RESILOC

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Abstract

The report gives an overview of approaches to resilience based on experiences from outside of Europe. Many inspiring local and regional projects have been launched (with support of UNDRR and other platforms). Projects focused on resilience of communities, cities and critical infrastructures are contacted and analysed in order to enrich the RESILOC project base of information. The report is based on publicly available information, review of literature, reports, interviews with stakeholders in resilience in a selected group of cities all over the world and interviews with relevant players in the working field, like UNDRR, the Rockefeller Foundation and other (inter)national organization in resilience and disaster risk reduction. The collected data is analysed and studied along the same lines of the European data, so that it will be possible to abstract approaches, study results and identify replicable lessons learned.

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VI. List of Acronyms

Acronym	Meaning
100RC	100 Resilient Cities Initiative
AAAA	Addis Ababa Action Agenda
AFDRS	Australian Fire Danger Rating System
AFAC	National Council for Fire & Emergency Services
AIDR	Australian institute for disaster resilience
ANCI	National Association of Italian Municipalities
BRIC	Baseline Resilience Indicators for Communities
CCS	UK Civil Contingencies Secretariat
CEPAL	Comisión Económica para América Latina (Mexico)
CoE	Council of Europe
CRF	City Resilience Framework
DCP	Italian National Civil Protection Department
DFID	Department for International Development (UK)
DRR	Disaster Risk Reduction
DPPI SEE	Disaster Preparedness and Prevention Initiative for South-Eastern Europe
EC	European Commission
ECAS	European Commission Authentication Service
EFDRR	European Forum on Disaster Risk Reduction
EM-COP	Emergency Management facing Common Operating Picture
EU	European Union
GA	General Assembly, Grant Agreement
GRC	German Red Cross
HFA	Hyogo Framework for Action
IAFC	International Association of Fire Chiefs
IFRC	International Federation of Red Cross/Red Crescent
MDG	Millennium Development Goal
NERA	National Emergency Relief Agency (Nigeria)
NGO	Non-Governmental Organization
OECD	Organization for Economic Co-operation and Development
SDGs	Sustainable Development Goals
Sendai Framework	The Sendai Framework for disaster risk reduction 2015-2030
SFM	Sendai Framework Monitor

SoVI	Social Vulnerability Index
TAMD	Tracking Adaptation and Measuring Development
UCRA	Urban Community Resilience Assessment
WP	Work Package
UNDRR	United Nations Office for Disaster Risk Reduction

The terminology used within this report is defined within the Project Glossaries[1]. The terms and phrases used within this document have the meanings described by the glossary unless explicitly described otherwise in the relevant text.

[1] https://www.resilocproject.eu/publication/

1 Executive Summary

1.1 Overview

This deliverable gives an overview of approaches to community resilience based on a range of case studies from outside of Europe. Resilience in this report refers to the definition developed within the UNDRR's Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction:

> *The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.".*

RESILOC as a project subjects a comprehensive set of studies, procedures and programming instruments to scientific analyses in order to identify aspects enabling it to establish physical and less-tangible influences contributing to the resilience of communities. The research has gathered primary accounts of how community resilience has been approached in a series of localities and then aligns it with known global strategies in order to identify common themes and practices.

These examinations and methods will also serve to inform two further outcomes of the project:

1. The RESILOC inventory - an extensive, live structure for social affairs, portraying and using information on urban networks and neighbourhood systems, realized as a Software as a Service (SaaS) solution and

2. The RESILOC Cloud-based platform (Platform as a Service or PaaS) for assessing and determining resilience pointers of a city or system, for making procedures and affirming their consequences for the resilience of the community. The Cloud solution arranges a mix of SaaS and PaaS, joins the inventory together in its storage facility.

The task consolidates an examination of alternative elective approaches to managing resilience from the experiences outside of Europe and draws a series of key recommendations for the RESILOC project to benefit from this learning.

1.2 Methodology

The study does not claim to present a comprehensive or scientific evaluation of different approaches but rather aims to describe the major global practices and their implementation by providing examples. In order to do this, a clear set of 'starting points' were defined ahead of commencement.

The study was constructed around a logical flow of defining what is important to know, assembling data, analysing and specify the forthcoming knowledge.

The methodology examined and followed an analysis of frameworks and cooperation systems which focused on proportionate and context-driven solutions commensurate with the disproportionate exposure to environmental and economic risk faced by many countries, regions and communities.

Indicator sets and score lists were identified and discussed according to their applicability. Policy focused score cards were preferred to specific indicator sets by respondents who indicated their positive impact on decision-making within a socially and politically acceptable context.

In seeking a range of suitable examples of global strategies, an initial survey was undertaken amongst Resilience Advisors 20 experts from outside of the EU to receive suggestions for potential case study localities. From over 20 suggestions, 8 cities were selected based upon the application of structured approaches and willingness to engage in this study. Key individuals were identified from each locality and interviews held to obtain extra information and to interrogate against the research objects.

Initial plans also included an analyse of key strategies from USA and Australia. Early communications with each showed that the scope was likely to be too large to result in meaningful outcomes. After a series of interviews with resilience experts from both continents, a decision was taken to only present detail from Australia. The metropolitan area of Melbourne & the state of Victoria were chosen as access points to understand the broader Australasian approach to resilience on the basis that it offered a more coherent study with greater opportunity to examine the use and application of data.

Data assembly was conducted in line with the confirmed relevant ethical principles and national, EU and international legislation. Two forms (appendix VII) were used for data collection. Both were designed to assist in ordering information and based on the templates delivered in the context of the research done within Europe and included in Deliverable 2.1. The forms gather general information and address the methods used to interpret and use the concepts of resilience. A standard set of questions were used to identify indicators actually used by the locality.

The 8 cities chosen for the analyses were considered to be acknowledged as front runners of resilience-related policies and early adopters of progressive actions outside of Europe although no empirical method was employed to quantify this. Projects were selected based on their global impact on worldwide networks.

The report considers in detail the context of three substantial under-pinning frameworks – the *Sendai Framework*[2] and the *Global strategy for the European Union*[3] whilst two main global initiatives were identified as having been used to build local resilience outside Europe; firstly, the *100 Resilient Cities* Initiative developed and implemented by the Rockefeller Foundation through 2013 to 2019, and secondly, the UNDRR *Making Cities Resilient*[4] Campaign developed and implemented by UN having active engagement with over 4.000 Cities around the World to implement the Sendai Framework for DRR at the local level.

[2] https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf
[3] https://eeas.europa.eu/topics/eu-global-strategy_en

[4] https://www.unisdr.org/campaign/resilientcities/home/article/making-cities-resilient-2030-mcr2030-initial-proposal

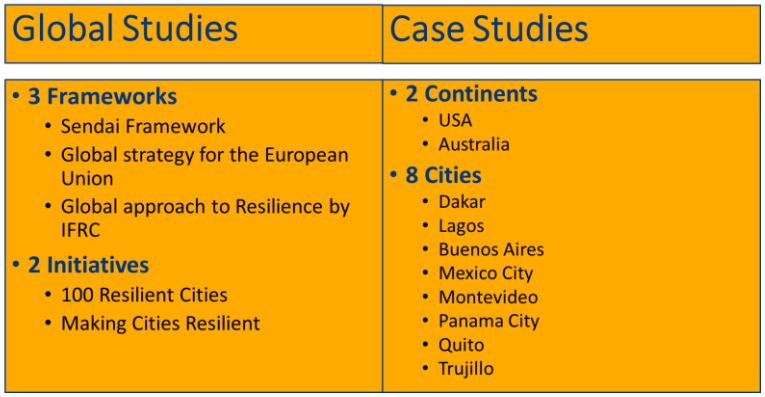

Figure 1 Study Focus

The Study examined the performance measures embedded within each locality and queried if and how they had been applied within individual locality strategies.

1.3 Overall Analysis:

1.3.1 General Approaches to Resilience:

The expanding interest for better methodologies bringing about stronger social orders, ready to address complex difficulties including developing dangers and calamities, calls for open, receptive systems. In this way, attention to dangers and empowering reception of helpful practices will be expanded. Both the 100 Resilient Cities and the Making Cities Resilient initiatives improve correspondence between specialists, responders and those influenced, utilising the intensity of new advancements, and incorporating new solutions.

There are various frameworks and indicators of resilience that can be applied. By exploring these in literature and with interviewees, we can say that all cities examined have different approaches. However, for disaster risk reduction and resilience strategies, a focus on Disaster Risk Reduction appears to have become increasingly common for all. Section 6 at Table 2 presents a comparison and analysis of the approaches adopted by each.

In terms of their approach, respondents indicated:

- That DRR should be considered in all aspects of development and planning, infrastructure, social welfare, environmental management, health and education.
- An understanding that, with the passage of time, economic losses due to disasters are increasing.
- Economic losses are the worst in middle income countries.
- By 2018 55% of world's population was living in urban areas and this will rise to 68% by 2050. Consequently, increased focus on Urban localities was felt to be appropriate.

Extrapolating this, it is apparent that disaster risks will increase their impact in cities, thus quality infrastructures, policies and effective response mechanisms to emergency situations will be required for disaster risk reduction. To enable this, all community sectors need guidance, timeframes and incentives for development of local DRR strategies.

1.3.2 Discussion and Conclusion:

The study has shown that resilience as a recognised discipline is becoming more common. A series of recurring themes from the case studies identified with success can be converted into concise recommendations. These are presented in the Deliverable as supported conclusions. Starting with the importance of agreeing common definitions of resilience across stakeholders.

When developing relevant performance measures, a common form of resilience construct is also required. DRR is less focused on classifying the cause of a disaster and more on its prevention and mitigation of impacts.

Qualitative indicators need to be based upon shared and mutually agreed inputs. Good indicators alone are not enough. Expert assessment of those indicators is required for their meaning to result in a tangible improvement in resilience building approaches.

A full compendium of those indicators collected from Case Studies has been presented in Annex 5 to assist with creation of the RESILOC Inventory. This is a powerful collection but above all else, shows that, apart from a full version of the inventory, the project will need to introduce a stepped version for staged implementation. **I**n the implementation stage, incorporating resilience in broader policy goals like those for sustainable development (the SDG's) should be encouraged of local communities.

Community involvement should be used to its full extent, implying that community users must acknowledged as core drivers and partners, with lived knowledge and experience of resilience complementing that held by technical and research partners. The project will wish to use the unique characteristics of its practitioners as professionals and deeply rooted, dedicated community members to build bridges among the key stakeholders.

2 Overview

2.1 Background

Resilience involves people developing a culture of preparedness not only in the community, physical, social and economic infrastructure but also in decision-making which impacts complex systems responsible for the delivery of services, taking into consideration their interconnectedness and interdependencies. With an increase in complexity and the need for interaction of systems, it thus requires re-examination and redesign of how it is addressed. The traditional approaches to risk classification and management need to advance to meet the challenges of the multifaceted interconnectedness of hazard, the scope of exposure and vulnerability, steering towards resilience, enabling all to better prepare, anticipate and adapt.

Global policy frameworks such as the Sendai Framework for Disaster Risk Reduction 2015-2030 offer tools for assessing progress towards resilience enabling decision-makers at all levels to address a broader scope of hazards and risks. The Sendai Framework also maps out a policy pathway for governments, communities and citizens to prevent and mitigate shocks caused by natural and man-made hazards as well as related environmental, technological and biological hazards and risks. In making the logical connection between reducing risk and building resilience, the Sendai Framework also bridges the 2030 Agenda for Sustainable Development[5], the Paris Agreement[6], the New Urban Agenda[7], the Addis Ababa Action Agenda[8] and the Agenda for Humanity[9] offering tools to implement cross cutting strategic objectives, enabling risk-informed sustainable development.

2.2 Introduction to RESILOC

Resilience is defined by the United Nations as *"The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management".* Thus, resilient communities are those in which their citizens, environment, businesses, and infrastructures have the capacity to withstand, adapt, and recover in a timely manner from any kind of hazards they face, either planned or unplanned. In recent years efforts have been spent to tackle the concept of resilience and there is still a long path forward in defining an EU valid and sound approach to the challenge.

RESILOC aims at studying and implementing a holistic framework of studies, methods and software instruments to combine physical with less tangible aspects associated with human behaviour.

The study-oriented section of the framework will move from a thorough collection and analysis of literature and stories from the many approaches to resilience adopted all over the World. The results of the studies will lead to the definition of a set of new methods and strategies where the assessment of the resilience indicators of a community will be performed together with simulations on the "what-if" certain measures are taken. These studies and methods will serve for designing and implementing two software instruments:

[5] https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf
[6] https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
[7] http://habitat3.org/the-new-urban-agenda/
[8] https://www.un.org/esa/ffd/wp-content/uploads/2015/08/AAAAOutcome.pdf
[9] https://agendaforhumanity.org

1. the RESILOC inventory, a comprehensive, live, structure for collecting, classifying and using information on cities and local communities, implemented as SaaS,
2. the RESILOC Cloud-based platform for assessing and calculating the resilience indicators of a city or a community, for developing localised strategies and verifying their impacts on the resilience of the community. The Cloud platform, a combination of SaaS and PaaS, includes the inventory as its repository.

The project makes use of a new concept of Local Resilience Teams and End-User participation to understand requirements, quantify input, and generate feedback to inform implementation of the platform. The LRT's will also be the enablers for RESILOC solutions to be trialled. The project includes a high-profile communication plan, heavily based on Social Media platforms to engage an expert/ end-user audience.

2.3 Research in RESILOC

The objective of the research in RESILOC is to organise the collection of information about the approaches to resilience adopted in literature and in ongoing initiatives all over the world and to derive definitions and classification that can help in organising data. The goals are to identify a method for classifying the elements contributing to the assessment of resilience and the comparative analysis of statuses, strategies, and actions in any kind of environment (cities, regions, rural settlements).

The human side of the analysis is focused on the risk perception by citizens in an area and of their awareness of local hazards and expected behaviours.

The research will also elaborate a tool for the evaluation of resilience of communities involved by means of self-assessment. The tool elaborated aims at highlighting the major areas of vulnerability as well as main resources for each community, so to direct local authorities to the most efficient and sustainable actions aimed at the enhancement of resilience.

The analysis of vulnerability, exposed values and hazard scenarios in the communities included in the project will allow the validation of the methodology and pave the way for a comparative analysis across Europe and, as much as possible, outside Europe.

The identified definitions and classifications will be part of the specifications for the RESILOC inventory, that will be one of the results of the research.

This report project focusses on the above mentioned possible alternative approaches to resilience learning from experiences outside of Europe. Many local projects have been undertaken by world bodies which are examined and specific projects on cities and critical infrastructures are contacted to enrich the project's base of information.

2.4 This Study as Part of RESILOC

To establish context, the project will benefit from learning how this issue may have been approached by localities and/or institutions outside of Europe. This is well described in 2.2 above as "collection and analysis of … stories from the many approaches to resilience adopted all over the World". Within this study, the collected intelligence from around the world is analysed and studied in a similar manner as that for Europe to make it possible to compare approaches, results and lessons learned but, most importantly, to present findings and recommendations in a relevant manner. The results of this activity are presented in this report.

2.5 Research Questions

Based on this report's position in the whole of the RESILOC research, the questions studied were established with partners as:

1. What is the global context of building resilience?
2. Which major global strategies are in place?
3. How do they relate to each other and the objectives of RESILOC?
4. Which resilience building strategies can be identified in leading, technology driven countries?
5. What are the resilience building strategies in urban communities which are forerunners by policy or by challenges?
6. Are there any indicators to be identified in those strategic frameworks, countries and urban communities (cities), which could be added to the RESILOC inventory?

Detailed research questions were developed to collect intelligence and data where possible on this:

1.1 Which global initiatives can be identified?

1.2 On which criteria is the selection made?

1.3 For each, what is the identified initiative:

1.3.1 The owner and the users/clients?

1.3.2 The theoretical base?

1.3.3 The used methodology?

1.3.4 The implementation strategy?

2.1 Which leading technology driven countries outside Europe can be identified and can be studied (public sources in English)?

2.2 Which policies are used to assess local resilience in the selected countries?

2.3 Which technologies are used to assess resilience and how are they used?

3.1 Which local communities/ cities can be identified as forerunners in using the global strategies and fall within the constraints set by the RESILOC project?

3.2 What are the characteristics of the selected local communities/ cities?

3.3 How is the concept of resilience implemented in the policies and strategies?

3.3. How is resilience measured and how are the results fitted in this implementation?

4.1 If resilience is measured or a tool is used to measure it. Which indicators are used? (global initiatives, countries, local)

2.6 Relationship to Other Research and Development in RESILOC

The study presented in this report runs as part of the 'comparative analysis of resilience in societies and communities' (**WP2 - Comparative analysis of resilience in societies and communities**) which seeds the establishment of the inventory and the processed analysis of projects and initiatives realised within the boundaries of the European Union as presented in the **Deliverable 2.1 - Analysis of Risk Perception**. The findings presented in this report also feed into the design of the inventory of indicators, as the indicators identified in this report will be evaluated and considered as additions to the inventory, processed in the context of the **Deliverable 2.7 - Architecture of the RESILOC Inventory**.

The Case Studies inform early work within **WP3 where consideration is given to New strategies for Improving Resilience.**

Design and data components of this study support the platform design being addressed through **WP4, implementation of the RESILOC platform** addressing issues in both the implementation and sustainability of the inventory.

The practices presented gathered at global level are expected to generate inspiration for the forming and (self)-tasking of the Local Resilience teams as a key component of **'communities involvement and field trials within WP5**. In particular, this is likely to be reflected in later versions of the Community and End-user Engagement Strategies

In the longer-term, the report will be used to support recommendations on **'strategies for improving resilience' arising from WP7,** ensuring that the global context is considered.

2.7 Background of Study Leader

This study has been conducted under the supervision of the Resilience Advisors Network (RAN). RAN is a group of more than 100 experts who are active individually or in tailored teams, coming together to form niche and specialist capabilities to address complex challenges in strengthening community, locality or infrastructure resilience from disasters and emergencies.

Advisors (as they are known) come from a broad range of Emergency Service and Disaster Management-related backgrounds, most holding senior positions in Emergency Management, Rescue Service or Civil Contingency Authorities.

The perspective of RAN stems from its competences in the disaster risk reduction field, where it uses practical experience and knowledge what is moving in the field, including practical science, new technologies and new conceptual approaches. RAN also administers and facilitates the Crisis Management Innovation Network Europe [CMINE[10]] which provides an overview of innovative approaches in the field of resilience research and is being actively utilized by the RESILOC team in support of key project activities and strategic objectives such as reaching beyond the project to others undertaking work under the Disaster Resilience Societies programme.

2.8 Study Challenges

Risk-informed sustainable development of communities requires robust data and statistics that are timely, accurate, disaggregated, people-centred and accessible. Integrated monitoring and reporting on the Sendai Framework and disaster-related SDGs contributed significantly to the availability of information thanks to the use of common metrics and the online Sendai Framework Monitor [SFM][11]. National statistical offices across the globe have been building the framework to include disaster related data within the domain of processed official statistics. Data availability and quality is generally improving as statistical capacity-building is starting to accommodate collaboration and synergies across increasingly complex data systems related to disasters as well as general aspects of resilience. Data collection however often remains fragmented, nonuniversal, incommensurable and biased, and the disconnect between "knowing" something, making it "available and accessible" and "applying" what is known often remains visible as many countries, regions and cities are unable to report adequately on progress in implementing the Sendai Framework and risk-related Strategic Development Goals. Others lack the capacity to analyse and use the collected data.

[10] www.cmine.eu
[11] https://sendaimonitor.unisdr.org/

In short: there is a need for establishment and learning from effective risk-informed policies supported by accurate, timely, relevant, interoperable, accessible and context specific data.

Multi-hazard disasters affected 88 million people in countries reporting through the SFM in the period 1997–2017, with floods alone affecting 76 million people. Disasters stemming from natural hazards have displaced an average of almost 24 million people each year over the last decade and remain the main trigger of displacement. Preliminary reporting on multi-hazard early warning system practice hints at lessons to be learned and efficiency improvements to be made in respect of analysis (data collection and risk assessment) and ensuing action (response) for the benefit of the affected communities. There seems to be a need to go deeper into distributional analysis, moving away from regional, national and subnational data to the community respectively household level, in order to understand how shocks and adverse events affect people's lives in a systemic way and derive guidance for empowering, resilience strengthening interventions. Communities should be supported in designing tailored solutions and systematically equipped with knowledge and tools to influence human behaviour, to prevent the multiplication of risks, as well as to support all in their ability to recover and rebound from disasters. As we believe that confident, risk-informed communities grow more resilient even in the face of great adversity, we deliberately analysed policies contributing to their empowerment.

3 Methodology

3.1 General Starting Point

The study does not constitute a comprehensive or scientific evaluation but rather aims to describe the major global practices and their implementation through a series of case studies providing examples. In order to do this, five 'starting points' were established ahead of commencement:

1. Acknowledging the holistic concept of resilience.

While it may seem practical to categorise risk, compare sets of utilised indicators and flag policies so that responsibility can be ascribed to specific organizations, institutions or individuals and added value ascribed to approaches, measurement frameworks and policies, yet as risk management and resilience are part of the same interacting complex system, they should not be "departmentalised". The complexity of challenges in resilience-related problem-solving makes it imperative that our understanding of risk is developed without resorting to reductive measures that isolate and remove approach from context and ignore systemic characteristics. As this approach applies to our institutional arrangements for risk governance as well as to community organization, research endeavours or policy formulation, we will try to avoid evaluation of the analysed approaches and present them as self-standing opportunities for further exploration and learning.

2. Recognising the priorities of the Sendai Framework for Disaster Risk Reduction,

The Sendai Framework for Disaster Risk Reduction[12] defines four priorities that are complementary and can be used as a direction for actions in DRR. They are 1) understanding disaster risk, 2) strengthening disaster risk governance to manage disaster risk, 3) investing in disaster risk reduction for resilience and 4) enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction.

With emphasis on:

2.1. Risk Awareness

one of the building blocks of effective DRR, as accepted by the international community, is knowing which risks are present to any kind of group, community or even nation. The assumption is that awareness of the risk leads to action to prevent it, reduce it and/or prepare for it.

2.2. Community Involvement

although not directly reflected in the four priorities, but generally used as base, is the concept that communities should be involved and included in a whole of society approach.

3. Presenting that innovation of and experience with implementation of resilience is not restricted to the first world.

an example is for instance the risk awareness of flooding in the Netherlands, despite of or due to a long tradition in preventing floods and flooding, local communities in general lack the awareness of key resilience aspects corresponding to the risk [82], creating an extra vulnerability. In other countries this complex awareness seems better developed and translated into resilience based on policies (see RESILOC Deliverable 2.1 - Analysis of Risk

[12] https://www.preventionweb.net/files/43291_sendaiframeworkfordrren.pdf

Perception).

4. Improving the accessibility of information (language, public availability of documents, ethics)

the availability of information is constrained in access to documents and interaction with respondents in English and Spanish and by the provision of information publicly or with informed consent.

5. Recognising the constraints of the abilities of identified experts

the knowledge, experience and contacts of the advisors of RAN was used to access information sources. The sources are therefore limited to available literature, reports on global policy frameworks, known examples, and direct and affiliated contacts within the Resilience Advisors Network as well as from the project local community managers and practitioners.

3.2 Constructing the Study

The research questions, starting points and requirements from within RESILOC, e.g. the comparative study with two frontrunner countries and global initiatives, constrained the study to be descriptive based on a document analysis and series of interviews. The study has been designed to give an overall impression of global initiatives along with examples of their implementation and of how community resilience is approached in other industrialised blocs at a global level.

Figure 2 provides an overview of the broad construct of the study. It is built around a logical flow of defining;

- what is important to know
- assembling data,
- analysis and
- specifying the required knowledge.

All of the above were undertaken within the constraints of the General Starting Point above.

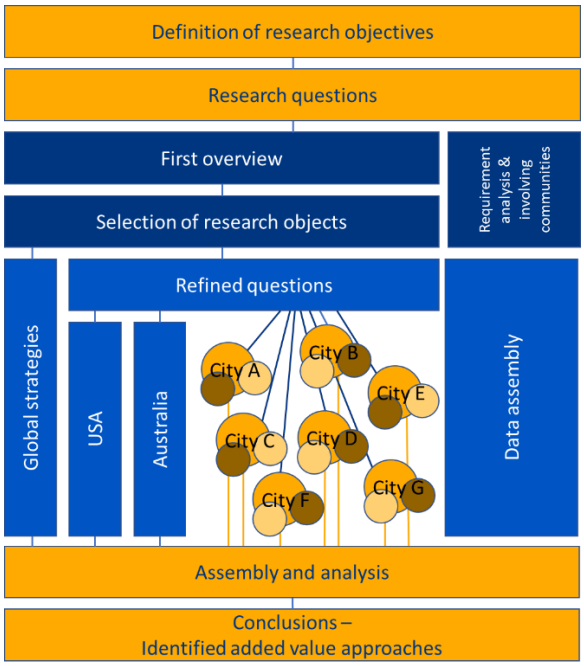

Figure 2: Methodological framework of the study

3.3 Structure of the Report

In presenting approaches to resilience outside EU, the report represents a qualitative, descriptive study of what has been done in the world's higher institutes and by some of the most progressive or challenged urban centres. Interviews with selected institutions and cities, using the Sendai Frameworks as the starting point, analysing what indicators are used, which definitions of resilience are being applied and what projects and policies are being implemented at national or international level in relevant areas.

The qualitative, descriptive research done in task 2.5 is presented in this report at Figure 2. In section 2.1.2, the research objectives are defined supporting study into the possible alternative approaches to resilience learning from experiences outside of Europe.

Based on the global strategies from various institutions described in Section 2.3 above, a first overview has been created. Apart from the data it provides (see research question 1), it has also led to a selection of research objects. In section 3.4 above, the research questions are refined to create review questions, which are synchronised with the review questions of RSILOC Deliverable 2.1.

The report is structured to present a logical flow of;

- Sections 1-3 – Introductory Information
  Executive Summary, an overview and description of the methodology

- Section 4 – Global Strategies
  An in-depth look at Sendai Framework and an overview of European and IFRC global strategies

- Section 5 – Case Studies
  A detailed look at Australia and the 8 city case studies

- Section 6 – Analysis
  An extensive research review of Resilience and summary of the approaches adopted by each of the case studies

- Section 7 – Conclusions, Discussions & Recommendations
  Identifying the implications and benefits to be derived from the study for RESILOC

- Appendices – Detailed Data and Supporting Documents

3.4 Initial Analysis

Unsustainable patterns of growth tend to hide the build-up of systemic risks across different sectors. Traditional coping mechanisms based on preferring reactive approaches (emphasizing response and recovery) over the proactive (focused on mitigation and preparedness) no longer seem to represent adequate answers to the impacts of climate change and growingly complex emerging risk. Analysis of frameworks and cooperation systems should include attention focused on proportionate and context-driven solutions which commensurate with the disproportionate exposure to environmental and economic risk faced by many countries, regions and communities.

The utilisation of indicator sets and score lists was thus identified mainly by their applicability. Policy focused score cards were preferred to specific indicator sets by respondents, who indicated their positive impact on decision-making within a socially and politically acceptable

context, respecting horizontal and vertical social mandates and ties, while referencing recommendations rather than seemingly representing tools of scrutiny and evaluation.

Conceptual and methodological challenges arise as theoretical resilience frameworks are often not linked to defined and actually performed measurement schemes and the links between resilience of individuals, households, communities, infrastructure and of entire countries are not straightforward. Resilience must thus be placed in relation to a given outcome for example in relation to identifiable threats or shocks and general contexts, precluding generic indicators and making comparison difficult. The multiscale, dynamic, multi-dimensional nature of resilience calls for non-standard survey instruments able to capture key aspects in a holistic manner, capturing its absorptive, adaptive and transformative capacities [83].

