SMART MATURE RESILIENCE

D6.2 SUMMARY OF STANDARDIZATION POTENTIALS

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Author(s)	Saskia Maresch, René Lindner
Co-author(s)	Susan Howick, Colin Eden, Igor Pyrko, Mihoko Sakurai, Tim A. Majchrzak, Vasileios Latinos, Maider Sainz
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EXECUTIVE SUMMARY

The task 6.2 ‘Identification of Standardization Potentials’ is a very important activity with regard to the dissemination of SMR project results. It is the basis for the initiation of standardization activities and thus the transfer of the developed SMR solutions into standardization. The results of this task are highlighted in the present deliverable.

In order to identify the standardization potential of the SMR project results; existing standards and ongoing standardization activities had to be assessed. The update of the analysis of existing standards and standardization activities resulted with the conclusion that 65 standards have a significant importance to one or more solutions developed out of the SMR project. The *supply side* for a city resilience building process is completed with the five city resilience solutions developed out of the project: Resilience Maturity Model (MM), Risk Systemicity Questionnaire (RSQ), Resilience Building Policies, System Dynamic Model (SD Model) and the Engagement and Communication Tool. Moreover, these five solutions inform the overarching European Resilience Management Guideline (ERMG) which, for example, demonstrates how these solutions can be used together to complement one another.

However, the developed solutions can only be transferred into a standard, if the city partners identify a matching need for these solutions. In this regard a survey and several standardization sessions were conducted throughout the task in order to receive the cities’ point of view and to assess their needs. These activities have been summarized as the *demand side* for the city resilience building process.

Finally the supply and demand side have been brought together to identify the standardization potential of each of the developed SMR solutions. The city and research partners evaluated four out of the six solutions to have a significant potential for standardization, i.e. the Resilience Maturity Model, the Risk Systemicity Questionnaire, the Engagement and Communication Tool, and the European Resilience Management Guideline. In the next steps several standardization activities will be initiated to meet the demand of the cities and to support their resilience related efforts.

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1. INTRODUCTION

1.1. BACKGROUND

The main objective of the work package 6 of the SMR project is to promote project results and to transfer the created knowledge into project-related standardization activities. A more detailed objective is to disseminate knowledge about relevant existing standards amongst project partners (Objective 6.1). Another objective of work package 6 is to analyze and assess the project results for their potentials to be transferred into standards; or to be used as input into existing standardization activities (Objective 6.2). Thus, this work package will contribute to bridging potential gaps between existing standards in the field of crisis management and urban resilience, while it will also support the improvement of EU crisis management.

The work on task 6.2 'Identification of Standardization Potentials' consisted of an assessment of each of the developed SMR solutions, a review of the project relevant standards, an analysis of newly published standards, a survey with city partners and a summary of the standardization sessions that were held during project meetings. These activities were conducted to identify project relevant standards that already exist as well as solutions that were developed during the project, and to compare them with the needs and challenges which cities are currently facing. Thereby the existing standards and created solutions can be described as the *support side* for cities and communities, whereas the needs and challenges can be described as the *demand side* of cities and communities.

By identifying the gaps between the support and demand sides, the standardization potential for the SMR project's results shall be explored. The result of this task will be a list of prioritized standardization potentials. These activities are primary for the initiation of the envisaged CEN Workshop Agreement(s).

Furthermore, the activities mentioned in this deliverable will be complemented by the outcomes of the European Workshop on Resilience in Cities and Communities to which project externals were also invited. The results of this workshop will be described in detail in deliverable 6.3 'Report on the European Workshop on Resilience in Cities and Communities' (due to August 2017).

1.2. OVERVIEW OF WP6 ACTIVITIES

Table 1-1 gives an overview of the activities that have been undertaken as part of the SMR project with respect to standardization. In the first project year a survey of existing standards with keywords from the project partners was conducted. In the second project year the task 6.2 'Identification of Standardization Potentials' will be completed and the work on task 6.3 'Initiation of Standardization Activities' will begin. With the present deliverable the second task will be accomplished. In the third project year, CEN Workshop Agreement(s) will be developed out of the research of existing standards and the standardization potential report.

Table 1-1: Overview of WP6 activities

Task	Deliverable	Month	Comment
6.1 Analysis of existing Standards and Standardization Activities	6.1 Existing Standards and Standardization Activities Report	12	Submitted in May 2016 and reviewed in November 2016
6.2 Identification of Standardization Potentials	6.2 Summary of Standardization Potentials	26	July 2017
6.3 Initiation of Standardization Activities	6.3 Report of the European Work-shop on Resilience in Cities and Communities	27	August 2017
6.3 Initiation of Standardization Activities	6.4 Proposal for (a) CWA(s)	30	November 2017
6.3 Initiation of Standardization Activities	6.5 Draft of the aspired CWA(s)	34	March 2018

1.3. METHODOLOGY

The following deliverable will at first describe the *supply side* of the city resilience topic. In the context of this deliverable the support side consists of solutions that were developed during the SMR project as well as standards that already exist on the topic of resilience. In chapter 2 the solutions developed in the SMR project will be described through their aim, users, structure, connection to other tools and status of development. In addition to this, the existing standards were reviewed and newly published standards were added to the supply side of city resilience.

In chapter 3 the *demand side*, with the needs of cities concerning the optimization of city resilience will be described. Against this background a survey, with tier one and tier two cities, was conducted as well as different interactive sessions during project workshops were held.

In chapter 4 the standardization potential will be identified by putting the supply and demand side together, like it is shown in Figure 1-1.

Figure 1-1: Methodology of identifying the standardization potential

2. SUPPLY SIDE – SMR SOLUTIONS AND STANDARDIZATION ACTIVITIES

The supply side is the amount of existing standards and ongoing standardization activities as well as developed results out of the SMR project, which will support cities and communities in becoming more resilient. In general, supply is understood as something tangible or intangible that is offered to somebody else [6].

The next subchapters will at first focus on the developed solutions and results of the SMR project having the potential to be transferred into a standard, and second on an update of relevant existing standards and ongoing standardization activities.

2.1. SOLUTIONS DEVELOPED IN THE SMR PROJECT

The Resilience Maturity Model (MM), the Risk Systemicity Questionnaire (RSQ) and the Resilience Building Policies are the three pillar solutions where the European Resilience Management Guideline (ERMG) rests. These three pillar solutions integrate and connect through the SD Model (System Dynamics Model). The Engagement and Communication Tool can host all other solutions developed in the SMR project. Figure 2-1 was developed in order to get a better overview of the solutions and how they are connected to each other. A detailed description of the solutions with their aim, users, structure, connection to other tools and status of development will be given in this subchapter.

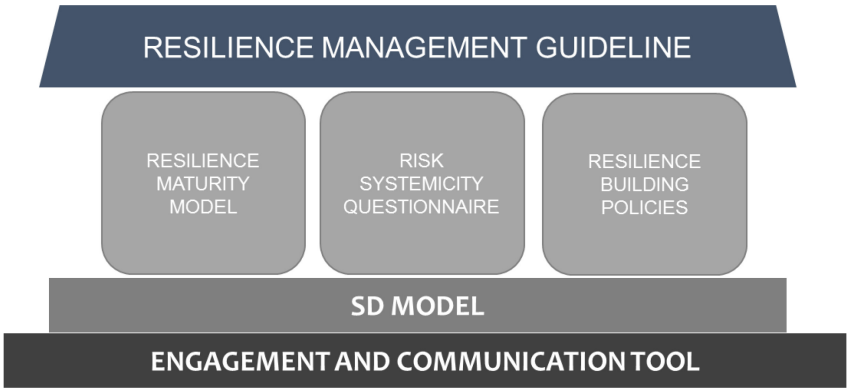

Figure 2-1: Overview of SMR solutions

2.1.1. RESILIENCE MATURITY MODEL (MM)

Aim of the Resilience Maturity Model

The MM helps to identify the ideal path for the evolution of the resilience building process from an initial stage to a more advanced stage, passing through a number of intermediate stages. The MM enables, from a strategic level, developing an assessment of the city current resilience status identifying areas of improvement. Based on this initial assessment, the city will use the MM as a guide to define the strategy to increase their resilience level, based on the policies included in it.

The main goal of the MM is to provide a roadmap for developing city resilience maturity. This tool also aids reflection since it provides a holistic overview of the resilience building process and helps end-users to understand resilience as a multidimensional objective. While using the MM, cities assess their current resilience status. The model then helps to identify the policies to implement in order for the city to evolve and move to the next maturity stage.

Structure of the Resilience Maturity Model

The MM is presented in the form of a matrix (see Figure 2-2) consisting of five maturity stages and four dimensions:

- Maturity stages (acronym SMART):
  - Starting: Starting with local departmental resilience plans
  - Moderate: Integration of local departmental resilience plans
  - Advance: Implementation of the integrated (holistic) resilience plan
  - Robust: Internationalizing resilience
  - Vertebrate: Leading resilience
- Dimensions (acronym LPIC):
  - Leadership & Governance
  - Preparedness
  - Infrastructures & Resources
  - Cooperation

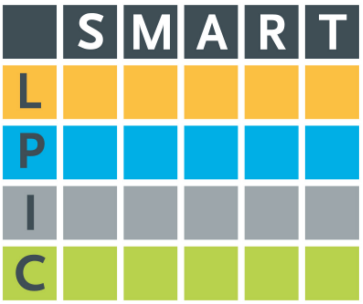

Figure 2-2: MM Matrix

Policies: For each dimension and sub-dimension a set of policies has been proposed to move forward from one maturity stage to a more advanced one. The MM is proposing a sequential order to develop these policies so that the use of resources is more effective. Some of the policies need to be developed throughout different maturity stages. However, such policies may not necessarily be fully developed and implemented at the same maturity stage. And so the policies developed in previous maturity stages still need to be considered as the City makes progress through the maturity stages. Therefore, the MM includes the concept of a continuous improvement management process, allowing policies to adapt to new situations, extending the well-known PDCA cycle (Plan Do Check Act).

Relevant Stakeholders: The MM also provides information about the stakeholders that need to be involved in a proactive way in each maturity stage.

Indicators: The indicators aim is to provide cities with metrics for discussion and analysis of the different policies developed in the resilience building process, giving an indication of positive behaviors and supporting the continuous development that is made towards resilience building policies. The proposed indicators serve as a source of inspiration to measure the progress of the policies. However, until experience occurs the proposed indicators should be considered as promising candidates for resilience metrics rather than being written in stone. Still, the periodical use of suitable indicators enables evaluation of progress towards objectives and identification of gaps and priority actions. Two types of indicators have been identified: effort indicators and result indicators. Effort indicators are indicators that reflect the amount of effort that has been invested in implementing policies, while result indicators estimate the level of implementation of the policies.

Users of the Resilience Maturity Model

The user group of the MM are CITIES (in capital letters). The SMR project considers a CITY (in capital letters) as an environment that involves all the relevant stakeholders in the resilience building process, as it is shown in Figure 2-3.

Figure 2-3: CITY concept

The end users of this solution will be mainly the ones in charge of developing the resilience strategy of a city, since this tool can help them to assess where the city is and identifying areas that need to be improved. For instance, the resilience officer can use it as an assessment tool to monitor the devel-

opment of the resilience strategy and the politicians to analyze the policies that they need to implement, prioritize them and assign a budget for their development. The MM is also useful for other stakeholders such as public and private companies as well as emergency services. It helps to understand how they can contribute to the resilience development process and to assess the priority to make investments on their specific responsibilities. Furthermore the MM can help all stakeholders by increasing their level of awareness and as a consequence their commitment level towards the resilience building process.

The MM may also be used as a training tool to help new employees grasp city resilience issues.

The process to follow in order to assess the city's current maturity stage is the following. The city stakeholders should research, categorise and record policies that have been implemented in their cities related to resilience. Afterwards, a training session can be held where the MM purpose and structure is explained. The participants of this session would categorise the policies that have been implemented or are in place in their cities, relate them to policies in the maturity model, and on that basis, make a self-assessment of their maturity level for each dimension included in the MM: Leadership & Governance, Preparedness, Infrastructure & Resources and Cooperation.

Three key user groups are as follows:

- Resilience Officer (should use it every 6 months in order to address a changing world) will use the MM as part of biannual evaluation of resilience planning and informed adjustment of strategic planning
- Politicians will use the MM systematically when a new city council or government is elected and annually before budget decisions to inform decision making prior to establishment of budgets
- Other organisational stakeholders: businesses, utilities etc. will use it as argument to 'sell' the value of prioritising measures in their interest over others stakeholders according to resilience maturity level

Connection to other SMR solution

The MM is supported by the RSQ in a number of ways. Firstly, the MM explicitly mentions the use of the RSQ. The use of the RSQ reflects a more sophisticated approach to risk assessment and thus indicates that a city is more mature when considering the 'preparedness' dimension of maturity. Secondly, the degree of risk awareness score, which is generated by the RSQ in addition to the risk score, helps cities to consider their knowledge of the risks that their city may face. Low risk awareness scores

may indicate lower maturity in the risk topic area being considered. And thirdly, the sets of policies that are built into the RSQ assist cities in determining their preparedness with respect to mitigating risk systemicity, enabling them to assess their level of maturity in this context.

