INDRIX
Inclusive Disaster
Resilience Index

Inclusive Disaster Resilience Index

Final report

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www.indrix.eu

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SAMARIESU APVIENIBA
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Introduction

This final document contains the most important results and the activities carried out during the INDRIX project. The project was supported by the Civil Protection Financial Instrument of the DG-ECHO (Humanitarian Aid and Civil Protection). The report is divided into sections that analyses the various design steps and the results achieved for each of the activities. The final part describes the elements of reflection and analysis that emerged during the project and shared both by the network of the partners and by the stakeholders/beneficiaries, and by the possible proposals to be submitted to the attention of the European decision makers.

1. Indrix:

Objectives and Partnership

Indrix (inclusive disaster resilience index) is a project funded by DG ECHO in the call for proposal 2015 for prevention and preparedness projects, Area of activity: Natural disaster - Prevention.

The project partners are:
– University of Rome Tor Vergata (IT)
– Samaritan International (DE)
– Anpas Associazione Nazionale Pubbliche Assistenze (IT)
– Samaritan association of Latvia (LT)
– Croce Bianca Bolzano (IT)
– Ubilabs (DE)

The main objective of the project is to develop an index of social resilience that allows stakeholders to evaluate the degree of community resilience and the identification of potential for improvement for a more inclusive disaster relief process chain. As an innovative aspect, technological aides used by the target group are defined as an indicator for inclusion and in consequence for social resilience.

2. Literature Review:

What is missing. Resilience "of what" and "to what"

The term "resilience" was firstly adopted by Hotelling (1973) who, in his contribution "Resilience and Stability of Ecological Systems", adopted the idea that ecological as well social systems are characterised by multiple equilibria and by transient behaviour among states. In the same article he pointed out the difference between "stability" and "resilience" of a system; the first relates to the property of a social system to restore the initial state after a shock, while the second measures the persistency of the state to the shock, i.e. the capacity of absorbing shocks without modifying the intrinsic characteristics of the system. In other words, the term "resilience" refers to the persistence of a given ecological, social, or economic structure and its ability in absorbing serious shocks.

According to Carpenter (et al., 2005), resilience is based on

a. The amount of external shock that the system can absorb
b. The extent to which the system is able to reorganize itself
c. The extent to which the system is able to learn and to adapt to the shock (Gunderson 2000)

The literature on resilience is now rather wide but it can be identified in two main branches. The first one, mainly referred to contributions before 2008, relates to the dynamics of complex, adaptive, social-ecological systems (SES), i.e. the ability of a society or a community to engage with external shocks. This ability is the result of the interaction of social, economic and environmental components (Hotelling 1973, 1996, 2001; Gunderson 2000; Adger 2000; Walker et al., 2004; Carpenter et al., 2005). In this case resilience focuses on the adaptive behaviour of a system to react and to reorganize its structure to changes, but without a serious modification of its inner structure (social relationships, institutional rules and so on).

The second branch, more common in recent times, comes from contributions originating from the MacArthur Foundation's study (Pendall 2007, Swanstrom 2008) and from a special issue of Cambridge Journal of Regions, Economy and Society (2010). Basically, these contributions have analysed the impact of the serious 2007 economic crises on Western societies. In particular (Lee 2014, Martin et al., 2015-2016; Fratesi and Perrucca 2017) have tried to provide a way to measure and a precise definition of "resilience".

Despite this growing interest, several aspects remain without an answer. A widespread consensus does not exist on what we mean by "resilience", neither "of what", nor " to what".
Our research tries to fill the gap, by considering a large number of variables able to describe, at a reasonably detailed level, a complex socio-economic context that can be considered as a "benchmark" for measuring and testing our proposed idea of a Social Resilience Index, in the particular field of natural disasters.

To achieve this aim in the first phase of the project the partners focused on the analysis of the existing scenario, and analysed the concept of resilience applied to communities at risk of natural disasters to a greater extent. One of the central themes in the scenario analysis concerns the relationship between the resilience of a community and the possibility of measuring it. The term "resilience" in fact risks being too abstractly designed to be used to improve public policies. But why does it become important to try to measure the degree of resilience in a community?

If it is true that the degree of resilience achieved by a community significantly determines the quality and speed of the process of returning to the pre-situation or improvement of community functions following a natural disaster, then being able to correctly measure the level of achieved resilience means that citizens, NGOs and policy-makers have a very effective instrument for participation, prevention and policy design. Furthermore, according to various authors, community resilience can be interpreted as a process rather than a goal (Norris 2008): the social, economic and cultural characteristics of communities are constantly changing, as well as the adaptability of individuals and organisations. This process of continuous evolution needs tools to assess and plan actions in order to guide the process of resilience and recognition of possible crises before a natural disaster occurs.

Being able to correctly measure the resilience of a community also means being able to evaluate the effectiveness of prevention and civil protection interventions with respect to the social and economic conditions of the community (Benè 2013). Analysis of the literature on social resilience has identified about 115 resilience indices proposed on a global level [Beccari 2016]. This is because resilience can be seen as a multidisciplinary and multidimensional phenomenon: the economic factors related to the costs of reconstruction add up to those related to the social and health conditions of the population, and also include environmental factors and those more specifically sociological (for example on the social capital and capabilities of individuals). Each of these disciplinary approaches has produced interpretation frameworks and specific resilience assessment indices.

Our objective was not to create a synthesis of the various proposals, but rather to propose a social resilience index that can be consistent with the objectives of European civil protection, The results of the analysis were discussed among the project's partners in order to be able to identify the areas of importance for developing a social resilience index that is:

a. inclusive of social vulnerabilities, with particular reference to the elderly and disabled people
b. capable of assessing the communities' social capital
c. closely connected to the risk management process

3. Building a new index for social resilience

a. The semantic map of resilience

The next step is the shared construction of a semantic map of social resilience [figure 1, 2 & 3]. The semantic map is a tool that makes it possible to identify, for each dimension, the semantic space upon which to then build the most suitable and consistent quality and quantity indicators. Starting from the semantic map, an initial analysis was developed of the dimensions of relevance for building a social resilience index, taking account of social vulnerability, social cohesion and the risk management process.

To construct the concept map, the main dimensions for the resilience of the communities in relation to natural disasters were first identified. The dimensions identified are described in figure 1.