Enhancing the resilience of communities and infrastructures requires their leaders resp. operators to determine the ability of the systems to withstand specific threats and to return to desired operations after disaster induced degradation. Thus, a resilience focused analyses requires comprehensive consideration of complex systems from threats to consequences, while the methodology should produce reproducible results that can support decision making in risk management, disaster response, business and service continuity, eventually strengthening not just the sustainability of social and economic infrastructure but the accessibility and effectiveness of safety nets for all affected by disasters.

The theoretical starting points included reflections on the ways in which a community creates, builds, maintains and uses its assets to generate capacities needed to protect it from threats. Framing basic questions based on the UK Department For International Development's Sustainable Livelihoods Framework, we aimed to identify elements that represent added value assets to community resilience and gather evidence on replicable approaches, gathering data to demonstrate their validity across multiple contexts focusing on what sources of resilience have been seen as instrumental in protection the analysed communities. By reflecting on real events with the respondents, we are hoping to establish evidence to show on what actually provides resilience.

We analysed 3 kinds of information related to the resilience concepts referred to by respondents, including

- concepts of resilience used,
- types of actions undertaken to strengthen resilience at policy, institutional respectively programme levels and
- methods used to measure resilience.

3.5 Operationalised Research Questions

Learning from effective interventions requires a deep understanding of context. Efforts were thus made to assemble data that could be explored in relevant contexts by members of the project less used to this environment.

Data assembly was conducted in line with the relevant ethical principles and relevant national, EU and international legislation and was based on two forms, both being designed to assist in ordering information and based fully on the templates delivered in the context of the research done for research within Europe [RESILOC D2.1). The forms include questions focused on general information and questions addressing how to interpret and use the concept of resilience. Finally, questions were included designed to identify indicators actually used by the interviewee / project.

Data collection was based on 4 basic questions:

1. The environment and the context: What is the context of the realised project, who is the project lead?
2. What kind of background policy shaped the action of the city? What are their goals?
3. What is the function of measuring resilience in the policies?
4. If you measure resilience, what kind of a system do you use? What is the function of the measurement?

The objective of these questions was to enable the study to describe policies and interventions, not to evaluate them. This would be an activity better undertaken in the relevant component of RESILOC such as design of the data inventory. Thus, data is recorded within this study but not always interpreted beyond presentation. This is one of the key differences between presentation of this report and some others within the RESILOC suite of Deliverables.

At the centre of this study, deployment of new approaches to citizen engagement including;

- efforts to translate data into insights,
- demonstrated openness of decision-making procedures
- examples of closer collaboration between public and private sectors
- enabling co-creation in resilience-focused initiatives such as using data and alternative forms of behavioural engagement
- providing insight and experiences that shape opinions and preferences key to achieving progress.

Capturing the bonding, bridging and linking of social capital for resilience through publicly available data should be a priority in the future research efforts to explore and demonstrate needs and capacity to address resilience related challenges and rise beyond the traditional focus on Baseline Resilience Indicators for Communities (BRIC) and the Social Vulnerability Index (SoVI). The ultimate goal can be described as to provide a more focused understanding of how communities can enhance their coping mechanisms, social ties and cohesion for the benefit of greater resilience towards disasters in the future.

3.6 Selection of Study Subjects

In seeking a range of suitable examples of global strategies (case studies), an initial survey was undertaken amongst Resilience Advisors 20 experts from outside of the EU to receive suggestions for potential case study localities. From over 20 suggestions, 8 cities were selected based upon the application of structured approaches and willingness to engage in this study. Key individuals were identified from each locality and interviews held to obtain extra information and to interrogate against the research objectives.

Initial plans also included presentation of key strategies from USA and Australia. Early communications with each showed that the scope was too large and diverse to result in meaningful outcomes. After a series of interviews with resilience experts from both continents, a decision was taken to only present detail from Australia. The metropolitan area of Melbourne & the State of Victoria were chosen as access points to understand the broader Australasian approach to resilience on the basis that it offered a more coherent study with greater opportunity to examine the use and application of data.

The 8 cities chosen for interrogation were considered to be acknowledged as front runners of resilience-related policies and early adopters of progressive actions outside of Europe although no empirical method was employed to quantify this. Localities were selected based on their global impact and engagement with worldwide networks.

During the study, interviews were also held with experts directly involved in two main global initiatives to build local resilience outside Europe. Firstly the 100 Resilient Cities Initiative developed and implemented by the Rockefeller Foundation since 2013 to 2019, and secondly, the UNDRR Making Cities Resilient Campaign developed and implemented by the United Nations having an active engagement with over 4000 Cities around the World to implement the Sendai Framework for DRR at a local level.

To get access to the resilience policies of (mega) cities, stakeholders were interviewed from each one. As cities tended to be involved in several global initiatives (like the 100 resilient cities or the UNDRR Making Cities Resilient campaign) all were queried on their structural approach towards enhancing resilience. Typically, 'City Resilience Managers' were interviewed followed up by additional stakeholders presented by them to add additional dimensions and perspectives.

3.7 Ethics

Collection of information did involve collection of data from individuals but this was invariably organizations data rather than personal. All activities that have fed into the report, comply with Regulation (EU) 2016/679 known as GDPR and 2002/58/EC Directive on privacy and electronic communications as well as with relevant national data protection and privacy laws, codes of practice and guidelines.

Analysing the structure of the study two processes were identified as susceptible to ethical considerations. The first process being the interviews with stakeholders. These interviews are done with persons which in most cases are speaking directly as representatives of a system, institution or other legal entity. As we are only interested in the system and not in the opinion or personal data of the interviewee. We ask from them only their names and their professional email addresses. Conforming to the ethical guidelines within the RESILOC projects, "informed consent forms" were used for each interviewee whose data is used in this report.

The second process subject to ethical consideration was the presented indicators and information. We did not analyse whether the use of the indicators could lead to unethical behaviour. We consider this report as presenting of what is used in the selected cases. It is upon the user of the data in the report to consider whether use of the data is ethical.

Undertaking the study involved the recruitment of research participants by virtue of the organizations / cities they represented. Basic criteria was implicit rather than explicit due to the nature of employment of the research participants and included criteria such as age, expertise, ability to provide informed consent on behalf of themselves and their organizations.

The consent form used is in this study is included at Appendix VII along with the RESILOC ethics self-assessment sheet.

The process and activities were approved by the Author's Data Protection Officer as registered through the RESILOC Management.

Only the data used in compiling this report has been retained. All other data collected incidental to this report has been permanently deleted on submission of this report.

3.8 Terminology

The terminology used within this report is defined within the Base and Project Glossaries[13]. The terms and phrases used within this study have the meanings described by this glossary unless explicitly described otherwise in the relevant text.

[13] https://www.resilocproject.eu/wp-content/uploads/2020/11/RESILOC_Glossary_of_terms_v1.2.pdf

4 Global Strategies & Initiatives

4.1 Introduction

The United Nations considers disaster risk reduction (DRR) as an integral part of social and economic development. It is conditionally for sustainable development in the future. This has been recognised by several global documents on DRR and sustainable development. The Yokohama Strategy and Plan of Action for a Safer World (1994), as the first major international framework for disaster risk reduction, recognized the interrelation between sustainable development and DRR. Ever since, this close interrelation was continuously strengthened within the key global agreements, from Millennium Development Goals (MDGs) to the Johannesburg Plan of Implementation (Johannesburg, September 2002), to the "Hyogo Framework for Action (2005-2015)" and to the "Future We Want" (Rio, June 2012), to the Sendai Framework for DRR (Sendai, Mach 2016) and the 2030 Agenda for Sustainable Development (New York, September 2015).

Today, there is a global consensus that disaster risk reduction should be mainstreamed into the general development planning and processes (including economic, social, territorial, environmental and infrastructure development) aiming for sustainable development, mitigation and adaptation to climate change. However, in practice, linking DRR with development has been very challenging. Current development pathways tend to increase disaster impacts as will anthropogenic climate change. Discussion around underlying risk drivers and their connection to development has been slow in permeating global agreements, agenda and the national policies and plans. The Sendai Framework for DRR highlights this as one of the areas where less progress has been made and greater efforts are required to improve resilience at all levels.

In this context, it is clear to the UN policy makers that disaster risk is directly linked to broader challenges. Underlying risk drivers, such as poverty and inequality, a permanent growing in the urban population with poor living conditions, unplanned urbanisation processes, environmental degradation and contamination and lack of good and efficient policies, regulations and enforcement, can and should be addressed by "good governance and development" practices at all levels and across all sectors. On the other side of the coin, is proved that having access to basic infrastructure and services (including risk-reducing infrastructure and services, good quality housing in safe locations, secure tenure and income and livelihood opportunities) reduces significantly the levels of hazard, exposure and vulnerability, and therefore the level of risk.

In the development strategy of the UN, reducing disaster risks and hazards is about addressing basic development that helps to gradually build resilience and preparing for and mitigating disasters. It also entails ensuring adequate governance that need to be transparent, accountable and representative decision-making structures, so that everyone's needs and voices (representatives from all sector) are considered and development gains benefit all. Thus, connecting DRR with broader development processes contributes to advance a people-centred risk reduction approach.

Success in achieving better resilience also depends on the competence and capacity of governments to advance and sustain locally rooted development processes and goals that integrate DRR and climate change mitigation and adaptation, transversally, into the national, regional and local plans.

It requires a strong risk assessment identification and analysis, mapping and permanent monitoring processes and indicators to learn about changing risks and opportunities, identifying and evaluating options, making decisions and revising strategies and plans in

collaboration with a range of actors, particularly those with highest levels of exposure, vulnerability and/or risk. It needs the focus to be on what must be done, but more importantly on how, by whom and with what support. Finally, it requires national governments and international agreements that are supportive of local work.

Reference examples of some of the globally applied resilience measurement and evaluation frameworks include the USAID Measurement Framework for Community Resilience [14], the OXFAM Multi-Dimensional Approach to Measuring Resilience,[15] the DFID Building resilience and Adaptation to Climate Extremes and Disasters[16] with DFID Guide[17] to developing indicators and the Urban Community Resilience Assessment (UCRA) evaluation framework.

The initiative TAMD or Tracking Adaptation and Measuring Development of the IIED developed a framework to track adaptation and measure its impact on development and the project BRACED & BRACED-X Building Resilience and Adaptation to Climate Extremes and Disasters have contributed to measuring resilience in relation to climate change adaptation. In the context of UK Climate Finance Results monitoring, experiences were also captured in relation to the fourth ICF Key Performance Indicator (KPI4) which is 'the number of people with improved resilience as a result of ICF support'. The aim of ICF KPI4 is to facilitate evaluation of project effectiveness by enabling M&E systems to measure changes in people's situations (circumstances, capacities, assets, contexts, etc.) that affect their ability to plan for, avoid, cope with, recover from, and adapt to evolving climate shocks and stresses (i.e. their resilience), some of the main challenges identifies in relation to its application was the multiple interpretations and resilience related objectives in different contexts, differing frequency of reporting and methods of data collection, considerable scope for reporting errors impacting quality of available data and ultimately the limits of indicators in their potential to support project or programme-level learning.

The value of resilience as a concept is that it combines programming with risk management approaches that build absorptive, adaptive and transformative capacities [84] and measuring it enables the multiplication of effective approaches and successful strategies.

ODI [85] completed a comparative overview of resilience measurement frameworks. Their analysis showed among else that each framework is strongly influenced by its conceptual entry point, making a comparison only partially possible and justifying the development of further frameworks; there is a clear gap between the theory on resilience and the way in which the indicators focus on well-being and general development factors; and indicators may not always provide a complete picture of resilience.

In a broader political perspective, today's risk landscape and the risks reduction strategies are being shaped in significant measure by the developing risks and an unsettled geopolitical environment—one in which new centres of power and influence are forming—as old alliance structures and global institutions are being tested and questioned. While these changes can create openings for new partnership structures, in the immediate term, they are putting stress on systems of coordination and challenging norms around shared responsibility. Unless stakeholders adapt multilateral mechanisms that can be translated into effective actions at international, regional, national and local levels, the risks will continue to put more pressure on

[14] https://www.usaid.gov/sites/default/files/documents/1866/Technical%20Note_Measuring%20Resilience%20in%20USAID_June%202013.pdf
[15] http://policy-practice.oxfam.org.uk/publications/a-multidimensional-approach-to-measuring-resilience-302641
[16] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/328254/BRACED-KPI4-methodology-June2014.pdf
[17] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/328254/BRACED-KPI4-methodology-June2014.pdf

all, and the impacts of disasters will significantly influence the sustainability of our lives and livelihoods. Coordinated, multi-stakeholder action is needed to mitigate against the impacts and outcomes of adversities and to build resiliency across communities and businesses [86]

The risk perceptions in all their complexity shape resilience policies as well as attitudes and eventually the likely behaviour of individuals and communities in adverse situations. Thus, risk perception as a dimension of resilience needs to be reflected in the scientific discourse, leading to more effective policies, accessible support and needs-based intervention strategies, eventually strengthening the resilience of those affected and engaged in response and recovery.

Global risk interconnections map illustrates the complexity of the risks faced by communities across the globe:

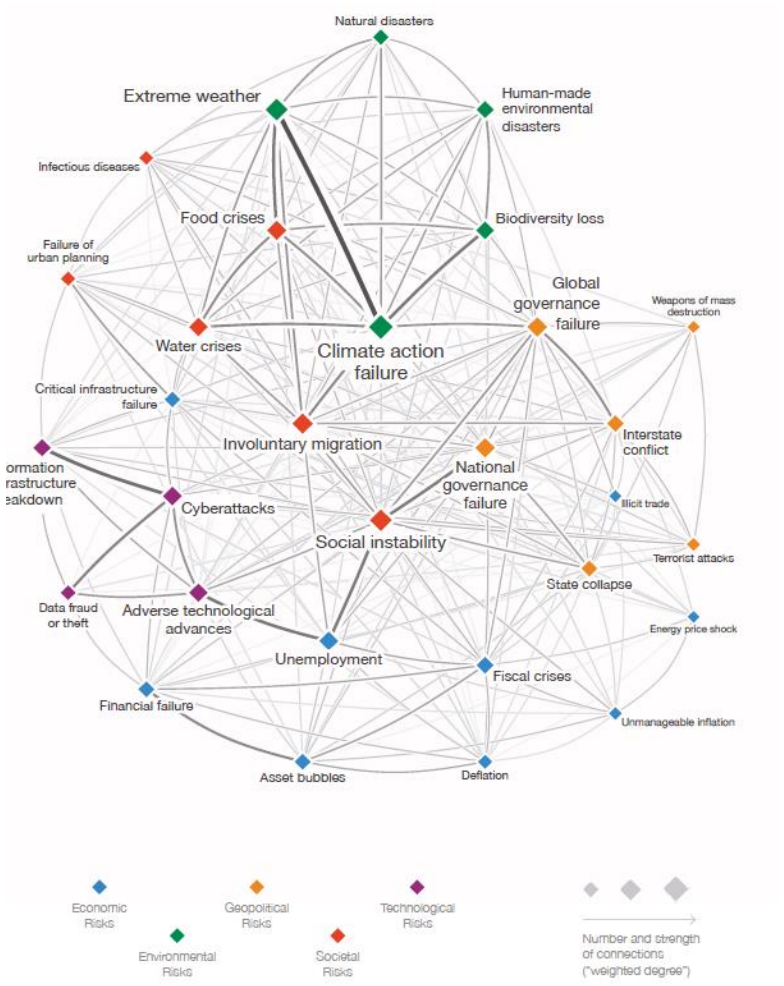

Figure 3: the global challenge of interlinking events[18].

The following international strategies have defined key strategic objectives related to risk-informed interventions to be implemented in order to increase resilience of communities.

4.2 The Sendai Framework

The **Sendai Framework for Disaster Risk Reduction 2015-2030** was adopted at the Third UN World Conference in Sendai, Japan, on March 18, 2015. It is the successor of the Hyogo

[18] World Economic Forum, Global risk perception survey 2019-2020

Framework for Action 2005-2015 (HFA). While the new framework acknowledges that good progress has been made in raising awareness, generating political commitment and catalysing actions by a wider range of stakeholders, it also highlights that more still needs to be done. In this context, the Sendai Framework represents a transition from understanding the interactions between hazard, exposure and vulnerability to a greater concern with how to act upon these risk factors through prospective, corrective and compensatory measures. This has motivated greater attention to the role of local governments and the relevance of the local level.

It puts strong emphasis on disaster risk management as opposed to disaster management. It is based on the definition of seven global targets, including the reduction of disaster risk as an expected outcome, a goal focused on preventing new risk, reducing existing risk and strengthening resilience, as well as a set of guiding principles, including primary responsibility of states to prevent and reduce disaster risk, all-of-society and all-of-State institutions engagement. In addition, the scope of disaster risk reduction has been broadened significantly to focus on both natural and man-made hazards and related environmental, technological and biological hazards and risks.

The Sendai Framework also articulates the need for improved understanding of disaster risk in all its dimensions of exposure, vulnerability and hazard characteristics; the strengthening of disaster risk governance, including national platforms; accountability for disaster risk management; preparedness to “Build Back Better”; recognition of stakeholders and their roles; mobilization of risk-sensitive investment to avoid the creation of new risk; resilience of health and community infrastructure and the importance of investing into disaster risk reduction for resilience.

Figure 4: Chart of the Sendai Framework for Disaster Risk Reduction 2015-2030 (UNDRR)

At national and local level, the Sendai Framework approach related to building resilience is, among all else, shaped by the following priorities:

1. to prepare or review and periodically update disaster preparedness and contingency policies, plans and programmes with the involvement of the relevant institutions,

considering climate change scenarios and their impact on disaster risk, and facilitating, as appropriate, the participation of all sectors and relevant stakeholders;

2. to invest in, develop, maintain and strengthen people-centred multi-hazard, multisectoral forecasting and early warning systems, disaster risk and emergency communications mechanisms, social technologies and hazard-monitoring telecommunications systems; develop such systems through a participatory process; tailor them to the needs of users, including social and cultural requirements, in particular gender; promote the application of simple and low-cost early warning equipment and facilities; and broaden release channels for natural disaster early warning information;
3. to promote the resilience of new and existing critical infrastructure, including water, transportation and telecommunications infrastructure, educational facilities, hospitals and other health facilities, to ensure that they remain safe, effective and operational during and after disasters in order to provide live-saving and essential services;
4. to establish community centres (local resilience teams) for the promotion of public awareness and the stockpiling of necessary materials to implement rescue and relief activities;
5. to adopt public policies and actions that support the role of public service workers to establish or strengthen coordination and funding mechanisms and procedures for relief assistance and plan and prepare for post-disaster recovery and reconstruction;
6. to train the existing workforce and voluntary workers in disaster response and strengthen technical and logistical capacities to ensure better response in emergencies.

4.2.1 Resilience and Vulnerability

The **Sendai resolution defines resilience** slightly differently to UNDRR as: "*The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.*" Compared, for instance, European definitions of resilience tend to be more narrow in scope than both the EU (2012) and the OECD (2014) definition where it simply talks about 'hazards' rather than the arguably wider phrases used in the EU and OECD of "stresses and shocks" and "shocks" respectively (rather than hazards); does not explicitly talk about individuals (like the EU definition) or households (EU 2012 and OECD 2014) but does mention community and society; and does not talk about adaptation.

Resilience appears to be seen as a function / result of investment in disaster risk reduction measures, rather than a risk reduction measure itself (but this perhaps raises the question about the relationship between those concepts which I'm not sure we've tackled): the resolution has as its goal the implementation of a range of measures that "prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, **and thus strengthen resilience**" [Annex 2, II (17)]. **Resilience is included in Priority 3 (out of 4) entitled: "Investing in disaster risk reduction for resilience".** The Resolution then outlines 17 activities to implement at national and local level to achieve this priority, most of them focused on (state) systems, structures and (planning) processes. Only one of these actions is explicitly focused on people and communities. Activity (l) calls on governments "To encourage the adoption of policies and programmes addressing disaster-induced human mobility to strengthen the resilience of affected people and that of host communities, in accordance with national laws and circumstances". This is consistent with the overall framing of the resolution which foregrounds the role of governments in disaster risk reduction. Priority 4 (Enhancing disaster preparedness etc) Seeks to promote the resilience of new and existing

critical infrastructure so that they remain operational during and after disasters [Annex 2, IV (33c)].

Vulnerability is not defined but is included in **Priority 1: understanding disaster risk**. This priority is all about information, data and knowledge. In paragraph b) it encourages "the use of and **strengthening of baselines and periodic assessment of "disaster risk, vulnerability**, capacity, exposure, hazard characteristics and their possible sequential effects at the relevant social and spatial scale on ecosystems, in line with national circumstances." Paragraph n) calls on governments to "**apply risk information in all its dimensions of vulnerability,** capacity and exposure of persons, communities, countries and assets, as well as hazard characteristics, to develop and implement disaster risk reduction policies" [Annex 2, IV (24n)]. Knowledge is mentioned not in connection with vulnerability and resilience but disaster risk reduction: sharing experiences, lessons learned, good practices and training to build knowledge not only of governmental actors at all levels but also among civil society, communities and volunteers [Annex 2, IV (24g)]; using traditional, indigenous and local knowledge and practices to complement scientific knowledge in disaster risk assessment and development / implementation of policies, strategies, plans and programmes [Annex 2, IV (24i)].

The Sendai framework stresses the community as one of the starting points for building resilience, on the other hand, however, it is a strategy of nations. This is reflected for example the indicators that are used for reporting the progress of the implementation of the framework. The most of them are nation-based indicators.

4.2.2 Implementation

The Sendai Framework encourages the design and implementation of local DRR strategies by every local authority and traces progress based on the number of local governments with DRR strategies vis-à-vis the total number of local governments in a country. Compared with national strategies, local DRR strategies are far more heterogeneous, vary across countries and local administrative units, and change over time.

The Sendai Framework calls for the coherent implementation and reinforcement of actions and commitments of different international agreements adopted in 2015-2016, namely: the Sendai Framework itself; the Addis Ababa Action Agenda (AAAA) on Financing for Development; Transforming Our World: the 2030 Agenda for Sustainable Development; the Paris Agreement on Climate Change; and the New Urban Agenda resulting from the United Nations Conference on Housing and Sustainable Urban Development (Habitat III).

Whilst the Sendai framework is voluntary, there is a multi-level governance system in place to support its implementation:

- The Global Platform for Disaster Risk Reduction is the main gathering for the global disaster risk reduction community, providing strategic guidance and coherence for implementing the Sendai Framework, and sharing experiences and expertise among all its stakeholders. It brings together Governments, UN, international regional organizations and institutions, NGOs, scientific/academic institutions and the private sector and meets every two years.
- Regional Platforms for Disaster Risk Reduction represent core multi-stakeholder mechanisms that serve to assess progress, identify gaps and monitor the implementation of the Sendai Framework at the regional level. Regional Platforms are becoming more and more instrumental in building coherence across the disaster risk reduction, climate change and sustainable development agendas. The European Forum on Disaster Risk Reduction (EFDRR) has as members: UNDRR-Europe;

Council of Europe (CoE) - EUR-OPA Major Hazards Agreement; European Commission/European Union (EC/EU); The Disaster Preparedness and Prevention Initiative for South-Eastern Europe (DPPI SEE); The Regional Cooperation Council (RCC); A European Network of National Platforms.

- National platforms are officially declared national coordinating multi-sectoral and inter-disciplinary mechanisms for advocacy, coordination, analysis and advice on disaster risk reduction. European national platforms tend to include relevant ministries and other stakeholders depending on country. In Italy, for instance, the national platform is coordinated by the Italian National Civil Protection Department (DPC) and includes the following types of actors: relevant national ministries (e.g. Prime Minister's Office, Ministries of the interior, defence, economic development, environment, infrastructure, health, education), National Association of Italian Municipalities (ANCI); DRR stakeholders (National scientific and academic community; the community of NGOs and volunteers' organizations active in the field of DRR and disaster risk management; The community of insurance companies; other organizations invited to join the works of the Platform on a subject- matter basis.). The UK Civil Contingencies Secretariat (CCS) sits within the Cabinet Office at the heart of central government. It works in partnership with government departments, the devolved administrations (Scotland, Wales & Northern Ireland) and key stakeholders. In Germany, in addition to a range of ministries the national platform also includes the main German development agency the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the German Red Cross (GRC).

To help the implementation of the Sendai framework the United Nation Office for Disaster Risk Reduction [UNDRR[19]] published a number of 'words into action guidelines'. In these guidelines best practices are substantiated, possible strategies are given, and methodologies are presented.

4.2.3 Indicator Framework

The Sendai indicator system measures progress towards the Sendai global targets.[20] Only one of the seven targets includes resilience: **Global target D: Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030**. The associated indicators measure damage to infrastructure and services only:

D-1: (compound) Damage to critical infrastructure attributed to disasters.

D-2: Number of destroyed or damaged health facilities attributed to disasters.

D-3: Number of destroyed or damaged educational facilities attributed to disasters.

D-4: Number of other destroyed or damaged critical infrastructure units and facilities attributed to disasters.

D-5: (compound) Number of disruptions to basic services attributed to disasters.

D-6: Number of disruptions to educational services attributed to disasters.

D-7: Number of disruptions to health services attributed to disasters.

D-8: Number of disruptions to other basic services attributed to disasters.

[19] Previously known as UNISDR. The new name and abbreviation show the shift of focus to disaster risk management.
[20] https://www.preventionweb.net/sendai-framework/sendai-framework-monitor/indicators

Also relevant are global targets E and G:

Global target E: Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.

E-1: Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030.

E-2: Percentage of local governments that adopt and implement local disaster risk reduction strategies in line with national strategies.

Global target G: Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030.

G-1: (compound G2-G5) Number of countries that have multi-hazard early warning systems.

G-2: Number of countries that have multi-hazard monitoring and forecasting systems.

G-3: Number of people per 100,000 that are covered by early warning information through local governments or through national dissemination mechanisms.

G-4: Percentage of local governments having a plan to act on early warnings.

G-5: Number of countries that have accessible, understandable, usable and relevant disaster risk information and assessment available to the people at the national and local levels.

G-6: Percentage of population exposed to or at risk from disasters protected through pre-emptive evacuation following early warning.

4.2.4 Progress

In 2018, 74 countries had disaster risk reduction strategies aligned with Sendai that were either in progress (16), ready for validation (29) or had been validated (29)[21]. Countries self-assess the alignment of their disaster risk reduction strategies with Sendai, and the latest progress report comments that according to these self-assessments implementing Sendai Framework Priority 3 (resilience) seems to be more challenging than the other priorities.

[21] https://sendaimonitor.undrr.org/

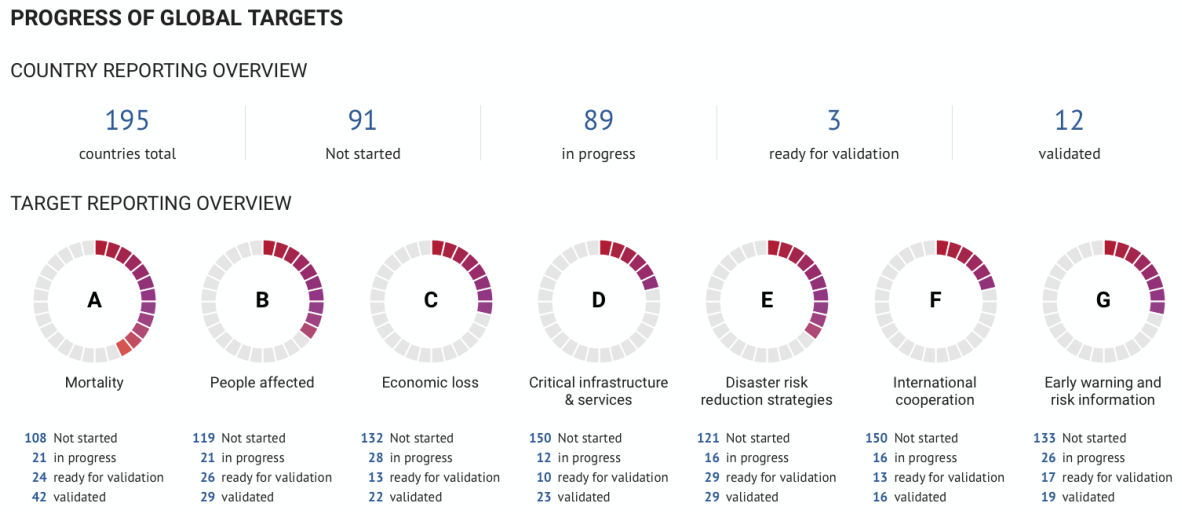

Figure 5: progress of global target set by the Sendai Framework in 2018

Djalante and Lassa [87] observe that data on progress at the local level is lacking. Whilst they highlight linked initiatives such as the UNDRR campaign Making Cities Resilient and Rockefeller's 100 Resilient Cities programme they also stress that lack of actions on the ground and those at the community level. They flag a number of challenges (see table below), of which two are have particular relevance for RESILOC: lack of capacity by local stakeholders and lack of understanding on societal issues that are influencing risk perceptions and actions.

