



*Driving Innovation in Crisis Management for European Resilience*

## D33.1 - Community Resilience Model

| Document Identification |            |
|-------------------------|------------|
| Due Date                | 30/04/2015 |
| Submission Date         | 01/02/2017 |
| Status                  | Final      |
| Version                 | 3.0        |

|                        |            |                     |                          |
|------------------------|------------|---------------------|--------------------------|
| Related SP / WP        | SP3 / WP33 | Document Reference  | D33.1                    |
| Related Deliverable(s) |            | Dissemination Level | PU                       |
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### Keywords:

Community Resilience, Emergency Preparedness, Crisis Management

This document is issued within the frame and for the purpose of the DRIVER project. This project has received funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under Grant Agreement No. 607798

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| Document History |            |  |   |
|------------------|------------|--|---|
| Version          | Date       | Change editors   | Changes   |
| 0.1              | 2015-02-28 | David Karikas, Jose Kerstholt, Martin Van De Lindt                 | First Draft – Full document edit from each partner  |
| 0.2              | 2015-03-15 | David Karikas, Jose Kerstholt, Hanneke Duijnhoven                  | Structural edit of chapters and removal of irrelevant information in relation to DoW                |
| 0.3              | 2015-03-25 | Cecilie Dinesen  | Full report and edit of definitions   |
| 0.4              | 2015-03-31 | David Karikas, Jose Kerstholt, Hanneke Duijnhoven, Cecilie Dinesen | Final review – edit the table of frameworks and review of final draft before peer review            |
| 0.5              | 2015-04-27 | Wolf Engelbach, Jasmin Pielorz                                     | Formatting, description of resilience model changes, table changes and definitions to be clarified. |
| 1.0              | 2015-04-29 | Scott Davis  | Submission  |
| 1.1              | 2015-11-17 | Cecilie Dinesen  | Review of changes to  |

|                |                                    |                |    |          |       |         |       |
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|     |            |   |  |
|-----|------------|---|--|
|     |            |   | methodology, Chapter 4 and full document edit of new draft.  |
| 1.2 | 2015-11-25 | Hanneke Duijnhoven                              | Review of changes to methodology, Chapter 4 and full document edit of new draft.                                       |
| 1.3 | 2015-12-14 | Willi Wendt, Wolf Engelbach                     | Peer-Review  |
| 1.4 | 2015-12-23 | Scott Davis, José Kerstholt, Hanneke Duijnhoven | Addressing comments from peer review and final draft   |
| 1.5 | 2016-01-12 | Scott Davis                                     | SUBMISSION FOR PEER REVIEW. Summary of changes: Changes to methodology, Chapter 4 and full document edit of new draft. |
| 2.0 | 2016-02-29 | ATOS  | Quality check performed on this document   |
| 2.1 | 2016-11-15 | Hanneke Duijnhoven, José Kerstholt              | Rewritten on the basis of review comments, comprehensive literature review included                                    |
| 3.0 | 2017-02-01 | ATOS  | Final version submitted  |

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## List of Acronyms

| Abbreviation / acronym | Description  |
|------------------------|--|
| BRC                    | British Red Cross  |
| CART                   | Community Advancing Resilience Toolkit                           |
| CET                    | Community Engagement Theory                                      |
| CR                     | Community Resilience   |
| DRC                    | Danish Red Cross   |
| DRR                    | Disaster Risk Reduction  |
| emBRACE                | Building Resilience Among Communities in Europe                  |
| EU                     | European Union   |
| FEMA                   | Federal Emergency Management Agency                              |
| HFA                    | Hyogo Framework for Action                                       |
| IFRC                   | International Federation of Red Cross and Red Crescent Societies |
| NGO                    | Non-governmental Organisation                                    |
| NOE                    | Negative Outcome Expectancy                                      |
| POE                    | Positive Outcome Expectancy                                      |
| RCRC                   | Red Cross and Red Crescent Movement                              |
| SOTA                   | State of the Art   |
| SP                     | Subproject   |
| TNO                    | Toegepast Natuurwetenschappelijk Onderzoek                       |
| UK                     | United Kingdom   |
| UN                     | United Nations   |
| UNISDR                 | United Nations Office for Disaster Risk Reduction                |
| US                     | United States  |

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## Project Description

**DRIVER** evaluates solutions in three key areas: civil society resilience, responder coordination as well as training and learning.

These solutions are evaluated using the DRIVER test-bed. Besides cost-effectiveness, DRIVER also considers societal impact and related regulatory frameworks and procedures. Evaluation results will be summarised in a roadmap for innovation in crisis management and societal resilience.

Finally, looking forward beyond the lifetime of the project, the benefits of DRIVER will materialize in enhanced crisis management practices, efficiency and through the DRIVER-promoted connection of existing networks.

### **DRIVER Step #1: Evaluation Framework**

- Developing test-bed infrastructure and methodology to test and evaluate novel solutions, during the project and beyond. It provides guidelines on how to plan and perform experiments, as well as a framework for evaluation.
- Analysing regulatory frameworks and procedures relevant for the implementation of DRIVER-tested solutions including standardisation.
- Developing methodology for fostering societal values and avoiding negative side-effects to society as a whole from crisis management and societal resilience solutions.

### **DRIVER Step #2: Compiling and evaluating solutions**

- Strengthening crisis communication and facilitating community engagement and self-organisation.
- Evaluating solutions for professional responders with a focus on improving the coordination of the response effort.
- Benefiting professionals across borders by sharing learning solutions, lessons learnt and competencies.

### **DRIVER Step #3: Large scale experiments and demonstration**

- Execution of large-scale experiments to integrate and evaluate crisis management solutions.
- Demonstrating improvements in enhanced crisis management practices and resilience through the DRIVER experiments.

DRIVER is a 54 month duration project co-funded by the European Commission Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 607798.

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## Executive Summary

This report presents a broad review of community resilience to inform the selection of two solutions. The two requirements of the solutions were: (i) a community resilience measurement method and (ii) a resilience awareness enhancement method.

Various concepts of resilience and community resilience are outlined; resulting in the creation of a resilience model. A range of theoretical frameworks and participatory method toolkits used to engage communities regarding resilience were reviewed, concluding with a comparison of community resilience toolkits in order to inform the selection of solutions.

The report selects Douglas Paton’s Community Engagement Theory as the theoretical framework to inform a community resilience measurement method and selects Pfefferbaum et al.’s Community Resilience Advancing Toolkit (CART) as a practical toolkit to adapt in order to enhance resilience awareness through participatory methods. The Community Engagement Theory (CET) framework will be used within “flood risk” areas of The Hague and the CART toolkit will be adapted into workshops within 8 rural and urban communities of Scotland. The results of these experiments will be presented in future Work Package deliverables.

CET was selected on the basis that it approaches community resilience from a psychosocial, behavioural perspective; the theoretical framework has been validated within different cultural contexts and is considered to be an “all hazards approach” (applicable to any disaster scenario).