Once the main dimensions of resilience had been identified, each of these has been analysed to find concrete and measurable elements, to be transformed into indicators.

Indicators are concepts that cover a part of the semantic space of other concepts on a higher level of abstraction. This is why it is essential to work well on the initial extension and delimitation of the semantic space, and then to develop the indicators that will compose the social resilience index. At the end of the map construction process, each dimension has come to define which indicators can be used to build the social resilience index.

created with www.bubbl.us

Fig.1: the main dimensions of social resilience

*Fig.2: the sub dimensions of social resilience*

Fig 3: the semantic map

b. Social vulnerability

According both to sociologists (Castel 1995) and economists (Galor and Zeira, 1993, Durlauf 2004, Giannini 2001 among others), the path of a potential subject may take place by transitioning, over the course of one's life, between the area of integration (stable integration into employment circles and the availability of solid relational – and especially family – support) to the area of disaffiliation that is the destiny of subjects in conditions of extreme poverty (characterised by processes of decay and self-abandonment, inability to control physical space, profoundly broken social bonds, lost ability to transform goods into life opportunities). This transition takes place

through micro-fractures in the subjects' experience, at the level of both work and relationships, generating situations of precariousness and fragility: this is the area of social vulnerability. The quantitative and qualitative extent of the vulnerability area is closely correlated with social resilience, because it signals how and to what extent a community of people contains fragile members who may react to situations of crisis during a natural disaster.

The dimensions of vulnerability we have deemed of relevance regard the following spheres of life:
– conditions of the living situation
– working and income situation
– available human and cultural capital
– social relationships
– health conditions
– level of education

For each of these dimensions, it will be necessary to identify measurable indicators for which data are available in all countries of the European Union.

c. Social cohesion

The networks of relationships to which individuals belong and in which they recognise themselves (social capital) are a supplementary resource (with respect to economic and cultural capital) of importance for pursuing individual and collective goals [Bourdieu 1983, Coleman 1988, Benabou 1996]. The literature shows the prevailing conviction that a general climate of trust between people, a high level of participation in associative networks, and a widespread presence of civic culture are bedrock elements for social cohesion and well-being (economists refers to these as "neighbourhood effects")

A community's degree of social cohesion is an important area for better understanding social resilience. For some, it is synonymous with it, while for others it is one of its constituent aspects. What is of interest to us is to focus on the density of the relationships that may be present prior to a crisis triggered by a natural disaster.

The dimensions of social cohesion we deemed relevant are the following:
– active citizenship
– social participation
– density of associations
– ability to access information

For each of these dimensions, it will be necessary to identify measurable indicators for which data are available in all countries of the European Union.

d. Management of the risk management process

The risk management process is the third pillar of our concept for planning the social resilience index. The four phases in the process (prevention, preparedness, response, recovery) are the basis for understanding whether a community is increasing its own capacity for social resilience. For each phase in the risk management process, we have imagined that some dimensions of relevance could be identified, such as:

– communication in the various phases of risk management
– processes of inclusion of marginal segments of the population
– getting citizens involved in risk management activities
– education for citizens
– coordination among civil protection figures

4. The composite index of social resilience

The multifaceted conceptual framework of Social Resilience necessitates an elaborated methodological approach. This chapter presents methodology and the data sources we have used to measure the level of social resilience across 276 European regions at NUTS 2 level in 2014. In the first step we have represented the process taken to operationalise the key elements and generate potential indicators, and the last step focuses on creating and validating the composite index.

Nonetheless, our conceptual framework is not totally accounted for by official statistics; in particular the risk management process requires the direct involvement of stakeholders active in the territory. For this reason we have built the overall resilience index by a two-step procedure leading to the construction of two sub-indexes: the first one relates to official data describing the socio-economic tissue of territories. The second one to the perception of safety in the population, the active implemented policies and the degree of awareness and preparedness entailed both in the population and stakeholders.

We have hence calculated a composite index of social resilience as a synthesis of two indexes. The first composite index is based on nine variables derived from the operationalisation of two dimensions of social vulnerability and social cohesion (see paragraph above).

The second composite index is the result of the synthesis of some questions from a questionnaire about the risk management process (see paragraph above).