In addition, the Resilience Building Policy Tool captures the relationships between the policies included in the MM and the risk mitigation policies included in the RSQ. Some of the MM policies also support the development of maturity and these will feed into the part of the Resilience Building Policy Tool that covers policies associated with maturity development. Finally, the SD Model integrates and connects these tools.

Status quo of the Resilience Maturity Model

The MM is completed and detailed information can be found in D3.1.

2.1.2. RISK SYSTEMICITY QUESTIONNAIRE (RSQ)

Aim of the Risk Systemicity Questionnaire

The RSQ is intended to help cities in their resilience building journey by providing a tool to support decision makers within the city anticipate and respond appropriately to future challenges. The RSQ does this by taking a novel approach to risk assessment through focusing on the dynamic interactions between risks (which are acute shocks and chronic stresses). Traditional approaches to risk management, such as risk registers, consider risks as independent from one another. However, such approaches fail to take account of the complex consequences and impacts that occur from the interactions between risks. The RSQ specifically supports cities in considering these complex consequences which can cause significant damage to a city. The tool promotes consideration of the dynamic interaction between risks and as a tool to facilitate focused communication and collaboration between different City teams and departments, and NGO's, with respect to risk assessment and mitigation.

Structure of the Risk Systemicity Questionnaire

The main elements of the RSQ:

- nine risk systemicity topics (each topic comprises between 8 to 15 risk scenarios)
- risk scores and awareness scores generated upon completion of each risk systemicity topic
- summary sheet showing a ranking of the risk and awareness scores and a summary of each of the user responses for every RSQ scenario

The risk systemicity topics in the RSQ can be explored as separate sheets in Excel, including such topics as health, flooding, or social cohesion. Each RSQ topic comprises between 8 to 15 risk systemicity scenarios which describe a chain of events that may occur in the user's city. For example, Figure 2-4 presents a risk scenario which appears under the 'social alienation' topic of the RSQ. In this risk scenario, a user is asked to consider whether it is likely that in their city the following chain of arguments may occur: social alienation in the city increases, leads to decreasing trust between citizens, leads to increasing citizens' loneliness, which reinforces increased social alienation within the city. Users would be asked to consider the occurrence of such a scenario over a set timeframe. Although this can be determined based on the specific context for which the RSQ is being used, during the work on the SMR project cities have found a period of 3-5 years a usual timeframe to consider. At the end of this risk scenario the chain of arguments returns to, and thus reinforces, the initial starting statement (increased social alienation) – which means that this is an example of a vicious feedback loop.

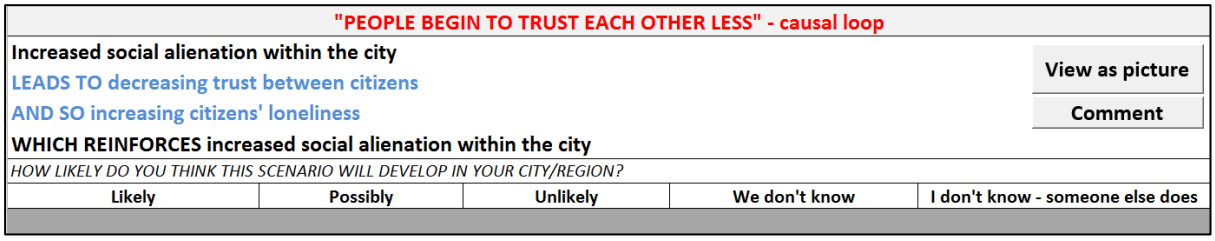

Figure 2-4: A vicious loop scenario in the RSQ

When completing the RSQ, for each scenario, a user is asked to consider the likelihood of the scenario happening in their city by selecting from one of five responses: 'likely' (to occur), 'possible', 'unlikely', 'we don't know but someone else (e.g. in my organization or project team) knows (if the risk event is likely to occur)', and 'I don't know'. Depending on the response, a risk score (an estimated risk level for the city) and an awareness score (the level of knowledge the city has about the possible risks) for individual risk scenarios are calculated. It should be noted that the RSQ was not designed as a technical risk diagnostic tool, but as a tool for facilitating group discussion, and therefore the calculation of the risk score and awareness score are only intended to allow for relative comparison between the RSQ topics, as well as to encourage further discussion. On that basis the calculations are not intended to provide objective risk scores that could be applied to anything beyond facilitating group discussion.

Furthermore, scenarios and topics in the RSQ interact with one another, which takes place in two different ways. Firstly, when an answer is given to a scenario as being unlikely to happen, if the scenario is a driver for other scenarios, it will disable (hide) those other scenarios which result from it. Secondly,

some scenarios belong to a number of different topics at the same time because they are relevant to those topics. However, when a scenario which interacts with a scenario under a different topic is completed by the user, then the same answer is also applied to that other scenario – and so the user does not need to complete the same scenario twice. In this way the RSQ scenarios capture the systemicity between different types of risks.

Another important feature of the RSQ is the summary sheet which allows the user to see the ranking of the scores, which they have received for each topic, as well as a summary of each of their answers for every RSQ scenario. This feature allows for a comparison of results, enabling prioritization of those areas that may require attention. In Figure 2-5, in the top half of the screen are listed the overall scores for each RSQ topic, with a green colored score signifying a positive outcome, and red color signifying a negative outcome (for the city). In the bottom half of the screen are listed the user's answers provided for the scenarios for each topic, with each different type of response highlighted by a different color.

Risk Systemicity Questionnaire

Risk Systemicity	Risk Level	Awareness Level	Rank by risk
Air Pollution	100%	100%	Rank by awareness level
Inequalities	75%	75%	
Social Alienation	50%	50%	
Social Cohesion	50%	50%	
Flooding	43%	61%	
Immigration	0%	100%	
Health	0%	100%	
Riots	no score yet	no score yet	
Ageing	no score yet	no score yet	

List of your answers to the RSQ topics

Climate change - flooding Hide/unhide	
FLOODING	I don't know-someone else does
INFORMAL SETTLEMENT IN FLOOD-PRONE AREAS	Likely
CITY WITHOUT SUSTAINABLE DRAINAGE SYSTEMS	Unlikely
DISRUPTION OF PUBLIC AND PRIVATE TRANSPORT IN THE FACE OF FLOODING	Unlikely
CITIZENS LOSE THEIR HOMES	Possible
SKILLED WORKERS LEAVE THE CITY	Likely
ELECTRICAL NETWORK OVERWHELMED	I don't know-someone else does
LOCAL BUSINESSES SUFFER FROM LACK OF ELECTRICAL POWER	Likely
LONG-TERM DECLINE IN SOIL HEALTH MEANS LESS LAND FOR FARMING IN THE REGION	I don't know-someone else does
LONG-TERM DECLINE IN SOIL HEALTH PUTS URBAN GREEN SPACE UNDER PRESSURE	I don't know-someone else does
EMERGENCE OF DISEASES RELATED TO INCREASED AMOUNTS OF STAGNANT WATER	We don't know
FLOODING LEADS TO NEW STRAINS OF DISEASES IN THE CITY	Unlikely
Climate change - air pollution Hide/unhide	
Health Hide/unhide	

Figure 2-5: RSQ summary sheet

Users of the Risk Systemicity Questionnaire

In general, the RSQ enables a wide variety of users to highlight future challenges for the city. The RSQ can be used as the basis for promoting and facilitating a designed and structured discussion about risk assessment and risk mitigation and thus support resource prioritization. The discussion would be across a small group responsible for assessing risk and its mitigation with respect to the city overall or with respect to a particular project. The process might be expected to help develop consensus and to flush out different perspectives on resilience.

Three key user groups are as follows:

- Resilience Office Team: The RSQ could be used regularly by the resilience office team to monitor the changing impact of risk scenarios on the city's resilience strategy. The RSQ could help to identify those areas of the city that require most attention with respect to resilience and thus help the team prioritize limited resources.
- Project Teams: The RSQ may prove useful for teams that are working on city projects that bring together a range of stakeholders from across the city. The RSQ could be used at the beginning of a project in order for the team to think differently about risks that may impact the success of their project.
- Engagement with City Stakeholders: the RSQ can be used as a way of raising consciousness among a wide set of city stakeholders. The RSQ would be the basis for focus group meetings involving, for example, pressure and voluntary groups seeking to help the city become more resilient. In particular, given the significance of social cohesion as a force for making a city more resilient, the RSQ could be used to promote discussion about the potential risks associated with a specific city concern, for example, social cohesion.

In each of these uses, participants can gain an appreciation of a range of perspectives with respect to risk, explore risk systemicity in the context of their own city and/or project and use the final evaluations as a basis for prioritizing resources for risk mitigation.

Connection to other tools

Firstly, the RSQ allows the assessment of a cities risk through the generation of a risk level. Secondly, it offers suggestions for mitigating actions with respect to the risk systemicity scenarios, and these mitigating actions contribute to the Resilience Building Policies tool. And thirdly, the RSQ supports cities when they are assessing their resilience maturity level. This is achieved through enabling cities

to consider how prepared they are based on the policies they already have in place to deal with identified risks. In addition, the risk awareness score generated by the RSQ provides an indication of the city's knowledge with respect to risks, with increased knowledge indicating higher maturity of a city in the specific risk area.

Status quo of the Risk Systemicity Questionnaire

The RSQ has been completed and detailed information can be found in D3.3.

2.1.3. RESILIENCE BUILDING POLICIES

Aim of the Resilience Building Policies

The aim of the tool is to offer a portfolio of policies that support the cities progression towards higher maturity levels. The tool will provide additional information on the MM policies to enable a city to understand what would be involved in adopting the policy.

Structure of the Resilience Building Policies

The following main elements are planned to be included in the solution:

- Case studies describing how cities implemented a MM policy.
- Links to mitigation actions to cope with risk scenarios that may be appropriate to deliver the policies.
- Related policies and related links (for example to the 100 Resilient Cities).
- References for the given policy.

The structure of the Resilience Building Policies solution was designed based on the web-based version of the MM (Figure 2-6). The Resilience Building Policies tool extends the MM by allowing the user to click on the policies in the MM and access further supporting information for that policy as detailed above.

Users of the Resilience Building Policies

It is anticipated that this solution will be utilized by users of the MM to drill down and find out further information on the policies contained in the MM (Figure 2-6). Where appropriate, it will also allow users to link MM policies with risks mitigation actions in the RSQ and thus to explore risk scenarios associated with the policies.

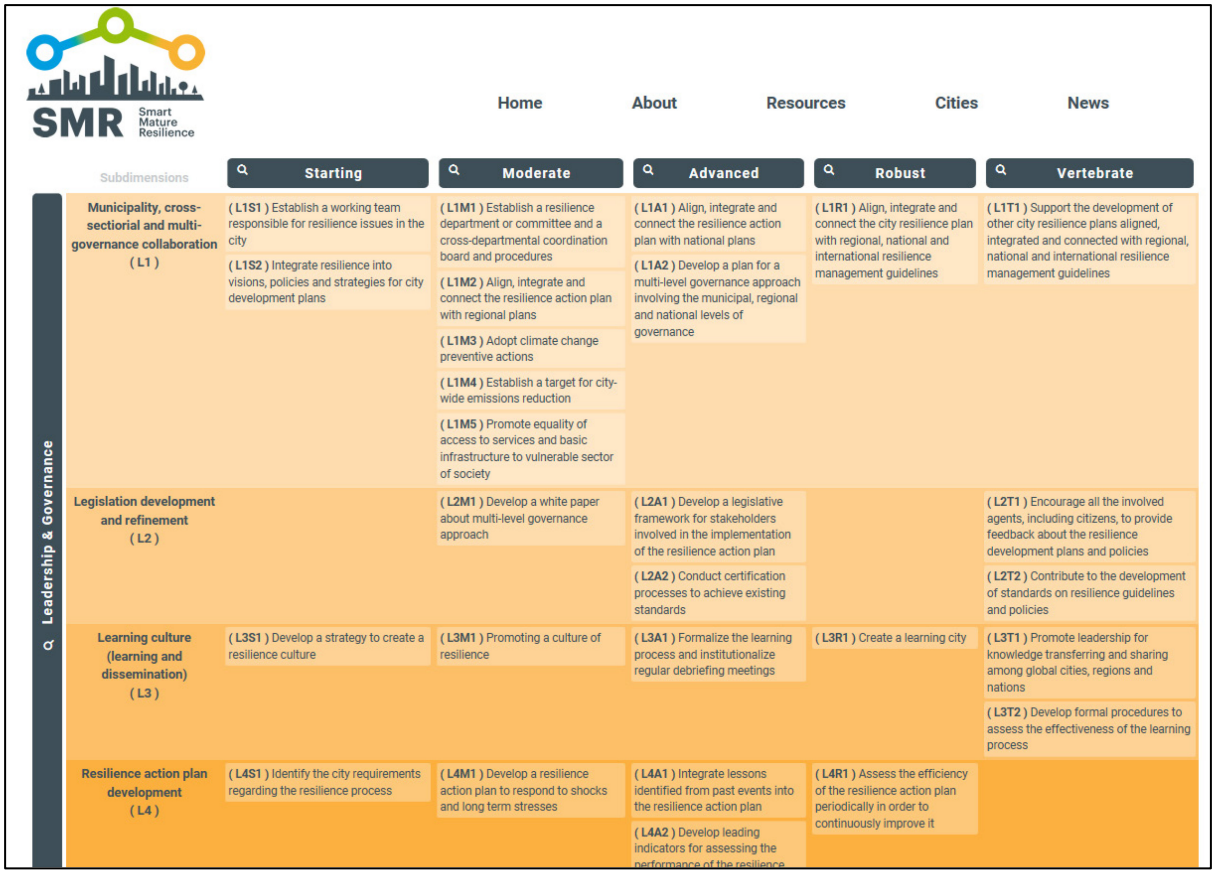

Figure 2-6: Section of the web-based version of the MM

Connection to other SMR tools

The solution extends and develops the existing policies in the MM and the mitigation actions in the RSQ. The solution also informs the portfolio of policies used in the SD Model, which simulates the implementation of Resilience Building Policies along different maturity levels.