The CART toolkit method was selected because it is considered to be a theoretically-informed comprehensive community engagement method with multiple participatory tools, taking a “bottom up” approach to raising resilience awareness within any type of community and can be applied to all hazards. The selected methods from this deliverable will inform the remaining DRIVER activities of WP 33.

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# 1 Introduction

## 1.1 Background

There is an increased interest in community resilience (the ability of a community to cope with disturbances). Worldwide the numbers of disasters are increasing and both the occurrence and impact are harder to predict due to, for example, climate changes [1]. The political will for community resilience initiatives can often be found in response to a recent crisis or disaster within the affected region. This can prompt an identification of high-risk areas which require resilience capacity building in order to mitigate future risk. The shift from a state-centred approach to an approach whereby an activated community also takes responsibility for their own safety and recovery has proven to be effective in a number of recent cases.

The Abruzzo region of Italy, for example, was struck by an earthquake on April 6<sup>th</sup> 2009, measuring 6.3 on the Richter scale, resulting in 308 fatalities and over 1500 injuries, 202 of a serious nature. A study into the aftermath of the disaster investigated the resilience of a group of affected people within a small mountain village called Pescomaggiore near the municipality of L’Aquila. The villagers were dissatisfied with the Italian government’s decision to re-locate the community over 8 kilometres away; in response to this, the villager’s set-up a community resilience eco-village initiative. The community did not want to be split from their original community, risking the loss of community identity and collaboration that can be valuable in post-disaster scenarios but also the risk of losing the original village in its entirety. The villagers therefore created a small eco-village as close as possible to the disaster site and their original community. In this case the community rejected a “top-down” disaster management strategy and implemented their own “bottom up” community resilience initiative [2], evidencing a common critique of government disaster management strategies, that there is a lack of involvement and participation from the residents that are most affected [3] that can undermine community resilience [2].

A second case concerns an example of Turkish earthquakes, recently studied in the EU project ‘emBRACE’ [4]. The case study was based in two locations within Turkey: Van, which suffered a recent earthquake in 2011 and Adapazari/Sakarya, which had a more remote experience of earthquake in 1999. The study focused on the differing perceptions of community resilience based on these past experiences. The results indicated that the earthquake experience of one region led to positive resilience changes in the region that later experienced the earthquake. Changes were found at an organisational state level but also applied to individuals and communities, whom also increased their hazard awareness as a result. The study however also found that over time, individuals may forget and stop prioritising resilience behaviour, therefore highlighting the need to keep reinforcing the importance of resilience in mitigating the effects of disaster. Overall, the effects of past disasters in one location positively improved the resilience of other; this change while significant at state level and NGO contributions also most importantly filtered down to resilience behavioural change at the community level.

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General findings from a number of case studies are that motivation is a central factor that should be considered when facilitating community resilience. Motivation is considered to be higher in communities that have already experienced a disaster, due to the higher risk perception within those affected communities. The British Red Cross study called “Living in fear of the rain” focused specifically on communities experiences of flooding hotspots across Greater Belfast, Northern Ireland [5]. Interviews were conducted with the residents of flood-hit communities in Belfast and examples of new resilience behaviours were found post flooding events. Such factors suggest that cognitive processes remain relatively constant regarding an individual’s resilience decision-making behaviour, adding credence to the viability of a pan-European community resilience model based on the individual behavioural level. Resilience measures to flooding are examples of something that many parts of Europe either do not experience or where the state assumes responsibility. As a result, motivation to implement resilient behaviours may be considered lower in some areas of Europe due to the lack of experience of disaster or the need to implement resilience behaviours. These examples show that disasters can provide a “window of opportunity” for community resilience processes [2]; however, the positive approach to a disaster or crisis is often dependent on the extent to which community members feel responsible for their resilience and the extent to which the state is able and willing to take responsibility. These factors are often fostered well in advance of any disaster and are often a reflection of the nature of the state-society relationship in a particular country.

In order to increase community resilience it is important to:

- 1) Know what the indicators of resilience are and how it can be measured
- 2) Have an overview of tools and methods covering how communities can increase their resilience awareness and motivate them to take responsibility for their own resilience

Task T33.1 aims to identify a community resilience model that can be applied and tested in rural and urban communities and this report presents a framework for conducting this research. As such, the report is informed by the SP3 Civil Society Resilience framework as outlined in D31.21, and at the same time, offers new conceptual insights into the future developments of the framework.

## 1.2 Methodology

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The methodology consists of two steps: 1) identification of relevant community resilience literature, including toolkits and 2) the selection of two tools for inclusion in the remaining work of WP33. We expanded on initial findings of the State of the Art (SOTA) in D31.21 regarding community resilience and a TNO-lead community resilience study commissioned by the Dutch Ministry of Security and Justice [6]. The study reviewed national and international literature regarding resilience policies and frameworks, culminating in a comparative analysis on the framework’s objective (e.g. awareness or empowerment), context (e.g. type of community or hazard) and measurement methods (e.g. data collection and indicators). This deliverable further expands this piece of research by including other bodies of literature from different networks, organisations and individuals available to the British Red Cross, the Danish Red Cross and TNO. These include:

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- The Multinational Resilience Policy Group, comprising of a broad range of resilience experts, from governmental agencies and research organisations, coming from different nations (a.o. Canada, UK, Sweden, USA, New Zealand, Australia, Germany, the Netherlands and Japan); including Prof. Dr. Jose Kerstholt who is involved in TNO’s contribution to the delivery of this deliverable.
- Literature and reports from the International Federation of the Red Cross (IFRC) provided by contacts within the IFRC Global Centre for Disaster Preparedness in the United States and the use of internal Red Cross search portals.
- Community resilience stakeholders from the United Kingdom, who were met with informally to gain community resilience insight from practitioners. This included various local authority resilience professionals (e.g. including The Scottish Borders Council Resilience Officer, Stirling Council Community Resilience Officer, Dumfries and Galloway Community Resilience Adviser) and first responders (e.g. include British Red Cross Emergency Response Manager, Northern Scotland, British Red Cross Emergency Response volunteers – UK wide).

In order to ensure that we would not miss any relevant work we did a systematic literature search by using the database Scopus. This database was chosen as it contains the most extensive coverage of the scientific journals (as compared to Web of Science, the second largest database [53], [54]). We started with one keyword; ‘community resilience’. This led to 8.887 hits. This set was subsequently reduced through the following limits: 1) only articles in the last 10 years (2007-2016); 2) only peer-reviewed articles; 3) only the subject areas ‘psychology’, ‘social sciences’ and ‘environmental sciences’. This led to a set of 395 hits. As we were mainly interested in resilience we additionally took ‘resilience’ as the keyword. This resulted in 123 hits. All titles in this final set were scrutinized on relevance with regard to our research question. This led to a set of 32 articles. In order to ensure that no relevant articles were missed we searched on Google Scholar for papers on community resilience with a high number of citations. Based on this search we added 13 papers.

Additionally we searched for the combined result of ‘community resilience AND toolkit’. This resulted in 15 hits of which 6 were useful for further consideration.