a. The first sub-index: social conditions

Taking into account the complexity of the concept of social resilience and the breakdown into three dimensions (social vulnerability, social cohesion and natural disaster risk prevention), we have decided to separate the analysis of the first two dimensions from the third one, because of the different nature of the data. In fact, the third dimension has been examined by the construction of a questionnaire, while we have analysed the other two dimensions by statistical data. We have defined them into measurable factors by the operationalisation of the two conceptual dimensions. In table 1 it is possible to see the breakdown of the concepts of social vulnerability and social cohesion in dimensions and indicators. Operationalisation is necessary because we need to define the measurement of a phenomenon that is not directly measurable.
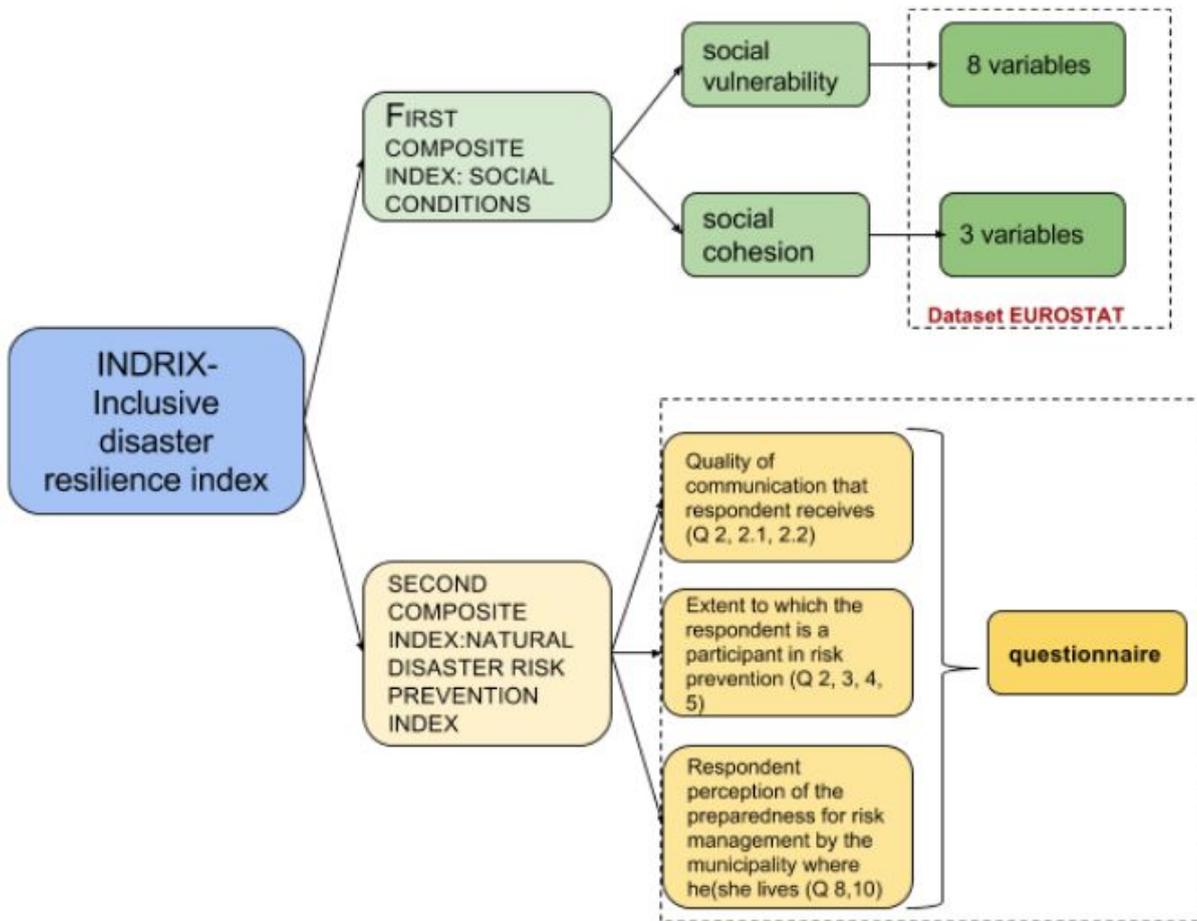
Fig 4: the composite index

Once the indicators had been found by the process of specifying the extension of a concept, for each indicator we have searched for the variables: all data comes from the dataset Eurostat and are at regional level (NUTS2). We created an exhaustive "wish list" of relevant measurements by operationalisation.

The first sub-index is the result of the synthesis of 11 variables. Because of the lack of information about some dimensions we don't have variables for the concept of social cohesion, in particular for the indicators of social participation, active citizenship, association density, blood donors and cultural capital.

The synthesis has been created by the methodology of the Mazziotta–Pareto index (MPI), available online at the following links:

– https://en.wikipedia.org/wiki/Mazziotta%E2%80%93Pareto_index

For the calculation of the index it is possible to use the COMIC software, implemented by ISTAT, that is available online at the following links:

– http://www.istat.it/it/strumenti/metodi-e-strumenti-it/strumenti-di-analisi/comic

Concept	Dimension	Indicator	Variables
Social vulnerability	Level of education	Early leavers from education and training	Early leavers from education and training - population aged 18-24
	Health conditions	Hospital care facilities	Hospital beds per one hundred thousand inhabitants
		Health status	Hospital discharges per one thousand inhabitants
	Conditions of the living situation	Severe social condition	Severe material deprivation rate (%)
		People at risk of poverty	People at risk of poverty or social exclusion (%)
		Social condition of young people	Young people neither in employment nor in education and training (NEET) – population aged 15-24
	Working and income situation	People living in households with very low work intensity	People living in households with very low work intensity (population aged 0 to 59 years)
		Unemployment	Unemployment rates - population aged 15-74

Tab. 1, Part 1 – Concepts, dimensions and indicator of social vulnerability and social cohesion

Concept	Dimension	Indicator	Variables
Social cohesion	Social participation	--	These indicators were not included in the index because of the lack of Nuts2 European data
	Active citizenship	--	
	Association density	--	
	Index of blood donors	--	
	Cultural capital	Participation in education system	Population aged 30-34 by upper secondary and post-secondary non-tertiary education (levels 3 and 4)
			Population aged 30-34 by Tertiary education (levels 5-8)
	Digital economy and society or ability to access information	Information and Communication Technologies usage in household	Households with access to the internet at home - Percentage of households

Tab. 1, Part 2 – Concepts, dimensions and indicator of social vulnerability and social cohesion

b. The second sub-index: constructing a Natural Disaster Risk Prevention Index

The second composite index is the result of the synthesis of some questions from a questionnaire about the management of the risk management process.

The questionnaire consists of 17 questions, all closed-ended and structured questions, where respondents are asked to choose from a list of options. In particular, the questionnaire is composed of:

- 9 dichotomous answers (Yes/No),
- 6 multiple choice questions where the respondent has several options from which to choose (2 with hierarchical scale);
- 2 scaled questions in which responses are graded on a continuum and 5 point Likert scales that are perfect for measuring respondents' attitudes or behaviours, particularly when they relate to sensitive subjects.

The language is friendly to encourage people to respond as there are no data collectors, and to avoid questions that could be interpreted differently by respondents. The final version of questionnaire is available online only at (link surveymonkey), the previous two versions were "beta versions", distributed in PAPI (pen and paper interviews) in Latvia and South Tyrol, and a digital version in Tuscany (Italy) and South Tyrol (Italy) in order to understand which questions are more precise, useful and clear. The target group for Beta versions were composed of civil protection volunteers and citizens to test if there are differences in understanding the questions. In the questionnaire there are some explanations of terms, like "civil protection exercise" for better understanding. The final version of the questionnaire is digital and explores different dimensions: it measures the opinions, experiences, behaviours and knowledge of the citizenships in terms of Natural Disaster Risk Prevention. The main topics are:

- the results of the communication that the respondent has received
- the participation in risk prevention
- the respondent's perception of the preparedness for risk management by the municipality.

A question on people with disabilities is also present because stakeholders found a lack of data regarding disability and perceptions of risk.

