, we will scrutinize to which extend the work on the portal can be aligned with it. We deem this collaboration in H2020 projects to be very promising since it could increase the effectiveness of all collaborating projects.

There are particularly two projects that we will scrutinize:

- The COBACORE project ("Corbacore") deals with "efficient emergency response in the recovery phase of a major disaster", i.e. a part of resilience. Since they create an "integrated and interactive workspace platform", there likely is overlap with our project.
- In the TURAS Cities ("TURAS – Urban Resilience and Sustainability") project, "guidance tools" are developed that should bring together a variety of stakeholder in building "more sustainable and resilient European cities". While the focus is slightly different to our project, the information systems needs overlap.

After initial talks with the responsible persons for these projects we will decide whether collaboration with further projects will be reasonable. Besides on the EU level, we also seek project coordination on the national level with several connections currently being established.

Projects mentioned here are not again mentioned in Section 2.5 when discussing existing approaches.

2.3 TECHNOLOGICAL CONSIDERATIONS

Since the underlying technologies have far reaching implications, it is of paramount importance that the technology meets the CITIES' requirements. There are two types of technology choices.

Firstly, basic technological considerations have to be made. The most profound has been set already by requiring the information system for communication and knowledge sharing to be a *portal*. "A portal aggregates information from multiple sources and makes" it "available to various users" (Tatnall, 2005, p. 3). Due to the nature of access patterns, a *Web portal* needs to be developed. Unlike the traditional understanding of acting as a gateway to other Web sites (Tatnall, 2005, p. 3f), Web portals nowadays can be more specific or focussed on a user group (as in our case).

For the client side of the portal, we need to adhere to current standards and best practices regarding Web Technology such as Hypertext Markup Language (HTML), HTML5, Cascading Style Sheets (CSS) and JavaScript. Thereby, wide compatibility is guaranteed. Due to a very large and heterogeneous user base, the portal should offer an extremely high level of compatibility. Besides the need for Web-based portal software, there are no specific principal requirements for the server side.

Secondly, actual technology (i.e. software products) needs to be chosen for implementation. This choice is narrowed down by the basic considerations above. Moreover, it is much less profound since portal implementations that are made after the SMR project is finished and that follow the guidelines that we will design, implementing cities are free to choose whatever software they prefer – as long as it is capable of empowering Web-based portals with the requirements described as design principles. Nevertheless, for our work we need to pin down a product. While several commercial products are available, we will use a license-free open source Content Management System (such as WordPress, Joomla!, and TYPO3) as the foundation since these systems not only come free of charge but provide industry-hard quality.

2.4 LITERATURE OVERVIEW

Regarding to literature review on emergency management tools, we picked up the following eight databases for academic publications: IEEE Explore, ACM digital library, AIS electronic library, Business source complete (EBSCO), Academic search complete, Science Direct, Springer Link, and Emerald Management.

We have focused on the AIS electronic library, since it covers the most applicable Journal outlets; the other libraries were used as supportive sources. "Disaster management" was used for searching relevant journals. As

of 25 September 2015, 641 articles were identified in the AIS library. Search keywords such as "'communication' AND 'application'" were added and the result was 139 papers. We went through the title and abstract and chose 23 papers. 11 papers among them went under review; the most relevant (i.e. after a peer-review process considered to be applicable for our situation) findings are compiled in Table 1.

Context	Requirements Described	Citation
Disaster relief in supply chain management	• Geospatial applications that can provide useful data about relief zones and reconstruction areas (Weather.com, Google Earth etc.) • Audio, video, or textual information which improving the technical conversion between data nature and data capture • A social network component • Issues: dealing with incongruent data and data credibility.	Day et al., 2009
First responders emergency response system	• Web services, which allow other applications to access the relevant data • Multi-device, which ensures that location specific emergency plans and evacuation notifications • Spatial data analysis • Voice XML, which provides a bidirectional and seamless response system that requires minimal human intervention	Thomas et al., 2009
Public health emergency IS	• Surveillance system for emergency alert and response to replace periodic manual reporting with online reporting • Database management system (DBMS) • Geographical information system (GIS) • Remote sensing system • Analysis and prediction system • Virtual reality system • Decision support system • Search and query system • Action system for resource planning and allocation	Xue et al., 2004
Information sharing in fire brigades	• General information requirements for emergency response is the following; environmental conditions, information on response participants, status of casualties, available resources • Prototype interface is designed to follow three levels of action based on situation awareness theory; perception, comprehension, and projection • Information should be categorized in each level as following: <At the perception level> Context summary, casualty summary, resources, surround summary, weather, material resource, human resource and water resource <At the comprehension level> Interface integrates static information with graphically represented dynamic one <At the projection level> Interface displays the actual and predicted information which assists making decisions	Yang et al., 2009
Pre-existing teams collab-	• Record widespread and detailed accounts of attributes • Track and display a wide variety of unsimplified data	McKinney, 2009

oration	• Increase the visibility of operational performance measures • Create a flexible system that enables simultaneous processing • Identify, and alert experts with ongoing problems • Support collaboration and analysis between crisis team and experts	

Table 1: Specific Design Requirements for Emergency Response Systems from the Literature

The literature that we focused on mainly addresses infrastructure, interface design, and data models. Regarding to the infrastructure, the importance of enabling multi-device access is underlined. As for interface design, it needs further analysis but it was suggested to follow the mechanism of peoples' awareness, i.e., the perception, comprehension and projection. As an example, Chen et al. (2013) propose the data model for fire response agencies (Figure 1). It argues that we should create data models first when developing an emergency response system.

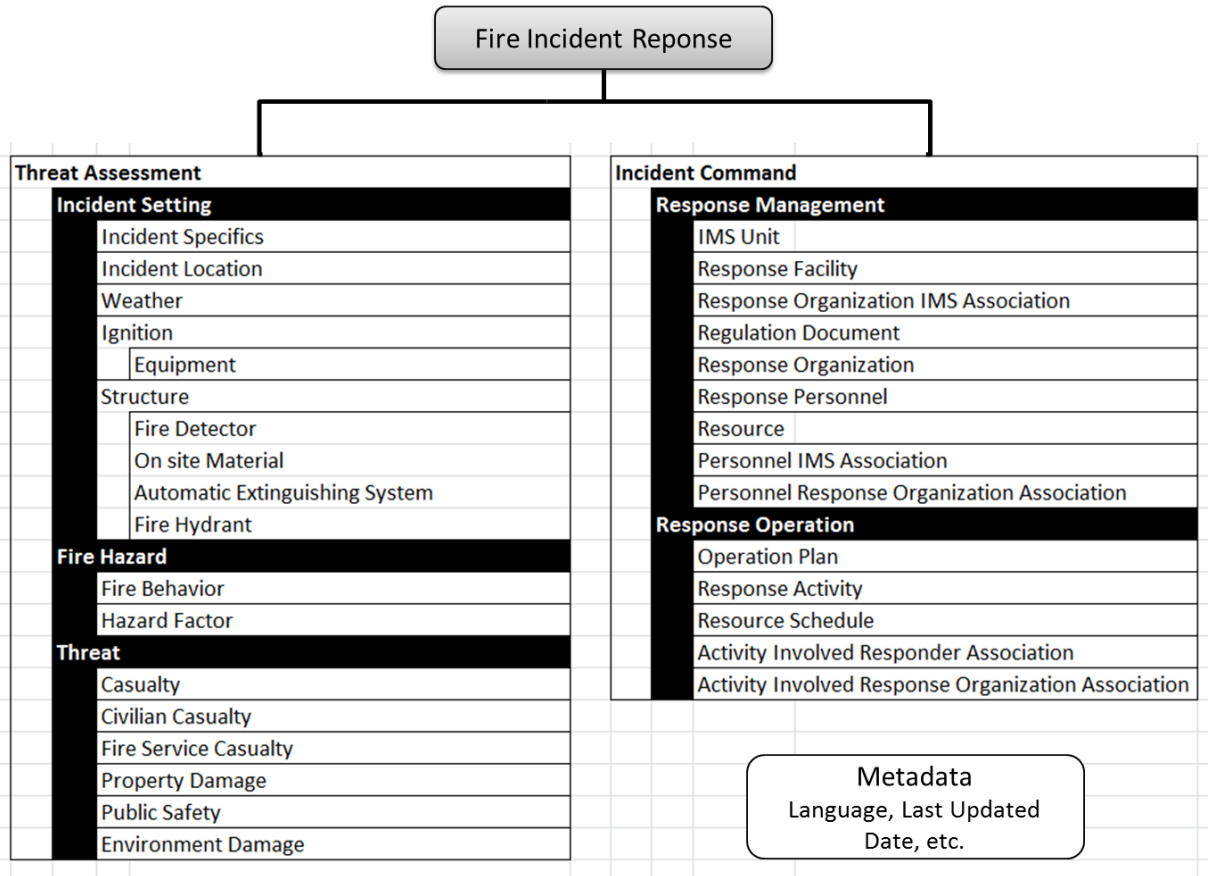


Figure 1: Data Model the Fire Response (Chen et al. 2013)

2.5 EXISTING PLATFORMS

For the initial survey of existing approached, we started with our CITY partner in Norway, the city of Kristiansand. We made this choice not only due to the close proximity of CIEM and Kristiansand, but since Kristiansand is a Tier-1 city and with its Maturity Level of "Advanced" rated between Donostia and Glasgow.

Kristiansand is currently using several Web-based tools to asses risk situations. The following are screenshots from each site. The tool is used mainly for monitoring and situation awareness. National civil protect agency develops an internal portal for information sharing. However, a collection of information is done by manually by city agents. The crisis manager of Kristiansand stressed that the municipality has a strong desire to develop an integrated information sharing portal which also enables situation awareness to its citizens.

Figure 2 and Figure 3 show regional power outages[4] and water flow data[5]. Risk awareness is increased by integrated systems such as illustrated in Figure 4 and Figure 5, which show flooding[6]and avalanche[7] threat levels. All of these systems are open to the general public. They are routinely used by crisis managers for proactive reasons such as assessing potential hazard and analysing room for improvements. They can also be used by first responders when needed, e.g. to tailor rescue approaches not only to the present situation but also to forecasts.