This resulted in a final set of 51 papers. The abstracts of all were read by two persons and judged on relevance. We finally ended up with 36 papers (see Appendix 1 for an overview). These papers were all read in order to find answers to the following questions:

1. Which indicators were identified?
2. How were these indicators measured?
3. Which community engagement methods were developed and validated?

After reading the abstracts we selected 16 papers that specifically focused on measuring resilience and 5 papers that described the following toolkits: Torrens, CART, Los Angeles. These papers were included for further analysis.

Step 2 –On the 2nd of December 2014 an internal workshop was held in Inverness, Scotland with the project participants. The project team discussed the plans for future experimentation and outlined the main criteria that should inform the selection of a tool for “measuring community resilience” and

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a “community resilience awareness-raising” tool. Selection for inclusion in the remaining work of WP33 was performed using a set of criteria outlined in Chapter 3 (Measuring Community Resilience) and Chapter 4 (Community Resilience Enhancement).

### 1.3 Deliverable Outline

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Taking into consideration the two themes outlined in section 1.1., this report provides an overview of:

- Concepts related to civil society and community resilience (chapter 2)
- Review and selection of community resilience measurement frameworks (chapter 3)
- Review and selection of community resilience enhancement toolkits (chapter 4)
- Conclusion (chapter 5)

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## 2 Civil Society Resilience

### 2.1 Introduction

A flu pandemic, terrorist attack, heavy snowfall or prolonged power failure are some of the events that may seriously disrupt contemporary societies. One of the biggest challenges for any government is to develop appropriate strategies to decrease the vulnerability against these threats and to limit the impact of such events when they do occur. Government action focuses on averting the dangers, limiting the impact and restoring any damage or disruption caused by disasters, and increasing the resilience of all societal actors. Their work involves identifying and putting in place appropriate measures that contribute to sustaining or increasing the level of resilience to a large variety of risks. To be able to make decisions, it is imperative that a government has continuous insight into, and understanding of the current state of resilience as well as up to date knowledge on those factors that contribute to or hamper resilience.

The concept of ‘resilience’ is used in a wide variety of academic disciplines, including systems engineering, organizational sciences, ecological science, psychology, economics, climate change, disaster management, safety and security research. It is recognized that it is a complex concept that remains subject to debate and diverging interpretations [7], [8], highlighting that there are many different perceptions with regard to the methods and models used to operationalise and measure resilience.

Societal resilience links to the SP3 conceptual framework for Civil Society Resilience as outlined in D31.21 in several ways. It is informed by the conceptual framework in the sense that it builds on the notion of society – as well as communities within society – as complex adaptive systems. At the same time, the findings from this deliverable will help improve further developments of the Civil Society Resilience framework and contribute with a refinement of the conceptual understanding of community resilience.

### 2.2 A Resilient Society

To understand the resilience of societies, many approaches use theories of complex (adaptive) systems. In adopting such approaches, society is considered to be a complex adaptive system that is composed of different social, economic, physical, environmental, and institutional components. These components are closely related and the functioning of the system is determined by the interplay between them. In case of disruption of a specific component, cascading effects may occur that can seriously affect the functioning of the entire system.

Resilience can be defined as the ability of a system to absorb, recover from or adapt to changes, whilst retaining its essential functions, structure and identity [9]. A resilient society is a society in which individuals, groups and communities are able to cope with threats and disturbances caused by social, economic, and physical changes [10], [11]. This can be understood more broadly in relation to

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general changes, but more often societal resilience is taken to mean in terms of resilience towards disasters: the process of preventing an event escalating into a disaster therefore requiring the ability to prepare, the capacity to cope with the impact of disasters when they occur and the capacity to implement recovery activities in such a way that the societal disruptions are minimised [12].

The concept of resilience can be understood using the following three concepts:

1. **Resistance:** The ability of the system to continue performing its functions in the case of a disturbance, without significant changes to the system. This notion of resilience applies to the design of engineered systems such as bridges, buildings, etc. that are designed in such a manner that they can withstand great amounts of pressure (they may bend, but will return to their normal state). This interpretation of resilience presupposes a more or less ‘closed system’ with a fixed normal state to which the system should return [13].
2. **Recovery:** The ability of a system to recover its essential functions in case of a disruption. This notion is related to complex open systems. Complex open systems are systems that interact with their environment and are constantly developing and evolving over time. This interpretation acknowledges the idea that the world is changing continuously. This means that there is no fixed ‘normal state’ to which the system can return, but there are specific functions of the system that are essential for people to survive or that are deemed valuable (for instance, food, drinking water, shelter, medical services, communities, parks, etc.). To preserve functions, one should consider all the elements in the system that contributes to the performance of these functions. The societal system is complex, open and non-linear, yet remains intact [13].
3. **Adaptivity:** The capacity of a system to react to changes in its environment, adapt to and learn from experiences. This notion is related to a specific class of systems which are complex and adaptive [14]. Such systems are characterised by self-organisation and coevolution. Self-organization refers to the ability of the system to develop a new structure based on internal, local interactions. Coevolution refers to the ability of the system to continue to operate while adapting to changes in the environment.

When society is defined as a complex adaptive system, resilience is defined as the ability of this complex, adaptive system to cope with threats and disruptions. In case of a disruption to the functioning of the system, the system will in the first place attempt to resist the changes in order to continue functioning ‘as normal’. The extent to which the system can resist changes is limited and in case of a more severe disruption the system will at some point experience (partial) dysfunction. At that point in time, the system will draw on its ability to recover and/or adapt to the changes. This will lead to the restoration of the essential functions of the system or adapt to a new state of functioning. The extent to which society is able to offer resistance or can recover or adapt to changes is determined by the different capacities that are part of the specific system that is being stressed. These capacities are related to the system’s components and range from social to physical or institutional capacities. They can be used in different phases of the disruption cycle, defined as pro-action, prevention, preparation, response and recovery. Capacities can be tangible, such as the population, schools, physical infrastructure, food and water or intangible, such as social networks, cultural identity, communication or wealth. The strength and quality of these capacities, and thus the

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resilience of the system, is determined by the qualities of the system’s components. According to Norris et al. [15] resilience capacities originate both in the components itself as well as the dynamic qualities of these components. With regard to the qualities of components, different authors refer to different qualities. For instance Longstaff et al. [9] distinguish between two categories of qualities (characteristics as they call them): robustness and adaptive capacity [9].

Robustness is determined by the performance, diversity and redundancy of a specific component. The general level of performance of a component refers to the contribution of that component’s function within the entire system. Diversity means that the system does not rely on a single component to perform a specific function within the system (e.g. a community has different sources of income which means there is diversity in providing its livelihood). Redundancy of a component means that there is a back-up (e.g. there is a replacement system when the electricity network fails).

The level of adaptive capacity is determined by the institutional memory, innovative learning and connectivity within the system. Institutional memory refers to the ability of individuals and groups of people to store and remember specific experiences. Innovative learning provides the opportunity to apply the institutional memory and experiences to learn, to innovate and to adapt to changes in the environment. Connectivity refers to the network of connections between individuals and groups within and outside the community. These connections enable people to exchange experiences and lessons, to (re)organise themselves, and to draw on external resources. Communities with high levels of institutional memory, innovative learning and connectivity possess a greater capacity to adapt to changes in the environment.