Status quo of the Resilience Building Policies

The Resilience Building Policies is a solution which is currently under development. The initial work on the Resilience Building Policies has been described in D3.2, and a complete description of the solution will be provided in the forthcoming D3.4. The tool is expected to be available in draft form by the beginning of September. It will then be implemented in tier one cities. The final version will be ready in October 2017.

2.1.4. SYSTEM DYNAMIC MODEL (SD MODEL)

Aim of the System Dynamic Model

Cities continue to grow and as a consequence there is a need to build practical city resilience. There are several researches that define resilience policies and actions in order to achieve higher resilience levels [1]. However, none of these studies explain the inter-relations existing between the policies and their operationalization. Therefore, recent crisis and catastrophic events have led to an increase of awareness regarding the necessity of developing tools which facilitate decision makers and crisis managers to deal with crisis and become more resilient. Decision makers such as local governments or involved stakeholders demand tools which enable to train and learn from past experiences in order to get prepared for future disasters. As a consequence, the use of serious games (SG) for didactical uses has augmented lately. Society has evolved into a more interactive and practical one [3] and, therefore, the way knowledge is taught and interiorized by learners has changed [2]. In some cases the literature shows that the use of SG have failed their purpose whereas in other cases it shows the high benefits of using SG for didactical application [4].

In this context the SD Model has been developed to help a policy maker to be aware of the potential counter-intuitive consequences of applying different policies. SD Model has been developed with the aim of providing decision makers with a tool to train, experiment and understand real life scenarios. The main goal is to assist city policy makers to understand the structure of the whole system, to test out their dynamic implications and cascading effects of the proposed resilience building policies and their interactions, and also to alert about the possible unintended consequences that may arise as a consequence of potential vicious and virtuous cycles.

Structure of the System Dynamic Model

The main element of the SD Model is the MM and a user friendly interface which allows the user to obtain the input data and show the results.

Concerning its structure, the SD Model is divided into three screens:

- Initial state screen
- Decision screen
- Result screen

When the users enter the tool they go into the initial state screen where the purpose and functionalities of the game are briefly defined. In this screen the users need to choose the current maturity stage and the annual available budget. Although the annual available budget is predefined, the budget can be changed at any moment in any of the three screens. Furthermore, the main parameters of the model are also adjusted in this initial screen. The cost of implementing a policy, the implementation time and the depletion time of each policy are the main parameters that can be adjusted.

Once the initial situation is established, the users move to the decision screen and start playing. In this screen, as input for the SD Model, the users select how much money they allocate to each policy. The screen shows the list of resilience policies already defined in the MM, classified by the four resilience dimensions and five maturity stages. Moreover, a short explanation of each policy appears when the mouse is put over the policy. The annual budget will limit the maximum amount of resources the user is able to allocate. Apart from that, the indicators related to the current year of the game, the available annual budget and the budget left are showed as well as the buttons to change the available annual budget.

Figure 2-7: Result screen of the SD Model

Once the resources have been allocated, the user will simulate and the model will run for one year. The results of the simulation are shown in the third screen, results screen. The result screen shows the outcomes of the simulation based on the taken decision (see Figure 2-7). Depending on the

amount of resources allocated to each policy and the temporal order of the policies the implementation level of each policy will vary and consequently the resilience level of each dimension. At the top left hand of the screen the percentages of the current implementation, named 'Actual', and the efficiency of the implementation of the policies, named 'Effectiveness', are presented for each resilience dimension. The 'Actual' percentage represents the implementation level of the policy and 'Effectiveness' percentage represents the effectiveness level of the implementation. These two percentages aim to represent the consequences of the relationships existing between the policies. Therefore, if policies are not implemented in the correct order percentages will show low effectivity and implementation level in comparison to what the user has decided in the decision-screen. Below this table, the speedometers are used to indicate the maturity stage the user has achieved in each resilience dimension. The speedometers start at 0 and go from the starting stage to vertebrate passing through moderate, advance and robust (S, M, A, R, T). Moreover, at the top right hand of the screen resilience dimension's implementation level results are presented through time evolution graphs. The simulation ends at 40 years, therefore time cannot be greater than 40 and the level of implementation is complete when the 100% is achieved.

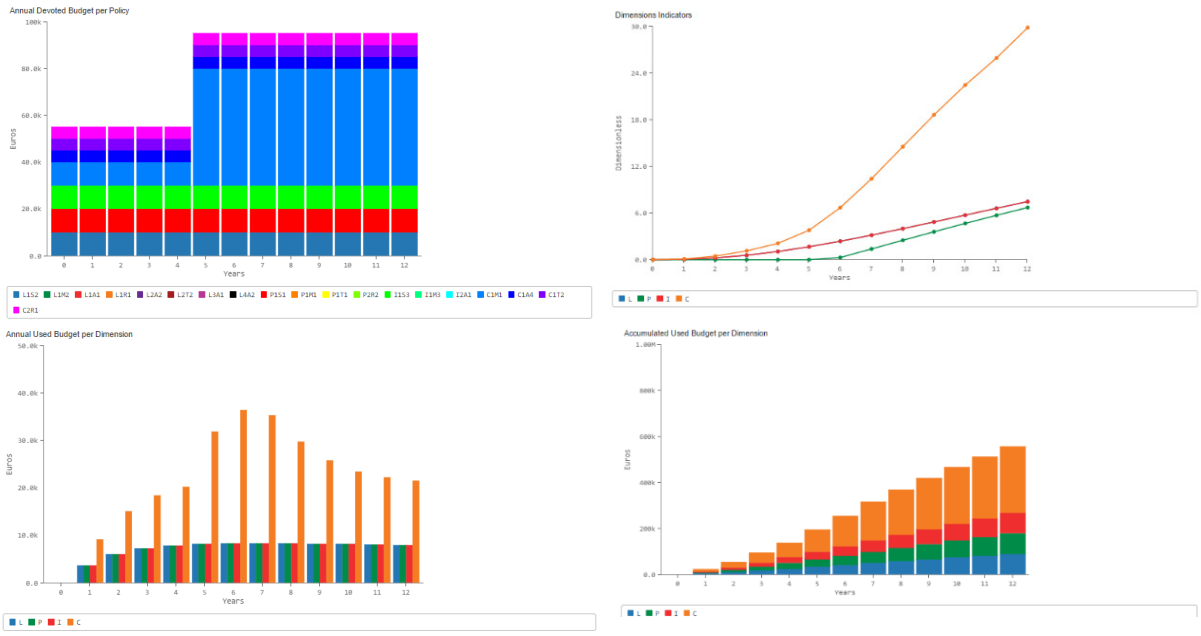

Figure 2-8: Additional result screen of the SD Model

Bellow the graph, the evolution of the used total budget is represented through a time evolution graph where the time is represented in years and the budget in Euros. Furthermore, on the bottom of the screen the current simulation year, the available annual budget, the left budget and the button that

gives the possibility to change the annual budget are shown. Furthermore, the buttons to step forward one year, to begin a new scenario and to go back to the decisions-screen are also represented.

Apart from that, when clicking on the top right button called 'Current scenario details' more detailed information concerning how the budget has been invested can be found (see Figure 2-8). In this additional result screen, graphs regarding the level of implementation of the policies and the evolution of the spent budget are shown. The graph representing the implementation level resumes how the resilience dimensions have evolved over time per dimension. Below, the graphs concerning budget represent the accumulated budget per resilience dimension, annual devoted budget per policy and annual devoted budget per resilience dimension.

Users of the System Dynamic Model

The user group of the SD Model is cities, specifically people who work on strategic levels with a holistic perspective with respect to building resilience.

Connection to other tools

The SD Model integrates and connects the MM and the Resilience Building Policies tool. The maturity development policies link into the SD Model where the dynamics between the MM policies are explored. Furthermore, the SD Model helps to understand the MM and the temporal order of implementation of the policies and learn from the resilience building process, targeting to make aware decision makers about the policies' interrelationships, their dynamic behaviour and the possible unintended consequences that may arise due to these precedence relationships.

Status quo of the System Dynamics Model

The SD Model is in test phase. It's expected to be finished by October 2017 with the D3.5.

2.1.5. ENGAGEMENT AND COMMUNICATION TOOL

Aim of the Engagement and Communication Tool

Building a resilience backbone requires collaboration and the constant as well as timely exchange of information. This leads to extensive requirements towards IT systems that support such activities. However, it is not possible to build resilience into a society the same way as an information system can be designed with resilient functionality in mind. Rather, municipal resilience can be reached through a many-step process in which a wide variety of actions are taken. Despite the technological

dimension being relatively straightforward, decision makers in municipal resilience typically have no profound IT background. In fact, due to the great reliance of resilience efforts on information systems support, a municipal IT strategy must go hand-in-hand with activities such as the implementation of resilience-related policies. To support cities in this IT endeavours, and to integrate the SMR solutions under a common platform, an engagement and communication tool has been envisioned.

Structure of the Engagement and Communication Tool

It is a Web-based information system that supports communication and collaboration activities within a city, between a city and its resilience-related stakeholders, and between a city and its citizens. Moreover, the citizens should also be engaged and eventually empowered through the portal. Cities can use a Resilience Information Portal as an extension to the municipal Website or as a stand-alone portal. A visual information portal example is shown in Figure 2-7 and Figure 2-8 through the City of Kristiansand. It should not only provide resilience-related information such as emergency plans but act as a tool the unified the resilience-related IT systems. For this purpose, diverse communication and collaboration functionality should either be embedded or linked from the portal, regardless of whether such functionality already exists in the IT or will be installed as part of the efforts to become more resilient. Moreover, the portal also offers the chance to integrate information systems that so far stand alone. This particularly concerns tools such as geographical information systems. Ideally, the portal should not merely provide access to these systems but allow their semantic integration. To give an example: data from an information system showing water levels in rivers could be feed into a map, which is populated with live data on resilience-relevant infrastructure from another system.

The Resilience Information Portal provides the basic functionality of a Web-based portal (a publicly available Web application following the ideas of a portal). It can host both static and dynamic content. For the latter, data structures can be defined to provide a high level of flexibility and versatility. Moreover, the portal needs to be capable to use data from external sources. Content should be easy to edit also for non-IT staff. To satisfy the idea of integration, the portal must provide extended possibilities for interlinking with other IT systems. Due to the heterogeneity of users, access rights must be controllable with a role concept. Finally, the portal should offer a so-called emergency mode, setting up a single home page with live information that is to be used in case of serious crises.

There are several notable quality requirements for the portal. It must be user-friendly and intuitive, and provide a good level of accessibility. To support future growth, it must be scalable, extensibility, and maintainable. Moreover, it needs to offer a sufficient level of security.