[4] http://aenett.no/virksomhet/om-ae-nett/service-og-vedlikehold#avbrudd
[5] http://www.ae.no/virksomhet/vannkraft/vannforing/
[6] http://www.varsom.no/Flom/Detaljside/?date=17.09.2015&region=10&municipalityid=1001
[7] http://www.skrednett.no/

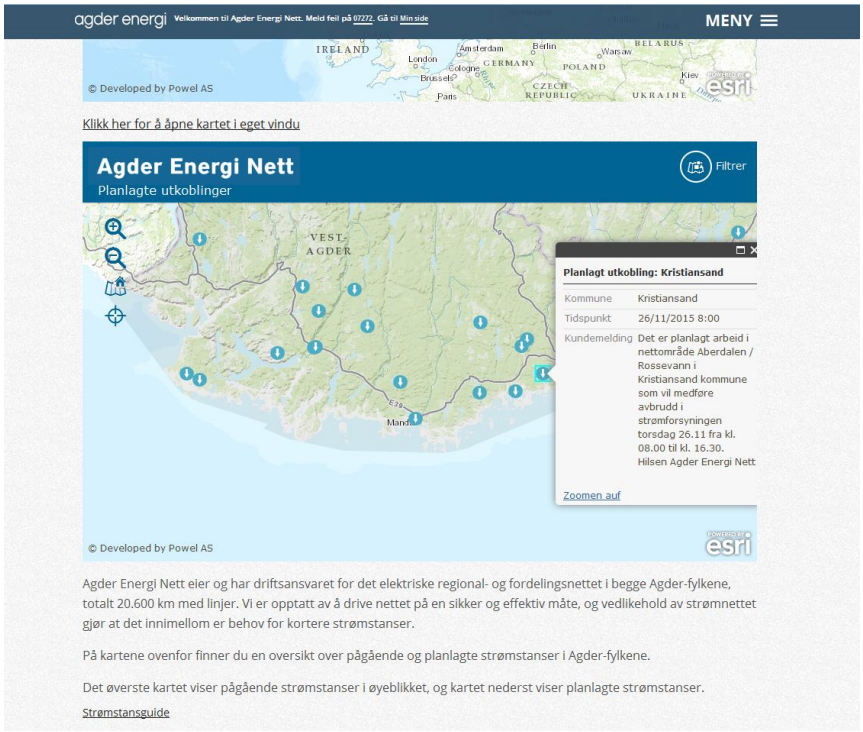


Figure 2: Regional Power Maintenance Screenshot

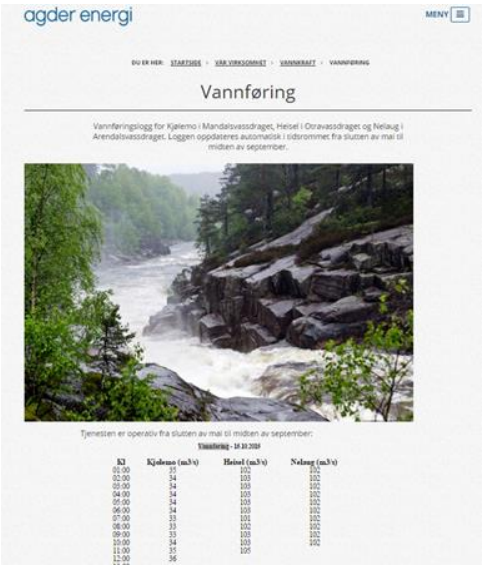


Figure 3: Regional Water Flow Data Screenshot

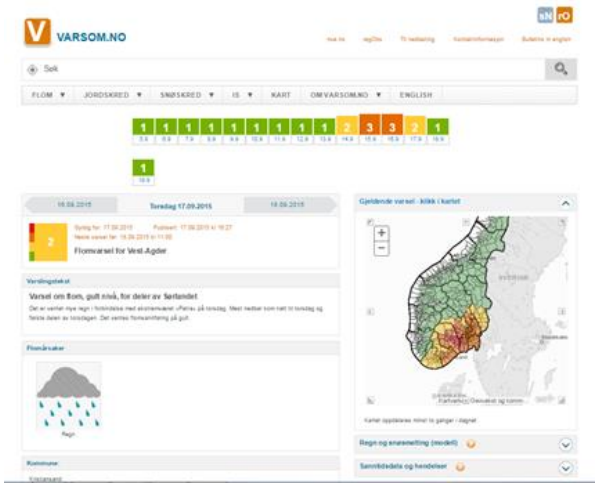


Figure 4: Flooding Threat Level Screenshot

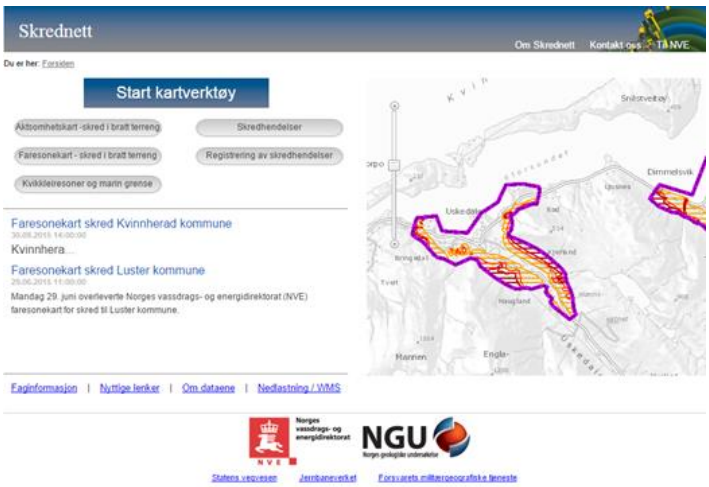


Figure 5: Avalanche Threat Level Screenshot

The Norwegian Directorate for Civil Protection (DSB) has developed an internal communication portal for regional governments[8], municipalities, first responders and emergency managers. This portal is a closed system but inside this tool they report incidents and conduct risk analysis.

Other municipalities have Web sites that try to increase risk awareness[9] and emergency planning[10]. There also exist non-portal information sharing activities. An example is that of *local resilience forums*[11] in the United

[8] https://www.dsb-cim.no/

[9] E.g. https://www.bristol.gov.uk/crime-emergencies/hazardous-chemicals-and-control-of-major-accident-hazards-comah

[10] E.g. https://www.gov.uk/government/policies/emergency-planning

[11] https://www.gov.uk/guidance/local-resilience-forums-contact-details

Kingdom. However, with the possibility of sharing information online, even such Web sites at least have some portal features.[12]

While a high number of approaches exists that more or less fall into the category of Web-based solutions for knowledge sharing, we did not identify any tools that could be called a Resilience Information Portal in the sense of the SMR proposal.

[12] Cf. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/62277/The_role_of_Local_Resilience_Forums-_A_reference_document_v2_July_2013.pdf

3 TOWARDS THE FIRST PORTAL

The first version of the portal is not yet a portal in the strict sense but “merely” an information sharing *platform*. It will be extended to our portal until the end of work on WP4. For unification, the platform shares the design with the Web site that has been designed for WP7 (“SMR :: Home”). In the following, we will introduce initial work on the portal.

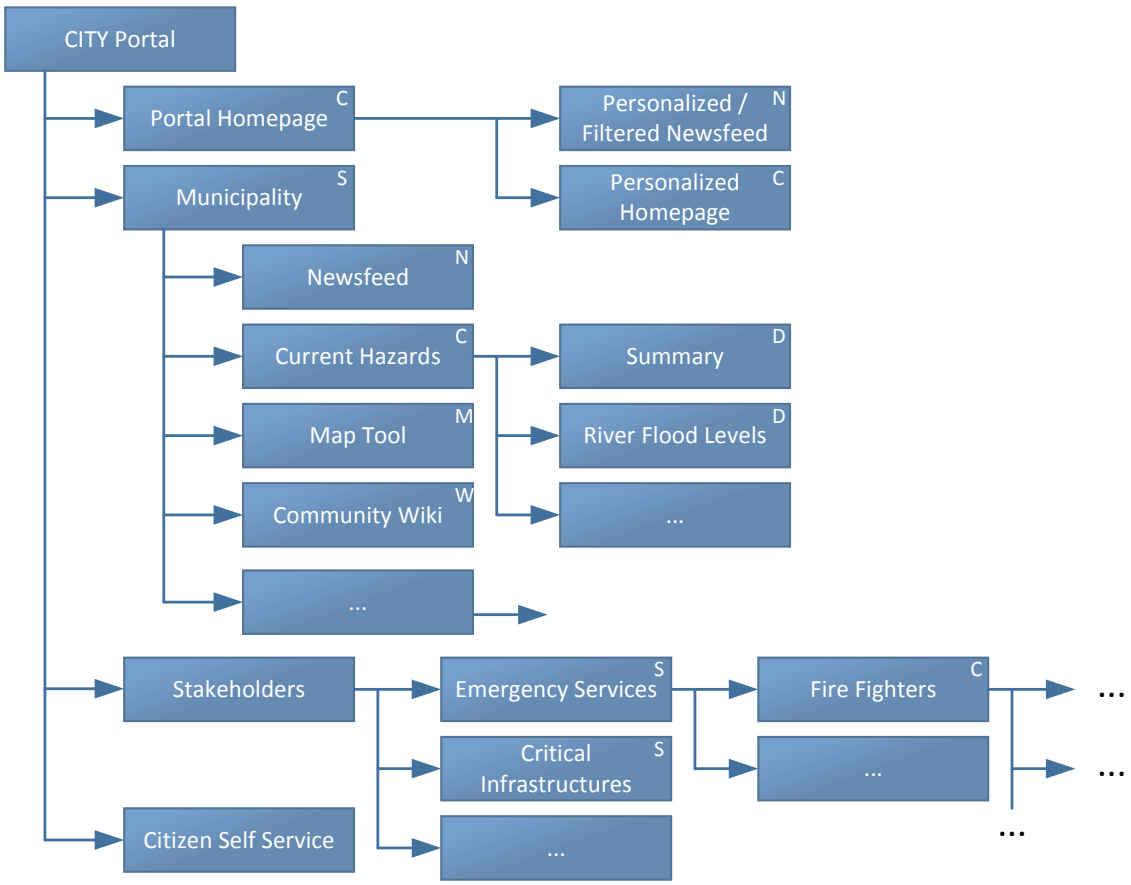
3.1 INITIAL SETUP

For the initial setup, we have decided to combine a top-down and a bottom-up approach. As argue earlier, we cannot propose a comprehensive guide to structuring the portal, yet, for this must be based on the interviews with CITIES. However, based on the literature and existing approaches we can make a first suggestion that will be iterated with the CITIES. Moreover, the initial setup emphasizes work from a questionnaire on *collaborative networks* conducted by Raquel Gimenez from the SMR partner TECNUN. The first suggestion needs to be detailed enough to allow for discussion yet stay general. Therefore, we have decided to combine to approaches to it.