The questionnaire is managed through the Surveymonkey software platform, which allows us to manage and control the compilation through the presence of logical rules. All the questions have been made mandatory and there are also some filter questions where necessary. In Italy, the link has been spread by Anpas and Croce Bianca Bolzano during some meetings with volunteers and citizens scattered throughout the national territory. In Latvia the survey was spread to citizens by LSA (Samaritan association of Latvia) in different regions.

The following table summarises the main characteristics of the survey.

Survey	Characteristics
Dates of fieldwork	October 2017 - December 2017
Territory	Regions at NUTS2
Observation units	Individuals
Kind of date	Alpha/numeric data - Individual (micro) level
Universe	National – The survey covered all resident populations in European countries during 2016
Time dimensions	Yearly – The first survey was conducted in 2017. It will be conducted every two years from 2018.
Sampling procedures	Quota sampling (by regions and sex)
Number of units	The number of cases depends on the number of resident citizens
Method of data collection	Self-administered in electronic form
Weighting	Weighting used

Tab. 2 – Coverage, universe, methodology

In particular, the second sub-index was constructed considering three dimensions that emerge from semantic analysis of the questions in the questionnaire. The first dimension relates to the quality of the communication that the respondent receives (Question 2, 2.1 and 2.2); the second dimension relates to the extent to which the respondent is a participant in risk prevention (from Question 2 to Question 5), and the third dimension makes explicit the respondent's perception of the preparedness for risk management by the municipality in which she/he resides (Questions 8 and 10).

Finally, considering the three dimensions as partly independent (not replaceable), the final Natural Disaster Risk Prevention Index will be constructed as a synthesis of the three indices previously calculated, adopting the Mazziotta-Pareto index (IMP) method of calculation previously used for constructing the index in the first phase.

c. The questionnaire for the second part of the index

Below, we provide the questionnaire for the second part of the index available online. Thank you for filling out this questionnaire.

The questionnaire is part of the European project INDRIX (Inclusive Disaster Resilience), which we are taking part in together with several partners and with the support of the Civil Protection Agency. The objective of the project is to find a method to measure the level of resilience of regions. By filling out this questionnaire, you are supporting the successful completion of the project.

1. Have you taken out insurance against damages caused by a natural disaster?
   – yes/no

2. Have you seen any communication (local and/or national) on the prevention of natural disasters in 2017?
   – yes/no

a. The information you received was …

Options	Yes	No
Clear	○	○
Precise	○	○
Complete	○	○
Reliable	○	○
Useful	○	○
Satisfactory	○	○
Interesting	○	○
Instructive	○	○

b. Indicate to what extent you agree with the following statements regarding the information you have received about prevention

Options	`Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
I feel more informed	○	○	○	○	○
I am more aware of the risks I could encounter	○	○	○	○	○
I feel safer	○	○	○	○	○
I am more afraid of natural disasters	○	○	○	○	○
I am confused about the actions to be taken	○	○	○	○	○
I feel a greater sense of solidarity with populations affected by natural disasters	○	○	○	○	○

3. Have you watched any videos or listened to local television or radio broadcasts (at the regional level) on the prevention of natural disasters in 2017?
   – yes/no

4. Have you participated in any initiatives open to the public (e.g. assemblies, meetings) on the prevention of natural disasters in 2017?
   – yes/no

5. Have you participated in any Civil Protection exercises* on the prevention of natural disasters in 2017?
   – yes/no

6. If a natural disaster occurred in the area you live in, where would you seek information (Two responses can be provided here, in order of importance).

1st response	2nd response
Google or other search engines (e.g. Yahoo, Bing!...)	
Facebook	
Twitter	
Whatsapp/Messenger	
By telephone to a...	
News portal	
Local radio	
Local television	
National radio	
National television	

7. What would you consider to be the most reliable sources of information in the event of a natural disaster (Two responses can be provided here, in order of importance)?

1st response	2nd response
Local Civil Protection	
National Civil Protection	
Local authorities	
Associations	
Newspapers	

8. If a natural disaster occurred in the area in which you live, your Municipality …

Options	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
… would be well-prepared to manage the disaster	○	○	○	○	○
… would quickly take action to respond	○	○	○	○	○
… would know the risks of the territory well	○	○	○	○	○
… would have the economic means to reconstruct the buildings	○	○	○	○	○
… would assist the rescue services	○	○	○	○	○
… would apply the relevant technical regulations	○	○	○	○	○

9. Do you know if a local Civil Protection or Emergency plan exists?

   – yes/no

a. If so, what does it include?

   (More responses can be provided here)

   - ❏ Prevention activities for citizens
   - ❏ Activities to be carried out during a natural disaster
   - ❏ Reconstruction activities after a natural disaster
   - ❏ Don't know

10. If a natural disaster were to occur, how safe would you feel in your community?

   - ❏ Very Safe
   - ❏ Activities to be carried out during a natural disaster
   - ❏ Reconstruction activities after a natural disaster
   - ❏ Don't know

11. Do you know if a local Civil Protection or Emergency plan exists?

   – yes/no

12. Are you part of or engaged in a Civil Protection organisation?

   – yes/no

13. Are you registered as a person with disabilities?

   – yes/no

14. What is your year of birth?

15. Sex?

   – Female/male

16. What is your professional status?

   - ❏ Student
   - ❏ Employed
   - ❏ Unemployed
   - ❏ Retired
   - ❏ Other (specify)

17. Which country do you live in?

5. Indrix as an evaluation tool for other projects

INDRIX is also planned to be used as a basis for the assessment of social resilience in the context of European projects.

After testing the questionnaire and constructing the index, it was necessary to understand:
– If the Resilience Index can be applied to other contexts / activities
– Which indicators can be used to evaluate projects and services to improve community resilience

In order to understand this, in a preliminary phase some of the dimensions and indicators were identified by Indrix in order to evaluate resilience in other contexts/projects related to prevention and preparedness strategies in the EU. These aspects have been transformed into many questions which are to be submitted through a simple questionnaire to the subjects who present or have already submitted a project. The idea is to create an easy-to-use tool that helps those planning an intervention to take into account aspects related to social resilience, including those more connected to community perception. The questionnaire can be used both in the planning phase of an intervention to take into account the aspects of resilience in the activities foreseen and between the declared objectives, and in the phase of ongoing evaluation of the project to analyse if the activities can produce changes in the degree of resilience of the communities where the project develops. The first part of the questionnaire focuses on the ability of projects to take into account projects related to prevention, and risk preparation, the social and economic aspects of the territories as a basis on which to build interventions. The second part of the questionnaire includes the Indrix aspects related to the risk management process, and focuses more on the evaluation of the impact of the projects, analysing their ability to improve the aspects of participation, information and communication, in communities.
For this reason, we have selected some of the projects funded with the call "prevention and preparedness", which focused on community resilience and the relationship between NGOs, citizens and institutions.