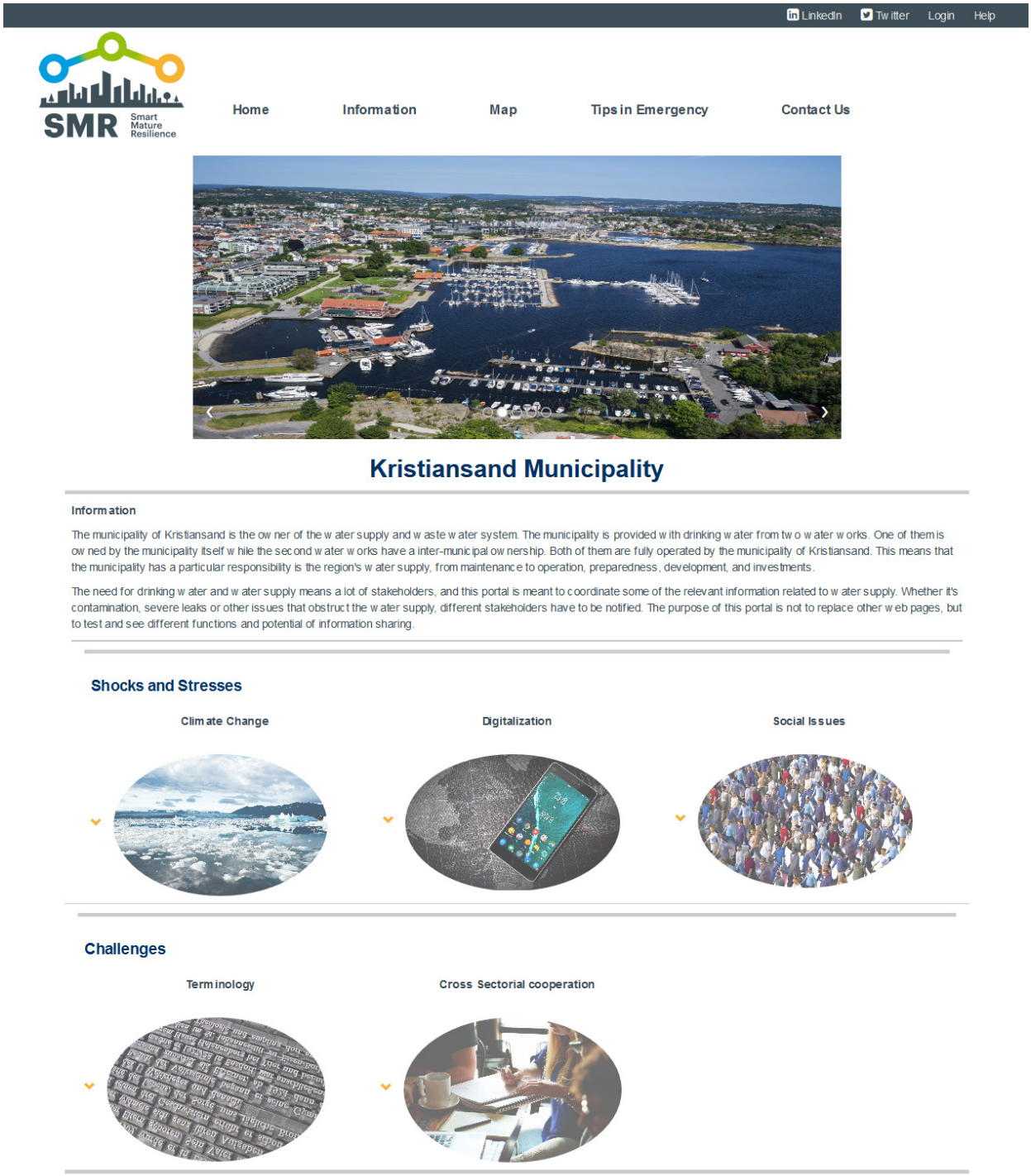

Figure 2-9: Screenshot of Kristiansand's Information Portal (Part 1/2)

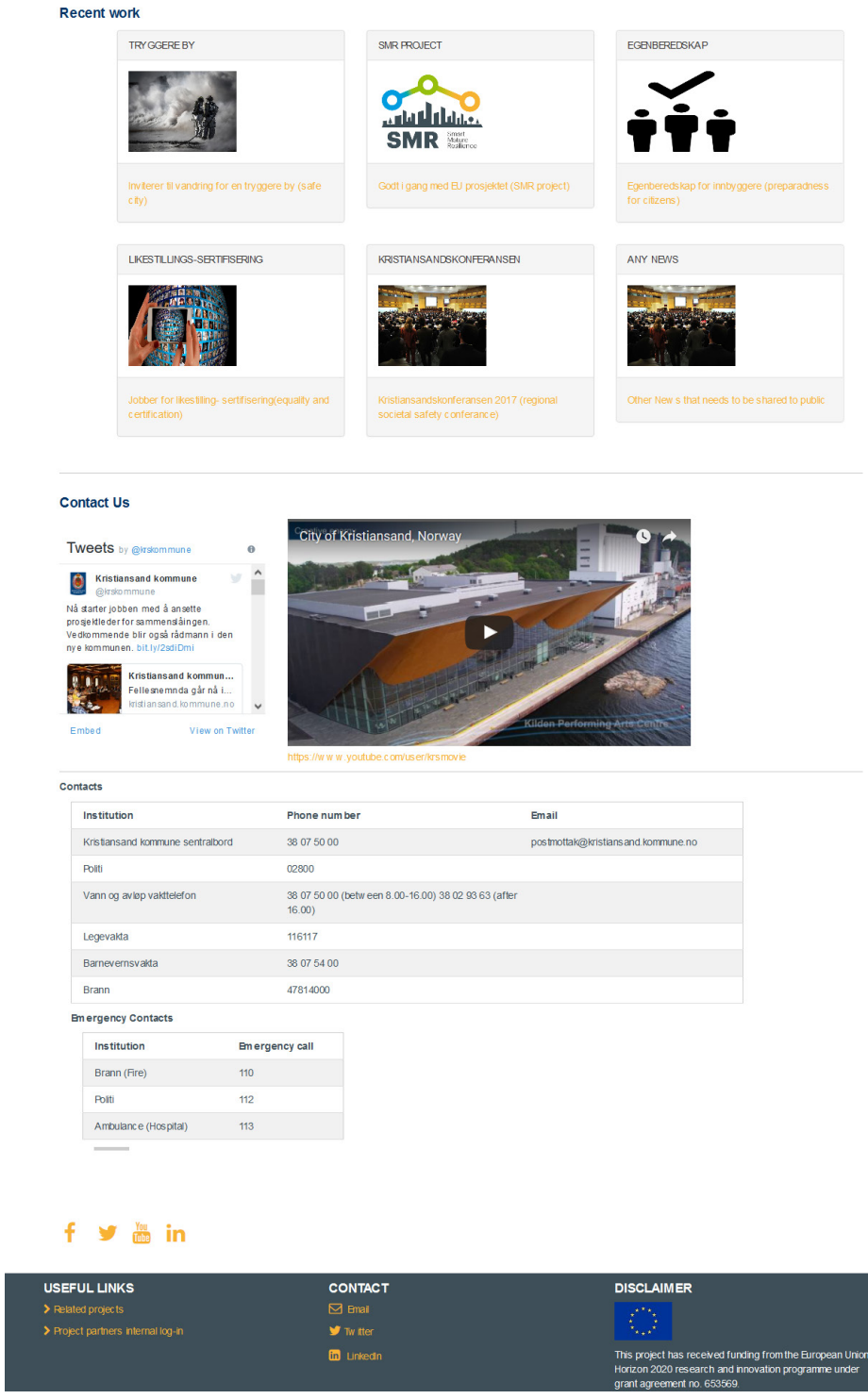

Figure 2-10: Screenshot of Kristiansand's Information Portal (Part 2/2)

Connection to other tools

First, the portal can be seen as the foundation tool in the project as it can host or embed the remaining four SMR solutions and thereby make them available to potential city users. Second, since the portal can contain arbitrary municipal information, it makes sense to heavily interlink the tool, pointing citizens, stakeholders and city council members at the relevant details of municipal resilience embodied by the SMR tools. To be more concrete:

- The MM stages can be interlinked from the portal when they are named, respectively. The same applies to the Resilience Building Policies. Deep links can make it easy to navigate them, e.g. when reporting on current resilience-related activities on the portal.
- The SD Model can be integrated as an example of a gamification approach.
- Finally, the RSQ might be provided in adapted versions for stakeholders, and later probably even for citizens.

The development process of the portal, the background of the work on communication, collaboration and engagement and the design principles have been described in D4.1, D4.2 and D4.3. The latter two also contain subsequent versions of the functional specification of the portal. Moreover, D4.4 describes the usage of the portal prototype.

Status quo of the Engagement and Communication Tool

The portal toolbox is completed and has been implemented in the three tier one cities. Strictly speaking, a software product that will be used for a longer period never reaches the state of being fully finished, but needs to be continuously updated. Anyhow the portal is finished and provides the functionality requested by the cities. Cities have also begun implementing city specific portals that take into account features of the portal.

2.1.6. EUROPEAN RESILIENCE MANAGEMENT GUIDELINE (ERMG)

Aim of the European Resilience Management Guideline

Based on the concept for pilot implementation and the experiences made during the pilot implementation, a European Resilience Management Guideline (ERMG) is going to be developed. The solution intends to strengthen cities resilience and to provide an integrated approach for resilience building activities at city level. The lessons learned from five pilot implementation processes will be integrated in the finalization of the ERMG. During the last months of the SMR project, and following the five pilot

implementation processes, a systematic review and assessment of the state of the art of all the five resilience tools will be made and this will also be combined with management ideas and concepts. This will be the basis for the deployment of the ERMG. The Guideline, which will be the final, exploitable deliverable of the project, will also include indicators and clearly defined guidelines for cities at the different stages of resilience maturity, and with clear focus on the SMR key topics, therefore, operationalizing and evaluating processes closely related to critical infrastructure, social dynamics and climate change. The ERMG adopts a highly co-creative and synergic approach towards the definition of resilience for cities that deploy all their forces and transform collaboration among city governance, stakeholders and emergency services into effective decision-making processes regarding local adaptation and resilience planning.

Structure of the European Resilience Management Guideline

The Guideline is currently under development, at the time being no statement can be made. A possible, preliminary structure of the Guideline, which will integrate all five SMR solutions in a cyclical approach, is as follows:

1. Baseline assessment
2. Risk awareness
3. Identification and description of policy types by maturity stage
4. Establishment of prioritisation of policy types
5. Mapping of policies for priority implementation for both resilience and risk and setting up the implementation of resilience building activities
6. Replication of existing use cases for each policy
7. Integration of communication platforms and engagement with relevant city stakeholders

Starting with an initial assessment of the city's current resilience status and some standard processes like vulnerability assessment, stakeholder mapping etc., the ERMG users pose the city within a stage of the MM. Then, using the RSQ, they may identify interconnected risks and understand the general risk environment. In the process, using the SD Model and the MM, the ERMG users can support their strategic planning decisions, while a subsequent combined use of the SD Model and the Resilience Policies Tool can further define the ideal path the city needs to take in order to move in the most advanced resilience stage of the MM. Throughout this process, the Resilience Information Portal may be used to foster user engagement, strengthen stakeholder involvement and integrate all the tools in a user-friendly, common platform.

Users of the European Resilience Management Guideline

- City Representatives and municipal employees engaged in sustainability, climate adaptation, resilience, environmental planning, strategic planning by providing guidance and training on resilience
- Decision Makers (EU, national, regional, local) and critical infrastructure (CI) managers by improving the current EU guidelines
- City Stakeholders involved in resilience activities by supporting their local decision making and complimenting their planned activities
- Citizens, NGOs, Associations, Volunteers by supporting their local decision making through providing knowledge and solutions

Connection to other tools

The ERMG is intended to encompass and combine all SMR solutions in an integrated management approach. The Guideline integrates all the SMR solutions and their qualities and creates a more complex, but also complete framework, enabling the users to work collectively on combined resilience building activities at city level. In each step of the guideline, a combination of different tools is being used, while some already used tools can be re-used in subsequent steps. The relation between the different solutions, within the ERMG, is in Figure 2-9.

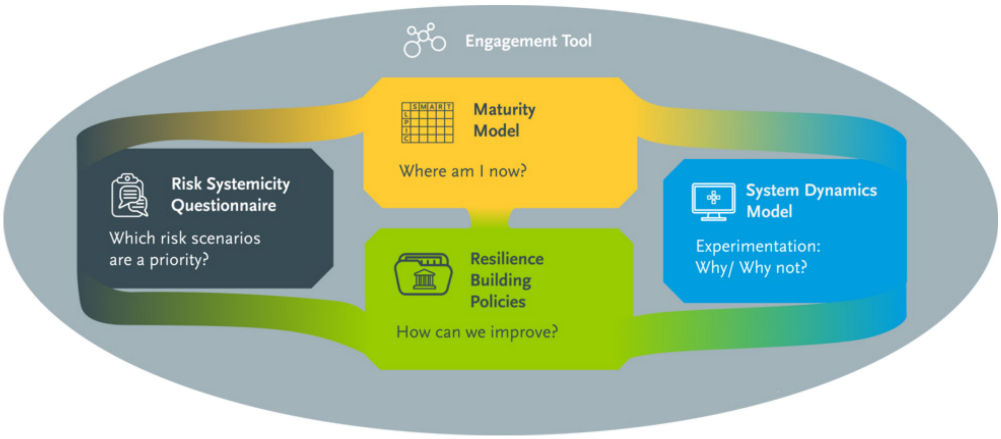

Figure 2-11: Integrated approach of the ERMG

Status quo of the European Resilience Management Guideline

The ERMG is expected to be ready in March 2018 with the D5.9 ‘Resilience Management Guideline’.

2.2. IMPORTANT PROJECT RELEVANT STANDARDS

In order to identify the standardization potential, the list of already identified standards from the D6.1 'Existing Standards and Standardization Activities Report' was reviewed and expanded with the analysis of newly published standards that where released in the last year. In total the updated analysis of existing standards and ongoing standardization activities includes the review of 72 as important identified standards as well as the assessment of 11 newly published standards.