Other authors focus on different types of qualities that are relevant for specific types of components. For example, the social component of a system (society/community) includes the people that live in that society/community. The qualities that contribute to the strength and quality of a system’s human capacities are examples such as empowerment or trust (see for instance Paton [16]).

The qualities of components can be measured through specific indicators and underlying data. There are many links between different components and the capacities (for example, when there is no back-up system for electricity and the network fails often, this means that the people may develop specific behaviour to cope with black-outs).The connections between different components and capacities can have a positive or negative influence on the overall resilience of the system and this is subject to changes over time or can be influenced through specific interventions.

Figure 1 presents a model of the systems approach of resilience (as a combination of resistance, recovery, adaptivity described earlier), including the capacities that influence resilience (the ability to resist, recover from or adapt to disruptions). The capacities can be classified into five domains: social, economic, institutional, physical and natural (based on a review by Ostadtaghizadeh et al. in 2015) [17].

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**Figure 1: WP33 – Resilience Model**

The systems -approach to resilience described in this section outlined above Figure 1, acknowledges the dynamic interaction between periods of incremental changes and moments of unexpected, abrupt changes, that are typical for all complex societal systems [18], [19]. The challenge in this regard, is to learn to live with changes and to develop specific capacities that help to cope with change instead of trying to stop changes from occurring, which is known to increase the vulnerability of the entire system. The relationship between resistance, recovery and adaptivity therefore contains a dimension of time. Resistance refers to the time during which the system is able to maintain its balance before disfunctioning occurs; recovery in this instance also refers to the time the system needs in order to restore the balance, and adaptivity refers to the time the system needs to find a new balance. The degree of resilience of the system is determined by the time it takes the system to regain its balance, either the original functioning or a new functioning. If the time between the disruptions and the full recovery is zero, the system is 100% resistant - however, it is recognised that systems are in a state of permanent change, and there is always uncertainty and risk within societal systems and environments Davoudi [20] calls this “evolutionary resilience”.

Therefore, the concept of resilience can be defined as follows: Resilience of an individual, community or system is the capacity to offer resistance, recover from or adapt to disruptions and changes from the state of functioning that is perceived as ‘normal’.

## 2.3 Approaches to Resilience Enhancement

The concept of resilience is subject to debate and diverging interpretations (e.g. [7], [8]) and thus there are many different perceptions of how resilience can be categorised and the operational implications of categorisation. The concept of resilience measurement requires definition/clarity around the scope of the system (i.e. resilience of what) and the type of disruption (i.e. resilience to what) to consider [13], [21], [9]. Depending on the aim and scope of how resilience is measured, there are different approaches of formulating resilience frameworks. Many communities endeavour to establish good practices, but their intent and emphasis differs quite significantly. Some are

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focused on enhancing resilience within a specific sector; others are aimed at a specific type of disaster or disaster-phase. Some recognisable types of approaches are as follows:

- **Phase-oriented resilience enhancement approaches.** These focus on enhancing resilience during a certain stage of a disaster. In the typical preparedness phase, the focus would be on enhancing the capability of a society to resist a threat, and in effectively preventing a disaster from happening. In a disaster response phase and the later recovery stages, the value of resilience enhancement would be to increase the absorption, accommodation and recovery capabilities of a society. More developed countries often have their own disaster preparedness, response and recovery programs.
- **Threat orientated enhancement approaches.** These focus on a specific type of threat, such as varieties of natural disasters (e.g. floods, earthquakes, wildfires, and droughts), technological or man-made disasters (e.g. industrial accidents, terrorist acts, critical infrastructure failure) or threats emerging from climate change or economic stresses. Such approaches usually result from local or national risk assessments, where countermeasures against high-risk threats are formalized into procedures and standards.
- **Sector-specific resilience enhancement approaches.** In most developed countries, critical infrastructure providers and their partners develop specific resilience strategies to safeguard their production should a disaster happen. An example of this can be found in the energy and telecommunications sectors whereby elaborated routing provisions are made as to create enough backup capabilities to withstand various disasters.

Specific societal groups, where specific vulnerability has been identified can also be the focal point of resilience enhancement. The objectives of such approaches would be to enhance the capabilities of societal communities to withstand specific disasters. Aside from nationally-developed frameworks of this kind, there are many good examples in the humanitarian domain. Many international organisations have working procedures to enhance the safety of vulnerable communities, as do many locally active humanitarian organisations. Examples of this include the disaster preparedness UNISDR work through the Hyogo Framework for Action and the most recent Red Cross emergency preparedness work; such as community development work in Bangladesh, earthquake relief in Nepal and the flooding resilience efforts in North Korea. [22]

Comprehensive resilience enhancement approaches aim to transcend societal sectors, disaster types or disaster phases by focusing on actions that increase resilience more generally. These approaches target the whole of society - and are rather process-oriented than solution-oriented. Several countries have developed such all-hazards, all-communities resilience frameworks, such as the Australian National Disaster Resilience Framework, the UK National Resilience Capabilities Programme, and the US FEMA National Planning Frameworks. In practice, these frameworks contain sections that focus on local priorities and specific disaster phases.

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## 2.4 Community Resilience

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Since the adoption of the Hyogo Framework for Action, there has been a shift within international disaster resilience discourse. Where once the main goal was that of hazard planning and disaster risk reduction, it has slightly moved towards focusing more on building community resilience [23]. The main challenge of this shift in thinking, is how to “define and develop indicators” that can accurately measure community resilience and how to analyse these measurements [23].

WP33 focuses on these community resilience challenges. For the purposes of this work, communities are understood as social units, which often, but not necessarily, have spatial (geographical) relations. More specifically, WP33 aims to identify and apply promising methods for measuring the level of resilience of a community and methods to support communities in the enhancement of resilience within the system (outlined in section 2.2).

Community resilience can be approached from the systems point of view (section 2.2), due to the complex and multi-variable nature of the concept [24]. The measurement of community resilience therefore often refers to the capacities of communities to deal with changes and disasters. The International Federation of Red Cross and Red Crescent Societies (IFRC) defines community resilience as “The ability of communities exposed to disasters, crises and underlying vulnerabilities to anticipate, prepare for, reduce the impact of, cope with and recover from the effects of shock and stresses without compromising their long term prospects” [25].

Community resilience is often theoretically framed within socio-ecological and psychological studies. From a socio-ecological perspective it no longer only considers risks, problems and negative consequences to the environment, but also analyses the societal strengths, competencies and positive factors of communities [26]. The psychological perspective is also considered within community resilience, including the analysis and improvement of the wellbeing of individuals through developing adaptive capacities that permit some level of personal control over future direction rather than being solely left to deal with unmanageable external forces, thus increasing psychological resilience of individuals within the community [27].

As the psychological perspective indicates, community resilience can operate on an individual level, seeking to engage and develop individuals within communities, pulling resources in order to deal with a change, uncertainty or unpredictability in their environment [28].