Below we present the questionnaire we have developed:

Questionnaire

Introduction:The following questionnaire is part of the "INDRIX: Inclusive Disaster Resilience Index" project, co-funded through the European Commission's DG ECHO programme "Prevention and Preparedness". The primary objective of INDRIX is to construct and test a social resilience index, useful for the prevention of natural disasters.

The following is a draft questionnaire to assess projects within this framework. The replies will primarily be analysed with the improvement of the questionnaire in mind.

Considering the work of your project, we kindly ask you to respond to this questionnaire and thereby give us your feedback on some aspects of INDRIX. In particular, we ask you to reflect on aspects of your project regarding social vulnerability, social cohesion and the risk management process. In answering, we ask you to focus only on the communities and territories that have been the subject of your project and/or affected by it.

1. Title of your project

2. Acronym of your project

3. My project addresses the following phases of emergency management
   – Mitigation/Prevention
   – Preparedness
   – Response
   – Recovery
   – Other

4. Social vulnerability
   These following aspects concern some basic conditions in the population that could affect social disadvantage in crisis situations. Does your project consider one or more of the following elements related to social cohesion? To what extent?

   The level of education of people in areas where it is active
   – Not considered=1/Completely/Central part of the project=5

   The health of citizens / the quality of health services
   – Not considered=1/Completely/Central part of the project=5

Do you think your project has had an impact on the health of the population, or has it improved the quality of health services in the area? *
– Definitely not=1/Definitely=5

The living conditions of the younger population *
– Not considered=1/Completely/Central part of the project=5

Does your project also target the unemployed or people on low income *
– Not considered=1/Completely/Central part of the project=5

5. Social cohesion
    Relational networks which involve individuals and the cultural and financial capital at the networks' disposal constitute an important resource which enables said individuals to pursue their own goals.

    Does your project consider one or more of the following elements related to social cohesion?
    The presence of many different associations in the area
    – Not considered=1/Completely/Central part of the project=5

    The active participation of citizens in the community
    – Not considered=1/Completely/Central part of the project=5

    The use of IT and the possibility of internet access in the area
    – Not considered=1/Completely/Central part of the project=5

6. The risk management process
    The four phases of the process (prevention, preparedness, response, recovery) are the basis for understanding whether a community is increasing its own capacity for social resilience. For each of these phases, we ask you to reflect on some aspects related to your project:

    Does your project consider the development of a public communication campaign focused on the prevention of natural disasters?
    – Yes/No
    – Other

    Do you think that after your project, the citizens of the areas where the project is active are more informed about natural disasters?
    – Definitely not=1/Definitely=5

Does your project (or a part of it) promote public initiatives (meetings, assemblies) focused on the prevention of natural disasters?
– Definitely not=1/Definitely=5

Do you think that your project will provide citizens with more opportunities to receive important information in the event of a natural disaster?
– Definitely not=1/Definitely=5

Do you think that your project helps citizens to know about the activities related to civil protection in the area?
– Definitely not=1/Definitely=5

Do you think your project contributes to improving the relationship between citizens and the municipality in the event of a natural disaster?
– Definitely not=1/Definitely=5

Do you think that, thanks to your project, citizens are better informed about the civil protection plans in the area?
Definitely not=1/Definitely=5

In conclusion, do you think the previous questions contain information about the degree of resilience of a territory or the resilience delivered to that territory by your project? Please let us know your comments (with examples, if possible):

On the basis of the responses given, it is possible to identify the profiles of resilience to be attributed to the project (high level of social resilience/low level of social resilience), depending on the weight attributed to each dimension.

6. Mapping + Visualisation

We created a website with an interactive map to present and analyse our results. The website allows stakeholders outside of the project working group to easily see the results and work with them. The website is centred around a map. The map is the main interaction element and is used to present the collected data. On interaction with the map the data can be explored and interacted with.

The application is live and open for anyone interested to access. It can be accessed here: map.indrix.eu

a. Brief description of the website and its features

The following subsections give a brief overview of the different sections of the website and its various functions.