2.2.1. ASSESSMENT OF STANDARDS

The project partners, which were mainly involved in task 6.1 (TECNUN, CIEM and ICLEI), indicated the importance of each standard by classifying their relevance to the project with regard to the following four criteria’s: Project relevance, connection to sustainability, impact and effectiveness. For further information see D6.1 'Existing Standards and Standardization Activities Report. These standards were also evaluated by the project partners in relation to the five SMR solutions and the EMRG.

This task was completed by also drawing on the newly published standards. The following subchapters give an overview of the results of this analysis. As a result of this work, some of the standards originally classified as being relevant to the broadly understood aims of the project had to be excluded because they were not seen as being relevant to the specific characteristics of the SMR solutions. Thus the project partners considered 18 out of the original 72 standards as being no longer relevant – this can be explained by the evolution of the SMR solutions during the course of the project. From the 11 newly published standards were all addressed as relevant for the SMR project.

2.2.2. CATEGORY 'CRISIS'

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
ITU-T E.106	International Emergency Preference Scheme (IEPS) for disaster relief operations	This Recommendation describes an international preference scheme for the use of public telecommunications by national authorities for emergency and disaster relief operations. The International Emergency Preference Scheme for Disaster Relief Operations (IEPS) is needed when there is a crisis situation causing an increased demand for telecommunications when use of the International Telephone Service may be restricted due to damage, reduced capacity, congestion or faults. In crisis situations there is a requirement for IEPS users of public telecommunications to have preferential treatment.	2003-10-00	MM, RSQ, Communication and Engagement Tool
ITU-T E.409	Incident organization and security incident handling: Guidelines for telecommunication organizations	The purpose of this Recommendation is to analyse, structure and suggest a method for establishing an incident management organization within a telecommunication organization involved in the provision of international telecommunications, where the flow and structure of an incident are focused. The flow and the handling are useful in determining whether an event is to be classified as an event, an incident, a security incident or a crisis. The flow also covers the critical first decisions that have to be made.	2004-05-00	MM, RSQ, Communication and Engagement Tool
CWA 15537	Network Enabled Abilities - Service-Oriented Architecture for civilian and military crisis management	This CWA specifies services and other items mandatory or optional for a Network Enabled Abilities environment. It also includes an inventory of standards and standard-like specifications applicable to each such item. These items include recommended general principles and framework for system design, overall architectures, generic functionality to be considered, concepts, conventions, and terminology in order to ensure an optimum multi-purpose interoperability, in particular of national and multi-national military and civil operations. This CWA is applicable to the full life cycle of information system abilities for network centric operations, including specification, development, deployment, registration, and execution.	2006-04-01	MM, RSQ, Communication and Engagement Tool
ISO 31000	Risk Management - Principles and guidelines	This International Standard provides principles and generic guidelines on risk management. This International Standard can be used by any public, private or community enterprise, association, group or individual. Therefore, this International Standard is not specific to any industry or sector. This International Standard can be applied throughout the life of an organization, and to a wide range of activities, including strategies and decisions, operations, processes, functions, projects, products, services and assets. This International Standard can be applied to any type of risk, whatever its nature, whether having positive or negative consequenc-	2009-11-00	MM, RSQ

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
		es. This International Standard is not intended for the purpose of certification.		
ISO/IEC 31010	Risk management - Risk assessment techniques	This Standard is a supporting standard for ISO 31000 and provides guidance on selection and application of systematic techniques for risk assessment. Risk assessment carried out in accordance with this standard contributes to other risk management activities. The application of a range of techniques is introduced, with specific referances to other international standards where the concept and application of techniques are describes in greater detail.	2009-11-00	MM, RSQ
ISO Guide 73	Risk management - Vocabulary	This guide provides the definitions of generic terms related to risk management. It aims to encourage a mutual and consistent understanding of, and a coherent approach to, the description of activities relating to the management of risk, and the use of uniform risk management terminology in processes and frameworks dealing with the management of risk. This Guide is intended to be used by:- those engaged in managing risks,- those who are involved in activities of ISO and IEC, and- developers of national or sector-specific standards, guides, procedures and codes of practice relating to the management of risk.	2009-11-00	All
ARP 6:2010	Guidelines for the management of drinking water utilities under crisis conditions	Identifies and charts the critical elements that are of great significance to drinking water security. Sets in motion a continuous process for the establishment of guidelines on management systems for drinking water utilities under crisis conditions. Provides the guidelines for a water utility, or any body responsible for the management of parts of the water supply system, to be prepared and ready to manage a water crisis. Provides a roadmap for possible relevant international standards that could be useful and could be developed.	2010-07-28	All
ISO 22320	Societal security - Emergency management - Requirements for incident response	This International Standard specifies minimum requirements for effective incident response and provides the basics for command and control, operational information, coordination and cooperation within an incident response organization. It includes command and control organizational structures and procedures, decision support, traceability, information management, and interoperability. It establishes requirements for operational information for incident response which specifies processes, systems of work, data capture and management in order to produce timely, relevant and accurate information. It supports the process of command and control as well as coordination and cooperation, internally within the organization and externally with other involved parties, and specifies requirements for coordination and cooperation between organizations.	2011-11-00	MM, RSQ, Communication and Engagement Tool

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
CEN/TS 16595	CBRN - Vulnerability Assessment and Protection of People at Risk	This Technical Specification is based on an all-hazards approach, with a specific focus on terrorism and other security related risks. Looking at the combination of threats, vulnerabilities and values to be protected, threats may be terrorist attacks with chemical, explosive and biological agents, or nuclear waste materials, or with conventional means on CBRN plants, causing a similar devastating effect on a potentially large scale. Major CBRN incidents may jeopardise critical infrastructure, while emergency services may have great difficulty performing their response tasks. The scope excludes the vulnerability assessment of some specific systems that comply, at the European and Member State level, with existing sets of legal measures: network for drinking water distribution, food chain supply and cosmetics and pharmaceutical products production and distribution chains. The objective of this Technical Specification is to strengthen common understanding and a common frame of reference for all organisations with an interest and involvement in CBRN.	2013-09-00	MM, RSQ
EN 15975-2	Security of drinking water supply - Guidelines for risk and crisis management - Part 2: Risk management	This document specifies the good practice principles of risk management within the corporate drinking water supply management to improve the security of drinking water supply and to reduce possible effects from hazards.	2013-08-00	MM
ISO/TR 31004	Risk management - Guidance for the implementation of ISO 31000	This Technical Report provides guidance for organizations on managing risk effectively by implementing ISO 31000:2009. It provides: This Technical Report can be used by any public, private or community enterprise, association, group or individual. This Technical Report is not specific to any industry or sector, or to any particular type of risk, and can be applied to all activities and to all parts of organizations.	2013-10-00	MM, RSQ
ISO/IEC 30111	Information technology - Security techniques - Vulnerability handling processes	This International Standard gives guidelines for how to process and resolve potential vulnerability information in a product or online service. This International Standard is applicable to vendors involved in handling vulnerabilities.	2013-11-00	RSQ
BS 11200	Crisis management. Guidance and good practice	Guidance and good practice which offers guidance to help management plan, establish, operate, maintain and improve their organizations crisis management capability.	2014-05-31	MM, RSQ
EN ISO 22301	Societal security - Business continuity management systems - Requirements (ISO 22301:2012)	This International Standard for business continuity management specifies requirements to plan, establish,implement, operate, monitor, review, maintain and continually improve a documented management system to protect against, reduce the likelihood of occurrence, prepare for, respond to, and recover from disruptive	2014-07-00	MM, RSQ, Communication and Engagement Tool

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
		incidents when they arise. The requirements specified in this International Standard are generic and intended to be applicable to all organizations, or parts thereof, regardless of type, size and nature of the organization.		
EN ISO 22313	Societal security - Business continuity management systems - Guidance (ISO 22313:2012)	This International Standard for business continuity management systems provides guidance based on good international practice for planning, establishing, implementing, operating, monitoring, reviewing, maintaining and continually improving a documented management system that enables organizations to prepare for, respond to and recover from disruptive incidents when they arise.	2014-11-00	MM, RSQ, RMG
ISO 22315	Societal security - Mass evacuation - Guidelines for planning	ISO 22315:2014 provides guidelines for mass evacuation planning in terms of establishing, implementing, monitoring, evaluating, reviewing, and improving preparedness. It establishes a framework for each activity in mass evacuation planning for all identified hazards. It will help organizations to develop plans that are evidence-based and that can be evaluated for effectiveness. ISO 22315:2014 is intended for use by organizations with responsibility for, or involvement in, part or all of the planning for mass evacuation.	2014-12-00	MM, RSQ, Communication and Engagement Tool
ISO/IEC 29147	Information technology - Security techniques - Vulnerability disclosure	This International Standard gives guidelines for the disclosure of potential vulnerabilities in products and online services. It details the methods a vendor should use to address issues related to vulnerability disclosure.	2014-02-00	MM, RSQ, RMG, Communication and Engagement Tool
ISO 22322	Societal security - Emergency management - Guidelines for public warning	ISO 22322:2015 provides guidelines for developing, managing, and implementing public warning before, during, and after incidents. This International Standard is applicable to any organization responsible for public warning. It is applicable at all levels, from local up to international. Before planning and implementing the public warning system, risks and consequences of potential hazards are assessed. This process is not part of this International Standard.	2015-05-00	MM, RSQ, Communication and Engagement Tool
ISO 22324	Societal security - Emergency management - Guidelines for colour-coded alerts	ISO 22324:2015 provides guidelines for the use of colour codes to inform people at risk as well as first response personnel about danger and to express the severity of a situation. It is applicable to all types of hazard in any location. This International Standard does not cover the method for displaying colour codes, detailed ergonomic considerations related with viewing displays, or safety signs covered by ISO 3864-1.	2015-06-00	MM, RSQ

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
EN 15975-1+A1	Security of drinking water supply - Guidelines for risk and crisis management - Part 1: Crisis management	This European standard describes good practice principles of drinking water supply management in the event of a crisis, including preparatory and follow-up measures.	2015-12-00	All
ISO 22325	Societal security - Emergency management - Guidelines for emergency management capability assessment	This International Standard provides guidelines to perform an emergency management capability assessment.	2016-10-00	MM, RSQ, RMG

2.2.3. CATEGORY 'RESILIENCE'

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
ARP 22399	Societal security - Guideline for incident preparedness and operational continuity management	Provides general guidance for an organization - private, governmental, and non-governmental organizations - to develop its own specific performance criteria for incident preparedness and operational continuity, and to design an appropriate management system. Provides a basis2010 for understanding, developing and implementing continuity of operations and services within an organization, and confidence in business, community, customer, first responder and organizational interactions. Also enables the organization to measure its resilience in a consistent and recognized manner.	2008-06-25	MM, RSQ, SD Model
DS 3001	Organizational resilience: Security, preparedness, and continuity management systems - Requirements with guidance for use	This Standard specifies requirements for an organizational resilience (OR) management system to enable an organization to develop and implement policies, objectives, and programs taking into account legal requirements and other requirements to which the organization subscribes, information about significant hazards and threats that might impact it and its stakeholders', and protection of critical assets (physical, intangible, environmental, and human).	2009-10-24	MM, SD Model
PAS 2015	Framework for health services resilience	Publicly Available Specification (PAS) 2015 recommends techniques for improving and maintaining resilience for NHS-funded organizations that build on the activities that are already in progress within the organization.	2010-10-21	MM, RSQ
ANSI/ASIS SPC.4	Maturity Model for the Phased Implementation of the Organizational Resilience Management System	Provides guidance for the use of a maturity model for the phased implementation of ANSI/ASIS SPC.1-2009, as a series of steps designed to help organizations evaluate where they currently are with regards to resilience management and preparedness; set goals for where they want to go; and plot a business/mission	2012-00-00	MM

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
		appropriate path to get there.		
BS 65000	Guidance on organizational resilience	BS 65000 defines organizational resilience as the ability to anticipate, prepare for, respond and adapt to events – both sudden shocks and gradual change. That means being adaptable, competitive, agile and robust.	2014-11-30	MM
ISO 37101	Sustainable development of communities - Management systems - Requirements with guidance for resilience and smartness	Under development - by ISO/TC 268 - Sustainable development in communities	2016-07-00	MM, RSQ, Communication and Engagement Tool

2.2.4. CATEGORY 'CRITICAL INFRASTRUCTURES'

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
EN ISO 24978	Intelligent transport systems - ITS Safety and emergency messages using any available wireless media - Data registry procedures (ISO 24978:2009)	This International Standard provides a standardized set of protocols, parameters, and a method of management of an updateable "Data Registry" to provide application layers for "ITS Safety messages" using any available wireless media.	2009-10-00	Communication and Engagement Tool
ISO/IEC 27031	Information technology - Security techniques - Guidelines for information and communication technology readiness for business continuity	ISO/IEC 27031:2010 describes the concepts and principles of information and communication technology (ICT) readiness for business continuity, and provides a framework of methods and processes to identify and specify all aspects (such as performance criteria, design, and implementation) for improving an organization's ICT readiness to ensure business continuity.	2011-03-00	Communication and Engagement Tool, SD Model
ISO/IEC 27032	Information technology - Security techniques - Guidelines for cybersecurity	This International Standard provides guidance for improving the state of Cybersecurity, drawing out the unique aspects of that activity and its dependencies on other security domains, in particular:- information security,- network security,- internet security, and- critical information infrastructure protection (CIIP). It covers the baseline security practices for stakeholders in the Cyberspace.	2012-07-00	Communication and Engagement Tool, SD Model
CEN/TS 16850	Societal and Citizen Security. Guidance for managing security in healthcare facilities	The standard will specify requirements for planning, establishing, implementing, operating, monitoring, reviewing, maintaining and continually improving a documented security management system in healthcare facilities.	2015-11-27	MM