Key progress and challenges in disaster risk governance.

Level	Examples of key progress (P)/challenges (C)
International	– Adoption of the HFA (P) – Stronger recognition of the UNISDR within the UN system (P) – Global Platform for Disaster Risk Reduction (P) – Global Fund for Disaster Risk Reduction(P) – ARISE (private sector alliance for disaster resilient societies) (P) – Global Network of Civil Society Organizations for Disaster Reduction (GNDR) (P) – Scientific and Technical Advisory Group (STAG) (P)
Regional	– 6 regional platforms for DRR, those in the Americas, Europe, Asia, Arabs, Africa, and the Pacific (P) – Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) (P) – ASEAN Agreement on Disaster Management and Emergency Response (AADMER) (P)
National	– 121 countries that have enacted legislation on DRR (P) – 111 countries have Sendai Framework focal points (P) – 85 countries have established National Platforms (P) – Varying capacity between national governments worldwide (C)
Local	– Greater recognition on the importance of focusing efforts at the local level (P) – Lack of capacity at the local by local stakeholders (C) – Lack of understanding on societal issues that are influencing risks perceptions and actions (C) – Lack of local coordination due to inexistence of plans and local platform (C)

Figure 6: Progress and challenges on disaster risk governance at the different governance levels. (source: Dialante and Lassa, 2019) [87]

4.3 100 Resilient Cities Initiative (100RC) – Rockefeller Foundation

Founded in 2013, the Rockefeller Foundation's 100 Resilient Cities program worked with a network of cities all around the World, helping them prepare for future disasters developing a resilience strategy and doing things such as launching storm management projects, creating chief resilience officer positions, and generally preparing their communities to handle future stressors that would affect the way residents, businesses and infrastructure thrive. Then, in July 2019, it was suddenly dissolved.

The aim of 100RC, to which the Rockefeller Foundation has donated $164 million, was to get cities key stakeholders thinking proactively and collaboratively about how to address the interconnected problems of climate change and equity. By doing so, they would foster resilience, the ability to withstand or protect against future disasters or stressors in a way that enables residents, communities, businesses, institutions, and systems to grow and thrive, despite such challenges.

Each of the 100 member cities received two years support of seed funding to create a new Chief Resilience Officer position in the local government, which would oversee the development of the mentioned strategy, and eventually implementation of specific projects. Since the programme launched, the cities have been working toward those goals at varying speeds and communicating with each other about strategies and approaches through the collaborative forum that the 100RC platform provided.

By almost all accounts–including an independent study of the program conducted in 2018 by the Urban Institute [88], the 100RC initiative was working. As one of the main outcomes it got cities actively thinking about long-term strategies for some of their most important problems through an application process that asked them to examine their vulnerabilities, stressors, and preparedness. It crossed global boundaries to foster a conversation across different urban contexts. According to Michael Berkowitz, former president of 100RC, cities are undertaking over 2,600 resilience focused projects, and the initiative has brought in over $3.35 billion in funding for different projects across the cities.

According to the Urban Institute report: "Most comparable programmes have focused directly on projects or services, while 100RC's theory of change focuses on the long-term transformation of institutions and systems in cities as a precursor to project implementation."

Long-term is the key idea here, continue saying the report: 100RC was not interested in patchwork jobs or retroactive fixes (which is what makes the fact that part of the Rockefeller Foundation's pivot revolves around disaster relief–instead of prevention–rather disappointing). Instead, the program wanted to get cities thinking about how to embed future resilience and sustainability into their strategic objectives The resilience officers and the strategies they developed did not work in isolation: They had to get multiple government officers and local stakeholders on board, and source inputs from the residents they aimed to serve. It was a long process–evidenced by the fact that many cities are only now finalizing their strategies after over five years.

One of the main goals of the programme was to institutionalise and "integrate resilience in cities and communities around the world." So, 100RC could be seen as a launchpad for the cities who been participating and now have their resilience officers in place and can independently work toward implementing their resilience strategies gradually. But it also gave cities a crucial network of support, knowledge base and expertise, build-up of both 100RC's staff and leaders from other cities, to lean on throughout the process. The network created would have continued to be a vital resource as cities move toward the implementation phase, and as they work to continually adapt in the face of unforeseen challenges.

100RC foregrounded the importance of global collaboration, thinking globally, acting locally. Through its platform, cities kept each other on track to meet their targets, learning from each other and continually inspiring each other with new ideas and solutions that reduce exposure, vulnerability, dealing more effectively their risks and hazards, but also social inequity. It was a global, collaborative, forward-thinking platform.

100RC defines urban resilience as “the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience.”

Building urban resilience requires looking at a city holistically: understanding the systems that make up the city and the interdependencies and risks they may face. By strengthening the underlying fabric of a city and better understanding the potential shocks and stresses it may face, a city can improve its development trajectory and the well-being of its citizens, promoting the balance between social, economic and environmental development.

Figure 7: potential stress and shock factors which can threaten the urban fabric.[22]

4.3.1 The City Resilience Framework

The **City Resilience Framework** [89] based on the City Resilience Index [90] provide internationally acknowledged tools designed to facilitate a process of engagement with cities that generate new ideas and opportunities for involvement of new actors from communities, civil society, governments and industry in the efforts to increase resilience of cities and societies.

Helping individuals and communities to be better prepared for, withstand and recover from disasters is considered vital in reducing the impact of crises and avoiding loss of life and livelihoods. Supporting community initiatives, advocates and forward-thinking leaders across government, non-profit, academia and private sectors in rewriting the rules of disaster risk reduction, response and recovery empowers actions focused on the needs of the people whose lives and communities are affected and co-designed solutions which meet them effectively. Advancing new solutions by supporting local resilience teams, promoting integration of research outputs and community-based experiments, enhanced with storytelling across the media landscape works toward ensuring a more effective, equitable and sustainable approach to response and recovery.

[22] https://www.100resilientcities.org

Building communities' resilience can minimise the negative effects of disasters and prevent future humanitarian crises and thus is considered a pillar of the relevant international and EU strategies. This strategic objective is also at the heart of the goals to be addressed by the RESILOC project.

Cities are in the vision of Arup (100RC) made up of interlinked systems which respond and interact in different ways to a shock or stress and may exhibit varying levels of resilience. These systems are constantly working to move the state of a city along these three dimensions:

- on the physical dimension, from a worst-case scenario of danger to being safe,
- on the social dimension, from a worst-case scenario of conflict to harmony and
- on the economic dimension, from a worst-case scenario of deprivation to prosperity.

Figure 9 represents the 3 dimensions as 3 axes in cartographic space defining a cube. The black dot represents the worst-case scenario of total collapse while the yellow dot is the best-case scenario that resilient cities strive towards.

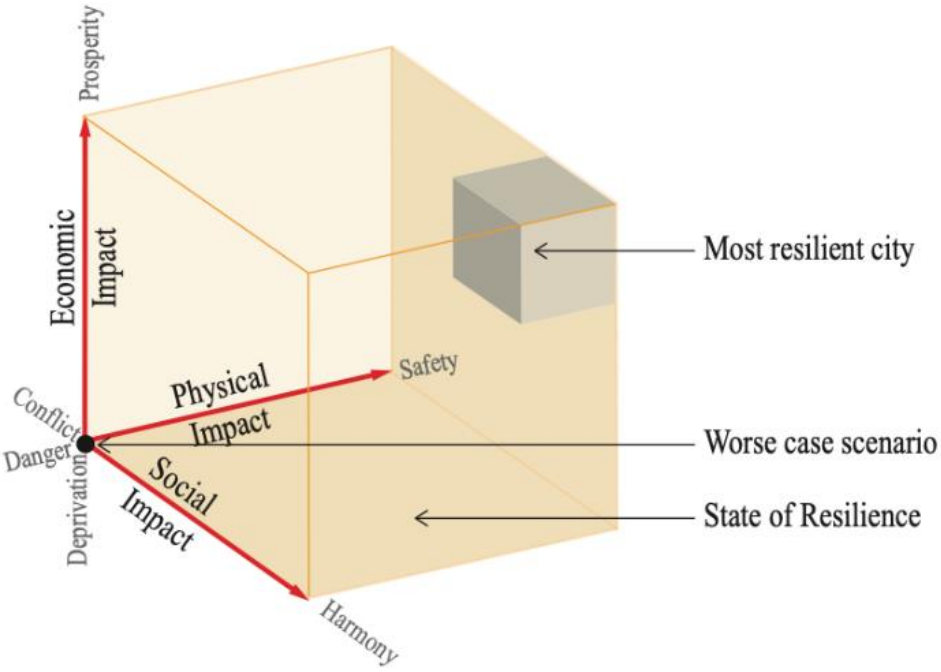

Figure 8: Relationship of the three dimensions to the types of impact to a city. [91]

In the project it was defined what a resilient city is. In the performance-based approach, a resilient city:

1. delivers basic needs by providing access to water, energy, food, shelter and waste management, despite on-going stresses and occasional shocks,
2. safeguards human life from threats by raising awareness, undertaking direct planning measures and ensuring adequate resources are available to deal with the effects of the shocks and stresses,
3. protects, maintains and enhances assets to reduce the likelihood and impacts of shocks and stresses, and continues to provide critical services during shock/stress events,
4. facilitates human relationships and identity to ensure a stable and peaceful society and to prevent societal breakdown aftershocks or during stresses,

5. promotes knowledge, education and innovation that increases understanding of threats, improves management of shock/stress events and creates an ability to learn from past experience,
6. defends the rule of law, justice and equity by maintaining an effective justice system that holds people and institutions accountable to preserve the peace,
7. supports livelihoods by improving access to income generating activities and support for business during shocks and stresses,
8. stimulates economic prosperity by strengthening competitiveness, diversifying the city's economic base and promoting a healthy business environment.

The eight functions are not seen as independent but interlinked. A disaster can effect one of the functions but will cause ripples that affect the other functions.

The eight functions were aggregated to four dimensions or pillars:

1. Health & Wellbeing;
2. Economy & Society;
3. Infrastructure & Environment; and
4. Leadership & Strategy.

Each dimension contains three "drivers" which reflect the actions cities can take to improve their resilience. As such resilience is not defined as a concept but as a container of functions and dimensions with an antonym 'worst case disaster'. The approach with the four dimensions/ pillars it is a useful tool to help cities explore the strengths and weaknesses of its systems. 100RC uses several diagnostic tools based on the CRF in its work with cities to examine interdependencies and diagnose where to build their capacities.

The City Resilience Framework[23] provides a lens through which the complexity of cities and the numerous factors that contribute to a city's resilience can be understood. It comprises 12 key goals that describe the fundamental outcomes of a resilient city, 4 categories (mentioned above), 52 indicators (see below) and 156 variables.

Cities need to ensure that their development strategies and investment decisions enhance, rather than undermine, the city's resilience.

[23] https://www.rockefellerfoundation.org/report/city-resilience-framework/

Figure 9: Framework of the Rockefeller resilient cities

If governments, donors, investors, policymakers, and the private sector are to collectively support and foster more resilient cities, there needs to be a common understanding of what constitutes a resilient city and how it can be achieved.

4.3.2 City Resilience Framework Indicators

The CFR has indicated the 52 indicators below to shape the four dimensions

Table 1: Indicators used city resilience framework [91]

Health and Wellbeing	
Indicator	Topic
1.1 Safe and accessible housing	Housing
1.2 Adequate affordable energy supply	Utilities - Energy
1.3 Inclusive access to safe drinking water	Utilities - Water Supply
1.4 Effective Sanitation	Utilities - Drainage & Sanitation
1.5 Sufficient affordable food supply	Food

2.1 Inclusive labour policies	Employment & Labour
2.2 Relevant skills and training	Education & Training
2.3 Dynamic local business development and innovation	Business, Finance & Economy
2.4 Supportive financing mechanisms	Business, Finance & Economy
2.5 Diverse protection of livelihoods following a shock	Employment & Labour
3.1 Robust public health systems	Health
3.2 Adequate access to quality healthcare	Health
3.3 Emergency medical care	Health
3.4 Effective emergency response services	Disaster management
Economy and Society	
4.1 Local Community Support	Support & welfare
4.2 Cohesive communities	Citizen participation and awareness
4.3 Strong city-wide identity and culture	Culture
4.4 Actively engaged citizens	Citizen participation and awareness
5.1 Effective systems to deter crime	Crime and Policing
5.2 Proactive corruption prevention	Crime and Policing
5.3 Competent policing	Crime and Policing
5.4 Accessible criminal and civil justice	Legal and justice
6.1 Well-managed public finances	Budget
6.2 Comprehensive business continuity planning	Business, Finance & Economy
6.3 Diverse economic base	Business, Finance & Economy
6.4 Attractive business environment	Business, Finance & Economy
6.5 Strong integration with regional and global economies	Business, Finance & Economy
Infrastructure and Ecosystems	
7.1 Comprehensive hazard and exposure mapping	Disaster management
7.2 Appropriate codes, standards and enforcement	Urban planning
7.3 Effectively managed protective ecosystems	Environment
7.4 Robust protective infrastructure	Protective infrastructure

8.1 Effective stewardship of ecosystems	Environment
8.2 Flexible infrastructure	Utilities
8.3. Retained spare capacity	Utilities
8.4 Diligent maintenance and continuity	Utilities
8.5 Adequate continuity for critical assets and services	Utilities
9.1 Diverse and affordable transport networks	Transport
9.2 Effective transport operation & maintenance	Transport
9.3 Reliable communications technology	ICT
9.4 Secure technology networks	ICT
Leadership and Strategy	
10.1 Appropriate government decision-making	Governance
10.2 Effective co-ordination with other government bodies	Governance
10.3 Proactive multi-stakeholder collaboration	Governance
10.4 Comprehensive hazard monitoring and risk assessment	Disaster management
10.5 Comprehensive emergency management	Disaster management
11.1 Adequate education for all	Education
11.2 Widespread community awareness and preparedness	Disaster management
11.3 Effective mechanisms for communities to engage with government	Citizen participation and awareness
12.1 Comprehensive city monitoring and data management	City data
12.2 Consultative planning process	Urban planning
12.3 Appropriate land use and zoning	Urban planning
12.4 Robust planning approval process	Urban planning

4.3.3 Independent Evaluation of the 100RC Initiative – Urban Institute

Findings suggest that 100RC is contributing positively to six key areas of interest in its member cities by embedding resilience principles in city planning and operations. These six areas of positive change include:

1. the explication of resilience in city planning;
2. the internal consistency across cities' various planning documents;
3. the establishment of a Chief Resilience Office or similar cross-sectoral coordinator;

4. a reduction in the strength of the government silos that promote ineffective solutions, duplication and inefficiency;
5. better collaboration across city, state, and national levels of government and
6. changes to budgetary review procedures or leveraged funds for resilience-building efforts which may ultimately lead to more efficient and effective use of city funds.

Cities report helpful guidance from 100RC in ensuring that their Strategy initiatives are developed by consensus, are feasible, and are expected to deliver multiple resilience benefits for residents. Critically, cities that published their strategies are identifying and implementing their priority initiatives – indicating the strategies are being enacted and not just sitting on a shelf. Tracking the completion and outcomes of these initiatives will be a focus of future evaluation efforts. Early observations suggest that cities that have more fully institutionalized changes (e.g. have made the City Resilience Officer position/office permanent) are doing more to implement their Strategy's initiatives.

100RC consciously employs a consistent set of core offerings that are then tailored to each member city's context and pace. The Urban Institute's analysis compared 100RC to 40 other programs, finding that alternatives to this effort – to mount a coordinated, city-driven effort to plan for worldwide resilience challenges – simply do not exist. 100RC is among the first global urban initiatives to employ a consistent set of tools, supports, and resources across so many diverse cities. It is also the first of its size to have the explicit mission of building city-level resilience. Most comparable programs have focused directly on projects or services, while 100RC's theory of change focuses on the long-term transformation of institutions and systems in cities as a precursor to project implementation.

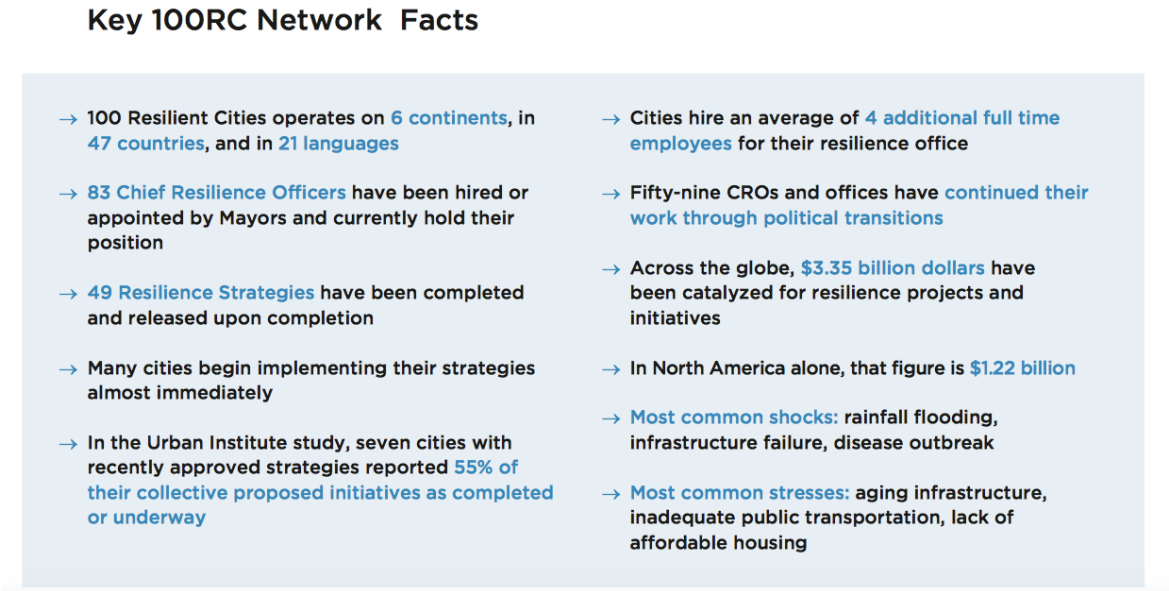

Figure 10: 100 resilient cities network facts[24]

[24] https://resilientcitiesnetwork.org/urban_resiliences/100-resilient-cities-midterm-evaluation-report-summary/

4.4 UNDRR Making Cities Resilient Global Campaign

The vision of the campaign is to achieve resilient, sustainable urban communities.

The campaign urges local governments to take action now to reduce cities' risks to disaster.

The objectives of the Making Cities Resilient campaign are threefold, and can be achieved through building long-lasting partnerships:

1. **Know more**: Raise the awareness of citizens and governments at all levels of the benefits of reducing urban risks.
2. **Invest wisely**: Identify budget allocations within local government funding plans to invest in disaster risk reduction activities.
3. **Build more safely**: Include disaster risk reduction in participatory urban development planning processes and protect critical infrastructure.

"My City is getting ready" which the slogan of the Campaign is a rallying call for all mayors and local governments to make as many cities as possible as resilient as possible. It is also a call for local community groups, citizens, planners, academia and the private sector to join these efforts.

While the campaign addresses citizens those who live in urban areas and who elect the decision makers who can take the necessary steps to make their cities safer, the campaign's principal target groups are mayors and local governments of cities of different sizes, characteristics, locations and risk profiles. Mayors and local governments are the agencies who can take action and make our cities safer. Mobilizing these important actors in the disaster risk reduction process is essential to making cities resilient.

The Making Cities Resilient campaign places cities in the spotlight, with more 4,000 signatory

Cities committed to build local strategies and action plans with Latin America as the region with the highest number of cities that joined the campaign, more than 800.

4.4.1 10 Essentials and Other Tools

The Ten Essentials for Making Cities Resilient are developed with the launch of the Campaign in order to accelerate implementation of the Sendai Framework for Disaster Risk Reduction (2015-2030) at local level. The ten Essentials map directly against the Sendai priorities of action and its indicators for monitoring actions on disaster risk reduction. They are the critical and independent steps that need to be undertaken to build and maintain resilience.

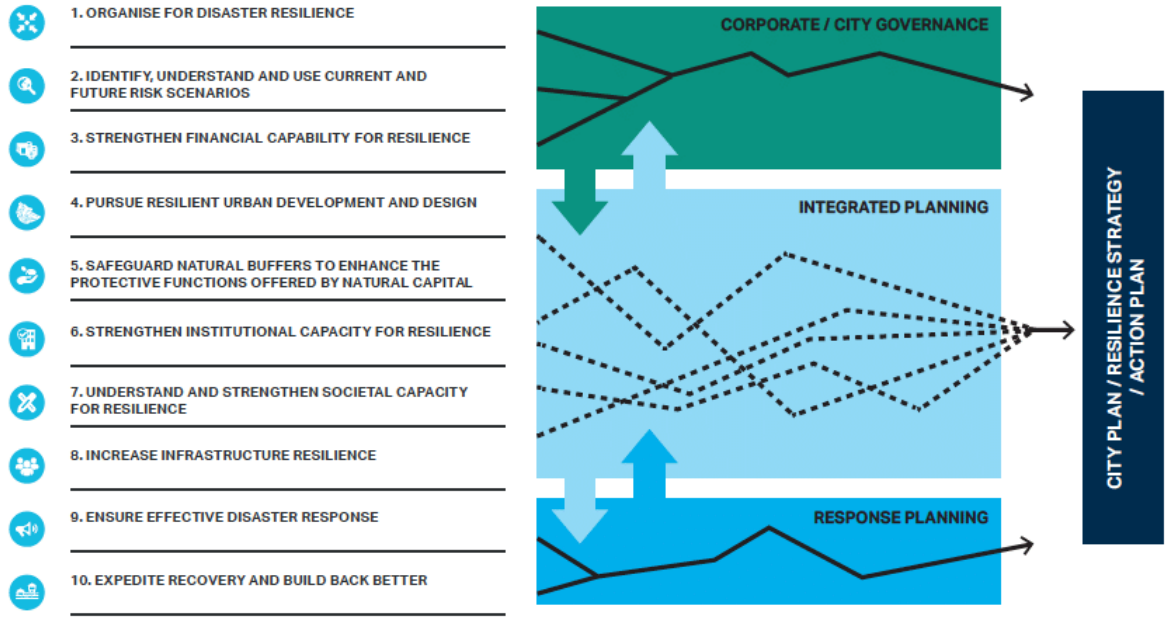

Figure 11: Scorecard for the Making Cities Resilience Campaign

Another important tool offered by the MCR Campaign is the Scorecard.

UNDRR with the support of European Commission, IBM, AECOM and other partners and cities participating in the Campaign developed the Disaster Resilience Scorecard for Cities.

The Scorecard provides a set of assessments that will allow local governments to assess their disaster resilience, structuring around UNDRR's Ten Essentials described above. It also helps to monitor and review progress and challenges in the implementation of the Sendai Framework for Disaster Risk Reduction: 2015-2030.

It offers the potential for scoring at two levels:

- **Level 1: Preliminary level:** responding to key Sendai Framework targets and indicators, and with some critical sub-questions. This approach is suggested for use in a 1- to 2-day city multi-stakeholder workshop. In total there are 47 questions indicators, each with a 0 – 3 score;
- **Level 2: Detailed assessment**: this approach is a multi-stakeholder exercise that may take 1 – 4 months and can be a basis for a detailed city resilience action plan. The detailed assessment includes 117 indicator criteria, each with a score of 0 – 5.

While the Scorecard can be used as a standalone tool, it does require the city to consider their hazards and risks. Specifically, the Scorecard prompts to identify "most probable" and "most severe" risk scenarios for each of the previously identified city hazards, or for a potential multi-hazard event.

In considering risk, the Campaign offers another important tool, which is the Quick Risk Estimation tool (QRE) developed by UNDRR and Deloitte.

Other initiatives to build resilience at the local level, included the Rockefeller Foundation 100 Resilient Cities (also included in our work for this project and analysed above), the C40, ICLEI Local Governments for Sustainability and United Cities and Local Governments.

4.5 The Global Strategy for the European Union

The **Global Strategy for the European Union** prioritises building resilience at home and abroad. The EU commits to strengthen the resilience of states and societies by supporting good governance, accountable institutions, and working closely with civil society.

The High Representative and the European Commission launched a Joint Communication on Resilience that aims to further enhance common action on building resilience on the ground. The European Union focuses its new strategy for resilience building, aiming to move from crisis containment to a more structural and long-term approach to global challenges. It puts a particular emphasis on anticipation, prevention and preparedness.

The official EU approach to resilience is based on a declared need to move away from crisis containment to a more structural and long-term approach to vulnerabilities. The strategy puts a strong emphasis on anticipation, prevention and preparedness, aiming to work along three linked lines:

- Expanded assistance for partner countries' resilience: The EU will continue to support domestic efforts of partner countries to become more resilient, with the help of broadened political, development and humanitarian support. This includes strengthening inclusive and participatory societies, alleviating long-lasting crises or preventing violent conflict. It will also take into account the vulnerabilities and needs of forcibly displaced people, while also recognising the positive contribution of migrants to inclusive growth and sustainable development.
- Policy dialogue and bilateral initiatives: The EU can draw upon significant experience of addressing complex domestic policy challenges and enhancing resilience. Examples of this include its work on energy security, climate adaptation, economic and social policy or addressing global health risks. Having invested heavily in research on resilience, the European Union is ready to share these insights with its international partners.
- Resilience and the security of the Union: Internal and external security dimensions of EU policy have to be closely integrated, in order to strengthen our response to hybrid threats, cyber-security, the security of critical infrastructure, terrorism and violent extremism.

Resilience from a humanitarian perspective is defined by EU as the ability of an individual, a community or a country to cope, adapt and recover quickly from stress and shocks caused by a disaster, violence or conflict. Resilience should be addressed in all stages of the disaster management cycle, from prevention (when possible) to adaptation (when necessary) and include positive transformation that strengthens the ability of current and future generations to meet their needs. During and following disasters, focus needs to be on rebuilding social infrastructure in addition to repairing physical infrastructure, the solutions must include new frameworks for assessing and addressing the needs for true resilience, including solutions catered to our new climate impact realities.

The **Agenda 2030 for Sustainable Development** specifically directs one of the 17 strategic goals towards making cities and human settlements inclusive, safe, resilient and sustainable (SDGs 11) ascribes importance to the relationship between circularity, productivity and resilience, to achieve sustainable, inclusive, safe and resilient communities. In particular it calls for the adoption and implementation of integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters and development of holistic disaster risk management at all levels, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030 strategy.