Therefore a resilient community is considered to be able to respond to changes within their physical and social environment positively and pro-actively, ideally maintaining their core functions despite the stresses placed on it. Different changes will demonstrate different degrees of resilience within communities, based on how resilient they are to that particular stress [29]. Broadly speaking; community resilience allows communities to feel empowered so that they can address local challenges more efficiently than through traditional top-down governance structures.

To be able to measure community resilience it is necessary to understand the indicators of a resilient community, for instance with regard to its members, networks and other community characteristics. This knowledge, in turn, can be used to support communities in self-assessing the level of resilience to identify possible actions for resilience enhancement.

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## 3 Measuring Community Resilience

### 3.1 Introduction

An important part of the work in WP33 is to identify and test a community resilience measurement framework. Of all papers that we have selected for further examination from our systematic research review, sixteen specifically addressed the measurement of community resilience. In this chapter we describe some important distinctions with regards to scope, operationalization and data gathering, as well as the considerations for selecting a method for further experimentation.

#### 3.1.1 Scope of indicators

A first distinction that can be made within these selected papers is the scope of indicators. Five papers used a rather broad scope which is in line with the review of Ostadtaghizadeh [17], including (a combination of) the social, economic, institutional, physical and natural domain. The most comprehensive framework in this regard is the Disaster Resilience Of Place (DROP) model [43]. DROP (described by Cutter et al. [43] and the subsequent study for Disaster Resilience Indicators [7], emphasizes the search for a summary of community resilience in a very limited number of instances (top resilience index and indices), based on a large number of existing quantitative data. In this study existing data from surveys and registrations were used to measure 36 variables divided into five categories: (i) social resilience; (ii) economic resilience; (iii) institutional resilience; (iv) infrastructure resilience; (v) community capital. Based on the outcome of the analyses, a Disaster Resilient Index (top index) is constructed and the level of resilience compared with that of other countries (U.S. Federal Emergency Management Agency's (FEMA) Region IV). According to Cutter et al. such an index and the measuring of its underlying components serve several objectives: (i) to provide public interest in disaster loss reduction; (ii) as a means of underpinning the setting of priorities, (iii) to monitor resilience by measuring on a regular basis (i.e. measuring the progress) and (iv) to support the decision making processes with respect to resilience.

Other frameworks use a more limited scope focusing on social capital. Norris et al. [15] for example, the most cited paper in this area, make a distinction in information and communication, community competence, social capital and economic development with community wellbeing as the eventual outcome variable. Paton [16][44][46] makes a distinction of indicators in three levels: individual, social and institutional.

#### 3.1.2 Operationalization of concepts

A second distinction concerns the operationalization of the various concepts. As also noted by others there is a wide disparity in how concepts are defined and measured, which points to the absence of a coherent theoretical foundation. In defining social capital for example, Kulig and Botey [55] distinguish between social interactions and attachment to place, Norris et al. [15] use social support, social embeddedness, organizational linkages, citizen participation, sense of community and

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attachment to place, whereas Prior and Eriksen [56] define social capital by sense of community, attachment to place and collective problem solving.

### 3.1.3 Data gathering

A third observation is the difference in the way data is gathered. Some researchers like Paton [16] [44] and Prior and Eriksen [56] used questionnaires and related resilience indicators to level of preparedness. Sherrieb, Norris and Galeo [57] used secondary data to measure two capitals as distinguished in the Norris model [15], economic development and social capital. These data were validated against an index of social vulnerability.

## 3.2 Selection of measurement method

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Our overall conclusion from studying the scientific studies to date is that most studies are based on an analysis of community characteristics rather than on how to measure the level of community resilience, based on theoretically grounded and valid indicators that relate to the level of communities' preparation and response. The research on community resilience is not very mature in that sense. An exception is the model of Paton, who related indicators of community resilience to the level of community preparedness on a range of disasters such as tsunami, earthquake and flooding. A limitation of this model is that it is mostly focused on the social domain, but a main advantage, opposite all other frameworks, is that the indicators that are distinguished are well theoretically grounded. In addition, the model has been validated in a range of different countries. Therefore we have selected the Community Engagement Theory (CET) by Paton as a measurement tool.

## 3.3 Community Engagement Theory

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Community Engagement Theory (CET) draws upon some of the psycho-social concepts of community resilience, consistent with emerging community resilience literature that puts "pro-active human agency" at the forefront of community resilience [16], [45], [46], [47]. This is in contrast to the more reactive, "bounce-back" nature of more traditional resilience literature [24], [48].

CET is considered an "all hazards" approach, validated across a range of communities and within different cultures using structural equation modelling (SEM) analysis. Cultural differences include, Australasian eco-zone countries considered similar to Western Europe (e.g. Australia and New Zealand) and also in countries with cultural variances (e.g. Japan, Taiwan). The theory has been therefore been tested in both individualist and collectivist communities, showing valid cross-cultural equivalence, necessary for testing within pan-European contexts. The theory has been validated in both urban individualist (e.g. Christchurch, New Zealand) and rural collectivist (e.g. Taiwan) communities.

The theory is a multi-level model, operating on three levels: (i) Individual (outcome expectancy), (ii) Community (community participation, collective efficacy, place attachment) and (iii) Societal

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(empowerment and trust). It's community-led and predominantly focuses on the decision-making processes regarding the uncertainty of community resilience and has been developed to examine the factors that influence how people change and adapt to in order to become more resilient. It measures the interpretive processes that occur at the individual, community and societal level of resilience and how they affect a community's decision-making to become more resilient/increase capacity. For communities to increase their resilience, they must engage in disaster risk reduction and preparedness activities through the development of resilience behaviours such as implementing household emergency plans or collaborating with fellow community members and local agencies to address local problems [16].

Traditional ways to engage communities such as financial assistance provision or resilience information dissemination have shown to have little influence on preparedness [49] CET seeks to address this by considering preparedness as a decision making process where "uncertainty" acts as the variable. It looks specifically at what influences an individual's decision to prepare, taking into account social, personal and cultural aspects. Other theories such as the socio-ecological system approach [50], and The Urban Resilience Framework [30] focus on specific factors of resilience; Community Engagement Theory instead addresses the decision making process of each individual within the community's response to risk. This universality of the decision making variable provides a cross cultural overlap, operating at the psychosocial level of resilience present in everyone regardless of cultural differences, access to finance, differing resources and organisational capacities.

Behaviour typically displayed by resilient communities is described by 7 indicators [16]:

- **Outcome expectancy (or response efficacy):** is the belief an individual may have in the effectiveness of specific behaviours such as preparing for disaster. This can be further subdivided into positive outcome expectancy and negative outcome expectancy (POE or NOE). Negative outcome expectancy refers to the belief that the disaster or crisis is too "catastrophic" for personal actions to make a difference to safety, while positive outcome expectancy refers to a belief that their actions can make a difference. It's important to note that holding a POE belief system does not mean the individual will know the correct way to prepare: before any action the individual must seek confirmation and guidance; firstly by looking at what other community members say and do [46]
- **Community participation:** interactions with others in regular social contexts. Paton & Buergelt [51] confirm that discussion within a community and sharing information regarding risks helped the community to identify and mitigate risks, and to decide what would be an effective response collectively, based on what additional information was required.
- **Collective efficacy:** community members' ability to assess their capabilities and resources needs and to formulate plans to use resources to meet challenges.
- **Place attachment:** identification with a neighbourhood – including attachment to the physical place as well as attachment to its members. Emotional investment from members of the community to the place they live in, could spur the community to take hazard preparedness actions.