b. Overview
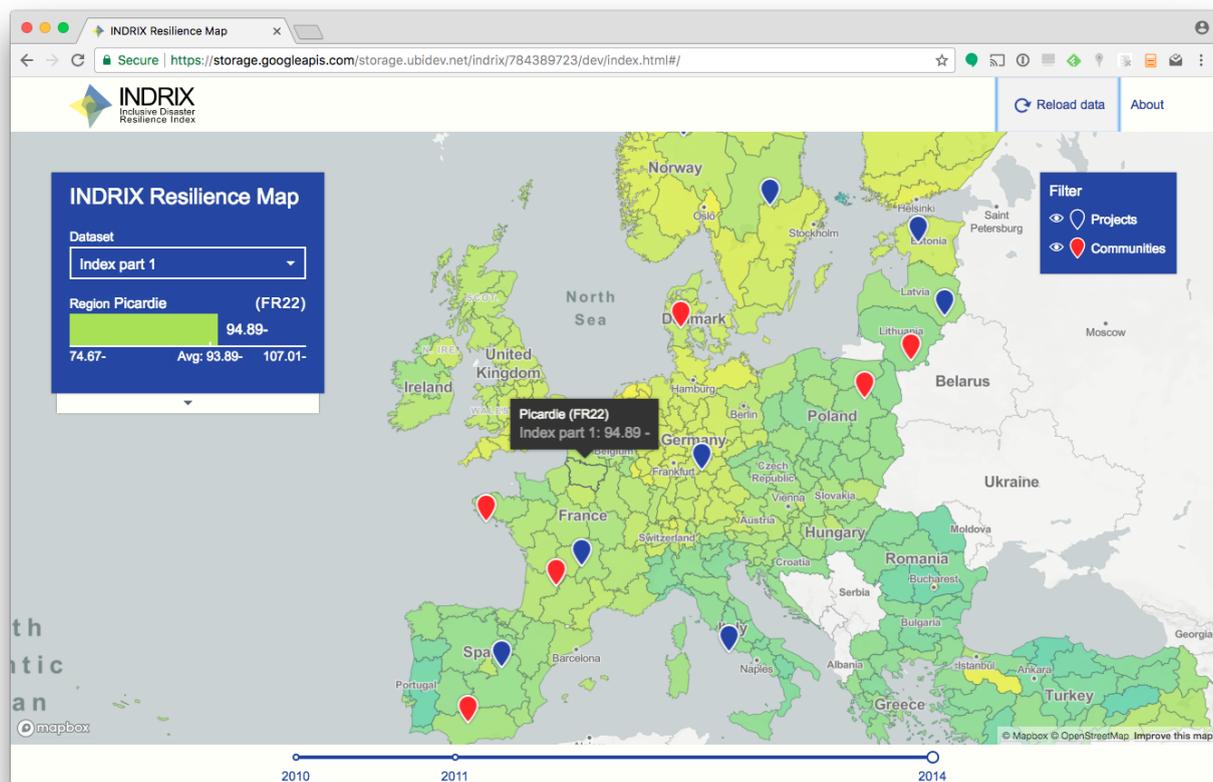
Fig 5: the interactive map

A world map. The map can be zoomed and panned. The different geographical areas are displayed on the map. They can be coloured according to data. The available dimensions can be selected from a drop down menu.

Map elements (regions and projects) can be hovered over to get quick access to information. Quick information is shown in a small tooltip at the location of the feature.
A little more context is given in the info area on the left where the information is presented numerically, graphically and with additional information on minimum, average and maximum values.

Once clicked the selection is made persistent and can be explored further.
When more than one time-step is available, a time-slider is shown to select one of the time-steps.

c. Area Detail Section
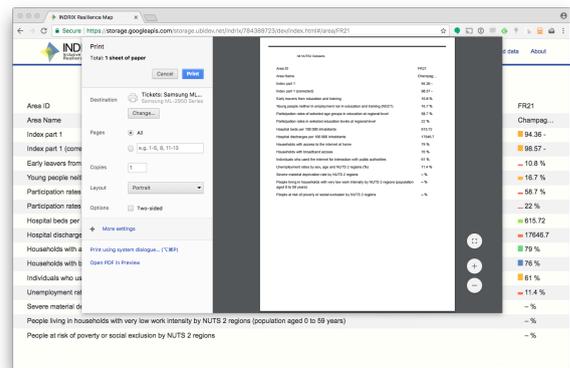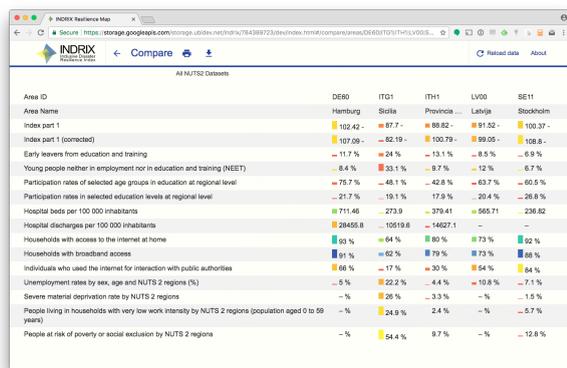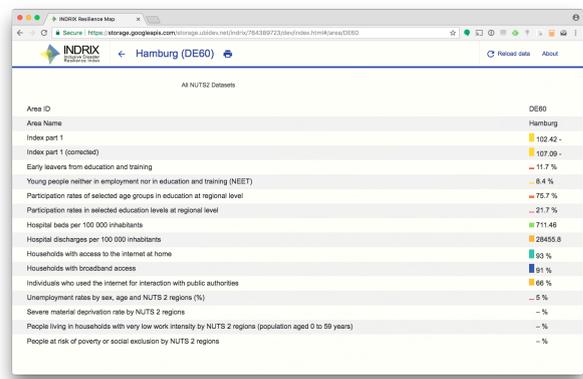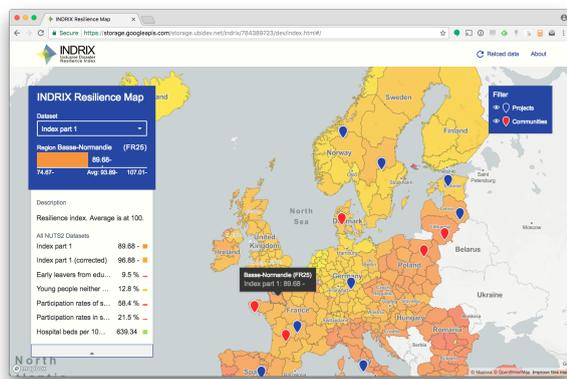
Fig 6: area detail section screens

The area detail section shows all available indicators for the selected area. The values are written out numerically and are displayed graphically as small bars to get a good and easy overview. Multiple areas can be directly compared in compare mode. Their individual values are displayed next to each other for easy comparison.

The area detail page and the area compare page are specifically prepared for printing and exporting so that they can be easily shared and processed further.

d. Project Detail Section
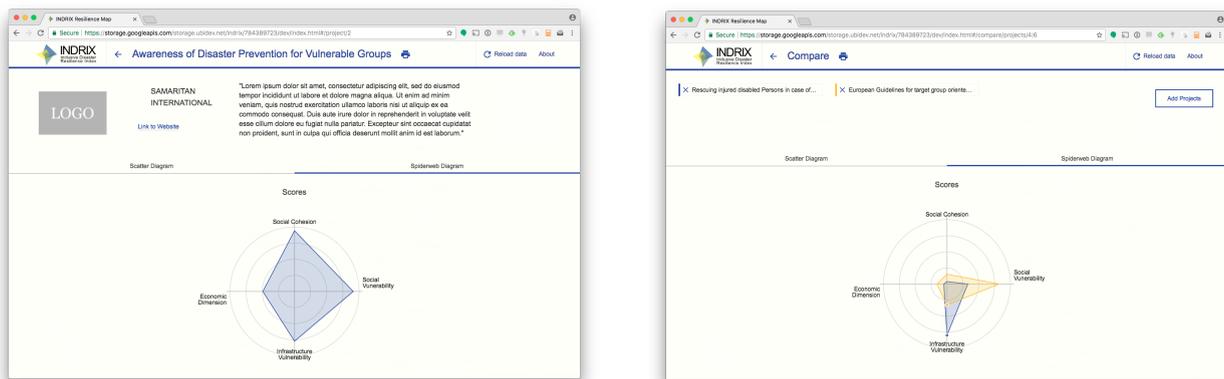
Fig 7: project detail section screens

The projects' detail pages have room for a brief project presentation. The values of the various dimensions that are describing the projects are presented in short small charts.