In relation to resource efficiency, other resilience approaches born out of analyses of previous experiences spotlight increased recognition of the fact that resilience spending creates its own economy and therefore must be treated as such. Just as disasters can blunt economic activity, disaster recovery increases it. The concept of **resilience economy** includes activity related to disaster recovery and the immediate response phase, as well as the phase of long-term rebuilding, which can span years or decades. In places where disasters hit again and again a significant part of the resilience economy can include disaster preparation, and, at best, climate adaptation. Where the money goes and how it is used determines how the resilience economy takes shape for the future. Those resources could be transformative for communities that rarely see investment, but not if the investment passes them over, or simply moves through them. The engine of the resilience economy and its growth must be investing in communities in a way that strengthens them and makes them more resilient.[25]

4.6 The Global Approach to Resilience by IFRC

For the International Federation of Red Cross and Red Crescent Societies (IFRC) the concept of community resilience represents a unique opportunity as this approach in many ways captures the totality of what the IFRC is working to achieve. Although their efforts may not have been characterized as 'strengthening community resilience,' this is in fact what many National Societies have been doing over the course of many decades by supporting their local communities. This framework has the principle objective to: 'Establish a foundation on which all IFRC programmes, projects, interventions and actions, across the contexts, which contribute to the strengthening of resilient communities can be created developed and sustained' and is translated at institutional level into the IFRC Framework for Community Resilience.[26]

The IFRC's understanding of community resilience has grown to recognize the ever evolving and dynamic nature of communities and the underlying vulnerabilities that challenge them. Responding to this reality, the IFRC's approach has focused on combining humanitarian concern for imminent threats with longer-term, sustainable approaches and institutional strengthening traditionally associated with development. With an increased ability to adapt and cope with disasters, crises, shocks and stresses communities can protect and build on development gains that they have already made and address the effects of underlying vulnerabilities that challenge them. As being resilient includes being flexible in the face of changing risks, and climate change is increasingly influencing risk patterns everywhere, climate change considerations are an integral element of its Framework for Community Resilience.

Resilience according the IFRC is also affected by geographical and political contexts, conflict and insecurity, as well as bureaucratic and legal bottlenecks. A lack of insight into local contexts can leave people and communities at risk even when support is being provided – because it is not the right kind of support or is being offered in ways that the target population cannot understand or access. Generic programming approaches often fail to meet the specific needs of particular groups and thus impact the resilience of the most vulnerable, struggling to access support due to physical, cultural, social or political limitations affecting the target population. Certain types of situations attract less support and thus fall under the category of underfunded crisis, often including small rapid-onset disasters, larger slow-onset disasters and long-term complex emergencies which have critical impact on the resilience of those affected.

Access to support is also tied to availability of information on needs and of data necessary for targeted interventions. The increased availability of data and the rapid use of new technologies

[25] https://resilienceforce.org/wp-content/uploads/2020/01/report_jan_v8.pdf
[26] https://media.ifrc.org/ifrc/document/ifrc-framework-community-resilience/

raise new questions and concerns about the gathering and use of sensitive data, the rights of people who are the subjects of collected data, as well as the responsibilities of data producers and users. The digital humanitarian sector is aware of the boundaries and the risks, though more discussion is undoubtedly needed on issues of consent and the ethics of making previously hidden people and places visible [Sumadiria, 2015] [27]. Initiatives such as the Signal Code (Signal Program on Human Security and Technology, Harvard Humanitarian Initiative, 2018) and the UN Secretary-General's High Level Panel on Digital Cooperation [UN, 2018a] aspire to provide such platforms and are addressed in the context of the institutional strategies.[28]

The IFRC understands that resilience strengthening programmes and activities impact at all levels and in all types of communities. The FCR uses the following definition for community: Communities are complex and dynamic and so are the vulnerabilities that challenge them. There are many factors that influence community resilience (e.g., physical, human, financial, natural and social aspects of life). These factors are also interconnected, which requires that they be considered and understood holistically, through a multi-disciplinary approach which takes account of how factors influence one another.

The IFRC recognizes that programmes developed from risk-informed decisions that adopt a holistic approach are more likely to contribute to reducing the underlying vulnerabilities of communities and ultimately lead to more resilient communities and thus supports community-led, risk-informed decision-making including:

1. Supporting assessments that capture the needs, risks, vulnerabilities and capacities of all members of the community, as well as the dynamic and complex context in which a community exists.
2. Supporting communities to develop solutions that are: i) holistic and appropriate to their context (e.g., considering innovative and emerging technologies whilst bearing in mind traditional knowledge, customs and practices); ii) technically sound; iii) effective and efficient (e.g., looking for low-tech, low-cost solutions); and iv) sensitive to issues such as gender equality, cultural diversity, climate change and violence prevention.
3. Supporting communities to self-mobilize and address their vulnerabilities and hazards from their own resources.
4. Supporting communities to access external support networks, such as the public authorities, civil society and the international Red Cross Red Crescent network.
5. Actively engaging communities in the monitoring and evaluation of programmes and services.
6. Being accountable to communities, public authorities and other partners (e.g., by proactively providing regular reports, feedback and information relating to programmes, services and activities).

The IFRC has been following the Guided by Strategy 2020 as the collective plan of action to tackle the major humanitarian and development challenges of this decade. Significant attention in the strategies is provided to the complex links between culture, risks and disasters, exploring culture specifically in relation to the issues of risk and how risk can be differently perceived: "Culture consists of beliefs, attitudes, values and their associated behaviours, that are shared by a significant number of people in hazard-affected places. Culture in relation to risk therefore refers to the ways that people interpret and live with risk, and how their perceptions, attitudes and behaviour influence their vulnerability to hazards." Beliefs and attitudes lead to particular

[27] https://www.preventionweb.net/publications/view/46682
[28] https://media.ifrc.org/ifrc/wp-content/uploads/sites/5/2018/10/B-WDR-2018-EN-LR.pdf

ways of perceiving risk; values affect how people prioritize risks and how they relate to other people when dealing with risks; behaviours are the outcome of the perception and values that relate to risk. This is all rooted in the ways that people interact with each other and with organizations in the context of power relations. The reason it is important to look at and understand culture in the context of resilience focused strategies is that a lot of it is related to hazards: culture often embodies beliefs about risk, attitudes and values about what priorities should be and what action people should take in relation to risk. Understanding culture is, therefore, highly relevant to how disaster preparedness and climate adaptation is carried out at community level and beyond [92]

The measurement of community resilience is relatively new and is still developing – in contrast to more traditional, sector-based approaches, the same body of experience in its measurement, or consensus for how to measure it does not currently exist. While the IFRC has policies, guidelines, frameworks and tools together with significant capacity and experience in measurement and evaluation of traditional approaches, it is important to acknowledge the limitations of the current methodologies in measuring community resilience strengthening. A critical distinction in measuring community resilience relates to assessing 1) a community's level of resilience versus 2) the IFRC's impact on community resilience being measured versus 3) the IFRC's contribution to the community's resilience.

Three key measures for community resilience applied at IFRC include:

1. Measuring community resilience: A composite measure of the various characteristics that comprise community resilience.
2. Measuring IFRC's impact on community resilience: Measurement of the attribution of IFRC's work to community resilience. How much of the measured impact on community resilience is the result of the IFRC's contributions versus other factors?
3. Measuring IFRC's contribution to community resilience: Measurement of the incorporation and achievement of specific activities supporting community resilience strengthening. Whether we accomplish the objectives we identify as supporting community resilience.

A good example of this approach is the IFRC's East Africa Framework for Community Resilience. [29] The framework was developed in 2013 and 2014 through targeted literature review, consultations with regional and Partner National Societies and external partners, and operationalizes the concepts and principles described in the FCR in the specific context of IFRC's work in East Africa. [30]

[29] https://www.researchgate.net/publication/325130435_IFRC_East_Africa_Framework_for_Community_Resilience
[30] https://media.ifrc.org/ifrc/wp-content/uploads/sites/5/2018/03/IFRC-Framework-for-Community-Resilience-EN-LR.pdf

5 Case Studies

Figure 12 Case Study Locations

5.1 National Council for Fire & Emergency Services (AFAC) - Australia

5.1.1 General Approach to Resilience

AFAC (formerly the Australasian Fire and emergency service Authorities Council) now hosts the National Council for Fire and Emergency Services. It is the main body representing fire, emergency services and Land Management agencies across the Australasian region. It has 34 members including Fire and Rescue services, Emergency Management services and interested parties from forestry, environmental and wildlife agencies.

The organization has a broad geographical coverage with representation from every state and territory in Australia and New Zealand as well as from around the Pacific.

The structure for organization of resilience within Australia is considered by federal legislation which overrides that off the state Ford territory. However, Emergency Management, is devolved to each state or territory. The Emergency Management act create an official entity within each state or territory as well as a commissioner for Emergency Management.

Whole states have a similar structure and employ bilateral agreements to ensure interoperability across boundaries. An Emergency Management Agency overseas federal capability which is diploid through a national resource sharing centre brackets NRSC close brackets which operates through regional hubs Co located with other emergency agencies.

Community based aspects of resilience oral vested at a state level with no equivalent national function.

The overall approach to resilience across the Australasian region is characterised by 2 factors. Firstly, the remote nature of most communities and secondly an inherent volunteering culture, not widely experienced within Europe. This influences the region's entire approach to both community and disaster resilience.

Civil organizations in the region operate against the four acknowledged phases of a disaster, namely: Prevention, Protection, Response and Recovery.

- Mitigation – reducing the loss of life and property by lessening the impact of emergencies

  Mostly characterised by volunteer models – most staff being focussed on Response to the exclusion of mitigation. Sub-regional committees often exist BUT these tend to be the same people focused on response creating a capacity problem.
- Preparation - planning, organizing, training, equipping, exercising, evaluating, and taking corrective action

  4-6 months of the year the EM arrangements are 'stood-up' due to the occurrence of bush fires. EM Manuals include generic State Plans with the main planning being done through **Planning Cells** which become operational during a crisis. A formal 'Lessons learned' team continually reviews preparation.
- Response - reaction to the occurrence of a catastrophic disaster or emergency

  Tends to be data driven and it is here that the example Victoria Emergency App starts to demonstrate where data is used at the interphase between emergency service and community response
- Early Recovery - restoring critical community functions and beginning to manage stabilization efforts

  Here the emphasis is very much on local authorities with limited national support.

5.1.2 Existing policies

The Australasia inter-agency management system (AINS) describes command and control arrangements at times of disaster. This process is owned by AFAC in a similar manner to most national arrangements around the World.

Structures are felt to be a product of Australia's history and exhibit a well-established devolved model of response, based on a federal stroke state hierarchy.

City resilience arrangements operate through the regional structure of open areas. These link into both regional and state levels within the emergency management agency. In practical terms a state appointed Controller will make these arrangements work.

5.1.3 Resilience Indicators

Discussions at several levels regarding the measurement of community resilience have exposed a relatively immature approach. It seems that thematic preparation is good albeit limited to bush and wildfire. The example of the Australian Fire Danger Rating System shows how social datasets are now being incorporated into early warning systems, to give them greater relevance from a community perspective.

At an organizational level, the concept of resilience is extremely operational and the example of the EM-COP provides insight into the manner in which thematic, geographical and operational data are drawn into a single platform, primarily for the benefit of emergency responders but also for local agencies responsible for resilient communities.

The resources used include a public-facing "Vic Emergency" App which presents selective data to potentially affected communities.

5.1.4 The Australian Fire Danger Rating System (AFDRS)

The AFDRS has been operating as a warning system since the 1960's but a recent programme has commenced to make it more responsive to the needs of local communities.

The need to develop a new system was recognised as a national priority it's 8 by all Australian governments in 2014. A phased approach to deliver the multiyear scalable program was approved. The program is being managed by a national programme board and supported by research organizations and the Bureau of meteorology.

Following an initial feasibility study (Phase 1) in 2016, in 2018, Phase 2 developed the Research Prototype, a newly created Fire behaviour index based on calculations from operationally ready fire spread models. It makes the criteria of being national, modular and open to continuous improvement.

Also and of particular relevance to RESILOC, late in 2018, an extensive national Social Research project identified that the apparent public facing system was too complex and needed optimising, re framing and simplifying.

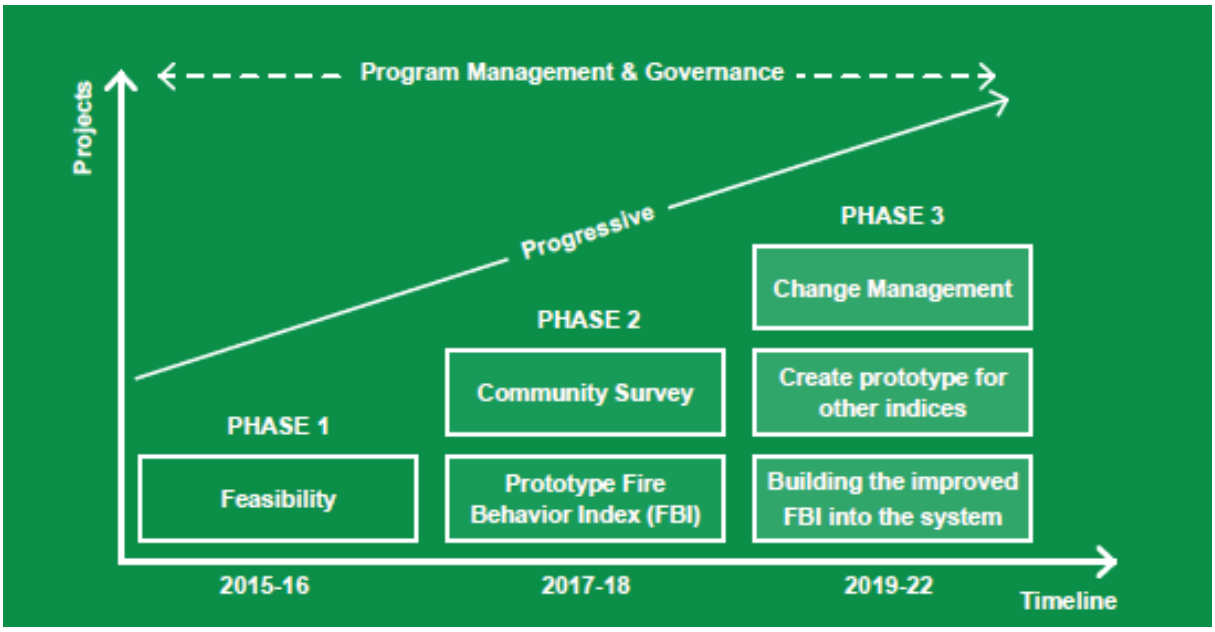

Figure 13 the three phases of development AFDRS

This year, in phase 3, the new AFDRS, based on the research prototype fire behaviour index is being built. Extensive consultation with key stakeholder groups is informing the design of the new Fire Danger Rating System and scoping the dimensions of change required prior to the proposed roll out over the next two years.

Also, under Phase 3, the program will build prototypes for ignition likelihood, suppression, and impact indices for potential inclusion in an expanded system in the future.

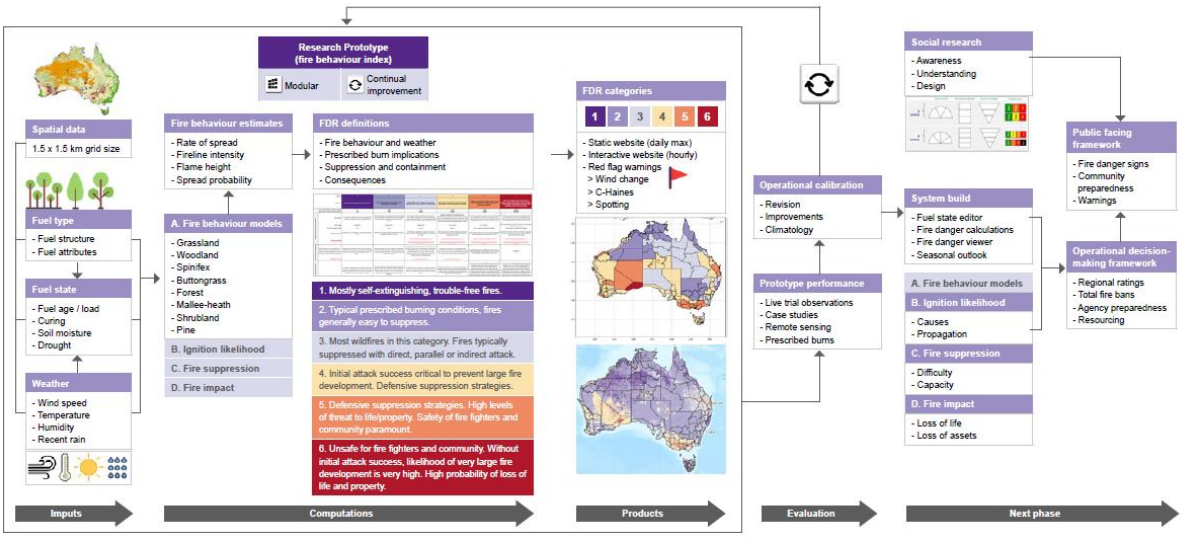

Figure 14 AFAC Fire Behaviour Index

To enable accurate information, a complex algorithm has been developed which takes into account fire dynamics, meteorological and other physical variables and seeks to complement them with sociological aspects more relevant to the communities affected.

5.1.5 EM-COP

EMCOP is the Emergency Management facing Common Operating Picture system used across Australia.

It is a web-based information gathering, planning and collaboration tool that runs on desktop computers, laptops and tablets.

The system is designed to provide users with a simple way to gather, organise, create and share emergency management information between emergency managers at no cost to agencies.

It can be used in any control centre, shire council, not-for-profit relief organization, essential service provider or on the ground. You will be able to access situation awareness more quickly and effectively than ever before.

EM-COP is used before an emergency (to help plan and prepare), during and after an emergency (to assist with recovery). EM-COP can also be used to manage planned events.

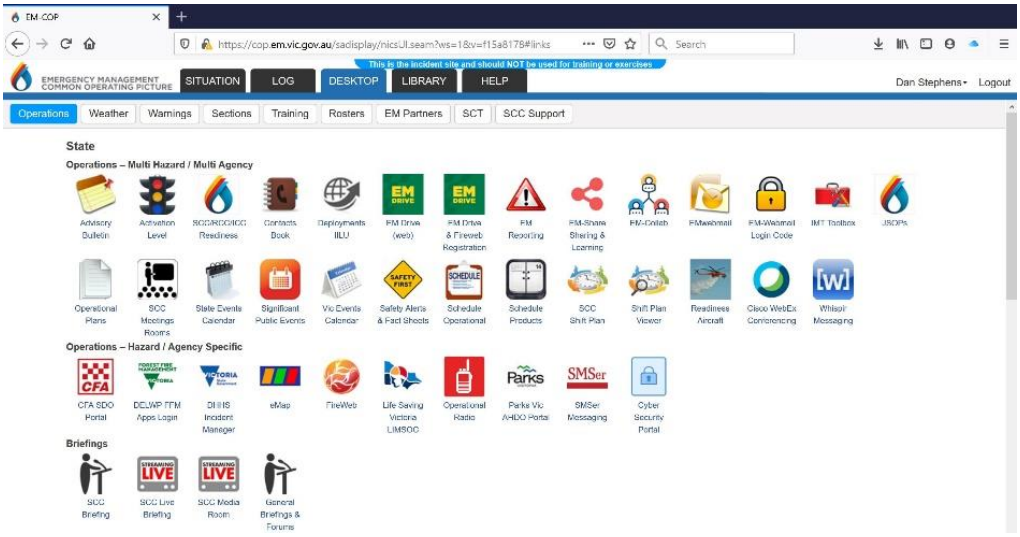

Figure 15 EM-COP State Level feeds

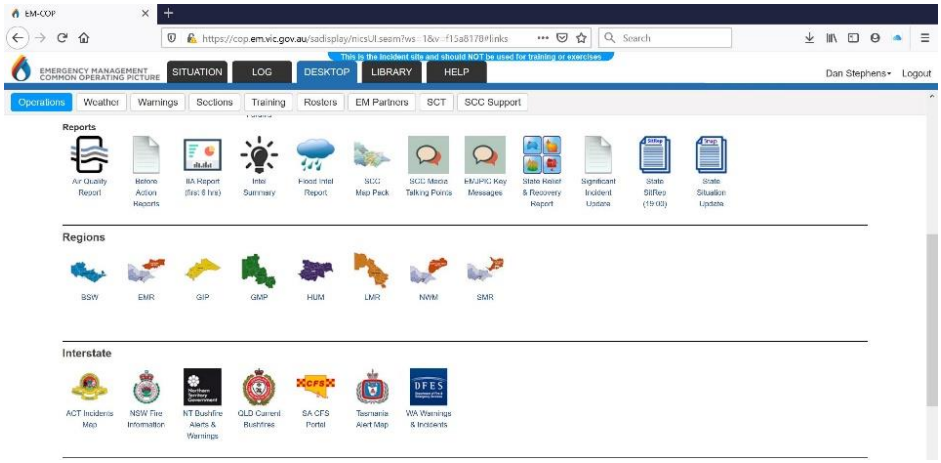

Figure 16 EM-COP Geographical Feeds

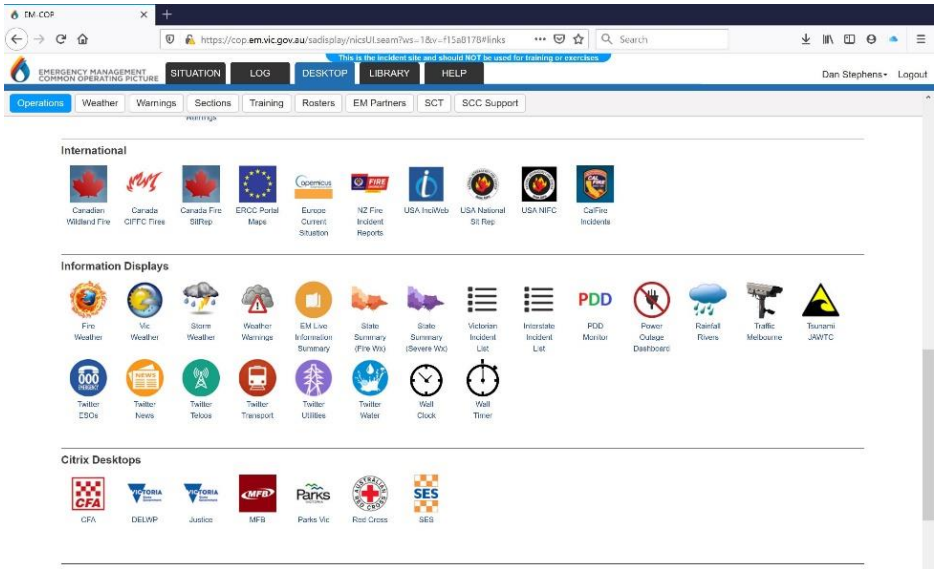

Figure 17 EM-COP International and Social Media Feeds

5.1.6 The VicEmergency App

The “VicEmergency” app is the official Victorian Government app for access to community information and warnings for all types of emergencies in the State of Victoria and metropolitan area of Melbourne.

It replaced a previous version known as “FireReady” in 2016. And is available on both android and IOS mobile platforms.

In a major improvement from its predecessor, the VicEmergency app extends warnings form a range of emergency agencies beyond simply that of fire including:

Country Fire Authority, Department of Economic Development and Transport and Resources, Department of Environment, Land, Water and Planning, Department of Health and Human Services, Life Saving Victoria and of course, local Fire Services.

The app is managed by Emergency Management Victoria who are the primary managers and suppliers of data into EM-COP described above. Also supported by the Department of Justice, this synergy is considered to be of importance if the information interphase between emergency managers and affected communities is to be effectively navigated.

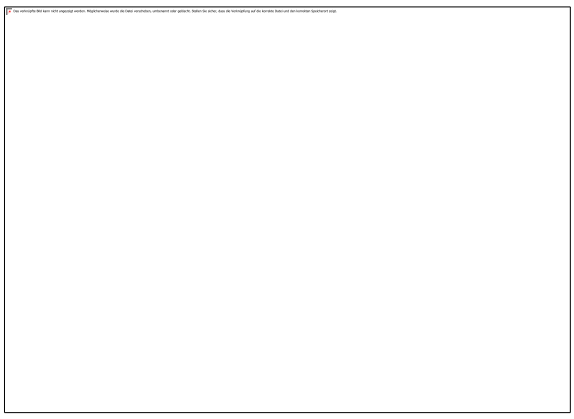

Figure 18 Range of Natural Hazards considered

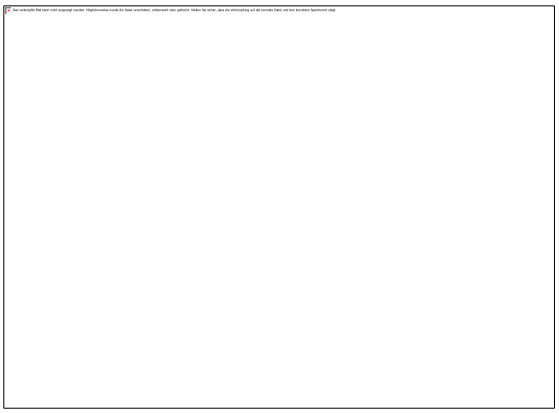

Figure 19 Geographical coverage

Figure 20 Direct & relevant alerts

5.2 Dakar (Senegal)

5.2.1 General Approach to Resilience

Dakar, Senegal's capital city, is the western-most location in Senegal and Africa and has 19 communes and two seasons: a dry one from November to May, and a wet season from June to October. Dakar is also an important metropolitan centre for Senegal ranked as the 5th most populated city in West Africa. Sustained urban migration since the 1970s, along with a population growth rate of 2.6%, contribute to the rapidly increasing population of the city. These trends represent a high urbanization rate of 4% on average between 2010 and 2015. At this pace, is estimated that population will be double by 2025.

The city Is facing many shocks and stresses that come with rapid urbanization which are putting its capacity to provide adequate services and quality living conditions to its citizens under a serious pressure. During the development of its Resilience Strategy under the 100 Resilient Cities initiative (Rockefeller Foundation), five areas have been identified as critical levers to reinforcing Dakar's resilience following a review process with the city's stakeholders.

These five areas are:

1. Civil engagement

The main persistent risks in the city are strongly linked to the behaviour and attitudes of citizens. Weak civic engagement, inconsistent construction practices, poor waste disposal behaviours, poor hygiene, and environmental degradation among other issues, are all stresses caused by citizens' habits.

2. Climate Change

Climate change represent also one the biggest challenges to the city. Rising sea levels are a threat to city coastlines and several other coastal areas in the West African countries. As a result, the coastal erosion not only threatens the city's beaches which have an important link with the tourist industry, but also threatens to displace 12 of the city's 19 communes by the Atlantic sea front.

3. Sanitation

The city's waste water drainage infrastructure system is always under pressure, especially in neighbourhoods that were built on old shallows that have long been dried by years of drought [93].

Waste disposal systems have also become obsolete and waste collection services reach only 39% of the population for solid waste, and between 10 to 30% for liquid waste. This waste is often disposed of in the open spaces like the ocean, or dumps without prior treatment [94].

4. Energy Efficiency

The city of Dakar consumes 56.9% of the national energy supply (about 1.3 TWh in 2013) and will need an additional supply of 50MW to meet its current demand. The majority of this electricity is produced by power stations built between the 1960s and 1980s, with a higher production cost (170 CFAF/kWh) than its market value (118 CFAF/kWh). Electricity production in the country is heavily dependent on fossil fuels, which is one of the most expensive sources of energy and the likely driver of production costs [95].

5. Transportation

The public transport service is like in many other countries in the region inadequate and is deteriorating from year-to-year. So, result very difficult to move in Dakar by public or private transport, either because of the congestion encountered on the main roads, especially in the central city area, or the poor quality of service [96].

More than 100,000 vehicles enter and exit Dakar every day on a congested, double-lane road, as up to 80% of economic activities are concentrated in the capital city. Since 2000, conventional bus services are operated by Dakar Dem Dikk (DDD), but capacity provided is very low (few vehicles are operated daily), resulting in low and irregular frequencies. In response to the low capacity to meet public demand, smaller buses, known as “cars rapides”, with between 25 and 40 seats, arose with 2,500 to 4,000 buses operating in the city [97].

Consequently, the development of a resilience strategy aims mainly to build the city of Dakar’s capacity and preparedness to address more effectively the many challenges that they have to deal with. The work to develop the strategy begin by implementing targeted awareness raising activities in order to solidify efforts to find the best possible solutions for the urban resilience of the city.