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- **Empowerment:** belief that the relationship with risk management agencies is fair and empowering. When this relationship is not perceived as fair, this can lead to a loss of trust within the agencies.
- **Trust:** Linked with empowerment, trustworthiness in the sources of information influences whether information is used to guide behaviour.
- **Intentions:** the Intention to acquire knowledge on the relevant hazards leads to an increase in actual preparedness and willingness/ confidence to work with other people and agencies in order to develop knowledge and capability.

In order to measure community resilience through these indicators, an existing survey [16], [52] will be administered in The Hague, the Netherlands. Using this existing survey will allow a comparison of our results with previous studies as conducted by Paton and his colleagues. This comparison concerns the predictive value of the resilience indicators for preparatory behaviour towards (potential) disaster. In addition, the indicators will also be used for a dashboard allowing professionals to gain insight into vulnerabilities and capabilities of a specific community. This insight can contribute to the adaptation of their response based on the specific profile of a community.

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## 4 Community Resilience Enhancement

### 4.1 Introduction

In addition to identifying useful methods for measuring community resilience, the work in WP33 also aims to identify relevant approaches for community resilience enhancement. While community resilience is said to have gained a lot of traction politically and given credence by disaster management professionals, this perception is not always shared by the individuals of communities - perhaps due to their view on the state's role in resilience or an individual's lack of previous disaster experience. Individuals can therefore find it difficult at times to appreciate the range and implications of consequences in the event of a disaster and the benefits of community resilience [52]. One solution to address the difficulty of individuals 'conceptualising' the benefits of resilience can be through the use of community resilience enhancement approaches aimed at facilitating an increase of communal resilience awareness.

### 4.2 Review of Community Resilience Enhancement Approaches

Based on previous work we already had a list of several international approaches for the enhancement of community resilience with a strong focus on awareness and practical operationalisations. Most of these approaches are government/NGO initiatives or (preliminary) results of other EU projects. These approaches do not necessarily appear in the academic literature and some of them are therefore also not part of the results of our Scopus/Google Scholar search (only five articles from our Scopus search describe a community resilience enhancement approach). For this reason we initially broadened the set of approaches to review with a number of approaches that have been gathered in previous projects (mostly through google search and snowball method or through our professional affiliations). Because creating awareness of risks and hazards and shared responsibilities of stakeholders are generally seen as an important starting point for enhancing community resilience, an important selection criterion to decide which approaches to include in our review is that the approaches are based on participatory approaches. Another initial selection criterion was that we need access to the actual community resilience enhancement approach, so we left out explorative guidelines or descriptions of an approach that do not contain the actual working method or process. As a result we have included the following five approaches in our review:

- The Community Resilience Manual (Canadian Centre for Community Renewal, Canada, 2000) [31];
- The Bay Localize Community Resilience Toolkit (Bay Localize, Oakland, USA, 2012) [32];
- Communities Advancing Resilience Toolkit: The CART Integrated System© (Terrorism and Disaster Centre, University of Oklahoma Health Sciences Center, Oklahoma, USA, 2013) [33], [34], [35];

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- Community Disaster Resilience Scorecard Toolkit (Torrens Resilience Institute, Adelaide, Australia, 2012) [36], [37], [38];
- The Los Angeles County Community Disaster Resilience Project (Los Angeles County Department of Public Health, 2012) [39], [40], [41].

When looking at the five approaches for community resilience enhancement, there are some important distinctions with regards to their scope, content and validation.

#### 4.2.1 Scope of the approaches

The Community Resilience Manual [31] and the Bay Area Community Resilience Toolkit [32] focus on enhancing community resilience towards profound social and economic changes that stem from long-term developments and na-tech hazards (e.g. environmental damage, long-term power failures). In doing so, the Community Resilience Manual [31] specifically aims to enhance the resilience of rural communities that are often strongly reliant on specific economic livelihoods (forestry, fishing, mining, agriculture, etc.). In turn, the Bay Area Community Resilience Toolkit [32] is a regional-oriented approach to enhance the resilience of the San Francisco Bay area in relation to long term climate change and dependency on fossil energy sources.

While the aforementioned approaches have a focus on stresses and shocks that result from long term developments, the other three approaches have a stronger disaster resilience orientation. The Communities Advancing Resilience Toolkit (CART) [33], the Community Disaster Resilience Score Card [36] and the Los Angeles County Community Disaster Resilience Project [39] have a broader scope both in terms of the type of communities they address and their all hazards orientation.

#### 4.2.2 Content of the approaches

Four of the five approaches are set up as toolkits, containing a range of different instruments or methods. Only the Community Disaster Resilience Scorecard [36] uses a single method (a scorecard consisting of 22 questions) to guide communities to assess their resilience and enhance awareness. The other four approaches provide communities with a combination of different tools including surveys, swot analysis, workshop formats, interview guidelines, stakeholder analysis, and methods for identification of community resources and capabilities, or templates for information gathering. All five approaches are essentially community-driven (to be used by community leaders or community organisations), although the Los Angeles County Community Disaster Resilience Project [39] specifically addresses community health workers in leading the application of the toolkit.

#### 4.2.3 Validation of the approaches

The Community Resilience Manual [31], The Los Angeles County Community Disaster Resilience Project [39] and the Bay Area Community Resilience Toolkit [32] originate from a government-led initiative that was meant to raise awareness and to identify possibilities for enhancing community resilience. This means that they are less grounded in scientific theories and there is not a lot of (systematic) information available about their validity or generalizability. This does not mean that

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these are not useful tools, but it is difficult to judge this on the basis of the information that is available. The Community Advancing Resilience Toolkit [33] and the Community Disaster Resilience Scorecard [36] have a more explicit theoretical grounding and there are several scientific publications available about the tools, underlying models and application of the tools.