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
EN 13200-8	Spectator facilities - Part 8: Safety Management	This European standard specifies general characteristics regarding infrastructure and safety management in spectator facilities. It specifies the layout and the planning of the management, the criteria to maintain this planning before, during and after any event. It covers the following: - the safety personnel; - Safety Policy - A document developed, reviewed and monitored by the event organiser or senior management; - Safety Procedures - An operational and emergency plan, containing roles and responsibilities, staffing levels, risk assessments, medical provisions and contingencies.	2015-02-00	MM, RSQ
DIN SPEC 91330	Terminology relating to events in pipeline- and cable-based infrastructures	This DIN SPEC defines concepts to describe, prepare for and deal with events occurring in gas, water, waste water and district heating networks. The definitions are intended first and foremost to provide the basis for communication between system operators in the same utility sector and in different sectors.	2015-08-00	MM, RSQ
EN 16747	Maritime and port security services	This European Standard is a service standard that specifies requirements for quality in organization, processes, staff and management of a security services provider and/or its independent branches and establishments under commercial law and trade as a provider with regard to port and maritime security services.	2015-09-00	MM

2.2.5. CATEGORY 'CLIMATE CHANGE'

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
CSA ICT Protocol - Version 1	ICT greenhouse gas reduction project protocol: Quantification and reporting - Version 1	Recognizing the impact of ICT on the environment and the increasing attention being placed on sourcing ICT with a low environmental footprint, CANARIE funded a project to initiate a consortium of industrial and commercial enterprises, universities, and government agencies with the common goal of reducing GHG emissions associated with ICT services. Part of this project included the development of a Protocol involving the quantification of emission reductions achieved by reducing greenhouse gas emissions associated with ICT services, either by moving to a lower carbon environment or by improving workload efficiency. The protocol was intended specifically to help in the potential creation of certified, and eventually	2012-00-00	MM, RSQ, Resilience Building Policies

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
		verified, emission reductions resulting from the delivery of low or zero greenhouse gas emissions associated with ICT services.		
ITU-T F.747.2	Deployment guidelines for ubiquitous sensor network applications and services for mitigating climate change	Recommendation ITU-T F.747.2 provides deployment guidelines for ubiquitous sensor network (USN) applications and services for mitigating climate change.	2012-06-00	MM, RSQ
BIP 2178	Climate change adaptation	Adapting to climate risks using ISO 9001, ISO 14001, BS 25999 and BS 31100	2014-03-10	MM, RSQ,
DIN SPEC 35810	Stakeholder Engagement - Guidelines for decision making processes dealing with climate change	This DIN SPEC (PAS) provides guidance and recommendations in stakeholder engagement in climate change decision-making. This DIN SPEC is applicable to organisations from the public and private sectors, including federal and local governmental agencies, companies, firms, industries, communities and non-governmental organisations. It is developed in a user-friendly manner, setting out principles and instructions in a straightforward step-by-step guide with which organisations can engage stakeholders in the decision-making process.	2014-11-00	MM, RSQ, Communication and Engagement Tool
DIN SPEC 35811	Scenario Planning - Guidelines for decision making processes dealing with climate change	DIN SPEC 35811 will assist (small and medium sized) enterprises from all fields to adapt to future challenges. It is applicable to companies, industries, and private and public sector organizations. Companies without a strategy department are especially set to benefit from the application. Within a scenario process companies identify future challenges that might shape their business, such as climate change, demographic change, or technological change. They develop possible pictures of the future, based on these, derive potential adaptation measures. In this multistep process, the companies are optionally accompanied by consultants. The process itself can be implemented either individually or within a group of companies. Furthermore, the PAS is related to the ISO 14000 Standard series on environmental management systems, especially DIN EN ISO 14001.	2014-08-00	MM, RSQ, Communication and Engagement Tool
ITU-T L.1500	Framework for information and communication technologies and adaptation to the effects of climate change	Recommendation ITU-T L.1500 describes a framework for information and communication technologies (ICTs) and adaptation to the effects of climate change.	2014-06-00	MM, RSQ
ITU-T L.1501	Best practices on how countries can utilize ICTs to adapt to the effects of climate	Recommendation ITU-T L.1501 provides guidance on how information and communication technologies (ICTs) can help countries to adapt to the effect of climate change. It also provides a framework and a checklist for countries to integrate	2014-12-00	MM, RSQ, Communication and

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
	change	ICTs in their national climate change adaptation strategies.		Engagement Tool
DIN SPEC 35220	Adaption to climate change - Projections on climate change and ways for handling uncertainties	This specification should encourage and support the discussion about climate protection and adaptation to climate change as one of the major challenge for all social circles.	2015-11-00	MM, RSQ, SD Model

2.2.6. CATEGORY 'SOCIAL ASPECTS'

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
ONR 192400	Business Continuity and Corporate Security Management - Requirements for the qualification of the Business Continuity and Security Manager	Specifies the requirements for the qualification of the Business Continuity and Security Manager.	2009-11-15	MM, RMG
ISO 22398	Societal security - Guidelines for exercises	This International Standard recommends good practice and guidelines for an organization to plan, conduct and improve its exercise projects which may be organized within an exercise programme.	2013-09-00	MM, SD Model
ANSI/APCO 1.112.1	Best Practices for the Use of Social Media by Public Safety Communications	Social media is a common form of communication used by agencies and agency employees. This standard provides guidance on the use of social media for developing specific local procedures (ex: Facebook, Twitter, Instagram, Google+, etc.).	2014-00-00	MM, Communication and Engagement Tool
EN ISO 22300	Societal security - Terminology (ISO 22300:2012)	Terms and definitions applicable to societal security to establish common understanding so that consistent terms are used.	2014-07-00	MM
ISO 22397	Societal security - Guidelines for establishing partnering arrangements	ISO 22397:2014 provides guidelines for establishing partnering arrangements among organizations to manage multiple relationships for events impacting on societal security. It incorporates principles and describes the process for planning, developing, implementing and reviewing partnering arrangements.	2014-07-00	MM, RSQ

2.2.7. CATEGORY 'SMART CITY'

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
EN 14892	Transport service - City logistics - Guideline for the definition of limited access to city centers	This European Standard establishes a code of best practice for the definition and application of measures designed to ensure the efficient and the environmentally acceptable movement of transport in cities.	2005-11-00	MM, Communication and Engagement Tool
ISO 37120	Sustainable development of communities - Indicators for city services and quality of life	ISO 37120:2014 defines and establishes methodologies for a set of indicators to steer and measure the performance of city services and quality of life. ISO 37120:2014 is applicable to any city, municipality or local government that undertakes to measure its performance in a comparable and verifiable manner, irrespective of size and location.	2014-05-00	MM, RSQ
ISO/TR 37150	Smart community infrastructures - Review of existing activities relevant to metrics	ISO/TR 37150:2014 provides a review of existing activities relevant to metrics for smart community infrastructures. In ISO/TR 37150:2014, the concept of smartness is addressed in terms of performance relevant to technologically implementable solutions, in accordance with sustainable development and resilience of communities, as defined in ISO/TC 268. ISO/TR 37150:2014 addresses community infrastructures such as energy, water, transportation, waste and information and communications technology (ICT). It focuses on the technical aspects of existing activities which have been published, implemented or discussed. Economic, political or societal aspects are not analysed in ISO/TR 37150:2014.	2014-02-00	MM, Communication and Engagement Tool
PAS 182	Smart city concept model. Guide to establishing a model for data interoperability	PAS 182:2014 gives guidance on how to apply a data concept model to promote data sharing across sectors in a city and help bridge the differences in data analysis between sectors like health, education and transport. It is intended to facilitate discussions between decision-makers and the specialists who build and design the systems and services that enable a city to function. The guidance in PAS 182:2014 addresses the fact that service providers do not always have the expertise to analyse the data they accumulate, that different sectors use a different language when describing data and offers a model that can be used by a variety of sectors.	2014-10-31	MM, RSQ, Communication and Engagement Tool

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
		PAS 182:2014 is aimed at service providers such as national and local government departments, utilities, healthcare providers, transport, construction companies, ICT solution providers, city planners and developers.		
ISO/TS 37151	Smart community infrastructures - Principles and requirements for performance metrics	ISO/TS 37151:2015 gives principles and specifies requirements for the definition, identification, optimization, and harmonization of community infrastructure performance metrics, and gives recommendations for analysis, including smartness, interoperability, synergy, resilience, safety, and security of community infrastructures. Community infrastructures include, but are not limited to, energy, water, transportation, waste, and ICT.	2015-05-00	MM, Communication and Engagement Tool
ISO/DIS 37154	Smart community infrastructures - Best practice guidelines for transportation	Under development - by ISO/TC 268 - Sustainable development in communities	2016-10-00	MM, Communication and Engagement Tool
ISO/TR 37152	Smart community infrastructures - Common framework for development and operation -- Ad hoc group report	This document outlines the basic concept of a common framework for the development and operation of smart community infrastructures. The framework describes the planning, development, operation and maintenance methodology to facilitate the harmonization of each infrastructure as a part of a smart community and ensures that the interactions between multiple infrastructures are well orchestrated.	2016-08-00	MM

2.2.8. NEWLY PUBLISHED STANDARDS

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
ISO/DIS 22300	Security and Resilience - Terminology	This document contains terms and their definitions applicable to security and resilience that are used in Standards published under the control of ISO/TC 292 – Security and resilience up to and including 2016-03-01 to encourage consistent definitions of terms used in all documents published by the Technical Committee.	2016-12-00	All
ISO 37100	Sustainable cities and communities - Vocabulary	This document defines terms relating to sustainable development in communities, smart community infrastructure and related subjects.	2016-12-00	MM, RSQ, Communication and Engagement Tool

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
ISO/TR 37121	Sustainable development in communities - Inventory and review of existing indicators on sustainable development and resilience in cities	This document provides an inventory of existing guidelines and approaches on sustainable development and resilience in cities.	2017-01-00	All
EN ISO/IEC 27000	Information technology - Security techniques - Information security management systems - Overview and vocabulary	This International Standard provides the overview of information security management systems, and terms and definitions commonly used in the ISMS family of standards. This International Standard is applicable to all types and sizes of organization (e.g. commercial enterprises, government agencies, not-for-profit organizations).	2017-02-00	MM
ISO/DIS 37153	Smart community infrastructures - Maturity model for assessment and improvement	The international Standard provides the basis, requirements and guidance for a maturity model for the assessment of technical performance, process and interoperability of community infrastructures as well as its contribution to the community, and guidance for future improvements.	2017-02-00	MM, Communication and Engagement Tool
ISO/ DIS 31000	Risk Management - Guidelines	N/A	2017-02-00	MM, RSQ
DIN SPEC 91347	Humble Lamppost - Integration of smart technologies into existing urban infrastructures	This DIN SPEC (PAS) describes the "integrated multi-functional humble lamppost" (imHLa) as an integral part of a municipality's digital infrastructure. It is described as an integrated system made up of individual functional components. Particular emphasis is placed on the efficient use and reuse of these functional components to maximize synergies, particularly for innovative services arising from the digitalization process. New services based on the introduction of functional components as part of the "Internet of Things" (IoT), and the data thus generated, are what make standardization of the multifunctional lampposts so urgent, because current standards only relate to individual functional components, mostly seen in isolation. Standardization of the integration of these functional components: - The physical integration of the hardware within the lamppost, and - where technically and economically feasible - the integration of individual components with each other - The logical integration of individual functional components, for example for communication and exchanging data - The economic integration of individual functional components for operational and business models - The overall integration in urban platforms for implementing smart city objectives and integrated digitalization of urban space. Terminology, a selection of use cases and a classification are also	2017-03-00	All

Document No.	Title	Abstract	Date of publication	Relation to which SMR solution
		included. This DIN SPEC (PAS) aims to create systematic comparability, since the first products, i.e. integrated multifunctional lampposts and individual functional components as attachments or fixtures, are already on the market. It relates to public spaces, i.e. street lighting for which cities and municipalities are responsible. It can also be applied to comparable outdoor lighting on private properties or privately owned public spaces, or anywhere else where a lamppost has been or will be used.		
ISO 22316	Security and resilience - Organizational resilience - Principles and attributes	This document provides guidance to enhance organizational resilience for any size or type of organization. It is not specific to any industry or sector. This document can be applied throughout the life of an organization. This document does not promote uniformity in approach across all organizations, as specific objectives and initiatives are tailored to suit an individual organization's needs.	2017-03-00	MM, RSQ
PAS 184	Smart Cities. Developing project proposals for delivering smart city solutions. Guide	N/A	2017-03-31	All
ISO 22319	Security and resilience - Community resilience - Guidelines for planning the involvement of spontaneous volunteers	This document provides guidelines for planning the involvement of spontaneous volunteers (SVs) in incident response and recovery. It is intended to help organizations to establish a plan to consider whether, how and when SVs can provide relief to a coordinated response and recovery for all identified hazards. It helps identify issues to ensure the plan is risk-based and can be shown to prioritize the safety of SVs, the public they seek to assist and incident response staff.	2017-04-00	MM, RSQ, RMG, Communication and Engagement Too
ISO/DIS 14080	Greenhouse gas management and related activities - Framework and principles for methodologies on climate actions	This International Standard describes a framework with principles and guidance to establish approaches and processes to: identify, assess and revise methodologies as well as develop and manage methodologies.	2017-04-28	All

2.3. SUMMARY OF THE SUPPLY SIDE

The five solutions and the ERMG developed within the project have different approaches and can fulfil different demands of potential users. Most of the solutions are already in a very advanced level and are in the implementation phase. The others are envisaged to be finalized within the timeframe of the project.