5.2.2 Existing Policies

The Dakar Strategy has the ambition to transform current challenges into opportunities. Envisioning to empower citizens whilst advocating for the active engagement of the private and public sectors to make the city a clean, safe, energy efficient and with an inclusive growth community to constrain future shocks and stresses.

Under the process to build the strategy, stakeholders and stakeholder groups were consulted during the Preliminary Resilience Assessment (PRA) phase. Interviews were conducted to:

1. Present the initiative concept;
2. Understand the vision for the city’s resilience and the project; and
3. Identify the most critical shocks and stresses for the city

The interviews enabled a refinement of the strategy through an iterative process of generating new ideas and a prioritization of existing ideas and groups to work in each priority was formed to promote diversity of backgrounds and maximize the quality of the outcomes.

The country set up the goal to emerge out of poverty by 2035. The Emerging Senegal Plan is an ambitious strategy developed by the government to foster economic growth with a high impact on human development. National authorities are determined to consolidate their achievements, especially in terms of democratic governance, and to reprioritize economic, political, and social stability.

Politically speaking, Senegal is one of Africa’s most stable countries. It’s proved that they considerably strengthened its democratic institutions since the independence in 1960. Is a secular and democratic republic, promoting equality for all its citizens under the rule of law, regardless of their origins, race, gender, or religion. It acknowledges and respects all faiths.

The city is also member of the UNDRR Global Campaign; Making Cities Resilient, my city is getting ready and in relation to the INDICATORS they were working with one of the tools provided by the Campaign, which is and initial assessment with up to 47 indicators across the 10 essentials of the campaign.

The tool responded to key Sendai Framework targets and indicators, and include some critical sub-questions. This approach is suggested for use in a 1 to 2 day city multi-stakeholder workshop. Each indicator have a 0 to 3 score.

All the details of this important tool to build resilience in cities can be found at the UNISDR website.[31]

5.2.3 Resilience Indicators

In the last decade, African countries, including Senegal have taken various measures to plan for and adapt to different hazards and risks in order to reduce exposure and its impacts on human health, livelihoods, and infrastructure. However, measuring the effects of such initiatives on social and economic resilience is challenging as it requires to combine multiple variables and indicators that embrace thematic, spatial, and temporal dimensions inherent to the resilience thinking and concept.

Current literature on urban resilience has largely focused on understanding the main drivers of vulnerability such as inadequate urban planning, uncontrolled migration and extreme climate variability. However, very little research has analysed the social-ecological outcomes of main risks and hazards adaptation programmes supporting urban resilience.

It is clear that collaborative work in the application and measurement of different indicators combine different academic and non-academic stakeholders, proving to be a powerful design, allowing a coordination of research and interventions activities, knowledge, and information exchanges and to provide a relevant interpretation of results that can potentially support a progressive improvement of resilience programmes, strategies and action plans.

Social appropriation, adaptation, and systemic transformation at all levels, are considered to be key components to improve local resilience.

5.3 Lagos (Nigeria)

5.3.1 General Approach to Resilience

Lagos is the cultural and economic heart of Nigeria and includes financial, commercial, and tourist centres located on islands in the Gulf of Guinea. This means that, in addition to other risks, the city is especially susceptible to be affected from rising sea levels and coastal erosion. This has already led to a decline in water quality, the destruction of drainage infrastructure, and an increase in incidences of water and vector borne disease. This hazard and associated risks have also hurt indigenous communities that depend on coastal resources for survival.

Lagos features a complex socio-political ecology. Population growth is expected to reach 34 million people 2050, and projections show Lagos to be the first city in the world to reach an urban population of 100 million. Expansion comes hand-in-hand with population growth: the city is growing well beyond the administrative boundaries of the Lagos State. This has huge implications for resilience at the metropolitan level.

As Mr. Simon Gusah (*Former Chief Resilience Officer for the 100 Resilient Cities initiative*) explained during the interview,

> *"a critical element of Lagos State's resilience will be the ability to better embrace informality and bridge the divide between the formal and the informal. Taking steps to integrate informal and unplanned residential, economic, and*

[31] https://www.undrr.org/publication/disaster-resilience-scorecard-cities

other areas into the formal planning and development processes, although not easy, will have huge benefits across Lagos and Nigeria in general."

Lagosians instinctively understand resilience at a personal level, if not as a system then as a tool for survival. An example of that is The Nigerian Nollywood industry: self-starting and adaptive, within ten years the industry had moved from an informal business model to one that attracted external support and built out an online distribution model. Within twenty years, it transformed into a professional industry backed by international investment, championing copyright enforcement and featuring global distribution.

The development of the 100 Resilient Cities initiative received the support of the Lagos State Resilience Office (LASRO), which is a multi-disciplinary team of technical and administrative staff drawn from ten different Ministries within Lagos State Government and housed within the Ministry of Economic Planning and Budget.

5.3.2 Existing Policies

Disaster management started to be implemented as a concept in Nigeria in 1906 with the establishment of the Fire Brigade (now known as the Federal Fire Service), responsible for saving lives and property in addition to its primary function of firefighting and provision of humanitarian services during emergencies.

In the past the country suffered a devastating drought disaster with high socio-economic losses of lives and property worth millions of dollars. The impact of the disaster was so enormous that the government decided to create a response body to take care of disaster related issues. This led to the creation of the National Emergency Relief Agency (NERA) by Decree 48 of 1976.

NERA was charged with the responsibility of collecting and distributing relief materials to disaster victims. However, based on the need for a holistic approach to disaster management, the name NERA was changed to **National Emergency Management Agency** (NEMA) to accommodate its expanded functions.

In March 1999, NEMA was established through Act 12 of 1999 as amended by Act 50 of 1999. NEMA was given the responsibility of coordinating disaster management activities for the country.

NEMA has roles and functions that were designed for a holistic approach to disaster management as stated in its mission statement.

Their mission is: *to coordinate and facilitate disaster management efforts aimed at reducing the loss of lives and property and protect lives from hazard by the leading and support of disaster management stakeholders in a comprehensive risk based emergency management program of mitigation, preparedness response and recovery.*

The specific functions of NEMA include:

1. disaster preparedness and mitigation activities;
2. notify, activate, mobilise and deploy staff as well as set up all necessary facilities for response;
3. evaluation and assessment of disaster damages;
4. management of funds for disaster;
5. inform and enlighten the public;
6. formulation of disaster management policies and guidelines in the country and

7. distribution of relief materials to disaster victims by liaising with State Emergency Management Committees, non-governmental organizations (NGOs), regional and international bodies (NEMA 2004a).

The objectives of NEMA are achieved by collaborating with state government, local government, voluntary organizations, international agencies and 57 disaster response units scattered all over the country (Ndiribe 2010; NEMA n.d.b). In August 2006, zonal offices of NEMA were opened in the six geopolitical zones of the country to take disaster management to the community level.

At the same time, Local Government Emergency Management Committees were established in response to calls from communities with strong facts that disaster strikes are felt mostly in communities.

The development of policy documents and guidelines such as the National Disaster Management Framework (NDMF) which guides the Agency and its stakeholders on effective disaster management.

Other policy documents related to this include a National Disaster Response Plan (NDRP), a Lake Nyos Disaster Response Manual and a National Action Plan for Disaster Risk Reduction.

Federal Government allocated 1% of the GDP and 20% of Ecological Fund is allocated to Disaster Management while others are utilized by the Federal Ministries such Environment, Health and others that contribute to disaster risk reduction and mitigation, as well as States and local governments in Nigeria.

5.3.3 Resilience Indicators

In relation to the Strategy as the main outcome of the 100 Resilient Cities initiative, under the leadership of the new CRO the final version of the strategy was adopted and the remains implementation an ongoing challenge. Indicators are going to be defined as part of the current work.

Risk assessment and early warning systems

It's also important to remark that the following actions has been undertaken in order to measure the evolution of some plans and/or to prepare those plans and improve resilience at the local level:

1. Baseline studies for six (6) States in Nigeria were conducted.
2. Conducted Multi-hazard risk assessment- Vulnerability and Capacity Analysis in six states and FCT.
3. Monitor weather and climate related hazards and seasonal Rainfall Prediction (SRP) by Nigeria Meteorological Agency.
4. Space application technology for disaster risk management
5. Equipment for telemetric measure of seismic activities and lemnic eruption at Lake Nyos have been installed.
6. Conducted Post Disaster Needs Assessments (PDNA).
7. Flood early warning systems have been established by the Ministry of Environment.
8. Drought forecast for the Sahel in 2010 informed the decision of the Ministry of Agriculture to expand its capacity for the National Grain Reserve.
9. Early warning systems are in place for all major hazards, with outreach to communities.

10. Participate in regional or sub-regional DRR programmes or projects addressing trans-boundary issues - West Africa Regional Study on Transnational Flood Impacts and Preparedness Mechanisms (2010).

Nigeria is gradually adopting the Sendai Framework for DRR. Final indicators to be used are in the process to be defined. At the moment what we found is a Sendai Framework data readiness review report. This report reviews the availability of data in Nigeria to report against the indicators recommended to measure the global targets of the Sendai Framework, and identify current gaps.[32]

5.4 Buenos Aires (Argentina

5.4.1 General Approach to Resilience

The city of Buenos Aires is the political, economic and institutional centre of Argentina.

The process to build resilience in the City was inspired by the classic concept of urban resilience and experiences of other cities around the world, but also seeks to leave its own mark. Thus, the city's major milestones, such as the acknowledgement and social and urban integration of popular neighbourhoods, the new conception of the city through its new urban planning and building codes, or the development of the most ambitious hydraulic plan in recent decades are part of their strategy.

The strategy developed under the 100 Resilient Cities initiative was a joint piece of work which reflects the essence of how it was put together: the integration among sectors, the conjunction of visions and the proactivity of the initiatives stated in the final document.

As a result of the work developed and described below, the following Resilient VISION was agreed for the city:

> *Buenos Aires will be a worldwide reference in the promotion and generation of talent. A City that integrates its neighbourhoods and enhances its leisure areas, anticipates its risks and gets ready. It innovates in education and bets today on the jobs of the future, committing to gender equity, diversity and sustainability.*

5.4.2 Existing Policies

The "Resilient Buenos Aires" programme is a turning point in the design of public policies aimed at building a new and resilient vision for the City. It has been an exercise allowing them to confirm the direction of work on and the pathway to follow in the future whilst, at the same time, thinking about the city that will be better prepared for the challenges of the future.

For the city, the concept of Resilience implies focusing its strategy and planning its policies around people and neighbours who live in and move around the City every day.

They are part of the 100 Resilient Cities initiative launched and implemented by the Rockefeller Foundation.

"Resilient Buenos Aires" is the articulated statement of the City's development strategy for 2030, and is in-line with other major international commitments such as the UN Sustainable Development Goals and the Habitat New Urban Agenda.

[32] https://www.preventionweb.net/files/53091_nigerianga.pdf

The Buenos Aires' Resilience Strategy stands-out because it was jointly developed by all areas of the City Government together with civil society, academia, the private sector, and neighbourhoods with the support of the 100 Resilient Cities Network.

Participation included:

- Interviews (covering different sectors) and various workshops organised
- focus groups with city residents
- neighbours surveyed
- co-created ideas
- social/vulnerability map to disasters
- analysed projects
- special studies with local and international partners

The Strategy remarks that Buenos Aires has developed infrastructure capable of reducing the impact of Natural hazards, so, the City continues the work of adapting its infrastructure to build resilience through structural measures under the Hydraulic Plan to reduce water risk. However, it is essential to complement this type of infrastructure plans with non-structural measures that deliver a better understanding of the risks by the residents of the city of Buenos Aires. Thus, this strategy will seek to direct efforts to raise risk awareness through creative and innovative citizen communication and participation plans that will allow citizens to know their environment and be better prepared.

The approach to implement the strategy is divided into 5 pillars and only one is directly related to DRR (Security and risk management), the rest have a social focus concentrating on attracting talent, social integration in neighbourhoods, adaptation and mitigation of climate change among other key topics.

The 5 pillars are:

1. diversity, gender and coexistence,
2. innovation, talent and opportunities,
3. environment and sustainability,
4. social and urban integration,
5. security and risk Management, which is aligned to the Sendai Framework.

The city is also member of the UNDRR Making Cities Resilient global campaign and some of the Campaign tools has been implemented, specifically the Scorecard with 47 indicators along the 10 essentials of the campaign, that include:

- Essential 1: Organise for disaster resilience.
- Essential 2: Identify, understand and use current and future risk scenarios.
- Essential 3: Strengthen financial capacity for resilience.
- Essential 4: Pursue resilient urban development and design.
- Essential 5: Safeguard natural buffers to enhance the protective functions offered by natural ecosystems.
- Essential 6: Strengthen institutional capacity for resilience.

- Essential 7: Understand and strengthen societal capacity for resilience.
- Essential 8: Increase infrastructure resilience.
- Essential 9: Ensure effective preparedness and disaster response.
- Essential 10: Expedite recovery and build back better.

As an example of the work developed, a video presenting the early warning system has been produced[33].

Different plans are also available to the community[34].

A platform has also been developed to inform the community about the evolution in new infrastructure development projects defining in the different plans[35].

Information also helps local residents identify if they are living over a specific sensible/or most exposed area for the risk of flood. They simply enter their address to know that.

Additionally, the local administrations are promoting a 'Green Schools' Programme whose main objective is to promote education and environmental action through a transversal and innovative approach. The implementation of green roofs as part of the program intends to be framed as a useful tool for achieving goals set by the city's resilience strategy as they provide a set of benefits that respond to the great challenges of the city:

- **Urban naturalization and quality of life**: The creation of new green spaces in urban centres and their environmental benefits and social improvement plays a fundamental role in the level of urban quality of life in cities.
- **Urban regeneration and social integration**: the increase of green areas in certain areas of the city can also become an 'identity tractor' for the neighbourhoods when assuming simultaneously, an attractiveness (improved aesthetics of buildings) and a new functionality: One of the great values of the green spaces is that they open the possibility of associating with other complementary objectives through the programming of activities, transforming into new meeting and integration spaces.
- **From an environmental point of view, the benefits are multiple and known**: the plant cover will contribute to a temperature reduction caused by the insulation it creates for the buildings. This saves air conditioning energy and reduces the heat effect; how the vegetation retains and absorbs part of the runoff, the flood prevention and mitigation; partially mitigate the air pollution because vegetation is a carbon sink and filters the dust. Plants not only isolate against temperature but also retain part of the noise; and improve the visual quality of the environment.

5.4.3 Resilience Indicators

Indicators are defined for each of the 5 pillars of the Resilient Buenos Aires Strategy mentioned above. In the case of the pillar 5 the main ones included:

- Know Buenos Aires
    - Number of communication actions related to climate change and risk management.

[33] https://www.buenosaires.gob.ar/desarrollourbano/desarrollo/programas-y-acciones/sistema-hidrometeorologico-de-observacion-vigilancia-y-alerta
[34] https://www.buenosaires.gob.ar/desarrollourbano/desarrollo/planes
[35] https://www.buenosaires.gob.ar/compromisos/23000-metros-de-obras-hidraulicas-y-sistema-de-alerta-temprana

    - Number of neighbours who participated in activities related to raising awareness of floods.

- Schools get ready
    - Number of schools where the program was implemented.
    - Number of children who participated in the workshop.
    - Number of teachers trained in risk management basic knowledge.
- Network of residents in the face of climate change
    - Number of volunteer resident members of the Network.
    - Number of trained volunteer residents.
- Hydraulic plan
    - New linear km of rainwater piping.
    - Percentage of Maximum Flooded Area over total City area.

More indicators will be developed and measured for the following aspects:

- early warning systems for storms and heat waves,
- risk contingency and preparedness fund,
- single coordination and control center,
- transformation of public spaces through tactical urbanism,
- integrated public security system.

The improvement of resilience in Buenos Aires will continue to be a living process and a tool for the City's international projection to the world. It will highlight its commitment to gender equity, diversity and sustainability, while continuing to promote innovation, talent and opportunities for City residents.

Apart of the specific indicators for each pillars of the strategy mentioned above, for the ones [98] measured under the Scorecard of the UNDRR Making Cities Resilient Campaign, the city of Buenos Aires has been part of a parallel initiative that seeks to develop and adapt tools in order to collect urban risk data and build a baseline for 200 cities at the global level. The results obtained after applying the preliminary level of the Self-Assessment Tool for Resilience included up to 50 cities of the Americas[36].

THE MAIN FINDINGS

Local governments in the region, including Buenos Aires showed strengths in:

Peer exchange and the ability to build networks. Learning through exchange with other cities and the inclusion of the various key actors in the reduction of disaster risk, are values of this process. The exchanges help to consolidate work networks and to align visions, strategies and plans to promote resilience at local and regional level.

The knowledge of the risk. A large number of the local governments involved have mapped hazards with tools that allow different stakeholders involved to easily access comparative information. Exposure and vulnerability are mapped with a clear description of the scenarios.

[36] https://www.unisdr.org/campaign/resilientcities/assets/toolkit/documents/Brochure%20-%20Regional%20Synthesis%20of%2050%20Prelim%20Scorecard%20Americas%20-%20Final.pdf

Organization. At the regional level, governments have a great ability to identify, understand and use current and future risk scenarios, have institutional capacity for resilience and in general are organized according to it (planning and institutionally).

The main challenges relate to:

Financial capacity. It is necessary to strengthen the financial capacity for resilience, specifically on the issue of insurance and incentives. This topic represents a challenge for local governments and mechanisms must be identified and adapted to the legal frameworks of the region.

The private sector. It should seek to involve the private sector in disaster risk reduction, specifically in the stages of preparation, in order to seek continuity of business in case of an event and guarantee the means of life for the communities.

Ensure recovery and reconstruction. The efforts they should also focus on strengthening financial capacity to accelerate the recovery and reconstruction processes. This refers to events not only intensive but also to recurring small-scale events; especially those derived from the impacts of climate change.

Furthermore, the scope and scale of the Strategy will leverage the city's strengths and systems to build a more resilient urban ecosystem. The indicators allow the city planners and developers to address in the Strategy the main challenges faced by the City, from chronic stresses, like the difficulty of access to housing, informal settlements and insecurity, to shocks associated mainly to the effects of climate change, such as heat waves, floods and/or powerful storms.

Based on this progress and the innovative work developed the Resilient Buenos Aires Strategy include 5 pillars, 14 strategic objectives and 60 initiatives that will help consolidate the City's vision, as a result of a substantial civic engagement effort, jointly developed by different areas of government, citizens, academia and the private sector, working together.

5.5 Mexico City (Mexico)

5.5.1 General Approach to Resilience

Up to eight million people live in the megalopolis of Mexico City, and a large percentage under extremely vulnerable conditions. Informal employment, lack of infrastructure, strong social inequality, severe weather conditions are only part of the hazards and risks in this beautiful City. Its geographical conditions make it continually susceptible to seismic hazards and being located on land that was once a lake makes the city prone to flooding. Runoff from the nearby mountains is improperly managed, which, in addition to flooding, can lead to mudslides and diseases born from standing water.

So, the city faces resilience challenges from different perspectives; environmental, social, and economic issues, given its geographic situation, history of great social-environmental transformation, and social context are part of this challenges. Rapid urban expansion and soaring population that growth significantly in the last few decades, have added to the problems and as result of insufficient long term planning and weak metropolitan coordination, that make even more difficult the monitoring and tracking of important regional issues, such as water management based on a long-term sustainability perspective.

Climate change may exacerbate risks and potentially increase the intensity of hydrometeorological events, causing historically unprecedented heat waves, extreme rainfall events, and long droughts.

Mexico City has been part of the 100 Resilient Cities initiative to develop a new strategy with an active integration of the key sectors. The strategy developed is divided in the following 5 pillars:

1) Foster regional coordination

Given the urban growth experienced by the City, resilience building must transcend political and administrative boundaries. Maintaining a regional view and coordination at all levels are key to building resilience, especially on priorities such as water and integrated mobility management. In the vision of this pillar, Megalopolis and the Metropolitan Area of the Valley of Mexico (ZMVM) work together under a regional institutional framework on key issues to drive a common agenda and ensure shared responsibility in building resilience.

Infrastructure projects with a regional impact, such as the New International Airport of Mexico City (NAICM) currently under development, are an opportunity to work more closely on resilience efforts and move toward a collaborative regional agenda.

2) Promote water resilience as a new paradigm to manage water in the Mexico basin

A major resilience issue is linked to the future supply and management of water resources. The water management system has material inefficiencies; for example, there is a great loss of potable water due to leaks in the potable water distribution system. There is also great overexploitation of the aquifer. This overexploitation threatens the future supply of aquifer water for the metropolitan area, and it may be exacerbated by climate change, as there is a potential for a long drought. In the case of extreme rainfall events, ponding and floods may affect City operations, such as the mobility network.

The vision for this pillar is that water in the Mexico Basin is handled under the Comprehensive Management of City Water Resources (GIRHU), which is responsible for the integrated management of urban water resources and the response to risks and impacts related to climate change and social and environmental pressures.

3) Plan for urban and regional resilience

Urban and regional planning play a fundamental role in building resilience. The vision for this pillar is that citizens have equal access to urban amenities, housing, green areas, and public spaces, and that improvements in the environment and mitigation of risks occur through a sustainable management of natural resources. Planning is a fundamental tool for maintaining a long-term vision and for addressing current challenges on issues such as inequality, and for increasing resilience in the face of new challenges created by dynamic processes, such as climate change.

4) Improve mobility through an integrated, safe, and sustainable system

Mobility is one of the most pressing issues that must be addressed in order to improve quality of life in Mexico City. Today, the mobility system involves long commute times, loss of competitiveness, and impacts on health and social cohesion. Investment in public transportation is required in order to improve the quality and safety of the mobility system, as well as to create an integrated system that serves the entire population of the city.

The vision of this Pillar is an integrated mobility system for Mexico City and the ZMVM that gives priority to public transportation over private vehicles and provides a safe urban environment for pedestrians and bicyclists. In this vision, innovative transportation projects, technologies, and the smart use of data validate the benefits of improving mobility via an integrated, safe, and sustainable mobility system while discouraging the use of cars.

5) Develop innovation and adaptive capacity

This pillar has the goal of increasing the capacity to respond to dynamic, changing risks of a natural or social origin without compromising economic competitiveness and sustainable development.

To build resilience, innovative processes and tools must be developed that enable government and various social and economic sectors to be aware of and understand their vulnerabilities and reduce the risks they face, particularly with respect to climate change.

Access to the full content of the Strategy is available via the website[37]

In addition to all the work described above they are implementing the SENDAI FRAMEWORK and new disaster risk reduction plans are under development. They are willing to integrate into this effort the 16 Municipalities of the Metropolitan area and at the moment 6 already joined.

5.5.2 Existing Policies

The Resilience Strategy drives an adaptive transformation by fostering a change of paradigm across different sectors, so that the development process and current policies transcends traditional frameworks to face complex problems and to design, modify, and implement public policies by cross-functional planning. To achieve this end, continuous learning and frequent review of plans and actions are required.

The commitment to this type of learning and review is an acknowledgment of the seriousness of the city's social environmental challenges and the opportunities the city has to make real progress on sustainable social and economic activities that can transform its future, improving community resilience at all levels.

Integrating resilience into regional programs allows for priority issues to be addressed in a way that strengthens projects and policies related to management and reduction of risks and social vulnerability in a crosscutting manner that brings together multiple sectors. Examples of this type of integration are the reactivation of the COMETRAVI and other initiatives from the local to the regional and national level.

5.5.3 Resilience Indicators

In parallel of the 52 indicators of the Strategy developed under the 100 Cities initiative and all the related work described above, the City participated also in the development and application of a new Resilient, Sustainable, Safe and Inclusive Community Rating System (RESSICOM)

This initiative provided a new tool to evaluate communities and cities by selecting 61 indicators from an extensive literature review, which were weighted subsequently to ensure the balance among the four sustainability dimensions, namely society, economy, environment and governance.

As part of the key tools to work on the ground the City has a Risk Atlas. [38] The Atlas includes a set of indicators covering different areas of work such as gender[39], indicators by neighbourhoods[40] and monitoring different hazards and risks affecting the City[41]

[37] https://use.metropolis.org/case-studies/cdmx-resilience-strategy
[38] http://www.atlas.cdmx.gob.mx/index.html
[39] http://www.atlas.cdmx.gob.mx/genero.html
[40] http://www.atlas.cdmx.gob.mx/indicadores/
[41] http://www.atlas.cdmx.gob.mx/monitoreo/

On addition, Mexico has been part of the **Resilience INDEX initiative**. The City Resilience Index has global relevance. It has been developed and tested in partnership with cities of every type and scale from around the world.

Under this initiative, a Resilience Profile is generated based on responses from city stakeholders to 156 questions that comprehensively cover urban systems in a city. This profile helps reveal the strengths and weaknesses of the city across the 4 dimensions, 12 goals, and 52 indicators of the CRI.

The **4 dimensions measured** included:

1. **Health and wellbeing:**
   - Minimal human vulnerability
   - Diverse livelihoods and employment
   - Effective safeguards to human health and life

2. **Economy and Society**
   - Collective identity and community support
   - Comprehensive security and the rule of law
   - Sustainable economy

3. **Infrastructure and ecosystems**
   - Reduce exposure and fragility
   - Effective provision of critical services
   - Reliable mobility and communications

4. **Leadership and Strategy**
   - Effective leadership and management
   - Empowered stakeholders
   - Integrated development planning

Full details are available[42]

Finally, the City also participated in a project with CEPAL, under which new indicators were defined and measured[43]

Data extracted from international organizations and the targets of the SDGs were used to score the indicators of the system. Mexico City, as one of the most overcrowded cities in the World, was selected as a case study to apply the proposed tool. The results determined that the minimum thresholds set for the safety, sustainability and inclusiveness domains were not reached.

Thus, Mexico City now works, thanks to all the initiatives described, with a broader outlook that understands the importance of prevention, communication and education in averting such disasters; facilitates speedy coordinated action when attending to them, and promotes community resilience to ensure governability even at the most difficult times, so as to overcome them quickly.

[42] https://www.cityresilienceindex.org/#/city-profiles
[43] https://repositorio.cepal.org/bitstream/handle/11362/44218/1/S1800995_es.pdf

5.6 Montevideo (Uruguay)

5.6.1 General Approach to Resilience

Montevideo has an area of 530 square kilometres and is the smallest of the 17 departments/regions in Uruguay, it's also the Uruguayan capital, home of almost half of the population and more than 50% of the national GDP.

These characteristics, together with its status of being the country's main port and one of the most important on the south Atlantic coast, render it as geopolitically and economically strategic. That is why its resilience capacity acquires a fundamental relevance, not only at the local level, but also in the national and regional context.

The City has a long tradition in participatory planning management processes. Even when the term 'resilience' has been incorporated only very recently within Montevideo's action framework, the concept, in its broad sense, has been underlying in several planning processes: from territorial planning to housing relocation programs in flood-prone zones; and similarly, from successive urban sanitation plans to public space policy prioritization (as a privileged area for social integration). However, it remains necessary to integrate the concept transversally to other strategic planning processes of the city, so that it permeates all of its management areas.

The Montevideo's resilience strategy developed under the 100 Resilient Cities initiative has being compiled in an integrated manner with other open planning development processes, both at departmental and national levels.

The strategy recognizes the initiatives that have already been carried out and relates them to identifying the emerging benefits of joint implementation; it complements them when necessary with a new perspective and integrates them into a new agenda designed to manage change under a resilience approach.

In fact, the beginning of the resilience strategy building process coincided with the department's prospective planning process called 'Montevideo del mañana', with the aim to build a long-term development (2050) vision and guide to the short, medium and long-term actions that are necessary for its realization.

During the preliminary resilience assessment, a collective identification of the most relevant shocks and chronic stresses for the city was made, based on the statistical analysis of the data available (in pre-existing studies) and in a study of perceptions specifically conducted to complete the diagnosis by the team in charge on the Strategy. The results were systematized under the resilience approach and were exposed in collective debates that allowed for the establishing of links, similarities and cause-effect relationships, that were sometimes unthinkable or hardly known.