In compare mode more multiple projects can be compared to each other. Their values are presented within the same chart to show how they score in relation each other.

e. About Screen
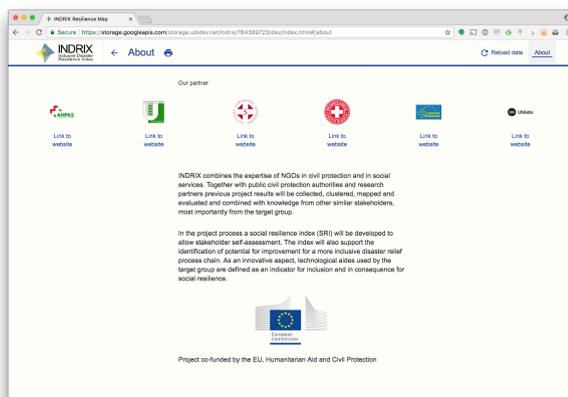
Fig 8: about screen

The about screen lists all project participants and stakeholders. It gives some background information about the project and acknowledges the European Union for its funding.

f. Feature Finding Process

During the Hamburg meeting in October 2016, Ubilabs organised a workshop to develop the set of features that the visualisation platform should provide. We applied modern feature finding workshop methodologies to aggregate and prioritise a final feature set. These methodologies ensured that every stakeholder involved had an equal opportunity to give their input and was able influence the final outcome.

Each workshop participant was asked to write down the most relevant user stories from their perspective. Each user story had to say who the stakeholder was and what they were trying to achieve, and why, by using the Indrix platform. E.g. "As a mayor I want to be able to compare my city with other cities so that I can improve the resilience of my community".

After posting and presenting the results to each other, the stories were clustered to define features which enabled the user to achieve the described goal. With the dot voting methodology the participants could vote for their 5 most important features. The result was a prioritised feature list that formed the basis for actual development.

Fig 9: impressions from the feature finding process

A prototype version of the platform was available during that meeting and was used as a basis for discussion.

Ubilabs took the consolidated feature set and used this as a guideline for further development. The implementation of the extracted features was evaluated and validated during the subsequent project meetings. The prioritised list of features was then regularly revised with input from the different project meetings.

g. Importance of Data Visualisation and Mapping

Good visualisation is crucial for understanding the full meaning of data. By visually presenting data, underlying trends and patterns emerge and can be seen rather easily as compared to when the data is analysed on a numerical level only. Using charts to plot out different dimensions of the data and using colours to depict values and groups allows us to see individual data points in their context of the complete dataset.

Visualising information on a map shows data in its geographical context. Geographical trends (like a north-south trend or neighbourly influence) become apparent when a dataset is spread out over a map.

A choropleth map as chosen here is the visualisation type that is best suited for visualising geographically distributed areal data. By colour coding each geographical unit according to its individual score a good overview emerges from the map of how the indicator is geographically distributed. Furthermore a choropleth map puts the individual elements in spatial relation to each other. Therefore regions can easily be compared with their neighbouring regions.

h. Accessibility

Websites and visualisations are generally hard to access for visitors with limited sensory and motor-skills. When developing web applications, special attention needs to be given to make the platform and its information open to all groups of society.

To guarantee the accessibility of the results presented on the website we followed the best common best practices in the field as defined by the World Wide Web Consortium (https://www.w3.org/standards/webdesign/accessibility). Important points include: screen reader support for the static and dynamic screen elements; usage of high contrasts in website design to increase general readability; we put an emphasis on clear and easy to understand language; we avoided unnecessary visual effects to not distract the users; we ensured that all the necessary navigational elements are keyboard accessible in a logical and efficient way; all navigational elements communicate a clear interactional state.

Accessibility standards were also observed in project publications (screen-reader enabled PDFs).

i. Sustainability

To guarantee that the solution can be maintained and updated for another two years after the official end of the Indrix project we searched for a solution that was easy to maintain, usable by all project members and not just by specially trained key personal, as it had to be a solution with a long term focus.

We chose a spreadsheet from an online office application as data storage. The general working and usage of a spreadsheet is well known to digital savvy people. The data structures are kept very simple to allow every project member to upload and edit data sets as well as adding data for new regions or new temporal dimensions. Furthermore a spreadsheet has the possibility to apply calculations and make aggregations within the same tool and with the same high level of usability. This enabled every project partner to participate in the aggregation and analysis process.

Technically, the platform is based on freely available open source software. Open source software in general is low cost, well maintained and follows high security standards. By relying heavily on open source software we ensured that the platform is maintainable for the future.

The platform is designed to be able to handle partial or incomplete datasets.
The statistical data sets from the different national and international data providers are not always available for all areas of interest. So there is no guarantee of always having a comprehensive data set at hand.

The data sets that are collected as part of the project are collected incrementally. It will take some time until we can gain a complete picture. By allowing the platform to handle incomplete datasets, we are able to add new information gradually as it becomes available and still keep the data platform accessible and usable.

j. Data Structure

The statistical data that forms the basis for the regional distributed indices is stored in a data structure that allows the insertion of spatial and temporal dimensions.

The spatial dimension covers the whole European region on Nuts 2 level. This granularity standard is in accordance with what various organisations in Europe use, e.g. Eurostat and many national institutions. The aim of the Nuts standard is to subdivide countries into areas of roughly the same population size. As such they are well suited for statistical analysis.

The temporal dimension allows us to create the indices for various moments in time. The different time-steps can be accessed through a time-slider.