From a top-down view in (Figure 6), the home page and pages on high hierarchy levels are described. On successive levels the *page tree* quickly becomes larger, so that the top-down approach is then halted. The top-down view takes into account that

- an entry point to the portal is required,
- customizable portals are particularly useful for heterogeneous user groups,
- literature highlights particularly aspects of infrastructure, interfaces and data models, and
- many Web-based services are available that provide data regarding emergency management, and situational preparedness without much integration.

Part of the top-down view is embedded into the initial portal – in fact, we have selected some aspects that should be particularly good for discussion for it. Besides this page tree, we also have included quick navigation pages in the portal; cf. e.g. the right hand side of Figure 8 on p. 24.



C: Customizable Summary Page
D: Page with Dynamically Updated Data
F: Forum
M: Map- Mashup
N: Newsfeed
R: Response Form
S: Static Page
W: Wiki

Figure 6: Top-down View of the Initial Portal (Focus on Interface)

The bottom-up view for an example case is shown in Figure 7. We have continued from the "other" direction with this bottom-up approach, in our case describing the layout for pages concerning the risk of fire. It is superfluous to replicate this for other risks since this would possibly discarded after talking to the CITIES but for now bloat the page tree, decreasing clarity.

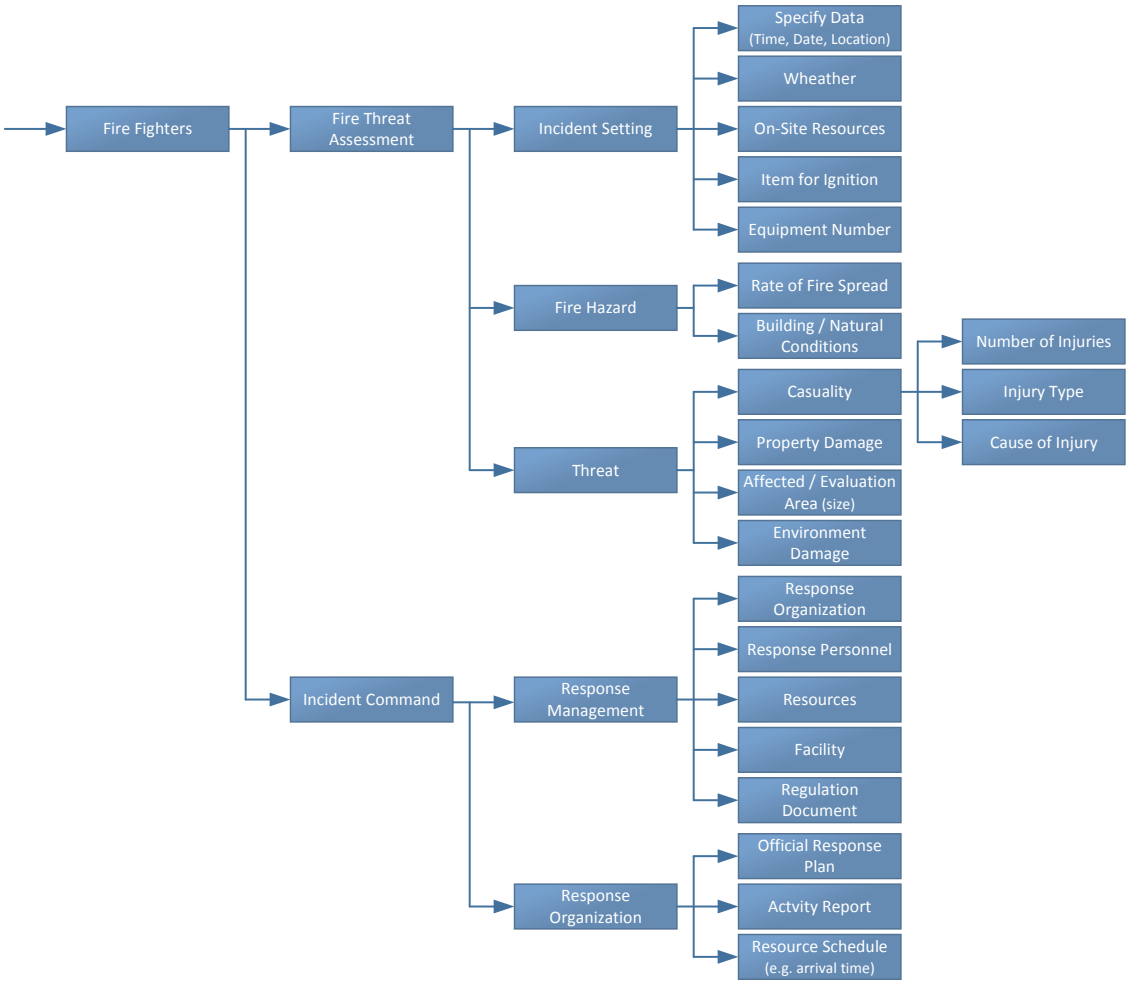


Figure 7: Bottom-up View of the Initial Portal for Fire Incidents Case (Focus on Data Model)

Both page trees embed the knowledge that we have so far and, in the case of the bottom-up view, also demonstrate that data models from the literature can be applied. In this case, the data model shown in Figure 1 (p. 15) was mapped. Similarly, further areas of the portal will be defined based on data models described in the literature.

The first portal provides a view of centralization. This seems to be the most pragmatic approach and it also inherent to a portal-design. Which level of centralization is desirable needs to be checked with the CITIES, though.

3.2 THE PORTAL

The prototype is online at http://portal.smr-project.eu/ since mid-November. Please note that we will be constantly working with it. By the time viewing it, there might have been changes or possible even the evolvement to a new revision.

While the prototype covers one CITY (Donostia), the same structure will be replicated for all CITIES. Once CITIES start working with "their" portal, we will actually provide them with their instantiating. This will also allow customization. For the current demonstration purpose, replicating the portal without changing it content would be rather confusing.

Please note that the content provided in the portal is a placeholder, inspired by several Web sites (that we have cited as sources). It does not mark actual content entered by the CITIES but rather the foundation for discussions with them. We expect first user-generated data to be fed to the portal shortly after the first interview, i.e. in February 2016.

For illustration, three screenshots are included within this document. Figure 8[13] shows the portal home page. Figure 9[14] illustrates how the portal a specific city looks like (in this case to Donostia). Finally, Figure 10[15] exemplarily shows how a sub-page looks like. In this case, general information for citizens on flooding is showcased.

[13] http://portal.smr-project.eu/home-smr-platform/
[14] http://portal.smr-project.eu/cities/donostia/
[15] http://portal.smr-project.eu/cities/donostia/information/floods/