As a result, stress factors have been divided into the following 5 key areas:

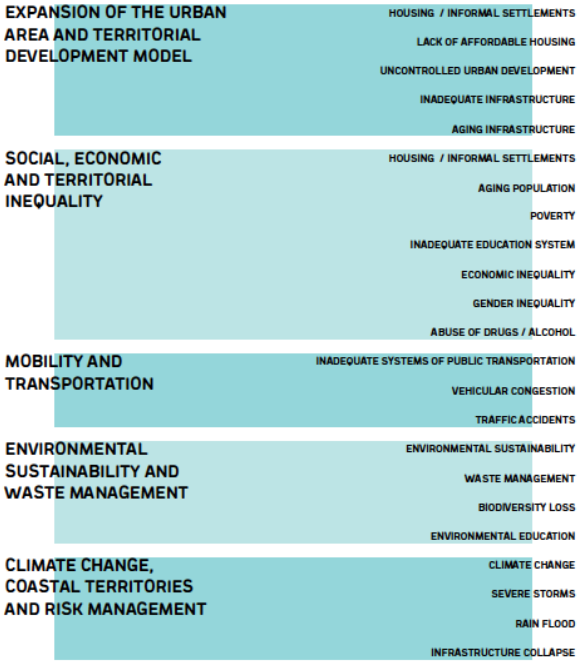

Figure 21 The 5 pillars of resilience in Montevideo

5.6.2 Existing Policies

The application of the Governance and Public Policies Index in Risk Management of Disasters (iGOPP) allows a City to establish a baseline and identify opportunities to improve legal conditions, institutions, indicators and budget of the country to implement the different policies necessary for an Effective Disaster Risk Management.

One of the most important gaps in the current regulatory framework for Disaster Risk Management that iGOPP reveals, is the lack of identification of an institutional actor responsible for provision of technical assistance and guidelines at territorial and sectoral levels for the disaster risk analysis.

The norm of DRR does not establish a mandate for the creation and maintenance of information systems for the DRR or technical guidelines to systematize and update databases on the effects of disasters. However, despite not being contemplated in the legislation, the SINAE (National Authority for DRR with strong focus in Response and Recovery and more recently prevention too) maintains a historical database on disaster impacts, which has been updated and strengthened recently.

The iGOPP does not replace other indicators related to the subject, by on the contrary it complements the different existing methodologies for the evaluation holistic risk and disaster risk management.

The iGOPP is a composite or synthetic indicator that allows to verify whether in a given country the appropriate governance conditions exist to be able to implement a public policy for comprehensive disaster risk management. In this sense allows to quantify the extent to which the actions, policies and reforms of the government and its institutions are consistent with the objectives, results and processes of disaster risk management.

5.6.3 Resilience Indicators

Indicators has been analysed and reinforced and those are divided in the following 5 areas:

1. Coordination and central articulation of the DRR policy among central level institutions (Ministries). Example of an indicator on this area; Number of Ministries integrating DRR policies transversally.
2. Definition of sectoral responsibilities, including other entities in charge of basic public services like water, energy, etc. Example; Progress on the development of water resilience infrastructure.
3. Definition of territorial responsibilities (including the regional and local level) Example; Number of Regions and Municipalities with a DRR Action plan in place.
4. Evidence of progress in implementation. Example; Number of actions executed from the plans.
5. Control, accountability and participation. Example; Number of sectors participating in each region in the process to build resilient communities.

The full document detailing these indicators is available[44]

The self-assessment scorecard tool Level 1 with 47 indicators under the UNDRR Making Cities Resilient Campaign has been also implemented in Montevideo.

This preliminary level responds to key Sendai Framework targets and indicators with some critical sub-questions. The approach suggested to use the scorecard in a 1- to 2-day city multi-stakeholder workshop in order to measure each indicator with a 0 to 3 score.

This Scorecard provides a set of assessments that will allow local governments to monitor and review progress and challenges in the implementation of the Sendai Framework for Disaster Risk Reduction: 2015-2030, and assess their disaster resilience. It is structured around UNDRR's Ten Essentials for Making Cities Resilient.

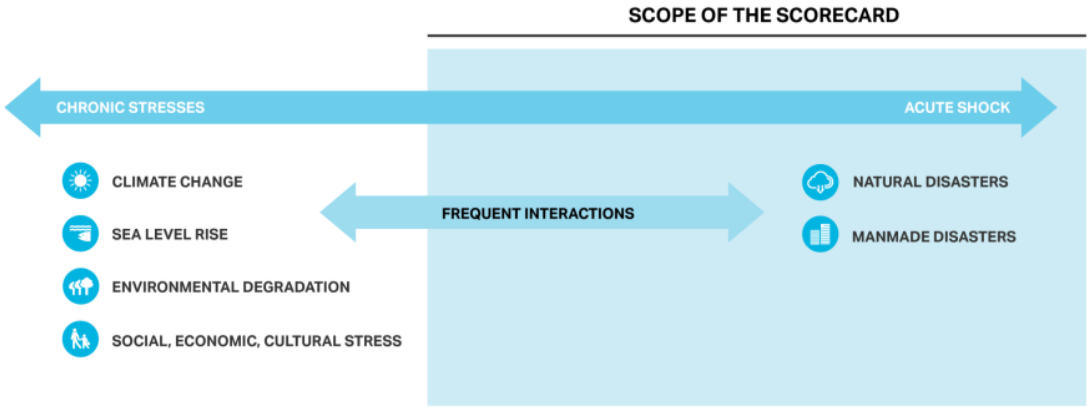

Figure 22 Montevideo Resilience Scorecard

As shown in the figure above, the Ten Essentials for Making Cities Resilient offer a broad coverage of the many issues cities need to address to become more disaster resilient:

- Essentials 1-3 cover governance and financial capacity;
- Essentials 4-8 cover the many dimensions of planning and disaster preparation;
- Essentials 9-10 cover the disaster response itself and post-event recovery.

[44] https://publications.iadb.org/en/publications/spanish/document/%C3%8Dndice-de-Gobernabilidad-y-Pol%C3%ADticas-P%C3%BAblicas-en-Gesti%C3%B3n-de-Riesgo-de-Desastres-%28iGOPP%29-Informe-nacional-Uruguay.pdf

The FULL CONTENT of this important tool and each of the questions associated with the 47 indicators is available [45]

Early users of the Disaster Resilience Scorecard for Cities have reported a number of benefits. The Scorecard can support cities to:

- Establish a baseline measurement of their current level of disaster resilience;
- Increase awareness and understanding of resilience challenges;
- Enable dialogue and consensus between key city stakeholders who may otherwise not collaborate regularly;
- Enable discussion of priorities for investment and action, based on a shared understanding of the current situation;
- Ultimately lead to actions and implementable projects that will deliver increased resilience for the city over time.
- Provide training in the education sector (schools) for risk prevention and management.
- Design and implement Specific campaigns such as Summer without fires are designed and implemented.

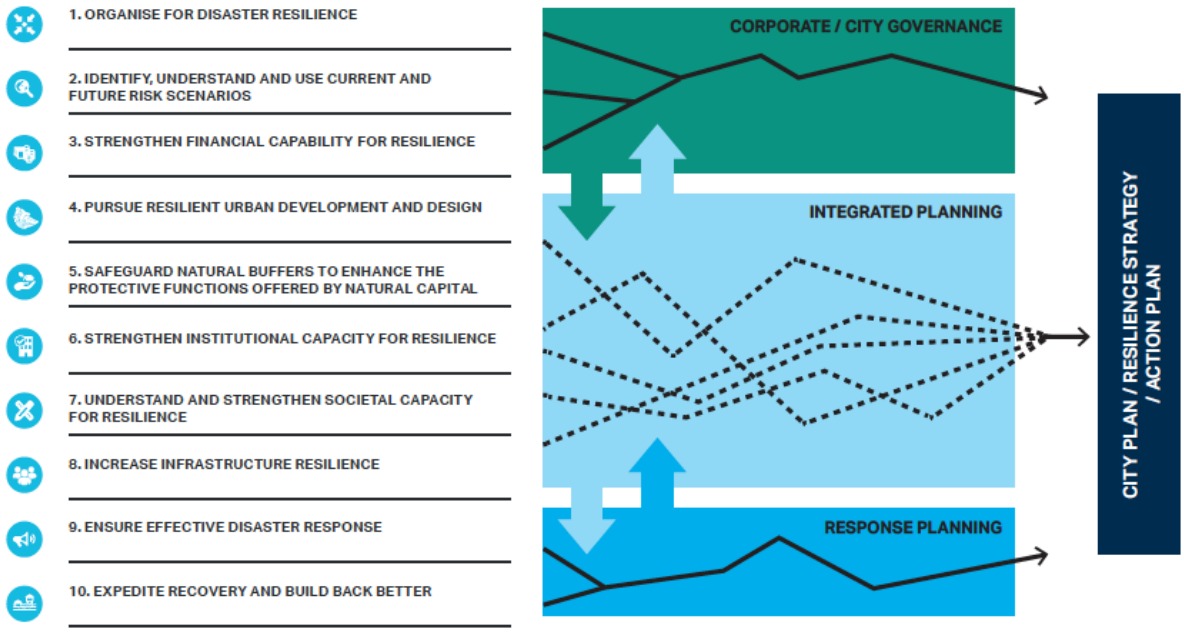

Figure 23 Montevideo resilience strategy

5.7 Panama City

5.7.1 General Approach to Resilience

The city of Panama is the Capital and the largest city of Panama. It has an urban population of 880,691, with over 1.5 million in its metropolitan area. Is located at the Pacific entrance of the Panama Canal, in the province called also Panama. It is the political and administrative centre of the country, as well as a hub for banking and commerce.

45 https://www.unisdr.org/campaign/resilientcities/assets/toolkit/Scorecard/UNDRR_Disaster%20resilience%20%20scorecard%20for%20cities_Preliminary_English.pdf

The construction of the Panama Canal was of great benefit to the infrastructure and economy until now and is responsible for an important portion of the country GDP.

The city is located between the Pacific Ocean and the tropical rain forest in the northern part of Panama. These tropical forests are vital for the functioning of the Panama Canal, providing it with the water required for its operation. Due to the canal's importance to the Panamanian economy, those forests around the canal have been kept in an almost pristine state; the canal is thus a rare example of a vast engineering project in the middle of a forest that helped to preserve that forest. It is also a strip of land home to highly rich biodiversity comprised of living organisms evolving from both regions of the Neo-tropics, living together within jungles and wetlands.

Nevertheless, the threats of urban development and climate change have already started to bring about some acute shocks and chronic stresses to the natural infrastructure built in Panama City, as well as on water supply and citizenship as a whole.

The Panama's Resilience Strategy developed under the 100 Resilient Cities initiative, establishes a clear vision of urban resilience that may serve as a role model for other cities in the country and around the world.

The Strategy becomes a key instrument to setting priorities when tackling social, economic and environmental risks and hazards, and even though it will not manage to provide solutions to all of them, represent a guiding course of action at hand. That course of action begins with the need for collective thoughtfulness and consensus opening the doors to new initiatives and alliances materialised along the way.

Each pillar is envisaged as action lines in the construction of resilience for the City, one which recognizes its own dynamics and power, in addition to its own strategic value. The goals outline the target at which the results of actions are aimed.

Figure 24 Panama City 5 Pillars of Resilience

5.7.2 Existing Policies

In recent years there has been an increase in floods, landslides and other hazards linked to the growth of the city; In this context, the Municipality of Panama identified the neighbourhoods most vulnerable (corregimientos) to disasters to implement different policies, activities and a specific workshops under the tittle: Comprehensive Risk Management and Resilience.

As a result of the workshops, the Risk Management Committee was created in each area, the Risk Maps were digitized, prepared by the local residents of each participating sector, and activity schedules were established for the specific areas.

Along the work, different tools of the UNDRR MCR campaign have been used too in order to measure the evolution of the work executed.

The economic growth of the country encouraged the building industry, which produce a high concentration of buildings in the coastline, without any coordination from the inter-institutional level and little intervention of Local Governments. So, disorderly construction has restricted access to various key areas and has resulted in low availability of public transport choices, a situation which has worsened in the farthest, isolated zones (Scodelario et al, 2015).

On the other hand, many informal housing areas has poor drainage systems that undergo interruptions to the potable water supply due to a lack of planning, causing different problems within the networks. The lack of maintenance of the system is also a result of a high level of delinquency in payment of utilities, since tax collection does not manage to provide sufficient funds for the maintenance of those systems (Delgado, 2014). In parallel, poor disposal of solid waste impairs the population's health, blocks drainage pipes and results in an increase of floods (Thompson, 2016). In this context, rivers tend to drag large concentrations of suspended solid waste during extreme hydrometeorological phenomena, thus affecting both the provision and quality the potable water supply.

5.7.3 Resilience Indicators

For each of the identified pillars specific indicators have been developed to be measured along the implementation of the objectives and the realisation of main activities. The main indicators are included in Annex 5.

The city also uses the Self-Assessment tool (47 indicators) of the UNDRR MCR Campaign, to measure the level of Resilience in up to 5 different cities in Panama (Panama City, Cithre, Aguadulce, Parita and Los Santos).

This initiative seeks to develop and adapt tools in order to collect urban risk data and build a baseline for 200 cities at the global level. The results obtained after applying the preliminary level of the Self-Assessment Tool for Resilience included up to 50 cities of the Americas[46].

5.8 Quito

5.8.1 General Approach to Resilience

The city of Quito is the Capital of Ecuador, a small country in the north west of South America. Considering its geographic position and its tangible and intangible heritage, Quito and the metropolitan area play an economic, ecological, and cultural role for the country and the region.

The population is settled along a horizontal strip surrounded by mountain ranges and high peaks, including the famous Mount Pichincha and Mount Itchimbía.

For many years, these high elevations contained urban sprawl. Within this plateau, the city developed many faces, including the identity of Quito's Historical City Centre that reflects a past connected to the present and needs to be preserved. Another face is the modern Quito, a city driven to become a prosperous urban centre while addressing structural inequalities.

[46] https://www.unisdr.org/campaign/resilientcities/assets/toolkit/documents/Brochure%20-%20Regional%20Synthesis%20of%2050%20Prelim%20Scorecard%20Americas%20-%20Final.pdf

At 2,800 meters above sea level, the city is located in the middle of volcanoes and deep valleys. Quito was recognised as a World Heritage Site in 1978 not only for its monumental architecture but also because of this particular landscape and its biological diversity. At the same time, this cultural and natural wealth is threatened by a variety of environmental, economic, and social challenges.

From a social perspective, Quito is a young city. Its demographic offers potential for significant economic development. The working age population (economically active) in the city is of higher proportion than the dependent population (children and senior citizens). This age distribution is an opportunity to boost the city's economic engine and contribute to its socioeconomic sustainable growth.

In environmental terms, the city's diverse ecosystems are part of the planet's life support systems. Its territory contains immensely rich valleys and mountains as well as conservation corridors that are part of the Tumbes-Chocó-Magdalena bioregion, one of the planet's biodiversity hotspots.

On the other hand, disorganized growth hinders the efforts of the municipality to address its citizens' demands for access to better and resilient services and infrastructure, including transportation. The construction of the city's first metro line and its integration with existing mobility systems represent a historic opportunity to rethink they urban development and its dynamics. A weak approach to capitalizing on this opportunity would reverse the city's potential for transformative action and worsen existing segregation and lack of coordination issues.

In 2017 Quito was part of the 100 Resilient Cities Initiative, actively working to develop their Resilience Strategy which is being implemented right now.

The Strategy is taking into account that the Directorate of Resilience is allocated at the General Secretary for Planning which is in charge of all of activities related to budget management of the Municipal corporation and the implementation of a "Development and Land Use Metropolitan Plan".

One of the main identified goals is to strengthen urban systems in a broader sense not only addressing the risk-related aspects. There is a citizen participation agenda being addressed with neighbourhood leaders involved with the aim of structuring a neighbourhood development agenda, with resilience-focused actions that address social, economic, environmental and risk management aspects, and then offer tailored solutions to be implemented with the local community.

The Metropolitan District of Quito builds resilience based on its human, biological, and geographic diversity. The city is prepared for the future thanks to its high adaptive capacity, which is in turn based on social and economic inclusion. By improving efficiency, the city guarantees a high quality of life for its residents and ensures environmental sustainability. Quito looks forward and grows ready to face the challenges of the 21st century, emerging as a stronger and more equitable city.

The Resilient Quito strategy highlights a need to develop mechanisms that strategically respond to the acute shocks and chronic stresses that afflict the city. While the city's complex location creates structural vulnerabilities, other characteristics, such as its human and biological diversity, are clear signs of its historic ability to adapt. Resilient Quito is developed at a time of transformation for the Metropolitan District of Quito, both in terms of mobility and urban development. The construction of the first metro line mentioned above and dedication to the New Urban Agenda, which was approved in Quito during Habitat III, define the new planning parameters.

The Strategy was developed with the following five pillars to approach the key challenges with the highest priority in order to build meaningful resilience[47]:

1. INCLUSIVE AND EMPOWERED CITIZENS

Building urban resilience begins with strengthening social fabric. This pillar focuses on facilitating participatory processes as guidelines for democracy, validating the public administration's work, and strengthening processes of co-responsibility between citizens and the municipality. It aims at strengthening institutional and community capacities to build participatory processes and provide clear and effective mechanisms for citizen engagement.

2. ROBUST AND SUSTAINABLE ENVIRONMENT

Management and conservation of the city's natural areas make sustainable urban development possible. The environmental pillar proposes developing efficient, participatory administration mechanisms for these areas that foster environmental consciousness and citizen involvement. This pillar also aims to encourage the use of nature based solutions for urban problems.

3. INTEGRATED AND COMPACT CITY

Scattered and uncontrolled urban sprawl has made the Metropolitan District of Quito a segregated and inefficient city. This pillar focuses on controlling urban sprawl, maximizing the positive impact of Quito's first metro line, and creating an integrated and efficient mobility system that favours active mobility.

4. RESOURCEFUL AND SOLID ECONOMY

Building economic resilience requires strengthening productive sectors and diversifying lines of business, all with an environment-friendly focus. This pillar creates an economic environment conducive to strengthening job supply and demand, with a special focus on youth. It fosters a diverse, sustainable, and innovative economy, and promotes the food-related economy as a guideline for development.

5. REFLECTIVE AND SAFE TERRITORY

This fifth pillar focuses on addressing the multiple threats and the high risk exposure due to the city's physical and socioeconomic vulnerability. This fifth pillar seeks to avoid creating new risks, mitigate existing risks, and prepare the city to respond to potential natural and man-made disasters.

5.8.2 Existing Policies

Resilience, as a cross-cutting element to be applied in the city's strategic planning, proposes efficient alternatives to the challenges of urban development. This approach requires a long-term vision which must include mechanisms that guarantee its incorporation and strengthening over time.

The actions at the Resilient Quito Strategy are presented in a way that shows their contribution to the management of the strategy's pillars and how they enable follow-up mechanism for implementation. At the same time, the actions are based on a holistic approach and qualities and must be reviewed on an ongoing basis to include principles of efficiency and sustainability.

Participatory policies must recognize citizen needs and the significant social diversity, while facilitating collaborative processes in an inclusive manner. The city has enough social capital to build solid institutions along the way and the municipal administration has developed

[47] Resilient Quito – 100 Resilient Cities initiative – Rockefeller Foundation

mechanisms to facilitate the process for an effective integration. However, the dynamics that are key to an effective citizen participation have not always come together as required. The Metropolitan District of Quito has more than 2000 neighbourhoods and only 189 have established assemblies.

This indicates a still-developing participatory agenda, resulting in a large majority of the population, which includes many vulnerable groups, with no representation.

5.8.3 Resilience Indicators

In total, the Quito Strategy has up to 64 actions and among which 18 have been prioritized, those are the ones that today have the support of the different institutions.

A total of 122 performance indicators are distributed among the 5 pillars of the strategy + the crosscutting actions. The main indicators are included in Annex 5.

5.9 Trujillo

5.9.1 General Approach to Resilience

Honduras in general and the City of Trujillo in particular has repeatedly suffered from disasters.

Hurricanes and tropical storms have been the main disaster events. The north of the country has been the main area affected. Flooding has been the most common event, affecting houses, roads, bridges, livestock, and cultivated land in the relatively flat coastal areas and river flood plans.

Trujillo is a city and a municipality on the northern Caribbean coast of the Honduran, department of Colón, of which the city is the capital. Located on a bluff overlooking the Bay of Trujillo, behind the city rise two prominent mountains, Mount Capiro and Mount Calentura. Three Garifuna fishing villages; Santa Fe, San Antonio, and Guadalupe, are located along the beach.

The impact of Hurricane Mitch in October 1998 provided a dramatic reminder of the high level of vulnerability in which Central America is (until now) and demonstrated how decades of environmental degradation had weakened the natural resilience and buffering capacity of the affected ecosystems.

Hurricane Mitch was the largest disaster experienced in Honduras in recent memory. The city of Trujillo, due to its geographical location that occupies a part of the Caribbean coast of Honduras, was particularly vulnerable to its effects because of environmental degradation, rapid population growth, inadequate infrastructure (especially for flood management), and massive disparities in the distribution of wealth, which resulted in extremely vulnerable living conditions for the poorest.

Across the country economic losses were estimated at some US$4 billion, and it was proved that the country was vulnerable and unprepared in terms of policy, systems, and resources in terms of prevention, response and recovery.

Positive steps in risk management have been taken. Housing reconstruction practices have improved in certain cases. Lessons have been learned, or good practices reinforced, such as the construction of houses on stilts in some locations at the North coast.

5.9.2 Existing Policies

The Honduran emergencies committee system is being strengthened. Communities have become more integrated with the disaster and risk management institutions. A system of

interrelated institutions has been established, each with an internal emergency coordinator linked nationally to COPECO (National DRR authority) and regionally to the seven emergency offices opened by COPECO. As a result, natural events subsequent to Mitch, such as tropical storm Michelle, have been managed markedly better than was the post-Hurricane Mitch phase.

Other positive developments have been the preparation of two important laws, one for risk management and the other establishing a new construction code.

Nonetheless, the overall system remains relatively weak with multiple challenges, while vulnerability remains on relatively high levels. While awareness of risk is currently higher than 21 years ago, and concepts are well disseminated in schools, media sources, community committees and events, with the implementation of the Sendai Framework for DRR, many effective actions are still needed to reduce current levels of exposure and vulnerability.

5.9.3 Resilience Indicators

In 2018, City local authorities took the decision to be reactive the membership to the UNDRR Global Campaign: Making Cities Resilient and four important decisions were made at that time;

1. The Mayor was personally involved in the process to integrate and implement the Campaign and the Sendai Framework at the local level.
2. They created a specific unit of work called **UMGIR**, to be in-charge of this process with the best technical staff for this task.
3. They been attending key meetings and workshops organised by UNDRR regional office base in Panama.
4. They been working to identify needs to increase local capacities through local and international experts and support improving the Disaster Risk Governance system to achieve a gradual and long-term resilience.

In relation to the areas of work, the focus was on:

PREVENTION; implementing gradually the following SENDAI framework 4 priorities, with special focus on 1 to 3, and including:

1. Understanding disaster risk; including all its dimensions of vulnerability, capacity, level of exposure of persons and assets, hazard characteristics, climate change impact and effects and the environment.

2. Strengthening disaster risk governance; for a better management of manage disaster risks.

3. Investing in disaster risk reduction for resilience; public but also private investment in disaster risk prevention and reduction through structural and non-structural measures are very important to enhance the economic, social, health and cultural resilience of persons, communities and our assets.

4. Enhancing disaster preparedness; for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction.

As part of the prevention activities and the set of tools provided by UNDRR global campaign they applied the Local Assessment (47 indicators) to measure the current level of resilience responding also to some of the key Sendai Framework targets and indicators, and with some critical sub-questions that allow then to define next steps and a road map towards resilient communities all around the Municipality with a multi sectorial approach.

All of the activities were coordinated from the unit of work mentioned above and include also the following actions/initiatives:

• Risk Mitigation (reduce loss of life and property by lessening the impact of emergencies)?

- Establishing DRR and Emergency Committees in different neighbourhoods under the acronyms of CODEL
- Mapping their risks, vulnerabilities and the level of exposure under each of the main hazards.
- Integration, development and gradual implementation of the first 3 essentials of the Global campaign:
  - Essential 1: Organise for disaster resilience
  - Essential 2: Identify, understand and use current and future risk scenarios.
  - Essential 3: Strengthen financial capacity for resilience

• Risk Preparation (planning, organizing, training, equipping, exercising, evaluating, and taking corrective action)?

- Open participatory processes to integrate the main stakeholders In each community.
- Raising awareness through sectorial programmes to work at all levels of the community; kids, youth, adults and businesses).
- Define and integrate specific groups of work in each CODEL to work more effectively in risk preparation.

• Risk Response (reaction to the occurrence of a catastrophic disaster or emergency)?

- Articulation of the efforts and local actions with the National (COPECO) and Regional (CEPREDENAC) authorities in charge of Disaster Response and civil protection groups.
- Coordination with the LOCAL Committees.

• (Early) recovery (restore critical community functions and begin to manage stabilization efforts)?

- Distribution of help and support through the CODELES
- Secure the assistants needed in the provisional shelters in coordination with the National authority.

UMGIR have also the mandate to measure the implementation of the Sendai Framework at the local level, based on the tool created by UNDRR under the name Sendai Monitor[48]

This tool includes a set of 38 indicators that has been identified to measure global progress in the implementation of the Sendai Framework for DRR. These indicators will measure progress in achieving the 7 global targets of framework and determine global trends in the reduction of risks and losses.

The idea is to measure and report the contribution from Trujillo and escalate this to the regional and national level.

The Sendai Framework targets and indicators contribute also to measuring disaster-related goals and targets of the 2030 Agenda for Sustainable Development, in particular SDG 1 (End poverty) in all its forms everywhere, 11 (Make cities and human settlements inclusive, safe, resilient and sustainable) and 13 (Take urgent action to combat climate change and its impacts). So, this integration with SDGs is also a task for UMGIR.

[48] https://sendaimonitor.undrr.org/

Figure 25 Disaster Loss Data Collection tool: "DesInventar Sendai"

The tool has an important sub-system which is the Disaster Loss Data Collection tool, called: "DesInventar Sendai". This allows the creation and maintenance of a fully compliant Loss Databases that can be used to gather data required for Global Targets A, B, C and D.

It is a tool that helps to analyse the disaster trends and their impacts in a systematic manner, increasing understanding of the disaster trends and their impacts, better prevention, mitigation and preparedness measures can be planned to reduce the impact of disasters on the communities[49].

[49] https://www.desinventar.net

6 Analysis of Global Resilience References

The previous sections reflected the results of systematic practitioner review, the following analyses is be grounded in an academic review, referencing and framing the concepts and perspectives on resilience in support of the derived conclusions.

As the concept of resilience covers a range of disciplinary perspectives, informed by research, policy and practice, we adopt a life course approach to resilience, incorporating results of concept analyses and consultations into a framework to highlight attributes and actions, approaches and resources which positively impact progress towards the identified strategic objectives.

6.1 Resilience

Resilience is one of the prominent concepts dominating risk management spheres [1, 2]. It is considered an antidote for numerous risks including environmental disasters [2-15], terrorism [16-27] security [8, 19, 27-30] climate change [3, 31-40], critical infrastructures [41-52], thus increasing the notions appeal to many policymakers [1]. Resilience is now a generally accepted concept within national, regional and international discourses and has significantly contributed to the design of the UN Sendai Framework for Disaster Risk Reduction [53], the Paris Agreement on Climate Change [54] and Sustainable Development Goals [55]. It has also been adopted in forty-five national resilience strategies of OECD countries.[50] At the national level, more than one hundred cities actively engaging in the 100 Resilient Cities network.[51] Under the leadership of UNISDR, more than 1000 cities are involved in the 'Making Cities Resilient Campaign' [1, 56]. The number of articles on resilience in the disaster risk reduction domain, based on the Web of Science publications increased from zero in 1987 to nearly 2,710 in 2019. A similar search in the risk management domain confirms that there is an exponential growth in scientific papers on resilience. Based on the Web of Science assessment, before 1989, there was no single article on resilience in the field of risk management.