In total there are 65 standards existing that are related to the SMR solutions and should be further considered within the SMR project. However, it can be concluded that there is no existing standards that has the scope or detailed content of one of the SMR solutions.

The supply side can be summarized with the listing of the different SMR solutions and the available relevant standards.

3. DEMAND SIDE – CITIES NEEDS TOWARD STANDARDIZATION

Demand is the quantity of a commodity or a service that people are willing or able to buy at a certain price [5]. In the SMR project, the demand side refers to a need of a city to overcome a certain resilience related obstacle.

The next subchapters will focus on a survey and several standardization sessions in format of workshops. Both activities where mainly targeted to identify the demand side of the city representatives and to start working on task 6.2 'Identification of Standardization Potentials'.

3.1. SURVEY

3.1.1. METHODOLOGY

The questionnaire targeted the representatives of the tier one and two cities. It was conducted to identify the needs of cities and communities with regard to new resilience-related standards. The questionnaire was sent out via Email to the SMR city partners from January until March 2017. After the

examination of the received responses, a series of focused discussion sessions with the respondents were organized both face-to-face and via online videoconferences. The results of the survey were presented at the Berlin Workshop on the 3rd of April 2017. Representatives from tier one and tier two cities attended the workshop and were given an opportunity to comment on the results.

The survey consisted of the following questions:

1. Which specific challenge is your city facing?
2. What are / should be the key elements of your city's resilience strategy?
3. What are your needs regarding new standards?
4. How are standards shared amongst city representatives?
5. What should be part of a standard on resilience management?
6. Do you have a best practice of using a formal standard?
7. What are the reasons for not using formal standards?
8. Which other standards or guideline are in use, why and how are they being used?
9. Which Format should a resilience related standard have?
10. Which SMR tools are you planning to implement in your city?

3.1.2. RESULTS

In the next subchapter the answers of the questions, which are the most important for the identification of the standardization potential, are going to be summarized in bullet points. All results have been anonymized. Since question two and question eight are both complex and not directly related to the standardization potential, they were excluded from the summary. Nevertheless they were a part of the survey to support other project related questions.

1. Which specific challenge is your city facing?

- Climate change e.g. flooding or heat waves
- Demographic change/ vulnerable population (e.g. aging population, family ties changes)
- Pollution and life quality issues
- Suitable housing for different groups
- Poor health and inequalities across communities in the city
- Abandoned public/ private real property
- Cultural heritage and natural resources
- Critical Infrastructures

- Immigration
- Terrorism

3. What are your needs regarding new Standards?

- Steps on how to build a robust cross-sectorial and holistic collaboration in the city
- Simplify cross-sectoral cooperation
- Guidance on the creation of a responsive structure within the city which embeds resilience-building and breaks down sectoral boundaries
- Clear and transparent action plan which will no increase bureaucracy
- Standard who help create the breathing space (avoid being overly prescriptive)

4. How are standards shared amongst city representatives?

- Through experts (mainly in workshops and conferences)
- Through working groups
- Round table discussion as well as specific workshops
- Within the city council committee (reports are publicly available)
- Promoted by government or other government bodies
- Exchange amongst professionals happens through formal and informal routes - through membership of specific networks, e-newsletters, readership of journals or attendance at conferences

5. What should be part of a standard on resilience management?

- Description on the difference between risk management and resilience management
- Explanation why resilience management is important
- General goals, action directions, evaluation scales, reporting templates
- Information and knowledge sharing among municipal administrations, research institutions, civil protection services at local and national level as well as concerned citizen associations
- A manual, a checklist or some informal standards for how initiatives should be prioritized, organized and launched
- Good practices

6. Do you have a best practice of using a formal standard?

- Standard for renovation activities towards lower energy consumptions
- Standard for public procurements, which has indirect impact on financial management
- Decision Support Systems (DDS) on critical infrastructures for risk analysis and civil protection purposes (the DSS refers to the application of innovative now casting techniques)
- City Resilience Index to evaluate resilience work by answering a series of questions

7. What are the reasons for not using formal standards?

- Every municipality is doing their own thing
- Sometimes local/national guidance are preferred
- Knowledge sharing issues and siloed skills as well as resources
- Growing criticism that all of the additional administrative burden is placed on employees
- Often experienced as a control function and a lack of confidence that employees solve the task in a professional manner

9. Which Format should a resilience related standards have?

- Toolbox for each city to 'pick and choose' the most appropriate issues for them
- Helpful if the standard was provided as a framework of steps or stages
- Quantifiable values can be described (e.g. indicators on climate change)

10. Which SMR tools are you planning to implement in your city?

- Too early to say
- All of them
- ERMG
- RSQ
- MM

3.2. WORKSHOPS

During the 2nd project year, a number of standardization sessions took part – in particular during the SMR workshop meetings in Amsterdam, Berlin, Glasgow and Brussels. On the one hand, the aim of

those sessions was to progress the work towards completion of task 6.2, but also to identify the needs of the cities regarding potential new standards. Those meetings are described below.

3.2.1. AMSTERDAM

December 14, 2016

The kick-off for task 6.2 'Identification of Standardization Potentials' was conducted during the WP5 and WP6 meeting in Amsterdam in mid-December 2016. The goal of this meeting was to raise awareness with regards to the planned activities for task 6.2 and the involvement of the city and research partners. The session included the initial preparation of the European Workshop and the survey in subchapter 3.1. Moreover, the transferability of the SMR results into standards was also discussed partially during that meeting.

3.2.2. BERLIN

April 3, 2017

A session to identify Standardization needs was conducted on 3rd April 2017, just one day before the European Workshop on Resilience in Cities and Communities (see the upcoming deliverable D6.3 'Report describing the European Workshop').

The 'Session to identify standardization needs' was held on Monday afternoon and took approximately 30 minutes. To provide a definitive assessment of the project partners' vision of the envisaged standard(s), participants were asked to use the session to discuss the structure and elements of the draft standards. Participants were split into five working groups comprising 3-5 people of which at least one person was a city representative. They were asked to list three main elements of the optimal standard in their point of view. In order to prompt the discussion, the DIN representatives provided participants with a number of hints, and those hints proved helpful in guiding participants to take into account of city needs for information, processes and collaboration. However, participants were encouraged to discuss also other topics which they could find relevant to the subject in question. Thus the session promoted creativity and it demonstrated slightly different perspectives with respect to the topic of standardization on behalf of each group. For practical reasons, particularly the ideas of the cities as future end-users of the standards were considered.

Four main outcomes of the session in terms of standardization needs can be ascertained as follows:

- The ERMG is to be standardized; the standard respectively should stay handy. In particular, it should be made clear both structurally and with accompanying descriptions which parts of the standard apply to whom. For example, while the introduction of the standard might be relevant for everyone who has to work with it, certain parts might be most relevant for a municipal resilience officer while other particularly address IT personnel, yet others communication managers.
- Along with *which* and *whom* questions, the standard(s) should consist of guidance towards *why*. It is apparent from the discussion that cities require justification for a decision to build resilience related policies and actions. They have to convince stakeholders and explain *why* they are doing this.
- Regarding the *how* and *who* questions, participants described their biggest attentions to cross-sectional collaboration. The standards should support *how* this collaboration can be achieved within the city. Creating a discussion guideline is one example submitted during the discussion. The *how* description in the standards should also contain methods for assessment in for instance urban planning and risk management. Functions and services which cities have to provide to residents are required to the description as well. The five tools developed by the SMR project can enhance clear description for the *how* question.
- To sum up the previous three outcomes, the standard must include both formalized, theoretical parts as well as framing parts. The latter can be used by cities to design their own work according to the standard.

April 5, 2017

On the last day of the European Workshop on Resilience in Cities and Communities, another session to identify standardization needs was organized.

Method: Participants split up into three groups and discussed the potential draft scope of the Standard(s). The exercise was conducted in order to raise awareness on the provision of information for initiating a standard and had mainly the objective to identify possible requests for standards. Within the session the groups were asked to answer the following questions:

- What could be the topic of the potential standard?
- What could the standard be about?
- What are the main elements of the standard?
- Who is the target group of the standard?

The results of the three groups can be summarized as follows:

Group 1

- Topic: Manual of City Resilience.
- This document provides instructions for proactive progress towards building up a high level of resilience maturity.
- That includes tools to: build capacity through hands on initiatives.
- This document is intended to be used by:
    - Municipalities
    - Citizens
    - Non-Government Organizations
    - National and regional organizations
    - Commercial entrepreneurs providing solutions

Group 2

- Topic: Tools for City Resilience.
- This document provides guidelines (urban)/ instructions for implementation of solutions for city resilience.
- This includes existing standards for resilience assessment, evaluation and monitoring table and proposed dissemination activities.
- This document is intended to be used by:
    - Municipalities
    - Citizens
    - Non-Government Organizations
    - SMEs involved in Private Public Partnership (PPP)

Group 3

- Topic: City Resilience Management.
- This document provides a Guideline (simple and friendly), good practice and a guide to “translate” global resilience goals into local needs/ story.
- This includes an assessment tool (Definition and stages) as well as processing tools.
- This document is intended to be used by Stakeholders:
    - Municipalities/ Decision makers at different levels (national, regional, local)

- Citizens
- Non-Government Organizations
- Private sector (Companies …)
- First responders
- Critical Structure Provider

3.2.3. GLASGOW

May 19, 2017

DIN prepared a standardization session at the Glasgow project meeting on the 19th of May 2017 with the following objectives:

- update the consortia with new standards published and standards that are currently under development,
- getting insights on the needs of cities for future standardization activities and
- provide information on the upcoming standardization activities within the SMR project.

At first DIN shortly presented standards of relevance for city resilience that have been published within the last year or are currently under development. The information of these standards will be integrated in the standards list prepared within the SMR project. Besides these standards, also solutions developed within the SMR project and beyond as well as other solutions for city resilience are summarizing the support or supply side for city resilience.

The aim of the standardization session was to collect further insights from the project cities regarding their structural challenges and their needs for improvements. Each city discussed internally their needs for improvement, which could be overcome by a standard. The results were put on a board and discussed with the whole group. The city representatives mentioned needs toward:

- cross-sectorial coordination,
- effective usage of communication platforms,
- availability of resources to coordinate resilience actions,
- minimum activities to involve citizens,
- commitment of the city stakeholders,
- support to training activities and a
- protocol for monitoring the resilience actions.

The results of the above mentioned activities are summarizing the demand side for city resilience. The outcomes of the support and demand side are the initiation of new standardization activities.

The last item of the standardization session was an outlook on the upcoming standardization activities within the project. Furthermore DIN presented the procedure of developing a standard within a research project like SMR by showing the process of the development of a CEN Workshop Agreement (CWA).

3.2.4. BRUSSELS

June 21, 2017

After the review meeting of the second year of the SMR project which took place on June the 20th, the project partners met internally to discuss the further work within WP6. During the session the following question was raised: which parts of the ERMG should be part of the envisaged standard. In this relatively short meeting the standardization potential of each of the SMR solutions was also discussed among the attending city and research partners. This activity prepared the project partners for the upcoming assessment of standardization potentials that was conducted afterwards (see chapter 4).

3.3. SUMMARY OF THE DEMAND SIDE

In summary, a mix of the survey and the standardization sessions organized as part of the project meetings were assessed very positive by all city partners, and those sessions allowed to gain a good understanding of cities' needs with respect to the future resilience work. In total, five different standardization sessions took place as part of different project meetings, which in turn allowed to support the results received from the survey.

The gathered needs of city partners can be seen as being diverse, but most of the partners agreed about the importance of developing an overarching supporting solution or a document beyond the individual and sometimes specific city related, resilience actions or policies. As another aspect, the importance of including all city stakeholders was often mentioned. There is an agreement among the city partners that without having all relevant stakeholders 'on board', and without securing their commitment, it can be difficult to work on developing city resilience.