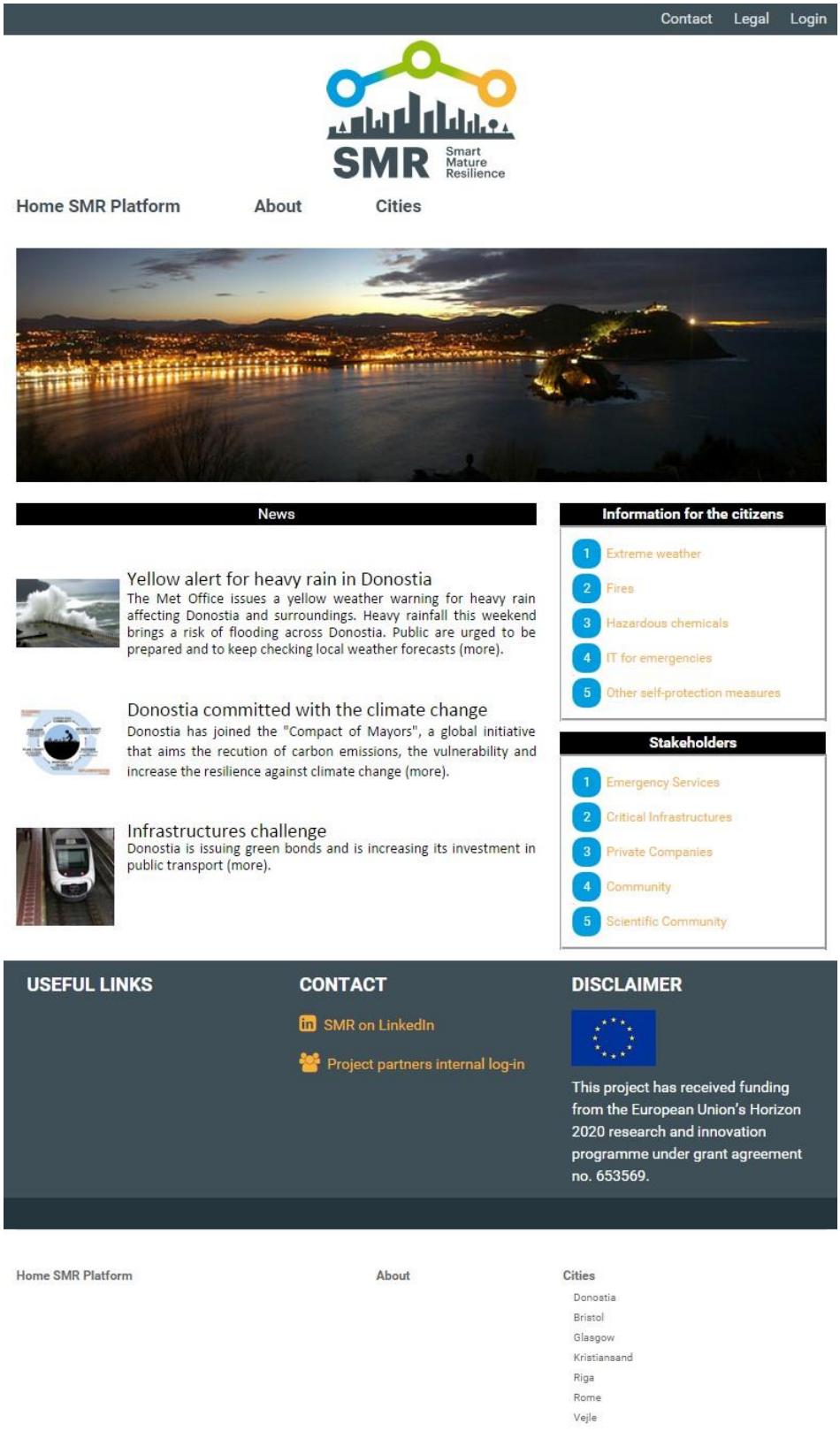


Figure 8: SMR Portal Home Page

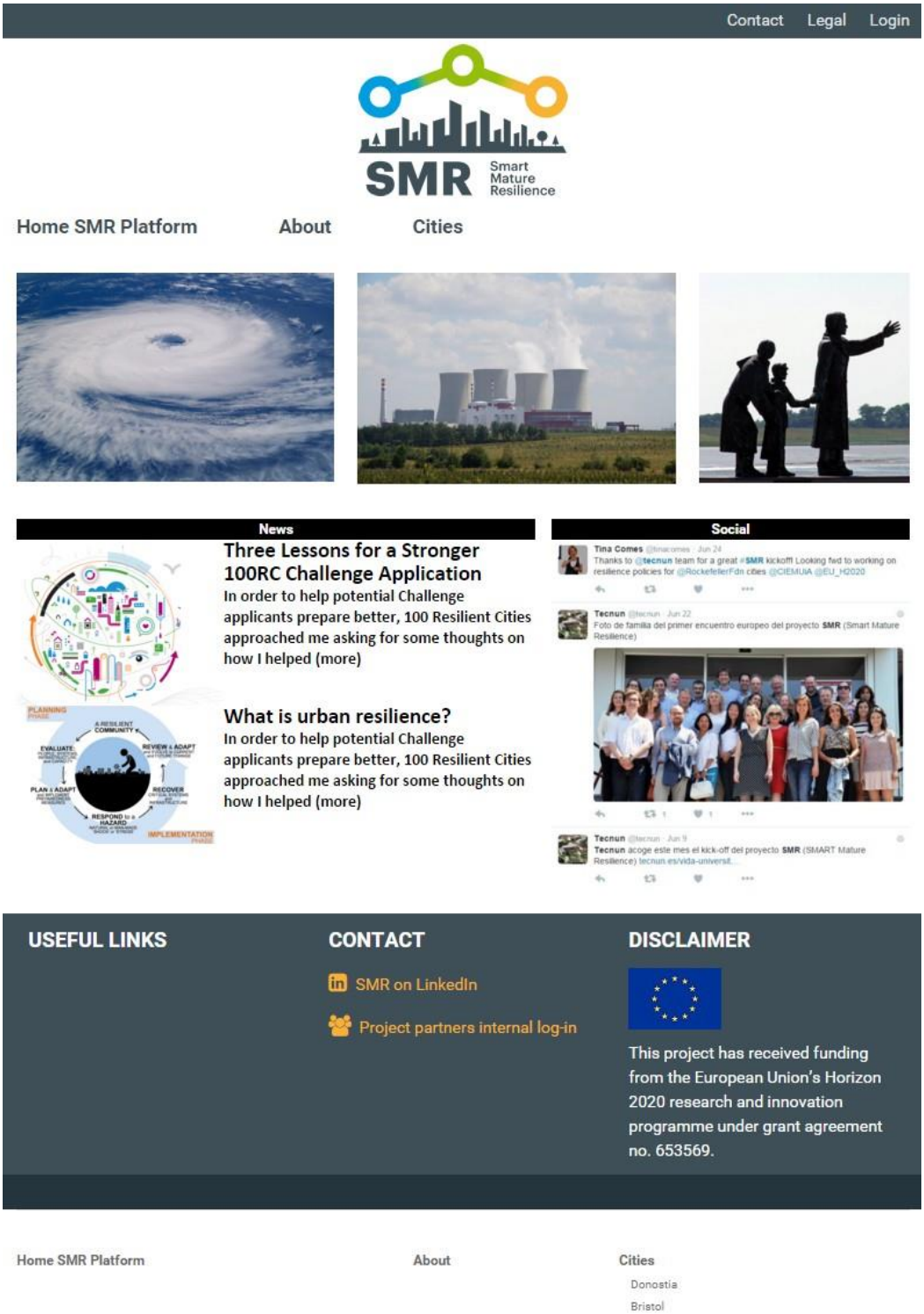


Figure 9: SMR Portal City Page

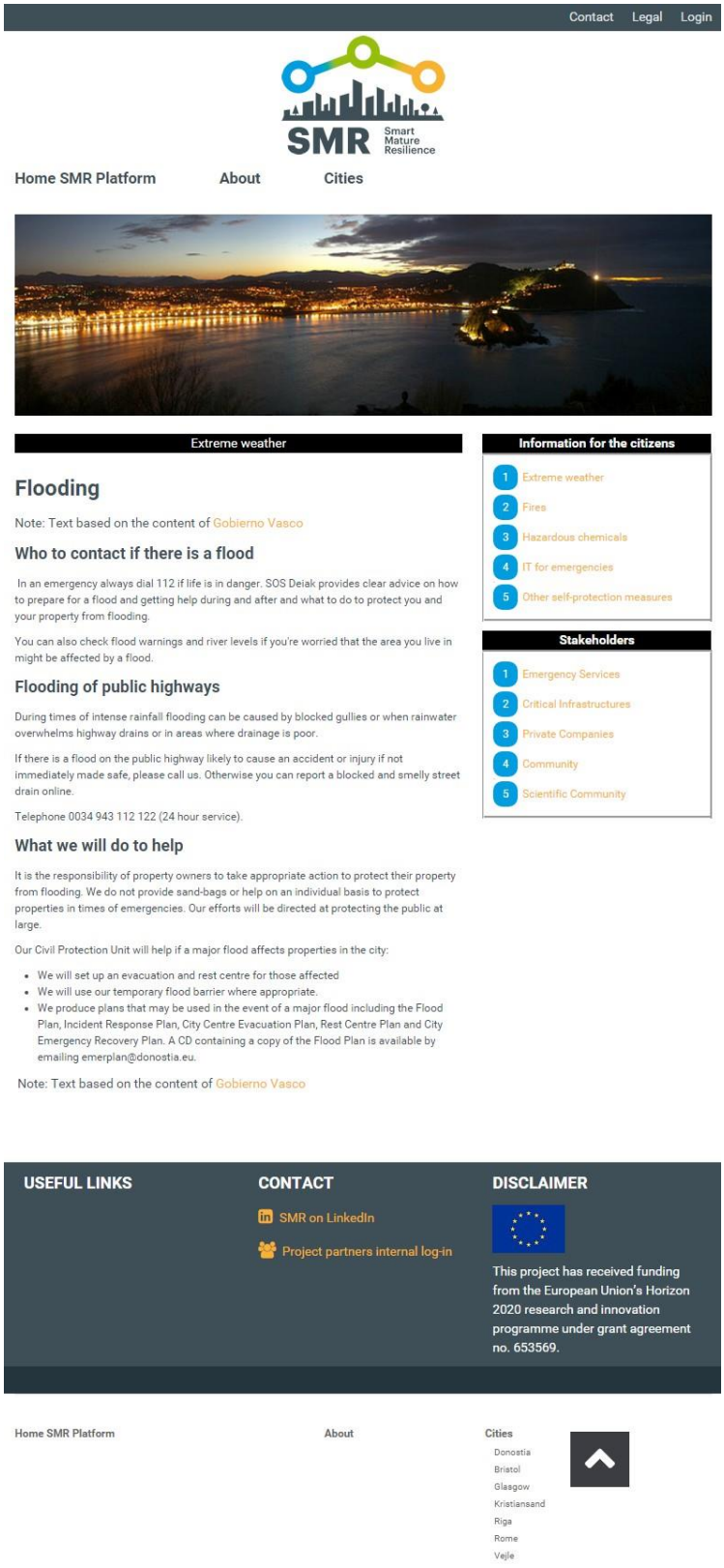


Figure 10: SMR Portal Information Page

3.3 MAIN CONCEPTS

The core concept of the portal is already defined in the proposal: it *is* a portal. This of course is a very broad setup. It allows embedding further concepts.

3.3.1 BASICS

Regarding the management of the portal, a content management system needs to be used to facilitate structured backend usage. Moreover, this includes concepts such as searches, versioning, and a variety of security measurements (particularly authentication and authorization).

With regard to the kind of content to be provided, we do not intend to make conceptual limitations. Static pages, Weblogs (or, in a simpler form, newsfeeds), Wiki pages, and – optional – structured content will be possible.

While we envision a role concept (see Section 3.3.3), representatives from the City of Kristiansand suggested our discussion should take up questions of information sovereignty as well as the inclusion of confidential information. While the role concept is a way to cover both topics, additional concepts might be required. Moreover, it might be a design decision to leave out certain information in the portal.

3.3.2 PORTAL OF PORTALS

Due to the general setup of the SMR project with several CITY partners, we intend extending the main concept of a portal to a *portal of portals*. This is the solution to two considerations:

- The project explicitly seeks to link cities, to enable knowledge sharing, and to build a network of resilient cities. Many risks such as pandemics do not affect a single municipality but likely a number of them. However, if a portal solution is developed that is instantiated by distinct cities, possibilities of information sharing are limited. Data that is fed into the portal would need to be shared with other cities over an additional channel (e.g. phone contact).
- If all CITIES use a central portal, complexity raises significantly. Not only does it become harder to scale such a solution but also concepts such as access rights become much more complicated than in a per-city scenario. Moreover, since CITIES cannot host their own portal at wish, juridical and administrative problems might occur.

Therefore, we deem it reasonable to provide a portal of portals (Figure 11). It will provide a gateway to the CITY portals. Moreover, it will directly integrate top-level information. To make an example: each CITY will likely decide to have a central newsfeed on their portals home page. For each news entry a *flag* could be provided to mark it as relevant beyond the CITY's scope. Such news would then be automatically fed into the central portal. It could either be shown to all users or toggled based on a user's filter settings.