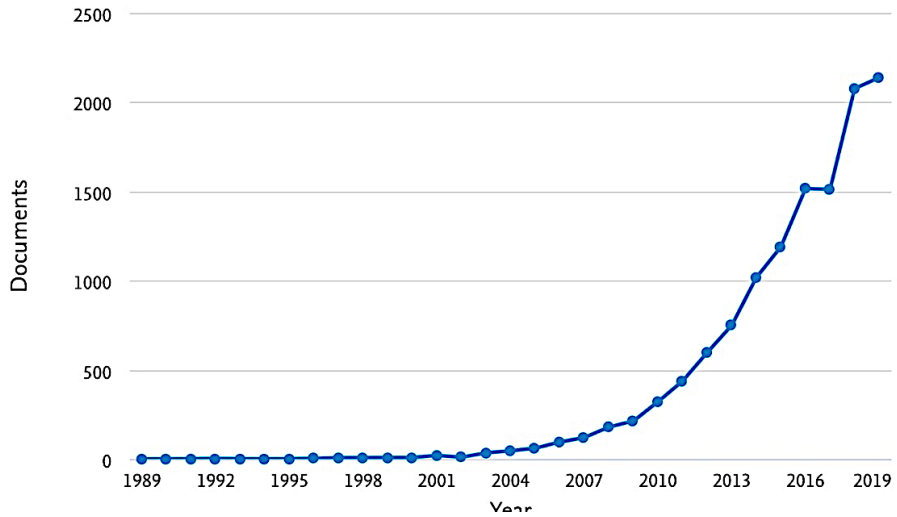

Figure 26: Documents published by year on Resilience, Web of Science Search: resilience AND disaster

To date, resilience remains a "challenged science" due to a number of factors, the most cited being absence of "a settled definitional, conceptual and theoretical basis which is widely recognised and adhered to" [1]. There are numerous definitions of resilience [57, 58].

[50] https://www.oecd.org/regional/resilient-cities.htm
[51] https://www.100resilientcities.org

Moreover, there is an exponential increase in scientific publications on case studies aimed at improving the application and measurement methods on resilience [1]. Studies reveal that epistemological orientations play a key role in the adopted definition for resilience [59]. Despite the burgeoning number of definitions, there is no universally accepted single definition of resilience or a generally agreed measurement method. However, there is growing consensus and convergence on some of the resilience core elements or building blocks [60]. The emerging consensus is centred on resilience attributes (e.g. economic, social, informational), the diverse competencies needed within various dimensions (e.g. disaster cycle stages), the components of resilience indicators (e.g. the '5Cs' -natural, physical, social, economic, and infrastructural capacities and the '4R's – robustness, rapidity, resourcefulness and redundancy). Nevertheless, these indications of an emerging consensus have not resolved the current state of concept ambiguity and lack of convergence on its measurement [1, 38, 61].

Consequently, scientific ambiguity on the definition and measurement of resilience has increased the burden for policy–makers and practitioners who are required by the growing number of resilience-based policies to champion, implement and measure their performance. There is also lack of clarity on variables that influence resilience. For instance, in 2015, Burton measured resilience using 64 variables, whereas the Zurich Alliance community flood resilience measurement framework consists of 88 sources of resilience [62].

Despite the lack of conceptual and methodological clarity and convergence, resilience continues to dominate scientific and policy domains. There is an increasing demand for better strategies resulting in more resilient societies and addressing complex challenges including emerging threats and disasters [63]. Specifically, the proposed strategies entail calls for innovation [64, 65], increasing awareness of risks [13, 14, 66, 67], encouraging adoption of constructive behaviours [11], improving communication between authorities, responders and those affected [12, 24, 66, 68], utilising the power of new technologies and integrating novelties [52, 69-71].

Each of the explored resilience framework is strongly influenced by its conceptual and structural entry points, making a comparison only partially possible [1]. This to us justifies the development of further frameworks enabling learning, broadening options and supporting flexibility in adjusting the selected resilience focused interventions to the needs and threat landscape of individual communities embracing uncertainty and change.

The main question examined in the context of our analyses was "How is the concept of resilience being used?"

Different perspectives on resilience:

The concept of resilience can be seen from different, not necessarily exclusive viewpoints.

1. **Resilience as a policy concept for (urban) development** [72]. Resilience is part of the broader development context described by local or global strategic development goals [53-55]. It is seen as an entity to strive toward and a vehicle to improve governance, community involvement, social cohesion, economic growth, poverty and so on. The broad focus of the development goals translates into a holistic approach of resilience [55]. As a consequence, the line between resilience and development is blurred [1]. The major benefit of this approach is that the improvement of resilience to disaster is embedded in a strategy. However, when the development of a cities is hampered by for example rapid degradation and the influx of new inhabitants is beyond the growth capacity, resilience can be more easily overlooked [73]. Since most development strategies have strong a strong community development component, communities are likely involved in resilience building [53, 56, 72].

2. **Resilience as an independent concept.** This is a broadly accepted terminology by Civil Protection organisations, while they apply classical terms from disaster risk management, like prevention, mitigation, and response. This more technocratic approach puts the response during a disastrous event in the centre of thinking. The basic question is: What capabilities, capacities and context are needed to counter an adverse event? Resilience is in this approach a way to improve the effectiveness of a response. The pillars under this perspective are risk information, planning and situational awareness. Risk information includes risk awareness, but also modelling and forecasting. Satellite data, meteorological weather forecasting, remote sensing is used for early warning, but also for planning of 'what to do?', 'when?', 'with what?'. During an event the planning and prepared information streams should lead to better actions. Smoother evacuation, the right capabilities at the right place. Communities are foremost seen as the object to be protected, and also seen as a data source for more effective planning and in some cases as a capacity [12]. [reference: Australia and USA]
3. **Resilience as an antonym to worst case scenario.** This comes from the Arup reports for the Rockefeller Foundation [74]. The resilient city is a city that will actively move away from the worst-case scenario. This concept recognises the possibility that adverse events can happen, but a resilient city will not allow nor provide the conditions for all parameters which steer toward the direction of an event will be in the worst possible position or any other unfavourable outcome. The concept uses three dimensions to describe the impact of a disastrous event, these are a) economic impact, b) physical impact and c) social impact. The concept integrates the possibility of cascading effects. As such the concept provide guidance on the relation with communities. However, the use of the worst-case scenario shows a close relation to the 'civil protection' approach mentioned above [75].

6.2 Action and Management Information

There seems to be a certain gap in between the generally acknowledged theories of resilience and the way in which the analysed communities embrace the concepts, the extent to which indicators used to measure resilience reflect upon key aspects of the theories such as well-being, sustainability and recovery. As we seek to identify applied and potentially replicable approaches, we focus on capturing basic information about realised actions, without necessarily evaluating them through externally imposed evaluation frameworks. In our study we thus record what kind of policies are adopted, what actions are being undertaken and with what primary focus, analysing their potential implications on exposure and vulnerability.

6.3 Resilience indicators

There are a number of internationally recognised resilience frameworks with diverse sets of indicators of resilience. The European Commission's EnSURE project,[52] aimed at integrating resilience and disaster vulnerability assessments. One of the project outputs was a multi-hazard matrix-based assessment framework. The framework's variables, parameters and indicators were designed to measure vulnerability and resilience. Subsequent analyses confirm that the framework made a substantial scientific contribution by meaningfully integrating vulnerability with resilience assessments. However, the same studies confirm that the framework did not capture the complexity of resilience and vulnerability (Menoni, Modaressi, Schneiderbauer, Kienberger, & Zeil, 2013). Another problem encountered by the project was the incongruities of resilience parameter data-sets between European Union nations.

Measuring resilience is complex due to numerous hazards in any given case study, and this is further compounded by three main factors:

[52] http://www.ensure-project.eu

- the temporal scale which is represented by the disaster cycle;
- the spatial scale; and
- hazard/disaster receptors (e.g. physical, economic and social) [1].

Despite the difficulty in measuring resilience there have been efforts to address this challenge. Parker [1] explain that complexities experienced by researchers who seek to develop a comprehensive resilience assessment framework has often led to the simplification of the models and further confinement of the assessment to a single hazard or scale, for instance a community scale [7]. The Zurich Alliance flood resilience measurement framework [62] is a community scale for both ex-post and ex-ante measurements. Though the scale is community-based, it is designed to take into consideration global, regional, national and household level scales.

Frazier [76] observe the limited or no consideration of the importance of differential weighting. According to Keating et al. [62] explain that the existing resilience

measurement frameworks often assume that ex-ante presence or absence of an indicator, that demonstrates a source of resilience, will impact ex-post resilience positively. Keating et al. (2017) further reports the lack of a single disaster resilience

measurement framework or method that has been validated through longitudinal studies. On the contrary, Heng et al. [77] identified 18 empirical (both qualitative and quantitative methods) validation studies of resilience models. However, these studies comprise only 10% of the total scientific articles that were analysed by Heng et al. [77] on measuring disaster resilience.

The development and verification of tools to measure resilience for different conditions and making them replicable, remains a major challenge. One such challenge is the slow advancements in modelling systemic physical interdependencies of infrastructure systems (transport systems, critical infrastructure, lifeline) and their cascading effects on socio-economic systems to facilitated deeper understanding and improvement of socio-economic resilience and adaptation in relation to disruption risk [60].

As the authors of a “Comparative overview of resilience measurement frameworks” (ODI 2015) acknowledged, indicators alone may not always provide a complete picture. In the context of our interviews we found that in most instances, only qualitative indicators were used by respondents, but our focus remained general to collect authentic experiences on the measurement of resilience. The main questions asked was: “What kind of measurements do they use?” and the following types of measurements have been observed:

A. Measuring progress using performance indicators.

This measurement relates to the development of resilience. This can be part of a development strategy. The performance indicators show which steps are taken and which outcomes the steps have. As such they don’t give a direct impression of how resilient a city or another entity is, although the underlying paradigm is that each fulfilled step is making a city more resilient. This measurement gives vital information for managing the development of a city towards set goals.

B. Measuring activities for resilience using performance indicators

This kind of measurement is closely related to the previous one. Emphasis is now on the performance of the resilience as an entity. It varies from input related indicators as ‘how many evacuation plans have been made, updated and trained in a period of time” or very high-level output indicators, like “how many deaths per time period are related to disasters”. Disaster loss data are also a good example of this kind of measurement, capturing specific aspects of impact of crises on social, economic and environmental infrastructure. Addressing uneven urbanisation, vulnerability and exposure while taking into consideration the intensifying climate

risk requires new approaches, based on strong data to advance local solutions, plan and manage transition towards inclusion, resilience and sustainability. Performance indicators for measuring activities empowering transition generate important data and knowledge exposing gaps and needs, enabling more targeted actions to address them with evidence-based policies and actions plans.

C. Measuring gaps in conditions for resilience.

Based on an overall picture of how resilience should look like a comparison is made with the reality. This comparison of the current status quo with what is needed is a starting point for policy making. Often the Sendai Framework is used as a reference framework for which policies should be in place. The measurement is static although in many cases it is repeated periodically. Examples are the scorecards.

D. Measuring parameters for risk assessment (vulnerability, exposure)

Geospatial data, demographic data and data on critical infrastructures are being layered by the respondents as input for risk assessments. The term risk mapping tends to be used as being synonymous with risk analysis in the overall framework of risk management. Risk assessments and the associated risk mapping generally include a review of the technical characteristics of main hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios. In the framework of natural hazards risk assessment, the term risk mapping also indicates the importance of the spatial aspects of risk assessment. All components of the risk equation are spatially varying, and the risk assessments are carried out in order to express the risk identified within certain areas. To be able to evaluate these components to a greater extent, spatially distributed information is needed.
Geographic Information Systems (GIS) are used in some cases to generate the data on the various risk components and to analyse the risk. Hazard data is derived from hazard scenarios, as hazard events with a certain magnitude/intensity/frequency relationship are identified by respondents and captured in the assessments.

Generally speaking, a separate analysis is required to determine a universal set of parameters defining the risk assessments implications in relation to applied aspects of vulnerability and exposure.

E. Measuring parameters for hazard modelling/ forecasting and early warning (satellite data, sensor data)

Real time measurements feeding in models which predict hazardous situations enable conversion of data into understanding, empowering effective preparedness and active coping. Smart use of data has positive impact across the disaster management cycle. Predictive impact analyses enable transformation of early warning into early action, automated impact maps[53] empower forecasting. For example, artificial intelligence generated ground acceleration measurement generates impulses to stop trains and halt nuclear power plants. Population movement tracking tools enable more complex and accurate decision-making in epidemics as is currently being applied across the globe in the COVID19 case. Another example of applied hazard modelling based partially on past experiences layered with new (satellite, sensor, special software assembled) data is the Impact based forecasting[54] which is used to predict impact of impeding disasters on vulnerable people living in areas prone to

[53] IFRC climate center
[54] IbF as applied by 510 + Global IFRC initiative, 510 News Scraper

disasters, empowering local communities to respond proactively to a disaster and activate forecast based financing mechanisms in some cases.

In annex C the indicators for the different measurements are listed in tables.

6.4 Relationships Between Global Strategies, Cities and Countries with Concepts of Resilience and Measurement Systems.

To give an overview what the drivers are behind the different case-studies are, they were analysed what kind of concept the primarily and secondarily used. Also, it was also analysed which kind of measurement system the case studies used. Because more measurement systems where used the one with the most emphasis was categorised as primary. In Table 1 the overview is presented in a table.

The global strategies are mostly using the concept of resilience as a policy concept for (urban) development, which is described previously. The global strategies adhering the 'Development' concept have, like for example the UNDRR Making Cities Resilient Campaign, a strong policy background. The strategic development goals are mostly measured by progress performance indicators. Examples of these indicators is whether certain elements are included in local policies, whether the communities are involved. The International Federation of the Red Cross/Red Crescent in contrary as a more practitioner-based organization, relates more to the independent concept of resilience, although the IFRC has for certain also a development agenda. The countries in the case-studies are focused on a more technological approach with a background in disaster risk management. As the countries are developed, they concentrate on technological innovation to strengthen resilience. Risks, and the measurement of risk is operationalised in hazard models that can real-time give information and that can provide forecasting. The aim is to make effective actions possible. In the case of Australia there is reference to the use of the worst-case concept. This based on their experiences in bush fires.

In the concept of resilience columns development refers to 'Resilience as a policy concept for (urban) development'; independent to 'Resilience as an independent concept' and worst-case to 'Resilience as an antonym to worst case scenario'. In the measurement system columns progress PI refers to 'Measuring progress using performance indicators'; Static PI to 'Measuring static data for resilience using performance indicators'; Gaps to 'Measuring gaps in conditions for resilience'; risk assessment to 'Measuring parameters for risk assessment (vulnerability, exposure)' and Hazard model to 'Measuring parameters for hazard modelling/ forecasting and early warning (satellite data, sensor data)'

Table 2: Relations between resilience and measurements concepts with the descriptions of global, national and local strategies.

	Concept of resilience		Measurement system		
	primary	secondary	primary	secondary	tertiary
Sendai Framework	development	--	Progress PI	Static PI	Gaps
EU global strategy	development	independent	--	--	--
IFRC	independent	development	Progress PI	Static PI	--
100 Resilient cities	worst case	development	Progress PI	Gaps	--
UNDRR MCRC	development		Progress PI	Gaps	Risk assessment
AFAC Australia	independent	worst case	Hazard model (Bush Fires)	Risk assessment	Progress PI
IAFC (USA & Canada)	independent	--	Hazard model (all hazards)	Risk assessment	--
Buenos Aires	development	independent	Progress PI	Hazard model (Meteo)	--
Dakar	independent	development	Progress PI	Static PI	Hazard model
Lagos	independent	--	Progress PI	Hazard model	--
Mexico City	independent	development	Progress PI	Hazard model	
Montevideo	development	Independent	Progress PI	Static PI	
Panama City	development		Progress PI	Hazard model	Static PI
Quito	development		Progress PI	Static PI	
Trujillo	development	independent	Progress PI	Risk assessment	Static PI

The cities in our case study are split between the concept of resilience as a policy tool and resilience as an independent conceptual entity. Most probably the split is more due to who are interviewed than to actually policy. A municipal policy maker will tend to lean towards the development concept, while a civil protection officer will emphasize the DRM in resilience. This can be seen in the measurement systems. Buenos Aires on one hand has sets of indicators purely focused on measuring the steps they take towards implementing policy goals, on the other hand it is also doing hazard modelling and tries to get better early warning systems and flooding models in place.

6.5 Reflection on Communities

A growing body of evidence suggest that community resilience can be enhanced through social ties, social capital and cohesion as social capital captures how involvement and participation

in groups can have positive consequences including raising awareness and gaining new skills and supporting relationships.[99] In the context of crises management studies show, that social capital enhances community resilience in responding to and recovering from disasters, empowering collective action, based on shared lived experience in the face of adversity [100]. The demonstrated persistence, incremental adjustment and transformational responses are the social outcomes of the capacities built in by implementing resilience-building initiatives.

Social capital contributes to building disaster resilience by promoting cooperation and collaboration among individual social networks along with encouraging engagement of diverse organizations towards the community, eventually strengthening the disaster management system [101]. Thus instead of searching for a universal measurement of resilience[55], it seems more productive to focus on scaled impact monitoring, deriving and applying lessons learned from interventions proven useful in specific situations and deepening the understanding of the key determinants of resilience (including the outcomes of efforts to measure it).

6.6 Comparative Analysis - What Different Cities Have in Common

Exploring the diversity of resilient pathways, we moves across different scales of “localness” and identify various entry points to the subnational level, from the micro scale of neighbourhoods and districts (example; the City of Buenos Aires), to the city and metropolitan scale (City of Quito and/or the City of Mexico for example).

It is through the collective practice and realization of actions undertaken at the different levels that local realities are transformed, and changes triggered at upper levels impacting the resilience of complex systems.

Actions and policies implemented at the city or metropolitan scale also support and guide transformative trajectories at the micro level. It is thus the job of each local DRR and resilience strategy to delineate the best way forward, facilitating access, ensuring inclusion and empowering local communities in pro-active approach to their safety and sustainability.

In order to develop and implement a local disaster risk reduction and resilience strategy, DRR should be mainstreamed into all the key functions that local authorities regularly undertake, involving different sectors and stakeholders. This means considering DRR in:

- Land use and urban development planning and management,
- Infrastructure and service planning,
- Construction and building codes,
- Social welfare,
- Environmental management,
- Health, education and finance.

Both, 100RC and UNDRR Making Cities Resilient Global Campaign open extensive participatory processes across their work to integrate all of these factors and also the city, district and metropolitan level.

More and more, the metropolitan or city-region scale is gaining relevance in terms of development planning. To this end, supra-local authorities and agencies are formed to coordinate between municipalities, cities and local governments.

Similarly, applied research on experimentation for climate change adaptation is increasingly taking place at the district, neighbourhood or block level. However, there are reasons why the

[55] Levine 2014

municipal scale (and the city, municipal or local government) is so relevant for local DRR, namely:

- DRR requires relatively consolidated and sustainable organizational and institutional structures.
- Local governments are the “first port of call” for citizen concerns on risk and vulnerability and therefore can face intense pressure to act.
- Local governments bear the ultimate responsibility for the safety of their citizens and communities.
- Local governments are in charge of promoting and supporting local development and therefore offer a real option for linking DRR with development.
- Local governments have normative and control responsibilities.

At the same time, year by year economic losses from disasters continue to rise across the world. They are increasing faster in OECD countries, but the impact of economic losses relative to GDP in low and middle-income countries is much higher and thus threatens their economies more. Moreover, low and middle-income nations show a rising trend in mortality and economic losses associated with extensive disaster risks.

By 2018, 55% of the world’s population was living in urban areas and this proportion is expected to rise to 68% by 2050 [UNDESA 2018]. As the world’s population becomes increasingly urban, disaster risk predominantly concentrates within cities and urban areas of all sizes, economic characteristics and locations. The concentration of people, assets and activities in urban centres usually generates new patterns of hazard, exposure and vulnerability.

Approximately 60% of the area to be urbanized by 2030 has yet to be built. This will happen mostly in countries and urban centres with low capacity to ensure risk-reducing infrastructure and services. It represents an opportunity to reduce disaster risk globally.

How cities develop shapes disaster risk, and disaster risk shapes development possibilities. Cities are usually described both as risk (a cause of risk) and at risk (affected by risk). Cities and urban areas concentrate population, economic activities and built environments in ways that the economies of scale or agglomeration can allow for better provision of risk-reducing infrastructure.

They can be safe places, if good quality housing, infrastructure and emergency-response services are in place and work for all. Ideally, for each city, there should be a long-term strategy to guide urbanization and urban growth, but often this has not been the case.

The two cases analysed lead to the conclusion that Governments alone cannot address the complex challenges of DRR in all the relevant areas and aspects. Every DRR success story involves planning and implementation that give importance to community or civil society involvement. In some cases, it is local governments leading the process of disaster risk reduction and resilience building. In many others, though, communities themselves take the lead in disaster risk reduction as they act based on experience in relation to absorbing shocks, perceived vulnerability and expected exposure.

Communities are a central actor (for both initiatives), as they inhabit the territory, whereas the involvement of practitioners and politicians is usually temporary. Therefore, the development of the local DRR strategies analysed under this work has been tuned to the needs and timeframes of all community sectors.

At the same time, their acknowledge that there are limits to community-driven processes. Communities themselves often do not have control over issues such as land tenure or the formulation of public policies. Hence, the institutionalization of community-driven processes at the local level needs the support of local governing bodies and national governments.

It is also worth noting that communities are not homogenous and thus require tailored approaches. Within each community there are usually unequal distributions of exposure and vulnerability, and therefore risk, which need to be considered and addressed within internal power structures.

Referencing national and local resilience frameworks against the internationally acknowledged strategies such as the Sendai Framework through and indicator-based approach seems to be the only method that allows to carry out a holistic risk assessment while including social, economic and environmental vulnerability and capacity. It can be successfully applied even in cases when there is not enough data to carry out a quantitative analysis, but also as a follow-up of a quantitative analysis as it allows to take into account other aspects than just physical damage [102]. Even though hazard and risk mapping may have taken place, real risk reduction will only happen when it leads to a reduction in either the hazards frequency and intensity, the number of exposed elements-at-risk and their vulnerability. This requires integration of risk analysis into a risk management framework, which includes the adoption and systematic implementation of policy and relevant regulations.

7 Conclusion and Discussion

7.1 General

The concept of resilience is now, according to our findings, widely spread and used by actors globally, among else as a vehicle to apply the results of the disaster management cycle to increase resilience. There is a shift from traditional risk management approaches that put vulnerability into the focus and from purely technical approaches to application of deeper understanding of the conditions associated with human actions, economic and environmental change and needs related to institutional capacity building.

The change in approach to politics with resilience as a policy level priority drives the approach leading to improvements in sustainability and resilience of urban systems, including their physical and social components. The indicators represent a tool guiding the decision-makers in identification of attributes whose resilience is to be strengthened and to what kind of disturbances, adjusting the thresholds of a system in respect to changes in response strategies, defining the level to which systems are capable of self-organizing and to which they are able to build and increase capacity for learning and adaptation.

The capacity of urban respectively community systems to improve in each part of the emergency management cycle translates into the ability to provide relief, resists adverse events while increasing its threshold capacities, respond with adequate capacity and capability while maintaining a high level of system performance during events and assist recovery actively, providing support to key recovery processes and reflecting to increase awareness and adaptive capacity, learning from past events and preparing for those to come.

The report gives an overview of selected approaches to resilience based on experiences from outside of Europe spotlighting added value approaches as well as gaps in availability and accessibility of data, schemes of prioritization of specific aspects, impacts, hazards and resources as well as inclusiveness of decision and policy making which translates effectively into societal endorsement of resilience as a shared aspiration and lived lifestyle. The collected data was analysed and studied along the same lines of the currently available European data, so that it will be possible to abstract approaches, study results and identify replicable lessons learned. The ultimate goal of the review was to contribute to awareness of how a progressive community responds to adversity in a positive manner in order to grow even more resilient for the future.

In conclusion we wish to highlight the general cultural shift in perception of resilience, shifting from emphasizing vulnerability towards a more positive concept of resilience as a strategic approach to be integrated with development goals representing a pro-active and essentially positive societal response to adversity.

7.2 Specific

In Section 2.5, six research questions were formulated, 4 of which are based on the task description of the RESILOC Task 2.5. Below these questions are answered based on the findings.

1. **What is the global context of building resilience, which major global strategies are in place and how do they relate to each other and the objectives of RESILOC?**

   The Global policy framework leaving the most visible footprint in the context of global action is the Sendai Framework for Disaster Risk Reduction 2015-2030, as the Sendai Framework represents a transition from understanding the interactions between hazard, exposure and vulnerability to a greater concern with how to act upon these risk

factors through prospective, corrective and compensatory measures. It is offering tools for assessing progress towards resilience, enabling decision-makers at all levels to address a broader scope of hazards and risks while mapping out a policy pathway for governments, communities and citizens to prevent and mitigate shocks caused by natural and man-made hazards, as well as related environmental, technological and biological hazards and risks. Its transposition into actually implemented actions requires multi-level governance system supported with open, interactive and inclusive platforms in place, which according to our observation, are still under development in many countries and thus supporting the application of the policy framework with innovative tools delivered at community level adds impetus.

Analysis of frameworks and cooperation systems was focused on proportionate and context-driven solutions, which commensurate with the disproportionate exposure to environmental and economic risk faced by many countries, regions and communities.

The objectives and approach of RESILOC are being streamlined with the relevant international and global strategies, adding a unique community centred perspective, prioritizing policy focused approaches with indicated positive impact on decision-making within a localized, socially and politically acceptable context, respecting horizontal and vertical social mandates and ties, while referencing recommendations rather than seemingly representing tools of scrutiny and evaluation.

The complexity of challenges in resilience related problem-solving makes it imperative that our understanding of vulnerability, risk and resilience which translates into the RESILOC approach is developed without resorting to reductive measures that isolate and remove approach from context and ignore systemic characteristics of progressive initiatives.

Community resilience has grown to recognize the ever evolving and dynamic nature of communities as well as the underlying vulnerabilities that challenge them. Capturing deployment of new approaches to citizen engagement in resilience building initiatives, including efforts to translate data into insights and to demonstrate openness of decision-making procedures, is identified as one of our priorities. Examples of closer collaboration between the public and private sector, enabling co-creation in resilience focused initiatives are at the centre of our search, as is using data and alternative forms of behavioural engagement to provide insight and capture experiences that shape opinions and preferences key for achieving progress.

A lack of insight into local contexts can leave people and communities at risk even when support is being provided so the ultimate goal of our efforts is to provide a more focused understanding of how communities can enhance their coping mechanisms, social ties and cohesion for the benefit of greater resilience towards disasters in the future.

2. **Which resilience building strategies can be identified in two leading, technology driven countries?**

Programmes and strategies, developed from risk-informed decisions, that adopt a holistic approach are more likely to contribute to reducing the underlying vulnerabilities of communities and ultimately lead to more resilient communities and thus supports community-led, risk-informed decision-making. The theoretical starting points therefore include reflections on the ways in which a community in a technology driven society creates, builds, maintains and uses its assets to generate capacities needed to protect it from threats, mitigate impacts of adversity and adapt to rebuild and move on.

Defining long-term strategies reflecting their most important problems through a perspective capturing their vulnerabilities, stressors, and preparedness related challenges as well as their social capital, adaptation potential and recovery resources empowers communities to take ownership of problems while maintaining a positive perspective and fostering a spirit of resilience. In an ideal situation this is supported by long-term transformation of institutions and systems as a precursor to diverse capacity building and resilience strengthening project implementation, with multiple government officers and local stakeholders on board and source inputs from the residents they aim to serve.