The data for each variable is kept in a separate sheet. The sheets contain some metadata that describe the dataset: where the data set comes from, a unique identifier of the source dataset, an exact description of what is included and what is excluded from the dataset. The actual data is then stored in the two aforementioned dimensions: space and time.

Year	2014
Description	Young people neither in employment nor in education and training by sex and NUTS 2 regions (NEET rates) - age: 15-24 - sex: total - unit: percentage; - wstatus: Not employed persons; - typtrai: Neither formal nor non-formal education and training
Dataset ID	[edat_lfse_22]
Unit	%
Min	3.7
Max	42.7
Colorscheme	yellowToRed
AT11	9.4
AT12	8.1
AT13	10.8
AT21	7.3
AT22	6.7
AT31	6.2
AT32	5.4
AT33	5.8
AT34	8
BE10	15.8
BE21	9
BE22	10.3

Fig 6: exemplary screenshots from the data sheets

The complete data set can be seen here https://goo.gl/wZMVU3

A different data structure is implemented to store the project related data. This data structure strongly follows the different stages of the disaster relief chain and its sub-dimensions.

7. Project dissemination activities

The central dissemination tool of INDRIX is the project website, which over the course of the work period, was continuously updated with posts about meetings and the project's progress. The website also contains links to the project's results, including the visualisation tool and the assessment questionnaires. The website can be accessed at www.indrix.eu

Furthermore, all project partners used the communication channels at their disposal (their own websites, social media, print publications etc.) to spread the word about the project and its results.
In addition, a brief info leaflet was authored which was distributed in print and as an accessible (screen reader enabled) PDF file.

8. Lessons learned

1. The degree of resilience of a community is also made up of elements related to the perception of people, which may differ from the situation described by statistical data. Indrix made it possible to bring out these differences in perception and transform them into elements of evaluation;

2. Framework: attention in emergency planning for resilience in general and for people with disabilities or other conditions involving specific needs/services (i.e.: the elderly, children, etc...) , that should be included in the emergency plan;

3. The activities to be carried out in the field after a natural disaster must be planned according to the specific needs of particular groups of people (e.g.: the elderly, children, disabled people, etc.). A specific protocol must also be developed for the recognition of the specific needs of people arriving in camps;

4. To compare the resilience index and to test the accuracy in the choice of indicators and their relevance for the Index purposes, we should give the questionnaire before and after a disaster (pre-post comparison);

5. There are three different types of users that can benefit from using Indrix: for local administrators Indrix can be useful to identify the critical issues present in their communities, also comparing them with geographically or culturally close regions, and improving social planning. Indrix can be used also to highlight the difference between data and real perception, and to foster synergy between government on regional levels (NUTS) in order to develop a mutual exchange of information between different scales. For NGO's (especially the ones that work with disabilities) Indrix can be useful in developing and implementing projects and in planning advocacy strategies for resilience-increasing measures. At the same time NGOs are the bridge between civil society/citizens and the civil protection system: they can convey knowledge gained from the Index to the citizens and increase risk awareness. Finally, for citizens it can be useful to become aware of the situation of their community, ask their administrators for the most appropriate measures with respect to communication and risk management, and promote participation through the associations of the territory.

9. Recommendations

The second part of the index is not yet covered by existing official data, not even on NUTS2 level. For each of the dimensions identified in the risk management process, it will be necessary to identify measurable indicators for which data are available in all countries of the European Union. For this reason, we recommend making the survey of this data part of official statistics, with at least NUTS2 accuracy;

1. Promoting the inclusion of the index in the statistics and the official surveys carried out by the local statistical offices could also be useful in order to allow continuous updating of data, and a more effective sustainability of the index after the closure of the project;

2. Going beyond the NUTS2-level: as a follow-up, systematic data surveys should be done in local communities (NUTS3), thereby improving local applicability and comparability for municipal civil protection authorities and decision-makers. We need the NUTS3 level (local level) to improve our efficacy - to stimulate discussions among communities, to provoke a sane comparison among them, leading to a general improvement of resilience;

3. It is very difficult, with reference to the European regions, to obtain a common database analysing the active participation of citizens in the life of the community. Our suggestion is to implement official statistics with data on the social capital of individuals and organisations, on the participation of citizens in NGOs as volunteers, and on activities directly proposed by citizens.

4. We have noted a significant lack of data on disability at the European level: this despite the numerous international efforts to ensure that people with disabilities are included in risk prevention and protection policies in humanitarian disasters. The constant comparison during the project with the beneficiaries and stakeholders coming from associations that promote the rights of people with disabilities has shown how, in situations of risk and natural disaster, a correct mapping of the conditions of people with disabilities could increase the ability to respond to the traumatic event and consequently community resilience. In addition to this, a deeper understanding of the living conditions of people with disabilities allows organisations involved in civil protection to provide dedicated rescuers with specific training that protects the dignity of people;

5. A further lack of data shared at the European level concerns the elderly. In order to develop specific strategies for the inclusion of older people in emergency plans and prevention activities, it is necessary that data on their living conditions is more specific and shared at NUTS 2 level (for example regarding non self-sufficiency, specific relationships and needs);

6. Develop specific communication strategies to improve awareness and therefore resilience based on the specific community needs highlighted from the results of the questionnaire. A correct interpretation of the data coming from the questionnaires may in fact allow an evaluation of the effectiveness of the tools and methods of communication implemented in the territories by public administrations or organisations;

7. The increase of community social resilience contributes to the achievement of the sustainable development goals (SDG), in particular n° 11: make cities inclusive, safe, resilient and sustainable. Cities are places where we must live well and where everyone must have the opportunity to live in dignity. Sex, social class and economic conditions must no longer be factors of discrimination. For this, Indrix can be included in city empowerment paths related to SDG strategies;

8. Considering the potential use of the index by local administrators, NGOs and citizens, we suggest experimentation on different European territories on actions and paths of participation with specific methodologies and techniques such as Open space technology, to understand the points of strength and weakness of communities and how it could be improved after the application of Indrix;

9. The quality of life: the improvement of community resilience can be a determining factor in improving the tourist and economic attraction of the territories. Indrix can be used as a tool to imagine new pathways of rebirth of territories based on reception and the creation of new entrepreneurship.

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