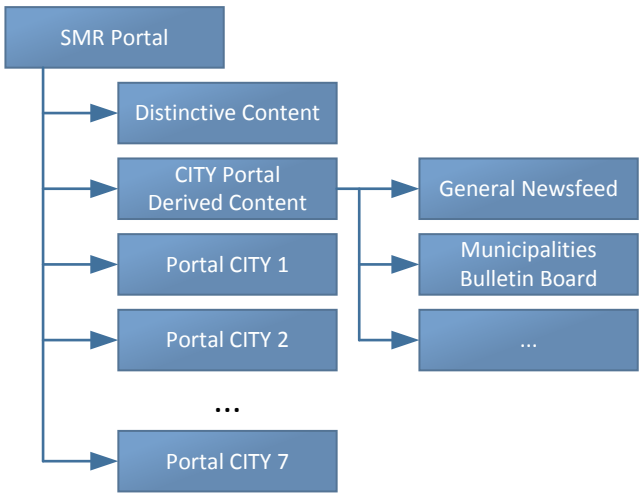


Figure 11: Portal of Portal Exemplary Structure

Feedback from the CITIES so far was not uniform; it might be possible that *one* uniform portal for all cities would be preferred. However, at least for some cities this might not be feasible for legislative reasons due to a loss of data sovereignty. The actual decision is, therefore, postponed to after the interviews are completed.

3.3.3 ROLE CONCEPT

As a result from the first talks with CITY representatives, particularly from the discussion at the WP2 workshop in Riga and several questionnaires, we have decided to equip the portal with a sophisticated *role concept*. The SMR proposal already includes a variety of stakeholder for the portal. From a high level, municipalities, first responders, and citizens can be distinguished. However, particularly in large municipalities many different roles in municipalities can contribute and draw from a resilience portal. First responders belong to different organizations. Besides first responders, authorities (e.g. for health) and organizations, possibly also commercial entities might be included in the work with the portal. Citizens can be passive or active users – passive usage would be readings whereas active usage would include some form of input to the portal. Communication channels might be unidirectional or bidirectional (i.e. user input). Information could be stored and retrieved or pushed, possibly even in a (selective) broadcast fashion.

A role concept will tackle the above-sketched variety of stakeholders and usage patterns. It will not be sufficient to use a single concept that merely distinguished administrators, editors and users. In fact, there will be a very small number of users with *superuser* rights, i.e. write access to all areas of the portal, only. Many users might have read access to many parts of the portal but very limited write access to most of it. To make a few examples:

- A municipal manager (e.g. the local crisis manager) could have broad read and write access rights and also the right to appoint new users (including setting their rights).
- A municipal agent (i.e. a stakeholder that is employed by the municipality) might have broad read rights, write rights concerning municipal newsfeeds and municipal-maintained knowledge repositories, but not the right to appoint new users.
- A volunteer fire brigade member might have read rights of the public areas of the portal and of the fire fighter's newsfeed and knowledge database, write access to the fire brigade's inventory list, and the right to appoint additional people in his brigade with similar rights.
- An unregistered user (e.g. a general visitor of the portal) might have read right to public areas (and nothing else).
- A registered user (i.e. a citizen of a municipality) might gain write rights to knowledge exchange forums and to functionality with which the municipality can be informed of perceived risks.

Consequently, a multi-tier role management needs to be implemented. This is technically challenging but manageable. How the concept will exactly look like needs to be developed carefully based on the CITIE's input. Besides solving the problem with multiple roles, the role concept will also allow the level of transparency. There seems to be some disaccord (to be verified in the interviews) regarding the disclosure of information. Some CITIES rather freely share infrastructure data (such as power wiring) with citizens while other consider this to be confidential data. While we will provide general guidance considering the level of transparency, we still need to make the portal flexible also in this regard.

3.4 TECHNOLOGICAL REALIZATION

As stressed earlier, the technological basis is only a means to an end. Even though it is reasonable to rely on standardized, industry-proven technology, it is impossible to develop a one-fits-all solution since municipal (as well as corporate) IT organizations typically favour specific technology stacks, kinds of system landscapes, and vendors. Therefore, we briefly summarize the technological basis.

The platform has been set up using the TYPO3 Content Management System (“TYPO3”). TYPO3 is an Open Source system that is used on an at least five-digit number of Web sites; it has an active community and mature enough for corporate usage. Moreover, the system is extensible and can be individualised by the inclusion of plug-ins. A further advantage was the existing experience of the project partner ICLEI, who provide hosting for the platform (and, successively, the portal). Finally, there is a high number of documented organizational and corporate users (“The TYPO3 references blog”). This suggests feasibility for scalable, function-rich projects.

TYPO3 is based on the Web programming language PHP and uses an SQL database (the most common commercial and open source products are supported). This is the typical setup for Web hosting and guarantees wide server support. On the client side, no particular technology but an up-to-date Web browser is required.

4 AGILE DEVELOPMENT PROCESS

In the following we describe a development process that will enable us to provide a portal that will be satisfying to the CITIES, include as much of their input as possible, and be actually usable.

4.1 BASICS

System development is typically described in a sequential, step-wise order. It then roughly follows the waterfall model and distinguishes planning, requirements analysis, system design, implementation (i.e. programming), testing and productive usage (Royce, 1970; Boehm, 1976). This form is comprehensible and provides a good overview. It, therefore, is typically used for reports. Moreover, it has been employed in the project proposal even though it stresses the step-wise nature of development already. For the actual work in WP4, we have decided on following an agile development approach[16]. This is done for a number of reasons:

- The portal means to reflect the information sharing needs of the CITIES. It, thereby, can only be built based on the input from the CITY partners, in particular with feedback from a variety of municipal stakeholders. However, at the beginning of the project CITIES cannot have a clear vision; this would anticipate the project outcomes. Moreover, the portal seeks to be a generalizable solution. Thus, work on the portal inherently needs to be *incremental*, i.e. working in repeated small steps that might even lead to changes to existing parts. In combination it needs to be *iterative* in that steps are not necessarily finished on the first attempt. In fact, many issues need to be tackled at the same time and many parts of the portal will require several steps until a first feasible solution is achieved.
- WP4 needs to collaborate heavily with the CITY partners. However, for a better utilization of resources, existing Workshops, meetings, and other project-related travelling should be used for exchange. This requires some flexibility since actual dates might not perfectly align with the time at which input or feedback might be desired from a development perspective. Using the existing meetings (for an overview of a tentative schedule, see Section 5.3) offers the chance to discuss with more than one CITY at a time as well as to get personal feedback form the academic partners, though. In addition, interviews are quite time-intensive for the CITY partners, requiring adjustment to *their* schedule.

[16] No separate references are given ford instinctive agile practices and the agile idea in general. For details please refer to the works by Sommerville (2011, Cha. 3), and the Web site “Manifesto for Agile Software Development”.

- CITIES have varying expectations and communicate in differing ways. A high level of heterogeneity is encountered with regard to experiences, expectations, assumptions, and communication strategies.

Rather than using a specific methods (such as Scrum), we have designed a process that combines elements from different software development methodologies. This better reflects the character of the project, which neither seeks to excel in technology for the sake of it nor means to provide a finished, installation-ready software product. In fact, the Resilience Information Portal will be a means to an end by supporting work in our project and by providing CITIES (and, eventually, all European cities) with support in setting up resilience portals. Thus, whereas the technological solution is important for a demonstration of feasibility and for having a tangible system to discuss, the underlying processes, concepts, and ideas are the more valuable contributions the SMR project will make.

4.2 AGILE PRINCIPLES RELEVANT TO THE PROJECT

Agile software development methodologies, such as the widely used Scrum and Extreme Programming, are specifically designed to deal with an ever changing reality. The main problem of commercial software development is the pace with which requirements change. Moreover, many requirements cannot be identified a-priori but become apparent (or at least clearer) *during* a software development project. While the Resilience Information Portal is not a commercial product, the preconditions for its development are similar. We not merely face an information system development project which allows for a plan-driven, waterfall-like approach. While very rough requirements have been laid out in the SMR proposal, requirements for the actual implementation are yet to be identified. These requirements can be expected to be quite extensive, given the myriad of possible information sources and considering the variety of stakeholders, as also hinted to in the description of WP2 in the proposal (pages 28-32). Therefore, the same principles that allow agile software development projects to react to a changing reality can be applied here to address the unpredictability of CITIES' wishes.

The procedure in agile projects is incremental, iterative, and typically also evolutionary. The latter refers to the fact that requirements might change in the course of a project based on findings with implementing them or due to interrelations with other requirements that are discovered. Incremental work is step-wise; in particular, rather than having a useable system only after completing all parts of it, it should be runnable after each increment has been implemented. This is particularly valuable for our project since it allows news features to be reviewed by CITIES and academic partners, thereby leading to changes to existing requirements or the discovery of new ones. Iterative work means that single parts (e.g. modules) are not finished at once but remain work-in-progress until finalized. While progress is made, they still might be used. This procedure makes it more

likely that the portal delivery in month 18 will be a portal that addresses the CITIES' needs regarding communication and knowledge sharing. Moreover, for to the cooperation with other WPs an early glimpse of what the portal is going to be will be very useful, too.

The above described principles and particularly the proverbial "embracing of change" also prevent *drawbacks* that might hinder progress, lead to suboptimal results, or could even endanger the success of WP4. It is impossible to do all interviews for WP4 at the same time for reasons of organizational overhead and unmanageable complexity. Moreover, this would not even be desirable since it leaves out the above sketched chances of a cyclical procedure in which each incremental step leads to be better understanding and each working increment can be used by CITIES to better comprehend their own needs regarding the portal. However, work with one city might lead to changes to requirements which could conflict or, in rare cases, even cancel out existing requirements. While plan-driven approaches require time-consuming and risky ways of incorporating such incidents (and still typically fail at a high level of change), they come naturally with an agile approach. Of course, conflicts need to be resolved nonetheless, but this is a mere domain-specific problem and does not hamper the software development process in any way. Actually, with the maxim of building the *best* portal, getting diverse input from the CITIES and trying out more than one possible solution even is desirable. This becomes even more apparent, if tasks 4.1, 4.2 and 4.3 are reviewed. With each task, the number of considered stakeholders grows. Although core requirements should be fixed with municipal managers, which whom we have established contacts from the beginning of the project on, still changes to requirements will likely be registered until the very last interview and the very last round of feedback from CITIES and academic partners. Thus, we truly need to embrace change.