In Table 1 an overview of the main characteristics of these five approaches is presented.

|                   | <b>Community Resilience Manual</b>   | <b>Bay Localize Community Resilience Toolkit</b>                                   | <b>Communities Advancing Resilience Toolkit (CART)</b>  | <b>Community Disaster Resilience Scorecard Toolkit</b>  | <b>Los Angeles County Community Disaster Resilience Project</b>  |
|-------------------|--|--|---|---|--|
| <b>Scope</b>      | Rural communities<br>Economic and social changes related to long term developments | Rural communities<br>Economic and social changes related to long term developments | All communities<br>Disaster Resilience<br>All-Hazards   | All communities<br>Disaster Resilience<br>All-Hazards   | All communities<br>Disaster Resilience<br>All-Hazards  |
| <b>Content</b>    | Toolkit  | Toolkit  | Toolkit   | Single method   | Toolkit  |
| <b>Validation</b> | Practice-oriented.<br>No scientific publications about application or validation   | Practice-oriented.<br>No scientific publications about application or validation   | Strong theoretical grounding, several scientific publications available about theory, applications and evaluation | Strong theoretical grounding, several scientific publications available about theory, applications and evaluation | Practice-oriented with some (implicit) theoretical grounding, several publications available about development and application |

**Table 1 Characteristics of Community Resilience Enhancement Approaches**

### 4.3 Selection of approach for experimentation

For our experimentation we aim to select an approach with a broad scope (all hazard, disaster resilience orientation, applicable to all types of communities). This means that the Community Resilience Manual [31] and the Bay Localize Community Resilience Toolkit [32] are not suitable for our purpose. The remaining three approaches show a lot of similarities. We decided to dismiss the Los Angeles County Community Disaster Resilience Project [39] because it has a less explicit theoretical and scientific background compared to the Communities Advancing Resilience Toolkit [33] and the Community Disaster Resilience Scorecard Toolkit [36]. Both of these approaches seem to be suitable for our experimentation. We decided to select the Communities Advancing Resilience Toolkit because it offers a range of different tools and has a modular set-up allowing for the selection of specific, relevant tools for a specific community and is therefore more flexible in its use.

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## 4.4 The Communities Advancing Resilience Toolkit

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The Community Advancing Resilience Toolkit (CART) is a community intervention toolkit designed to “enhance awareness of community resilience through assessment, group processes, planning and action” [33]. The approach is rooted in the theoretical framework of Norris et al. [15], which is in line with the conceptual model of resilience that we have adopted [see Figure 1]. The CART toolkit includes a combination of several participatory data gathering methods that can be used to gain information on the resilience ‘profile’ of a community and that allows the community to reflect upon its resilience capacities. The approach brings together community members regarding resilience, contributing to increasing awareness of resilience and improving community cohesion through the exchange of ideas throughout the process.

Three aspects of group behaviour within CART are facilitated through participatory methods:

- (i) Communication among the workshop group to pool skills and knowledge for better outcomes
- (ii) Individuals can learn and grow as result of group interactions
- (iii) Group participation to facilitate the acceptance and implementation of group goals

CART addresses four domains that describe and affect community resilience [33]:

- (i) Connection and Caring – participation, relatedness, shared values, support systems, fairness, hope.
- (ii) Resources – natural, physical, human, financial and social resources
- (iii) Transformative potential – identify and frame collective experiences, data collection, analysis, planning, skill building to create the potential for community charge
- (iv) Disaster Management – disaster prevention, mitigation, preparedness, response and recovery

The full CART process is both iterative and continuous for resilience improvement recognising that no community can ever be considered completely “free of risk” [42]. The process consists of four actions and when completed can be repeated:

- 1) Generate a community profile
- 2) Refine the profile
- 3) Develop a strategic plan
- 4) Implement the plan.

Each CART assessment begins with generating a community profile, creating a “snapshot” of the desired community’s resilience using the tools of a survey, interviews and the data collection framework. The profile is then refined through using various toolkit measures (e.g. Stakeholder analysis, SWOT analysis, community conversations). The outcome of these findings will inform a

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strategic plan through goal and objective setting and subsequently implemented into the community.

### The CART Process

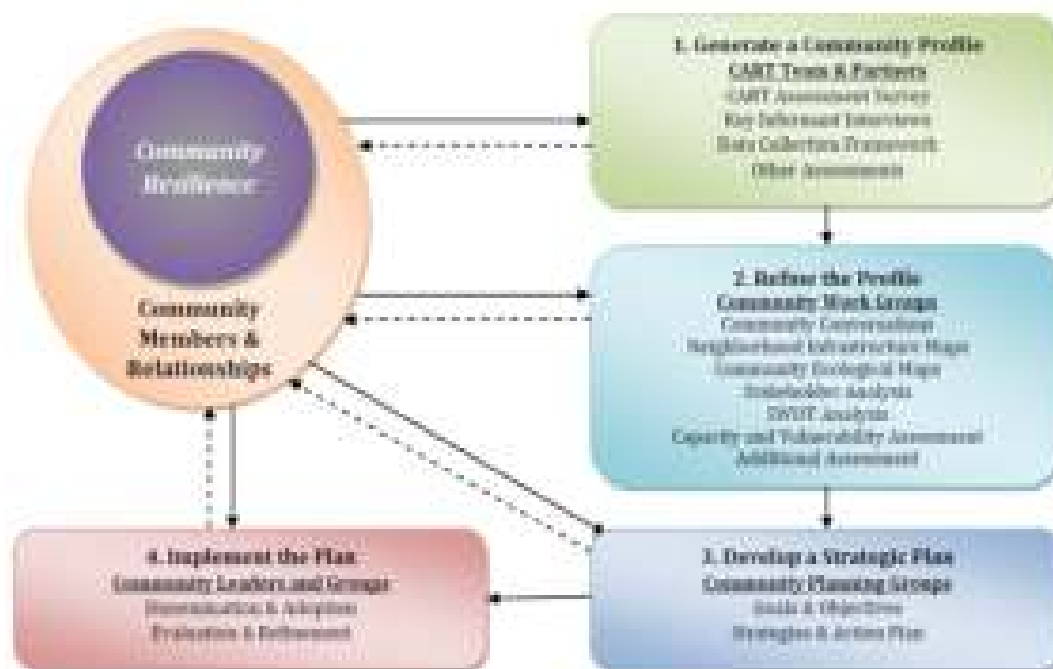


Figure 2: The CART process (Pfefferbaum et al. 2013)

The CART process outlined above (Figure 2) will provide the framework for the design of community resilience awareness-raising workshops for experimentation in WP33.

The workshops will be held in Scotland and will utilise aspects of the CART process and selected tools in order to raise the awareness of resilience among a broad range of rural and urban communities. In developing our participatory method, lessons learnt from other local rural and urban programmes will be taken into account. The findings from community resilience SRUC (Scotland’s Rural College) study will help to inform our initial approach to our workshops within our targeted rural areas; however urban communities are considered more delicate and harder to define. Urban communities can be categorised broadly by: (i) administrative boundaries (ii) function (interest) (iii) civil society networks [25]. Urban community engagement is often found within city-based community development centres, shared hobbies and interests, urban regeneration projects and local urban community partnerships.