4. IDENTIFICATION OF THE STANDARDIZATION POTENTIAL

The demand and supply side were assessed and the identified standardization potentials are presented in the following subchapters. Firstly, the indicators used to evaluate each SMR solution with regards to their standardization potential are presented. Secondly, drawing on these indicators, the SMR partners' evaluation of the standardization potential of each solution is explained. Finally, the results are shortly summarized.

4.1. INDICATORS FOR THE EVALUATION OF THE SMR SOLUTIONS

In order to assess the standardization potential of the developed solution, the following indicators were established:

- **Necessity**: City representatives have identified a need for having the SMR solution implemented or up taken in their city. *Question: Which SMR solution would the cities implement/ consider the most useful to be standardized (among a scale between 1 (very low) and 5 (very high)?*
- **Transferability:** Because of its content-related design the SMR solution has high potential to be transferred into a standard. Hereby the envisaged standard should consist of approx. minimum 90% requirements and maximum 10% recommendation. *Question: Would a standard on the SMR solution list a minimum set of requirements and maybe also recommendations?*
- **Feasibility**: The current status of the SMR solution is important for assessing the feasibility of developing a standard out of the SMR solution. If the tool is currently not close to the final state, then it is difficult to develop a standard on it by the end of the project. *Question: How is the development status of the SMR solution, and if applicable, when will it be finished?*
- **Complementation of existing standardization landscape**: There are no or some standards related to the SMR solution, but no one addresses the topic of the SMR solution. Thus there is a need to standardize the SMR solution in order to complement to the existing standardization landscape. *Question: Could the SMR solution be a useful complementation to the existing standardization landscape?*

- **Further input:** It is of benefit to include project externals for enhancing the quality and uptake of the SMR solution, e.g. by testing the SMR solution with externals or adding additional information for uplifting a potential standard on the SMR solution. *Question: Could project externals significantly contribute to the development of the SMR solution in general, and could they quickly join a discussion about the topic?*

4.2. STANDARDIZATION POTENTIAL OF THE SMR SOLUTIONS

The indicator 'Necessity' from the subchapter 4.1 was answered by city representatives of tier one and tier two cities (Rome, Vejle, Kristiansand, Glasgow, Bristol, Riga, San Sebastian). The research partners TECNUN, CIEM, Strathclyde as well as ICLEI answered the indicators 'Transferability', 'Feasibility', '**Complementation of existing standardization landscape**' and 'Further input'.

4.2.1. STANDARDIZATION POTENTIAL FROM THE CITIES' PERSPECTIVE

In the survey (see subchapter 3.1) the cities were asked, which SMR solution they are planning to implement in their city. This question is related to the standardization potential, since the answers are connected to the city's needs. For some cities this questions was asked too early in the development process of the SMR solutions. Others directly answered that they will implement all developed solution in some way. Some cities directly mentioned the MM, the RSQ and the ERMG. Since this question seemed to be asked too early, the cities were lately asked another more direct question (see subchapter 4.1).

The tier one and tier two cities were asked the following question: Which SMR solution would you implement/ consider the most useful to be standardized (among a scale between 1 (very low) and 5 (very high))? The answers for each SMR solution are visualized in a pie chart, followed by a short explanatory text.

Resilience Maturity Model (MM)

The Figure 4-1 shows that the cities are in favor of developing a standard on the MM. Cities consider the solution as useful, since it supports their self-assessment on the matter of resilience and it supports the planning of the resilience trajectory. They also consider the MM as a helpful tool to start up the complex process of becoming a more resilient city. The standard should be a lean version of the MM, which gives the cities space for customization.

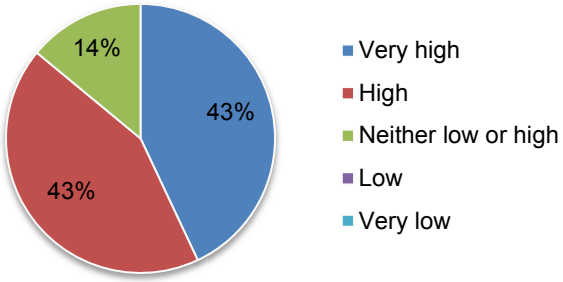

Figure 4-1: Necessity of standardizing the MM

Resilience Building Policies (RBP)

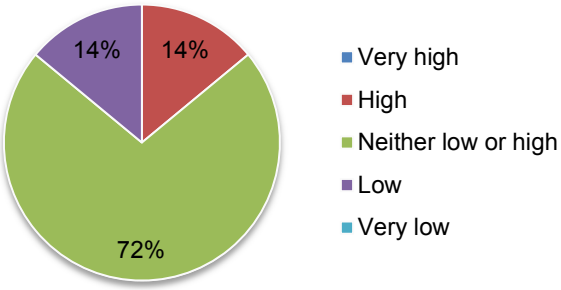

Figure 4-2: Necessity of standardizing the Resilience Building Policies

One reason for the result in Figure 4-2 is that the Resilience Building Policies are still in the development phase. Most of the cities responded that policies needed to take local context into consideration. The SMR solution could be interesting, if a city's own policies can be combined with it. One city also mentioned that the solution is too generic to be implemented and that its usage will depend on the

case studies that are going to be provided with the Resilience Building Policies. The outcome is that standardization could be possible in the future, but currently it is not favored by the cities.

Risk Systemicity Questionnaire (RSQ)

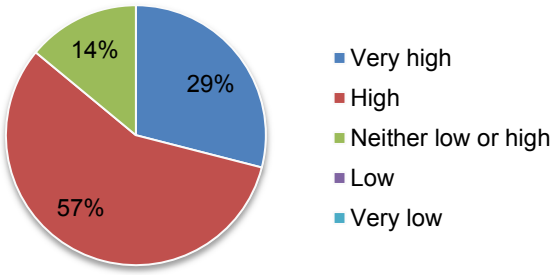

Figure 4-3: Necessity of standardizing the RSQ

The pie chart (see Figure 4-3) shows that the RSQ seems to be useful for cities, since it allows them to better understand the interactions between different types of risks. The cities favor the standardization of the solution, if it consists of general questions that city decision makers always have to ask themselves. This goes hand in hand with the idea of standardization. Standards are recommendation, which cities can adopt and adjust to their needs. Nevertheless, the cities also mentioned that customization is important. The overall result is that the cities are in favor of standardizing the RSQ.

System Dynamics Model (SDM)

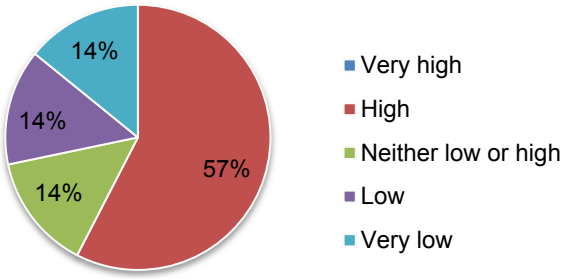

Figure 4-4: Necessity of standardizing the SD Model

Concerning the SD Model the answers of the cities were diverse. The pie chart (see Figure 4-4) shows that some cities see a high potential for standardization, others consider the potential as low or even

very low. One reason for the low ranking is that standardization of the SD Model would be in part achieved with the standardization of the MM. In general the answers of the cities were that they see a potential for standardization, but they would rather standardize the MM.

Engagement and Communication Tool/ Resilience Information Portal (RP)

As the Figure 4-5 displays the Engagement and Communication Tool is considered as a useful solution. The answer was that the solution promotes the sharing of best practices. Furthermore it is considered useful since it provides knowledge on how to develop, upgrade or revise an information portal. The overall response was that the solution has the potential to be standardized, since it meets the city's needs.

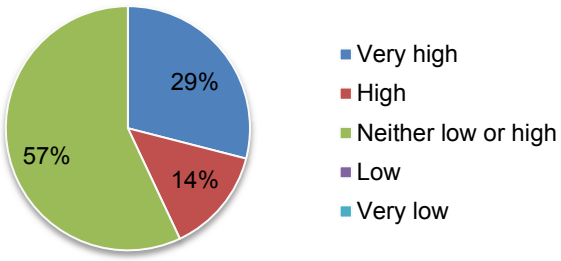

Figure 4-5: Necessity of standardizing the Engagement and Communication Tool

European Resilience Management Guideline (ERMG)

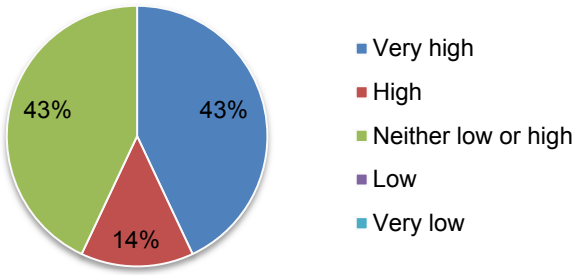

Figure 4-6: Necessity of standardizing the ERMG

The Figure 4-6 shows that they either see a high potential for standardization or they abstain their answer. Those in favor describe the ERMG as the goal of the project and thereby they approve the standardization of the solution. The cities mentioned that the standard should be like a user journey, which provides the cities with information on how to use the SMR solutions. They also mentioned that a standard on this solution could be a way of introducing standards to people who normally don't read standards. The overall result is that a standard on the ERMG is preferred by the cities.

Conclusion

The highest standardization potential from the cities perspective was identified for the following solution developed out of the SMR project:

- MM
- RSQ
- Engagement and Communication Tool
- ERMG

4.2.2. STANDARDIZATION POTENTIAL FROM THE RESEARCHERS' PERSPECTIVE

The research partners from TECNUN, CIEM, Strathclyde and ICLEI assessed the solutions they have mainly developed by answering the questions in subchapter 4.1 with a cross. They addressed all indicators accept 'Necessity', since they know the solutions the best. The indicator 'Necessity' was answered by the cities (see subchapter 4.2.1).

Table 4-1: Summary of standardization potential

	Necessity	Transferability	Feasibility	Complementation of existing standardization landscape	Further input	**Result**
MM	X	X	X	X		**4**
RSQ	X		X	X		**3**
RBP						0
SDM		X	X	X		3
RP	X	X	X	X	(X)	**5**
ERMG	X	X	(X)	X		**4**

Table 4-1 shows that the researchers and city representatives see the highest potential for standardization in the MM, the RSQ, the Engagement and Communication Tool and in the ERMG. All these SMR solutions fulfil at least three indicators. Since the city partners don't see a 'Necessity' in developing a standard on the SD Model, the solution will not be further considered to be standardized. Currently there is no demand for the SD Model to be standardized.

5. SUMMARY AND CONCLUSION

Especially the results of chapter 4 are highlighting the standardization potential of the solutions of the SMR project. This can be explained by the fact that the results of the project support the resilience building process of a city through different, yet complimentary, ways. Another reason could be that the resilience topic is still fairly under-developed and under-researched; therefore there is still much space for standardization activities in this regard. However, chapter 2 is listing more than 60 existing standards or ongoing standardization activities that are related to different extent to one or more of the six SMR solutions. Thus the results of the analysis of the supply side of the standardization offer a considerable variety of possibilities to be further considered as part of the standardization activities.

Furthermore, the needs of the cities to have more support for their resilience activities were clearly identified via a survey and several standardization sessions conducted during project meetings. It can therefore be concluded that the cities are willing to test different solutions to tackle their specific city-related resilience problems. The demand side described in chapter 3 is asking for assisting elements that can mostly be covered by the results of the supply side.

In chapter 4, four out of the six SMR solutions were evaluated to have a significant potential for further standardization. As a result of this assessment several standardization activities will be initiated in the upcoming months to address this potential and to meet the demands of the city partners. Especially the envisaged standardization activities on the MM, the ERMG and the Communication and Engagement tool need to be highlighted. For the latter one – which was already finalized by the end of 2016 - the kick-off of a CEN Workshop was already taking place on the 21st of June 2017. More detailed information on this will follow in the D6.4 'A cohesive strategy for standardization'.

6. REFERENCES

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7. ABBREVIATIONS

Abbreviation	Definition or Organisation/ Publisher
ANSI	American National Standards Institute
ARP	SABS STANDARDS DIVISION - South Africa
ASTM	American Society for Testing and Materials
BIP	British Standards Institution
BS	British Standards Institution
CAN	Canadian Standards Association
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
CI	Critical Infrastructure
CWA	CEN Workshop Agreement
D	Deliverable
DIN	German Institute for Standardization
DS	Danish Standards Foundation
EN	European Standard
ETSI	European Telecommunications Standards Institute
GOST	Federal Agency on Technical Regulating and Metrology (GOST) - Russia
IEC	International Electrotechnical Commission
IEEE	The Institute of Electrical and Electronics Engineers, Inc.
ISO	International Organization for Standardization
MM	Maturity Model
NGO	non-governmental organization
ONR	ASI Austrian Standards Institute
PAS	Publicly Available Specification
PDCA	Plan Do Check Act
RSQ	Resilience Systemicity Questionnaire
SD Model	System Dynamic Model
SG	Serious Games
TC	Technical Committee
UNE	AENOR Spanish Association for Standardization and Certification