Agile methods propose to have *working* software (i.e. runnable, executable, or – in Web terms – reachable) as a principal measure of progress. While deliverable 4.1 is our first measure, there now is a gap of six months before another gap of six months. Thus, monitoring the growth of the portal of the next twelve months will greatly guide project management and make sure we stay on time. It will also be useful for meetings with the academic partners and possibly in consultation with the European Commission.

Due to the scope of the project, we will not employ a commercial scale development team. It is even more important to have good exchange between domain-specific project members (i.e. most project members from the academic partners, who have expertise in resilience-related topics) and developers. Again, this is facilitated by agile methods.

Finally, agile methods seek to provide a simple design. Design, in this case, means system design, not design in terms of user interface creation or "fancy" looks. Against common conception, a simply system design does not

mean that it is not sustainable or that it will be implemented in a “quick and dirty” fashion. In fact, simplicity mandates finding the easiest possible solution to the architecture and the working principles of an information system that are still satisfying. This greatly reduces complexity and helps implementing the system. Our agile approach thereby also supports the compilation of design principles (for the second deliverable in WP4). These design principles should be profound and on a general, abstract level, yet as easy to use and to implement as possible.

4.3 THE SMR DEVELOPMENT PROCESS

As sketched already, the general idea in the development of the portal is to follow a circle of very small build and evaluate steps (cf. Figure 12). This enables the desired *feedback loop*, in which input from the CITIEs lead to new functionality and changes of existing features, which in turn stimulate advanced feedback from the CITIES.

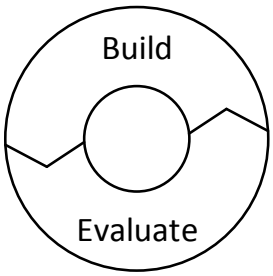


Figure 12: Build and Evaluate

This principle can theoretically be continued infinitely, striving against a hypothetical *perfect* portal. Obviously, in a real-world project time and budget are limited. Therefore, the principle needs to be embedded into a time-boxed process that ends on month 18. This process is sketched in Figure 13.

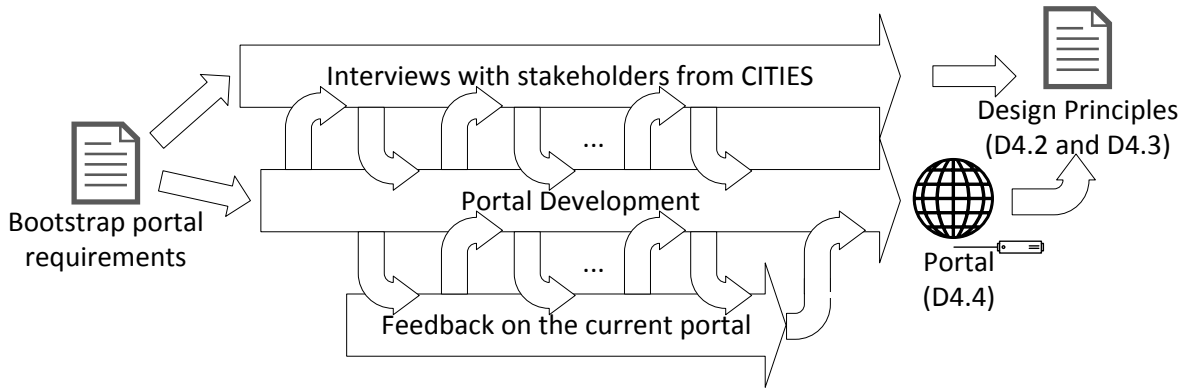


Figure 13: Our Process for WP4

The figure highlights the two activities already described in the proposal (portal development and interviews) along with introducing a third activity (gaining feedback individually). Development is started based on a set of bootstrap portal requirements. Since we can only rely on the literature and on existing approaches yet need to start with initial requirements for the first platform, this bootstrapping is done. Portal development will have a constant exchange with the other two activities. The arrows leading from the development can be read as both providing the next iteration of the portal (or, in the case of the first arrow, of the "naked" platform) and as giving replies about development activities. The latter is necessary since we might realize that some functionality described by the CITIES is not feasible for implementation or because we come to new ideas in the process of development that we want to discuss. The arrows leading to the development can be read as formal (interview data) or informal (comments, wishes) feedback.

While the sketch implies an extreme level of integration already, it even simplifies: since the portal is a Web-based system and will be always online, each change that has been quality controlled and cleared will *immediately* reflect on the live portal (the principle is called *continuous integration*). Moreover, CITIES (and the academic partners) can use the portal at wish and are not bound to our interview phases or to reviews with us. Thereby, our agile process will further facilitate a learning loop.

After 18 months, the activities come to an end. The portal will undergo the last quality check (we intend to also have a kind of acceptance testing done with CITIES) and roundup before being declared finalized. Further changes will be possible throughout the project (and even beyond it) even though WP4 is finished then: the preconditions for further iterations remain. Based on the interviews and also the experiences with the portals, the design guidelines will be derived. Thereby, the two final deliveries that also mark WP4's milestones are finished.

While portal development can be seen as a continuous process, the actual focus of development om the portal will change. Thereby, we will adhere to the plans laid out in the SMR proposal. This is directly reflected in the interview activity, which in fact is a composite activity made up of sub-activities. The proposal names three main phases:

- Firstly, we need to "explore communication and engagement practice between emergency manager in the CITIES and the scientific community". This is the narrowest focus that seeks to build the foundation.
- Secondly, we will "include first responders". This broadens the interviews much and will lead to a variety of new functionalities.

- Thirdly, we need to “integrate communication with citizens”. This activity comes third since it needs to rely on a portal that is working well for municipalities already. Moreover, due to the integration of social media it is a further broadening; it is, therefore, reasonable to keep this as an own activity.

The three phases (or sub-activities) roughly distribute equally over the available time. However, our process allows for parallelization to harvest synergies in the assessment and to make of for slower or faster progress with regard to some aspects of the portal.

4.4 TOOLS AND TECHNIQUES

Rather than relying on formats of our own or even an unstructured prose documentation of requirements and design principles, we will make use of tools and techniques described in the standard literature on Software Engineering (cf. e.g. Sommerville, 2011). Therefore, we will be using techniques of requirements analysis, which will be embedded with the interviews. This way, we will be working in a sound way from the perspective of Software Engineering while gaining the insights sought.

For documentation, we will make usage of the Unified Modelling Language (UML). UML diagrams such as use case diagrams, class diagrams, and sequence diagrams will be the main tool for describing design principles on a more concrete level. They will thereby amend the design principles formulated on a very high level of abstraction. The UML is standardized and widely used by software engineers. Its particular strength lies in the alignment of business (or other domain-specific) and technological notation. Thereby, we will be able to describe principles in a precise and concise way. The notation will be comprehensible to CITIES and the academic partners yet utilizable by software engineers. An example for a UML use case of a small portion of the portal functionality is given in Figure 14.

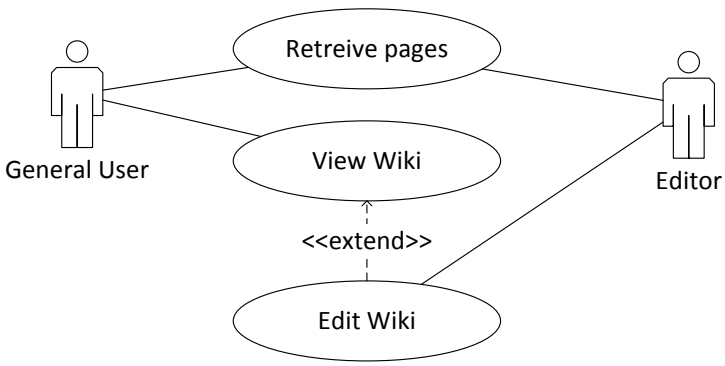


Figure 14: Simplified UML Use Case

Whether other modelling languages will be used is not decided, yet. Probably, process management techniques might be used, e.g. by employing the Business Process Model and Notation (BPMN).

Requirements will be compiled in a functional specification document. This is how requirements would be documented in a commercial project. This way we do not only provide a widely comprehensible structure but will also be able to provide a document that will be useful if after the end of the SMR project cities seek to implement a portal like ours – or rather to have it implemented by a software development company as contract work.

5 INTERVIEW STRATEGY

In this section, we describe how the interviews with CITIES will facilitate the development of the portal.

5.1 OVERVIEW

A structured interview will be conducted with the purpose of identifying communication and engagement needs related to resilience building activities in partner cities. Results of the analysis should be embedded into an integrated Resilience Information Portal guideline.

This activity contains the following four steps; 1) Questionnaire review, 2) Stakeholder definition, 3) interview(s), and 4) data analysis. A questionnaire developed based on the literature will be reviewed by at least one CITY partner. While a questionnaire is reviewed, stakeholders to be interviewed are decided by all partner cities: this selection thereby is a contribution in itself. Once questionnaire review and stakeholder definition are over, face-to-face interviews at each city and with related stakeholders will be conducted. Interview data will be analysed based on scientific methodology – in particular case study research (Yin, 2008; Benbasat et al., 1987; Eisenhardt, 1989; Eisenhardt et al., 2007) – and lead to design principles with following a design science methodology (March et al., 1995; Hevner et al., 2004; Baskerville et al., 2009; Beck et al., 2013; Kuechler et al., 2008). This design-oriented approach well aligns with the agile development process sketched in the previous section.

5.2 STEPS FOR ACHIEVING THE GOAL

Figure 15 shows four steps towards the whole interview process. The steps will be explained in the following.