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## 5 Conclusion

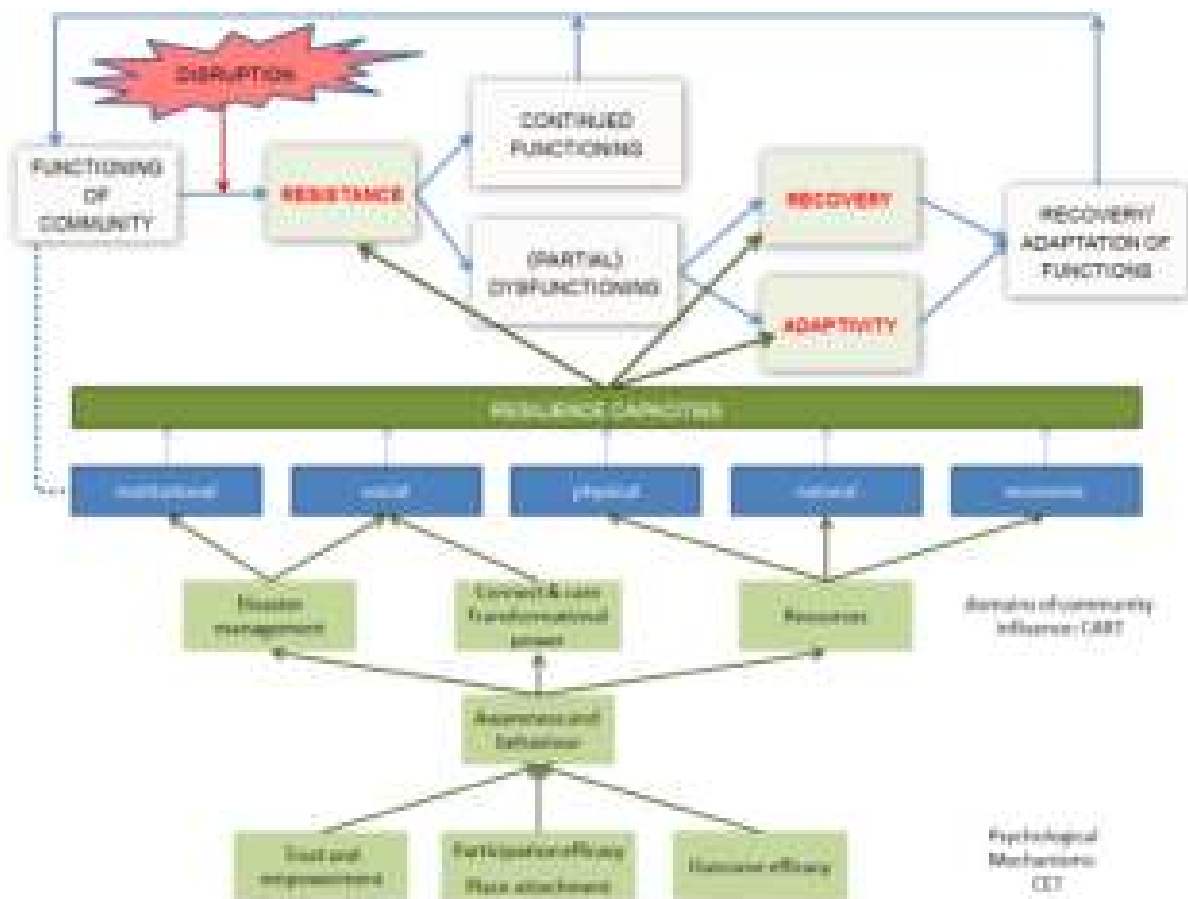
This report introduced community resilience, outlined the system-based resilience model to be used in relation to communities and reviewed a selection of measurement frameworks and community resilience toolkits in order to inform the choice of tools for experimentation in WP33.

While resilience generally is considered strong in Member States of the European Union, including the UK, community resilience is in need of improvement - without regular past experience of disaster, creative ways must be found to improve the likelihood of civilians implementing resilient decision-making behaviours with the objective of more resilient communities in Europe. The report viewed community resilience from a systems perspective, understanding community resilience as a multi-dimensional, complex concept which is often broken down into capacities allowing practitioners and citizens to address and strengthen component parts of community resilience through quantitative measurement tools, scorecards and/or qualitative methods.

Community Engagement Theory (CET) was the theoretical framework selected to inform the design of the measurement method. The Community Advancing Resilience Toolkit (CART) was selected as the participatory method toolkit to inform the design of community resilience awareness-raising workshops. Both toolkits will be adapted and then tested within rural and urban communities to inform the final community resilience model for the DRIVER programme. Both of the selected tools have open-source availability, and after the workshop in Inverness, the authors have been contacted and have both granted explicit permission for us to use the tools in the DRIVER experimentation. Both authors presented opportunities for dialogue through the experimentation design and implementation which was further reason to continue with our selected methods for each of the experiments.

Figure 2 (de) shows how each tool fits into the resilience model first outlined in Chapter 2. Both tools are used to enhance the resilience capacities. CET describes the psychological mechanisms that influence awareness and behaviour at three levels: individual (outcome expectancy), community (participation, community efficacy and place attachment) and societal (trust and empowerment). Through increased awareness and behavioural change the four domains as distinguished by CART can be improved: connection and caring, resources, transformative potential and disaster management.

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**Figure 3: WP33 – Resilience Model with selected DRIVER tools**

The two selected methods can be seen as complementary: The first tool (CART) is a “top-down” approach that can be useful, for example, for municipalities that would like to invest in building community resilience within their municipality and therefore want to produce an overview of the resilience capacities and vulnerabilities in the different neighbourhoods. The second tool (CET) is a “bottom-up” approach whereby the community members themselves raise their community resilience awareness and identify their strengths, their weaknesses and areas for improvement. The tool can be implemented by community members themselves, or facilitated by local government or civil society organisations such as the Red Cross. The two tools can be used separately or as two complementary approaches in the same area. Both tools are most suitable in the preparedness phase of a crisis management cycle in order to build the capacity to respond and recover.

For the joint experiments in DRIVER two scenarios were selected: flooding in combination with a pandemic scenario, and a heatwave. Flooding is a serious risk in both the UK and the Netherlands and we will therefore focus our experiments on this potential disaster. In the UK, flooding has a significant impact on communities in a time of crisis - “over 40% of Red Cross UK emergency response call-outs in 2009 were related to severe weather incidents, with 25% of these related to flooding” [56] . In a similar vein, a recent campaign has been introduced in The Netherlands for increasing flood awareness of the Dutch through a website and an app (<http://www.overstroomik.nl/>).

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The immediate next steps in WP33 are:

1. **Measuring resilience:** In this experiment a survey will be conducted to test whether the indicators as defined by the Community Engagement Theory predicts individuals' preparation for a flooding. The survey is administered in the Netherlands (where flooding is a serious threat, but has not experienced a major disaster yet). As such CET can be validated in a European context.
2. **Community resilience awareness-raising:** based on CART tools we will conduct workshops in both rural and urban communities in Scotland and measure the effect of the intervention both immediately after the workshop and after a couple of weeks.

Outlook ahead:

3. **A production of guidelines for professionals:** In an actual crisis, communities need to cooperate with professionals. Based on the selected Community Engagement Theory we will develop a dashboard that supports professionals to take resilience into account in order to maximally utilise this potential.

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# Appendix 1

## List of articles included in literature review

- Ainuddin, S., & Routray, J. K. (2012). Community resilience framework for an earthquake prone area in baluchistan. *International Journal of Disaster Risk Reduction*, 2, 25-36.
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