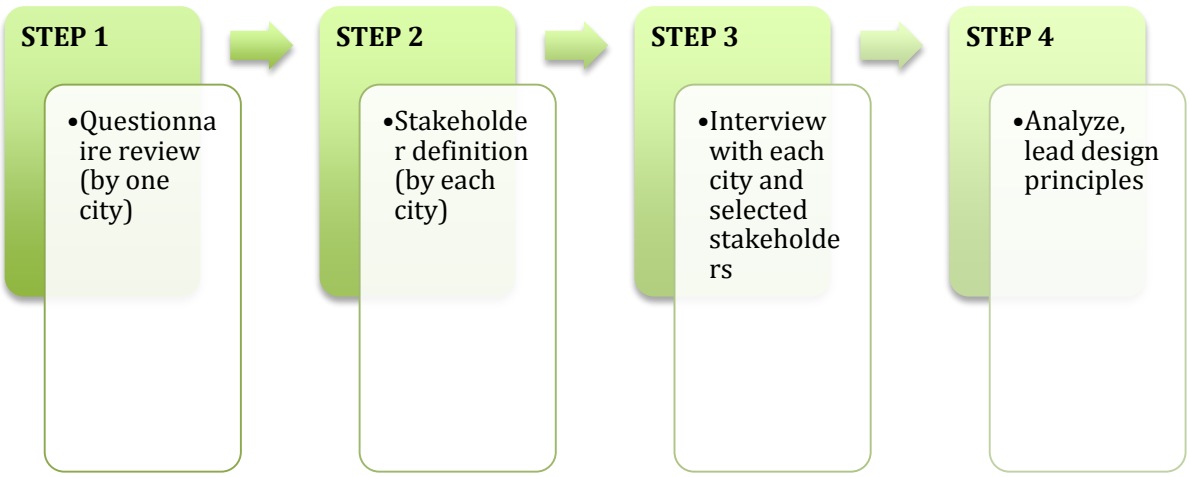


Figure 15: Steps Towards the Whole Interview Process

STEP 1: We will develop a questionnaire for interviews. It will ask cities and stakeholders how knowledge is shared, what kind of tools are used, what are challenges, how they can be solved and so on. Estimated interview time will take two hours for each agency. The development is currently in progress (see Section 4.4 for details) but the number of questions will be decided based on the time limitation (around 10). Once the first draft of the questionnaire is created, we will ask one city to conduct a review on it. An expected candidate is the City of Kristiansand. After going through this review process, the final draft will be employed.

STEP 2: While the questionnaire is developed, we need to define whom we are going to have an interview besides manager from the municipalities. Stakeholders for each city will be clear from a questionnaire survey which was conducted by TECNUN (Q1 and Q2). Based on the result of the survey, we will define candidate of interviewees on WP4. In this step, we will collaborate with Task 5.3 which plans to do stakeholder mapping for implementation of the tools.

STEP 3: A face-to-face interview will be conducted from January to May 2016. Most of the interviews are following the planned workshop of WP2 and meetings of WP5. A detailed schedule will be determined by January 2016 in consultation with the academic partners.

STEP 4: Results of interviews will be analysed. We have two goals here. The one is to identify communication and engagement needs related to resilience building activities. The other is to derive design principles for developing an information sharing tool.

Following the fourth step, work goes on with additional activities from Task 4.3.

5.3 TIME PLAN

Table 2 presents a tentative time schedule for each step.

Schedule (2016)	PLACE	STEP	Date
January	N/A	Step1 <Questionnaire review>	The 3rd week
January	N/A	Step2 <Stakeholder definition>	The 3rd week
January	Bristol	Step3 <Interview 1>	After T2.2 WS (Jan 25-28)
February	Kristiansand	Step3 <Interview 2>	After WP5 WS (Feb 15-16)
February	Rome	Step3 <Interview 3>	After T2.3 WS (Feb 22-25)
March or April	Riga	Step3 <Interview 4>	(to be decided)
April	Donostia	Step3 <Interview 5>	After or before WP 5 WS (date is TBD)
May	Vejle	Step3 <Interview 6>	After or before T2.4 WS (May 9-12)
May	Glasgow	Step3 <Interview 7>	After or before WP5 WS (date is TBD, if it is too close to the T4.2 deliverable due, we schedule this in March or April)
May	NA	Step4 <Analyse and define design principles>	Through Jan to May

Table 2: Tentative Schedule

This plan concretises the proposal and aligns it with the activities in the different WPs.

5.4 INITIAL SKETCH FOR THE QUESTIONNAIRE

The first draft of the questionnaire is planned to be accomplished by the third week of January 2016. In the following we already give an initial sketch of it.

Information sharing related questions

1. Which kind of information should be shared during an emergency situation (environmental conditions/ information on response participants/ status of casualties/ available resources, etc.)?

1.1 within your organization

1.2 with stakeholders / first responders (municipality, police, fire brigade, etc.)

1.3 with citizens

2. Which kind of tools are supposed to be used (defined in an emergency management plan) for sharing above information?

3. How is the drill to use those tools conducted?

4. What do you think are problems of those tools?

5. What do you think are challenges in terms of information sharing in an emergency situation?

Knowledge sharing related question

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

5.5 POSSIBLE PROBLEMS AND MITIGATION

Some problems may arise since the number of interviewees is expected to be large. This might lead to redundant work or to actually missing required input.

To define communication needs effectively, we should design the questionnaire rigorously structured. If results of the interview do not expose the same quality with all city partners and if we cannot derive some of the requirement in a general way, the alternative outcome will be a case description of one tool that each stakeholder possesses. This will be useful at least to define communication problems that each partner faces.

Due to the requirement of interview partners being available and able to spend a significant amount of time on the interviews, it is possible that some interviews will be delayed or might even need to be skipped. While this is unlikely for the managers from the CITIES (as funded SMR project partners), it is very likely that this will happen with several stakeholders such as first responders. In general, due to the agile process we employ this is unproblematic as long as it does not concern a majority of interviews we want to conduct. Changing order of skipping some interviews will have a minor effect due to the cyclic nature of our approach. It will be important, however, to accept these issues rather than to try to mitigate them in a case-wise fashion, which would induce a massive project management overhead. At the same time, in the case of inferior results in working with some CITY partner, conferring early with the municipal manager is required.

6 INITIAL SET OF REQUIREMENTS

As a summary to the argumentation in the preceding sections, we here present the initial set of requirements that we used to build the platform. The scheme follows the proposal for a functional specification document by Balzert (2009, Cha. 20.3). While these requirements are not static but rather mark a starting point, we will retain this scheme for the remainder of the work on WP4. Moreover, many of the basic requirements will very likely be kept.

Since no information can be provided for all applicable categories of the specification, and since a certain degree of freedom is required at this time, text in italics is used for explanations.

6.1 AIMS

6.1.1 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 means to offer knowledge sharing and facilitate collective learning.

6.1.2 MUST CRITERIA

- The portal must be a publicly available Web application.
- 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.
- Users must be able to register themselves for portal usage and log in.
- Logged in users must be able to customize pages that are set to be customizable. In particular, the home page should be customizable.
- An adaptive role management must be realized.
- Logged in users with respective rights must be able to edit pages. This includes the upload of documents.
- 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.
- Page editing must be supported by WYSIWYG tools (i.e. easy editing tools that do not require programming or design knowledge).

- Accessibility standards[17] as outlined by W3C must be followed.
- A search functionality must be provided that allows to sort information.

The category will be much extended based on the input from the CITIES.

6.1.3 MAY CRITERIA

- The portal may support multiple languages.
- Mobile device support ought to be pursued.
- Accompanying Wiki pages, Frequently Asked Questions (FAQ) pages could be provided
- Tools for interactively measuring the resilience maturity level of a city could be provided.

The category will be much extended based on the input from the CITIES.

6.1.4 MUST NOT CRITERIA

The portal is specific to the SMR project, even though it should yield generalizable insights. Nevertheless, it will not be designed nor implemented as an off-the-shelf product.

6.2 USAGE

6.2.1 AREAS OF APPLICATION

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.

6.2.2 TARGET GROUPS

The portal will be used by the seven partner CITIES of the SMR 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. A possible extension to further target groups needs to be expected.

6.2.3 STAKEHOLDERS

Stakeholders are the consortium members of the SMR EU project.[18]

[17] http://www.w3.org/standards/webdesign/accessibility

6.2.4 OPERATION CONDITIONS

The portal will be up and running from now (November 2015) until the end of the SMR EU project. Possible longer usage should be taken into account. Maintenance after the project will need to be discussed during the course of the project.

6.3 TECHNICAL PRODUCT ENVIRONMENT

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

6.3.1 SOFTWARE

- A current, up-to-date Web Browser for clients.
- TYPO3 in a current, up-to-date installation running on an appropriate Web Server that also provided a compatible database management system.
- For template design in TYPO3 Hypertext Markup Language (HTML) 4.01, Cascading Style Sheets (CSS) 2.1, JavaScript

6.3.2 HARDWARE

There are no specific hardware requirements. On the server side, any hardware that supports that required backend software suffices. On the client side, any hardware that can be used to run a modern Web browser suffices. Since the initial performance requirements are low but the portal will be scalable, no suggestions are proposed at this point.

6.3.3 INTERFACES

For the initial portal, no interfaces to other systems are required. However, literature suggests that interfaces will be required. We will discuss this with the CITIES.

6.3.4 HOSTING

Hosting is provided by ICLEI as part of their hosting of the project's Web site.

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[18] Please note that stakeholders in terms of the functional specification have a different connotation to the term as used in the remainder of the document, where it means portal users.

6.4 FUNCTIONS

Fine-grained functions are left out at this point. Rather, the portal is set-up based on the coarse-grained must criteria.

6.5 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.

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.

The generic data model is summarized in Figure 16. Multiplicities and most attributes have omitted for simplification.

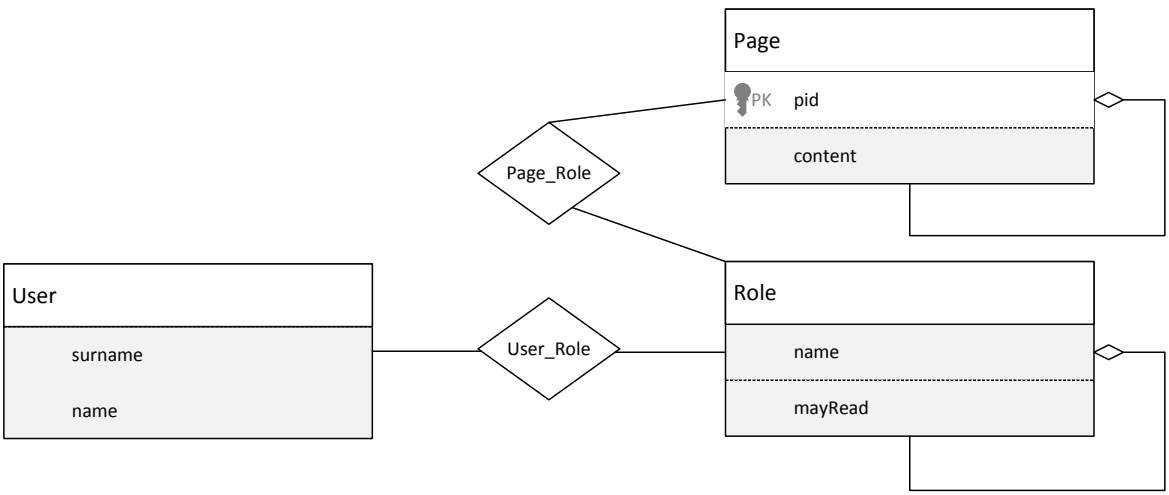

Figure 16: Data Model for the Portal (simplified)

6.6 PERFORMANCE

The following requirements concern the performance of the portal:

- 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.
- 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.
- Resource usage should align with typical TYPO3 installations.

6.7 USER INTERFACE

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. Figure 17 illustrates how for example the home page could be looking like[19]. The left side of the site is used for a news feed whereas the right side contains a box providing quick links.

[19] Screenshots that supersede this mockup are included in Section 3.2.

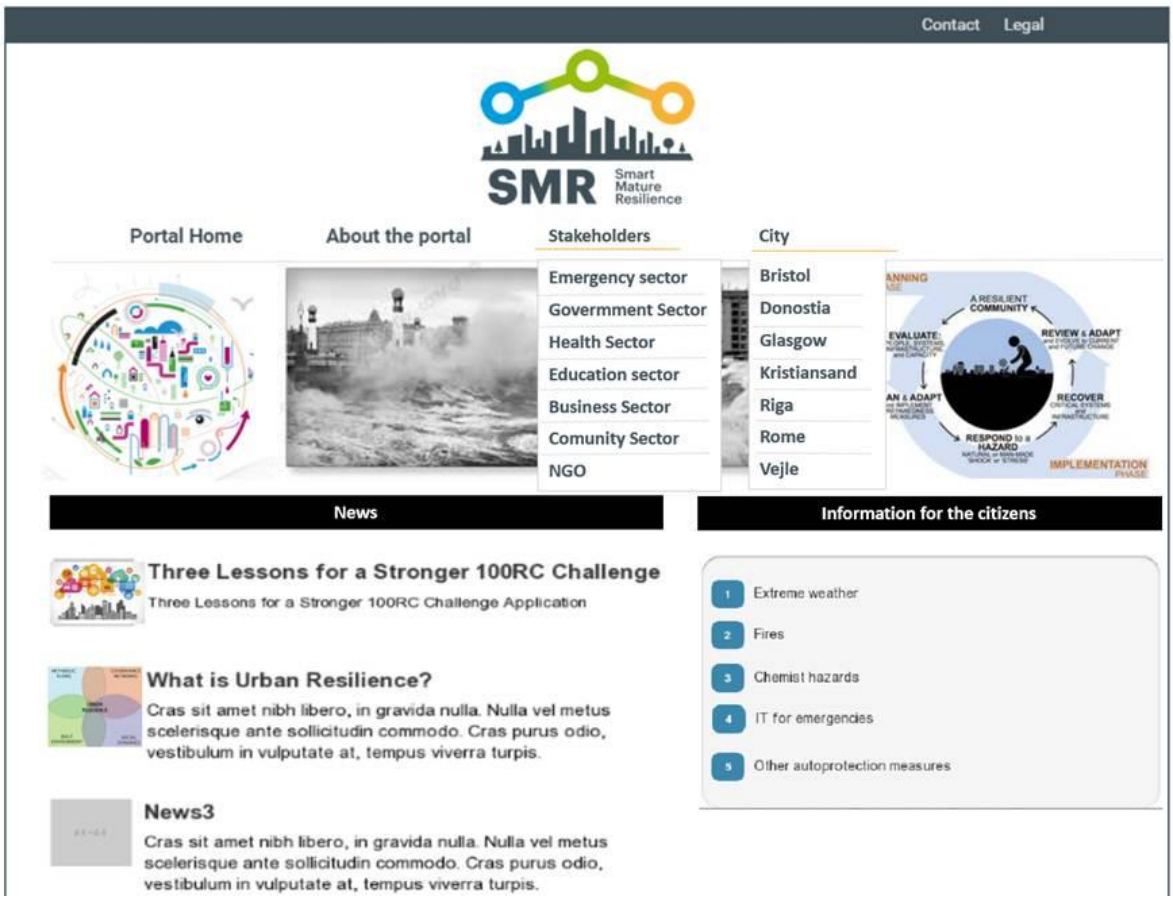

Figure 17: SMR Portal Mockup (Superseded by the First Version of the Portal)

In general, pages will be buildable from boxes. This concept is illustrated in

Figure 18. Contents can be aligned dynamically. Depending on the page, a fixed layout will be provided (possible of one box only), pages will be customizable for users with sufficient rights, or pages will be customizable for all users that are registered.

The following content will be supported for boxes: static pages, static list pages, Newsfeeds, Weblogs, Wiki pages, Forums, Map-Mashups, Social Media Integration.

It remains to be determined which social media services should be included.

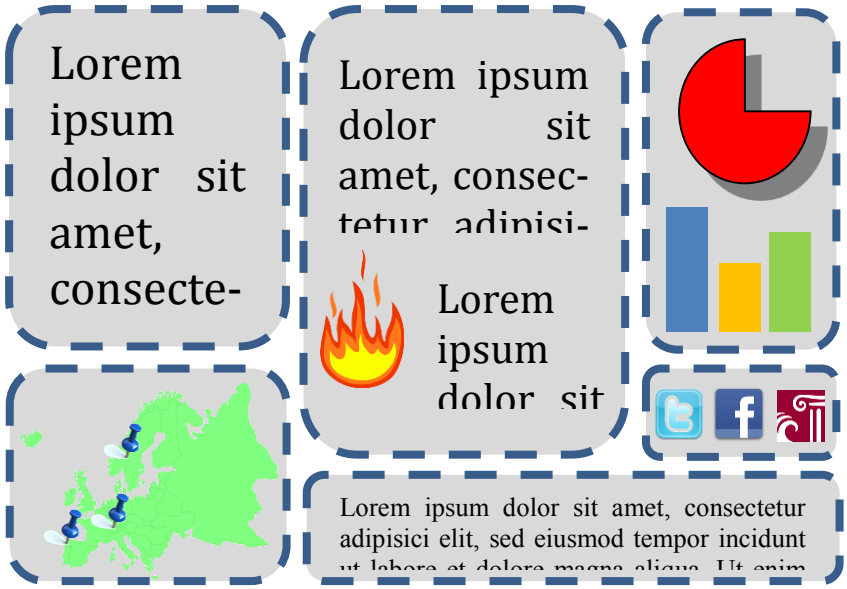

Figure 18: Boxes Concept

More detailed Graphical User Interface (GUI) sketches will be included after working with the CITIES.

6.8 QUALITY REQUIREMENTS

The following quality criteria will be observed to the described degree:

- 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.
- Maintainability: The portal must be highly maintainable. It must allow for further development, customization and adaption beyond the work of WP4. The level of maintainability should even be kept after the end of the project.
- 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.

- Resilience[20]: 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).
- Portability: No particular portability must be achieved.
- Usability: The portal should make use of the common ways of building Web applications. It should be ergonomic, pleasant to use, intuitive. It functions should be easy to learn. Basic editing functionality needs to be understandable even to technological laymen.
- Accessibility: The portal should be as accessible to people with disabilities as possible. This particularly includes friendliness to screen readings software for people with visual impairments. In general, adhering to the latest standards in HTML and CSS as well as to best practices in interface design should enable this.
- Documentation: A brief handbook for users with writing rights will be provided. For frontend users, the portal should be intuitive enough to make a handbook superfluous. Where needed, explanations can be put onto pages directly.
- Security: 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.
  The actually required level of security will need to be carefully discussed with the CITIES.

6.9 ADDITIONAL NON-FUNCTIONAL REQUIREMENTS

The following, additional non-functional requirements will be observed:

- The portal must be scalable. The architecture should allow for an extension to at least a two digit-number of cities. Moreover, it should scale seamlessly with a high number of parallel users requests.
- EU regulations and national laws regarding public (Web) services need to be respected. This particularly concerns accessibility, privacy, and security.

[20] Resilience is a term that is used in Software Engineering even longer than for smart cities. It essentially has the same idea: revert to an earlier state or recover to an acceptable state after something unforeseen has happened.

6.10 GLOSSARY

This Glossary will be filled with terms that may lead to misinterpretations or that have different meanings for different stakeholders. As of now, this remains empty, but we intend to put terms here that address risks and procedures described by distinctive CITIES. The fact that different meanings exist even for common terms has been stressed by the CITIES.

6.11 TEST CASES AND TESTING SCENARIOS

No test cases are specified as of now due to the dynamic nature of the development project. Test cases will be based on the CITIES feedback.

7 SUMMARY AND CONCLUSIONS

This document accompanies the first deliverable of work package 4, the initial communication platform. While the proposal asks for “just” the platform, we have decided to compile a description of the process to develop the Resilience Information Portal in this document. Moreover, we have laid out a discussion of requirements based on existing work, which led to an introduction of the platform so far.

The development of both portal and design principles needs to be highly dynamic. This is facilitated by an agile development process and an integration of interview activities with the other activities in the SMR project in the coming months. Literature only partly covers the aspects required for an elaborate set of requirements but offers plenty of hints that allow proposing an initial set of requirements. It is thereby not a problem to describe a portal solution based on existing approaches. Rather, there is an unmanageable number of choices how to structure the portal due to the variety of information sources and stakeholders.

We, therefore, have come up with a bootstrap suggestion that is backed by the literature. It serves as a starting point and will be used to discuss the portal with the CITIES. The suggestion is summarized in form of a functional specification document. In addition to this, we will try to derive abstract data models from the input from the CITIES. They will be the foundation for future iterations.

The first portal will enable a learning loop that in cycles of refinement develops this bootstrap set of requirements towards the portal that captures the actual, yet undisclosed needs of the CITIES.

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