Support in the form of seed funding going beyond development of strategies and supporting implementation of innovative, need-driven projects providing tailored solutions

3. **What are the resilience building strategies in urban communities which are forerunners by policy or by challenges?**

   The concepts of resilience used, types of actions undertaken to strengthen resilience at policy, institutional respectively programme levels and methods used to measure resilience predetermine the outcomes. Adapting multilateral mechanisms translated into effective actions not just at international, regional, national but also at local, community levels empowers communities to mitigate risks and the impacts of disasters on the sustainability of lives and livelihoods. Coordinated, multi-stakeholder action to mitigate against the impacts and outcomes of adversities, supporting a culture of resiliency across communities and businesses significantly contribute to progress.

   Harnessing the potential of cutting-edge information and communications technology to manage and reduce disaster risk and utilise the potential of technology for the benefit of all stages of the disaster management cycle is an important factor of progress and it impact the quality, speed of delivery and scope of provided information and services.

   Introducing mechanisms helping individuals and communities to be better prepared for, withstand and recover from disasters is considered vital in reducing the impact of crises and avoiding loss of life and livelihoods. Systematically supporting community initiatives, advocates and forward-thinking leaders across government, non-profit, academia and private sectors in rewriting the rules of disaster risk reduction, response and recovery empowers actions focused on the needs of the people, whose lives and communities are affected. Cities ensuring that their development strategies and investment decisions enhance resilience, embedding resilience principles in city planning and operations, increase their chances of measurable success.

   Co-designed solutions which meet the needs of those affected effectively and in active interaction across the disaster management cycle are being sought after in the trendsetting communities. Advancing new solutions by supporting local resilience teams, promoting integration of research outputs and community-based experiments, enhanced with storytelling across the media landscape works toward ensuring a more effective, equitable and sustainable approach to response and recovery.

4. **Are there any indicators to be identified in those strategic frameworks, countries and urban communities (cities), which could be added to the RESILOC inventory?**

   According to our analyses, at city respectively community level, mostly qualitative indicators are used to address resilience related actions.

Indicators enhancing “local knowledge” of needs, mapping community infrastructure resilience, social capital and active participation at community level and those bridging concepts of risk awareness and management with broader developments related to climate change seem to translate well in developmental contexts and thus should be given attention. Indicator reflecting on availability and quality of services such as early warning and consolidation of coordination and control in emergency management and integration of public safety and security systems contribute to response capacity building and have direct, measurable income on perceived quality of support provided to communities.

Measuring the social-ecological outcomes of main risks and hazards as well as adaptation programmes supporting community resilience remains a challenge yet to be addressed systematically. A major resilience related challenge is linked to the future supply and management of key basic resources at community level and beyond.

In relation to policies, most cities are working on awareness and early warning, while most of resilience indicators used are based on qualitative parameters such as those indicating if specific communities are involved. Local approaches take precedence in the context of planning. Thus, in a policy-driven logic it comes naturally to embrace multi-hazard approaches and challenges related to vulnerable and marginalised communities and cooperate across sectors integrating solutions.

7.3 Discussion

Preparedness translates words into action and investment policies into results. To strengthen these efforts in general, the terminology used in resilience focused polices has to be translated into the language of the common citizen, empowering prevention-oriented measures which reduce the impact of natural hazards and save lives.

At community level, the permanent presence of actors before, during and after emergencies enables pro-active mitigation of risks, stimulates motivation to alert communities to the risks and act early to respond. This potential has to be supported by actions encouraging informed decision-making, building awareness of all actors involved as well as strengthening capacity and capability at local level, while acknowledging and applying local knowledge in addressing the threats and challenges to strengthen resilience of all.

Peer exchange and the ability to build networks activates potential for progress, enabling learning through exchange with other communities and the inclusion of the various key actors in the reduction of disaster risks. The exchanges help to consolidate work networks and to align visions, strategies and plans to promote resilience at local and regional level.

The knowledge of the risk empowers, progressive local governments map hazards with tools, that allow different stakeholders involved to easily access comparative information, mapping exposure and vulnerability with a clear description of the scenarios.

Actions implemented at regional and local level benefit from an enhanced ability to identify, understand and use current and future risk scenarios matching them to experiences, resources and local social capital for mitigation and adaptation, while building institutional capacity for resilience through concrete, strategically focused projects.

The challenges to be addressed and potentially reflected in the evaluation and monitoring mechanisms for strategic purposes include among else:

- The need to strengthen the financial capacity for resilience, specifically in the area of insurance and availability of incentives, as local mechanisms must be identified and adapted to the national and international strategic objectives.

- The private sector engagement in disaster risk reduction, specifically in the stages of preparation and recovery, in order to seek continuity of business in case of an event and protect the livelihoods which are vital for the sustainability of communities.
- The capacity for recovery and reconstruction, with focus on strengthening the financial capacity to accelerate the recovery and reconstruction processes. This refers to all events with significant impact, including recurring small-scale events; especially those derived from the impacts of climate change.

Furthermore, the scope and scale of the strategy will leverage the city's strengths and systems to build a more resilient urban ecosystem. The indicators allow the city planners and developers to address in the Strategy the main challenges faced by the City, from chronic stresses, like the difficulty of access to housing, informal settlements and insecurity, to shocks associated mainly to the effects of climate change, such as heat waves, floods and/or powerful storms.

Investments into early action have a powerful spill-over effect as adaptive capacity and resilience of the society and ecosystems is tested, impacting other sectors of the economy and improving efficiency of preventive and response actions. Investing into new technology and innovations also enables more comprehensive risk management and support mobilisation in the field of action.

Thus, the utilisation of smart indicators in resilience planning strategies empowers the decision-makers to take on a new perspective on vulnerability, fragility and resilience empowering communities to take informed decisions and grow in confidence and resilience even in the face of adversity.

The underlying strategy can become a key instrument to setting priorities when tackling social, economic and environmental risks and hazards, building awareness which enables collective reflection and consensus creating space for new initiatives and alliances contributing to resilience for all.

7.4 Discussion on Methodology Used

In response to the increased frequency and severity of adverse events, emergency and disaster management strategies are moving from disaster-proofing towards building complex resilience with focus on the capacity to withstand adverse effects of extreme events and the ability to quickly recover system performance and functionality of social and economic systems.

The analyses of the conducted interviews derived a diversity in approaches as well as a variety of commonly analysed factors, shaping the polices and applied approaches to resilience. Developing of vulnerability and resilience assessment tools with indicators enables to provide a comprehensive overview of the vulnerability and resilience of a city or community, capturing ideally the relationship between the nature of interaction and the structure of a system, taking into account the natural, physical, economic, social and institutional dimensions.

At institutional level, the applied methodology lead to identification of risk management strategies scaling convergence and resilience, enabling analyses of diverse aspects taken into consideration, separating perspectives on urban resp. community functions and services.

Limitations of the applied approach rest in the fact that the frameworks relies on assumptions and to a certain degree on subjective interpretation of the key aspects of applied resilience strategies, which we tried to limit by avoiding an evaluation of the systems and focusing on the description of replicable practices perceived as beneficial by the participating communities. The ultimate goal is to identify experiences from urban systems that lead to decreasing

damage and disfunction, respectively faster and more effective recovery in order to support developing urban system in the application of good practices leading towards strengthened resilience and new levels of effective, sustainable functioning.

7.5 Summary of Recommendations

7.5.1 General

Recommendation 1

That the RESILOC project should adopt the UNDRR definition of resilience.

Resilience is mostly defined using the UNDRR definition as can be read in section 4. This definition gives enough room to incorporate very different approaches. It accommodates, sociological, technological, political, psychological approaches. Also, the level and scale of resilience can differ considerably. Not to mention the relation with hazard types and whether and how it fits in the classical DRR structure Constructing a framework in which the different approaches, perspectives, levels could come together would be helpful to get a full oversight and understanding of the complexity of the concept of resilience.

Recommendation 2

That the project should use the ‘Cube’ as the basis of its resilience construct.

In the light of the missing generally accepted construct of resilience, it is important for RESILOC to adopt and further develop a construct that respects its complexities. The ‘three dimensions used in the cube’ by the City Resilience Framework’ is a strong way to build such a construct. See Figure 8 in section 4.3.1 The City Resilience Framework.

Recommendation 3

Authors of Deliverables should show which part of the theory, modelling and other key reference frameworks are also applicable for non-natural hazards.

As RESILOC is focussing on resilience to natural hazards it is to realise that many stresses on communities are not direct results of a natural event. Communities, cities, regions face a broader pallet of events that test their resilience and can have the same or even more severe consequences as the consequences of natural hazards as can be seen in the case of the Cities 5.2 and further. If possible, it is recommended to at least show which part of the theory, modelling is also applicable for the other hazards.

7.5.2 Inventory

Recommendation 4

The project should use qualitative indicators by using scales and expert assessment.

The most indicators used by the global initiatives have a qualitative character, using expert judgement and/or ordinal scales to capture aspects of resilience. An example is the framework of the Rockefeller resilient cities in which indicators are presented in 6 scales (in Figure 9 presented in shades of grey). In the presentation this has strong merits because of its powerful graphical appearance.

It can be considered to include scaled qualitative indicators to cover areas in the complex construct of resilience which can’t be covered directly by a quantitative assessment, due to unavailability of data or missing modelling. It is to be considered to use expert judgement and

other methods to translate qualitative assessments into values which can be used for the modelling in the inventory.

7.5.3 Policy

Recommendation 5

In addition to the full version of its inventory, a step-in version should be developed to guide stepwise implementation.

A notion which was clear from the study in the implementation in the cities was the 'raw to refined' approach for understanding resilience. Start focussing first on the big chunks (is step taken, is a policy available, is risk assessment made) towards focussing on the details of what is really in those big chunks (what was the result of risk assessment and how was it used). The experience in the cities shows that first the concept of resilience has to be adopted before starting to go into depth on it. An example of this approach is the make cities resilient score card which comes in two level (preliminary level and detailed level, see section 4.4 UNDRR Making Cities Resilient Global Campaign.

Recommendation 6

Within its implementation strategy, the project should incorporate resilience from broader policy goals such as the SDGs.

As resilience is seen in the global strategies and the cases as a sociotechnical construct in which risks are intertwined with societal factors, like demographics, income distribution and so on, almost all the cities studied incorporate resilience in broader policies. In the global initiatives resilience is coupled with SDGs. On the local level an example is the five pillars of Buenos Aires for implementation (section 5.4).

7.5.4 Community Involvement

Recommendation 7

The project should use the unique characteristics of its first responders and other user-engaged practitioners as professionals and deeply rooted, knowledgeable community members.

The diverse community of practitioners not only represent unique capacities and capabilities deployable to mitigate impact of adverse effects, but also have special experience in addressing the needs of people affected by emergencies and disasters. In most countries the first response organization is not an external agency but a community-based entity, its members, first practitioners are deeply rooted in the communities.

Recommendation 8

The project community involvement should be used to its full extent, implying that communities need to be seen and engaged as full partners with knowledge and experience of resilience complementing that of the other partners.

The Sendai Framework (section 4.2) and the global initiatives (section 4.5 and further) all have strong component of community involvement in risk awareness, in education of the risks and involvement in decision making. It is seen that the government is not a know-it-all/ paternalistic reigning body but should involve itself with the community to be better aware of the hazards, vulnerabilities, cascading effects and in preventive and mitigative actions.

VII. Annex 1 - RESILOC Ethics Self-Assessment Sheet & Informed Consent Template

(Section 3.6 refers)

Resilient Europe & Societies by Innovating Local Communities (RESILOC)
***Worldwide Expert interviews* – Information Sheet**

What is this research about?
RESILOC is an EU research project RESILOC funded by the European Commission under the Horizon 2020 Programme. The projects objective is to increase Europe's resilience to crises and disasters. Resilience is defined by the United Nations as "the ability to resist, absorb and accommodate to the effects of a hazard, in a timely and efficient manner". Thus, resilient communities are those in which their citizens, environment, businesses, and infrastructures have the capacity to withstand, adapt, and recover in a timely manner from any kind of hazards they face, either planned or unplanned. In recent years, efforts have been spent to define resilience and there is, still, a long path forward in defining an EU-wide, valid and sound approach to the problem. RESILOC aims at studying and implementing a holistic framework of studies, methods and software instruments that combines the physical with the less tangible aspects associated with human behaviour.

Who is carrying out the study?
This is a research project being conducted by a consortium of 16 organizations across Europe. It is led by the Fraunhofer Research Institute for Material Flow and Logistics, and the interviews will be conducted by researchers working for the Resilience Advisors (RAN).

Why am I being contacted?
You are being invited to participate in this research project to provide your expert views and experiences of 'resilience'. The RESILOC research team will use the answers you provide to inform the development of its 'resilience' concept and to develop a system that measures and aims to improve resilience of local communities. Before you decide to take part in this study, it is important you understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What will I be asked about?
The interview will explore your experience of, and involvement in, previous projects relating to 'resilience' and your understanding of the concept of 'resilience', how it can be measured or assessed, and what challenges are associated with measuring 'resilience'; we will also ask you about what you see as the most significant risks and vulnerabilities to local communities during natural hazards and other emergencies.

How long will the interview last?
We want to talk with you over the telephone or via Skype for up to 60 minutes – this will be arranged at a date and time convenient to you. We will not contact you again as part of this study unless you specifically agree to be contacted again or to receive results of the research.

Will the study benefit me?

There are no direct financial benefits associated with participation in this study, although it is hoped that the study will be of public benefit by contributing to a better understanding of resilience to natural (and other) hazards.

Resilient Europe & Societies by Innovating Local Communities (RESILOC)
Expert interviews – Informed consent form

About this form: Please complete and sign this form to indicate your consent to take part in the expert interviews as part of the RESILOC research study – an EU research project funded by the European Commission under the Horizon 2020 Programme. Further details about the study and how the data from this interview will be used are provided in the attached information sheet.
Participant Requirements: Adult persons of at least 18 years old are permitted to participate.
RESILOC Consortium Contact Point: If you have any questions about the research study, please contact Sjirk Meijer (sjirk.meijer@resilienceadvisors.eu)
Risks: We do not foresee any particular risks related to your participation in this study – as detailed below, your answers will be treated in confidence. We may use quotes from the interviews in our publications, but these will be anonymised and any personal information that could be used to identify you will be removed.
Data Protection: All data collected as part of this study, including results, will be strictly confidential and only the researchers will have access to identifiable information about participants – other partners will only have access to anonymized data. It is intended that findings about the study will be disseminated, but individual participants will not be identifiable in these publications. The RESILOC ethical board members will monitor procedures for data collection and handling; this includes ethical compliance of deliverables including any kind of data.
Withdrawal information: Your participation in the RESILOC project is completely voluntary, and you can choose to stop participating at any time. If you decide to withdraw from the project, please contact the RESILOC consortium contact point(s) outlined above, and they will explain the best way for you to stop taking part
Your rights: If you decide to take part in the expert interviews, you have the following rights at all times: • to request access to your personal data • to ask Resilience Advisors to rectify any inaccuracies in your personal data • to receive your personal data in an understandable and common format • to have your personal data transferred to another organization • to complain to your national personal data authority • to ask Resilience Advisors to erase your personal data, if you decide to withdraw from the study
Declaration Please, tick the boxes if you agree (you need to tick all three boxes to participate in the study): ☒ I have read the information sheet and do not have any further questions about the project. ☒ I have read the terms outlined on this form and understand them. ☒ I consent to take part in this study under the terms listed on this consent from.   Signature and Date
Details of research participant (please complete):
Name:
Organization:
Position:

RESILOC ethics self-assessment sheet

This document is a self-assessment sheet that must be filled out by owners of RESILOC deliverables. This is to ensure that research and/or development activities related to each project deliverable comply with requirements of RESILOC Guidelines on Ethics and Data Protection (GDPR).

This RESILOC ethics self-assessment sheet must be used as part of each project deliverable that involves humans either in an active (e.g. data subjects) or passive (e.g. affected by tools) manner. Project reports (e.g. management or financial reports) are not required to undergo this ethics assessment.

This document is an important exercise part of the RESILOC Ethics Framework as it allows the owner of each RESILOC deliverable to reflect on ethical consideration and data protection requirements in a structured and approved manner before submitting the document to the Commission for review.

The document shall be used in line with the RESILOC Ethics Framework including the guidelines and procedures under deliverables D9.1 to D9.12 (all documents are made available on the RESILOC Own Cloud). The ethics self-assessment sheet must be included as the 1st Appendix A of the each RESILOC deliverable. In addition to filling out the sheet, authors must provide explanations of the answers given on the main table. Such explanations must be provided in the methodology section of the deliverable using the headline "Ethics Considerations and Data Protection". The ethics self-assessment sheets of private deliverables must be assessed through the responsible position within the issuing organisation. However, for public deliverables, the ethics self-assessment sheet must be approved by the RESILOC Internal Ethics Board. For that, please send this document to the Internal Ethics Board.

For Information or assistance contact:		helena.marruecos@iml.fraunhofer.de	
The self-assessment was conducted by:		The self-assessment was approved by:	
Name	Sjirk	Name	Jon
Surname	Meijer	Surname	Hall
Institution	Resilience Advisors Network	Institution	Resilience Advisors Network
Date	16/10/2020	Date	26/10/2020

		yes	no	n/a
G	**GENERAL**			
a	Did the research for this deliverable involve the collection of personal data?	x		
b	Does this deliverable, and the activities that have fed into it, comply with Regulation (EU) 2016/679 known as GDPR and 2002/58/EC Directive on privacy and electronic communications?	x		
c	Does this deliverable, and the activities that have fed into it, comply with the relevant national data protection and privacy laws, codes of practice and guidelines?	x		
d	Are there any ethics risk identified related to your work under this deliverable?		X	
1	**Human Participation/ Informed Consent**			
1.1	**Procedures and criteria that will be used to identify/recruit research participants** (D9.1)			
a	Did the research for this deliverable involve the recruitment of research participants? *(this includes surveys and interviews)*	X		
b	Did you identify selection, inclusion, & exclusion criteria?	X		
1.2	**Recruitment of respondents via social media** (D9.4)			
b	Were special measures taken to ensure that the participants are adults?		x	
c	Did the research for this deliverable involve data collection using social media?		x	
d	Were measures taken to use only public profiles for the collection of data?		x	

		yes	no		yes	no	n/a
1.3	**Use of the informed consent forms and Info sheets to recruit research participants** (D9.2)						
a	Consent Form was issued		x	Issued in local language			
b	Information sheet was issued		x				
c	Combined sheet was issued	x				x	
1.4	**Use of the informed consent forms and information sheets on data processing** (D9.9)						
a	Consent Form was issued		x	Issued in local language			
b	Information sheet was issued		x				
c	Combined sheet was issued		x				
2	**Organizational measures**						
2.1	**Data Protection Officer or contact person** (D9.5)						
a	Do you have a Data Protection Officer or contact person for participants?				x		
b	Was this contact mentioned on the Informed Consent Forms?					x	
3	**Technical measures**						
3.1	**Technical safeguard mechanisms for handling of personal data (PD) and special categories of personal data (SCOPD)** (D9.6 / D9.8) (SCOPD include information such as ethnic origin, political opinions, data concerning health, etc. For more details see Article 9(1) GDPR).						
a	Did the research for this deliverable involve the collection of SCOPD? (D9.6)					x	
b	Which mechanisms were used to safeguard the personal data collected?						
	pseudonymisation			anonymization			
	encryption			other *(specify in the line below)*			
	access restriction						
3.2	**Data minimisation** (D9.7)						
a	Has as little as possible data been collected throughout the research process?				x		
b	If more data was collected than initially needed, did you ensure the data was deleted?				x		
3.3	**Data profiling** (D9.10)						
a	Was or will the data collected in the deliverable be used for data profiling?					x	
b	Were all data subjects informed of the profiling and its possible consequences? (as part of the Inform Consent Form and the Information Sheet)					x	
c	Were sufficient measures in place to safeguard their fundamental rights?					x	
3.4	**Processing of previously collected personal data** (D9.11)						
a	Did you obtain consent to use personal data from previously executed research?					x	
b	Are technical/organisational measures required to safeguard the rights and freedoms of the data subject according to EU and national legislation in place in your organisation?					x	
4	**Other Issues of ethical concern**						
a	Were there any other ethical considerations detected during the work of this deliverable that are not covered by the list above?					x	
b	If yes, please list the concerns below and elaborate on the related counter measures in the methodology section of this document						

_5	Opinions/approvals provided by ethics committees and other experts								
5.1	**Following documents received opinions/approvals provided by ethics committees and other experts for the research conducted for this deliverable.**								
			yes	no		yes	no	n/a	
a	Informed Consent Forms and Information sheet	IEB			EEA				
		DPO	x		LEB				
b	Questionnaires / Surveys	IEB			EEA				
		DPO	X		LEB				
c	Design /Methodology of research activity	IEB			EEA				
		DPO	x		LEB				

VIII. Annex 2 - Acknowledgments

The authors would wish to thank and express gratitude to the interviewees, listed below.

Marianne Perez, Buenos Aires
Advocate of UNDRR Making Cities Resilient Campaign, National Secretary of Tourism – Leader of the Resilience Tourism Unit of work

Gaston Fimerpin, Buenos Aires
General Coordinator of the National Centre for the reduction of disasters (CENARRID)

Mauricio Saldivar, Buenos Aires
Advocate of UNDRR Making Cities Resilient Campaign in Argentina
Director of the Early Warning System for the City of Buenos Aires
Director of the Hydro-meteorological department in the City of La Plata

David Groisman, Buenos Aires
Chief Resilience Officer (CRO) 100 RESILIENT CITIES INITIATIVE – Local Government of Buenos Aires

Abdou Sane, Dakar
Advocate of the UNDRR Making Cities Resilient Campaign
Advisor to one of the General Director on DRR and Sustainable Development at the Environment Ministry.
Local Government Member – President of the Committee for DRR.

Simon Gusah, Lagos
Former Chief Resilience Officer in the City of Lagos, under the 100 Resilient Cities Campaign – Rockefeller Foundation.
Team Leader for the initiative Future Cities Nigeria founded by UK Global Pprosperity Ffund

Norlang Garcia & Mariana Olvera, Mexico City
Chief Resilience Officer, Metropolitan Director for Resilience

Prof. Javier Gonzales Mueller, Montevideo
Advocate of UNDRR Making Cities Resilient Campaign in Uruguay
International consultant on DRR

Albert Pascual, Panama City
UNDRR Advocate of Making Cities Resilient Global Campaign
Founder and Director of the NGO called: Fundación CoMunidad

David Jacome, Quito
Chief Resilience Officer, Metropolitan Director of Resilience

Ana Lucy Bengochea, Trujillo
Head of UMGIR (Disaster Risk Reduction and Management unit of work)

Hector Mendoza, Trujillo
Mayor City of Trujillo

Jeff Dulin, USA
International Association of fire Chiefs, USA and Canada

Dan Stephens QFSM
Chief Commander Melbourne Fire Brigade, Australia

IX. Annex 3 - Interview Framework

Expert details
Expert name:
Role of Expert:
Background questions
1. What organisation do you work for?
2. Can you briefly describe your own role in your organisation?
3. What is the role of your organisation in relation to the different phases of an emergency; • Mitigation (reduce loss of life and property by lessening the impact of emergencies)? • Preparation (planning, organizing, training, equipping, exercising, evaluating, and taking corrective action)? • Response (reaction to the occurrence of a catastrophic disaster or emergency)? • (Early) recovery (restore critical community functions and begin to manage stabilization efforts)?
Theme 1: Resilience concept and measures
1. In your own words, how would your organisation define what is meant by 'resilience'?

2. A common and general definition of resilience is ***"the ability to endure or bounce back quickly from adverse conditions."*** Others use the definition: ***"Disaster resilience is the ability of individuals, communities, organisations and states to adapt to and recover from hazards, shocks or stresses without compromising long-term prospects for development"***

- Do either of these two definitions more accurately reflect the understanding within your own organisation?

- Is anything fundamental missing from these definitions?

3. When improving resilience, can you comment on which factors of social, economic, demographic and physical context feature most highly in your organisation's support?

- A whole city or local communities?

- Particular social groups?

- Groups most affected by different types of risks or emergencies?

Theme 2: Actual and perceived risks and vulnerabilities

1. In your region, what would you say are the main challenges (risks, hazards) to the general population?

- What steps are taken to address these challenges?

2. To what extent are citizens in your region more or less vulnerable / resilient asa result of their age, gender, socio economic status, social capital, ethnicity or their awareness of risk? Is this taken into consideration in any way in preparing for or responding to emergencies?
Theme 3: Real incident and role resilience
1. Can you provide any examples of national / international emergencies where trained or created resilience resulted in an improved outcome for those affected?
Theme 4: citizen and community involvement
1. From your experience, what difference can increasing the direct involvement of citizens and local communities in their own resilience make to improved outcomes?
Contacts and data sources
1. Are you aware of any national or thematic studies that have been undertaken to consider improvements in community resilience resulting from either national risk assessments or previous incidents?
2. Can you suggest anyone else we should talk with about these topics?
3. Are you interested in receiving information on our project as it evolves over the next few years? If so, ask we'll collect your contact details and agreement to be contacted by email

Secondary question list (to be asked in call)

Background
1. Have you been/are you involved in any projects that aim at disaster risk reduction/ improvement of resilience? What were the key success factors and what the lessons learned?
Theme 3: Real incident and role resilience
1 Where you were directly involved in an emergency, big incident, disaster, can you shortly describe what happened? If possible, please describe a simple timeline and the involvement of other stakeholders
2 What was your role in the above described situation?
3 What elements of resilience appeared to be crucial in during and in the aftermath of the incident?
4 What lessons were learned after the incident regards to resilience?
Please replicate the questions in the theme for other incidents that showed other elements of resilience?

X. Annex 4 - Project Assessment Template

Name of project	
Main aim(s) of project	
Website(s)	
Start / end dates	
Funding stream	☐ Horizon 2020 ☐ FP7 ☐ Other:
Geographic area	☐ Europe ☐ USA ☐ Other:
Main outputs	☐ Literature review – topics (please specify): ☐ Case studies – details (please specify – where? What?): ☐ Tool/Application – details (please specify – type of tool?): ☐ Indicators – details (please specify – types of indicators?): ☐ Other (please specify):
Types of resilience	☐ Critical infrastructure ☐ Urban ☐ Social/community ☐ Other (please specify):
Phase in Disaster Risk Reduction	☐ Mitigation ☐ Preparation ☐ Response ☐ Recovery ☐ Adaptation / Transformation
Resilience definition(s)	
Other related concepts	
Evaluative comments	
Other notes	

XI. Annex 5 - Compendium of Indicators

100 Resilient cities

Pillars/ dimensions

1 Health & Wellbeing;
2 Economy & Society;
3 Infrastructure & Environment; and
4 Leadership & Strategy.

Indicator Topic

1.1 Safe and accessible housing Housing
1.2 Adequate affordable energy supply Utilities - Energy
1.3 Inclusive access to safe drinking water Utilities - Water Supply
1.4 Effective Sanitation Utilities - Drainage & Sanitation
1.5 Sufficient affordable food supply Food
2.1 Inclusive labour policies Employment & Labour
2.2 Relevant skills and training Education & Training
2.3 Dynamic local business development and innovation Business, Finance & Economy
2.4 Supportive financing mechanisms Business, Finance & Economy
2.5 Diverse protection of livelihoods following a shock Employment & Labour
3.1 Robust public health systems Health
3.2 Adequate access to quality healthcare Health
3.3 Emergency medical care Health
3.4 Effective emergency response services Disaster management

Economy and Society

4.1 Local Community Support Support & welfare
4.2 Cohesive communities Citizen participation and awareness
4.3 Strong city-wide identity and culture Culture
4.4 Actively engaged citizens Citizen participation and awareness
5.1 Effective systems to deter crime Crime and Policing
5.2 Proactive corruption prevention Crime and Policing
5.3 Competent policing Crime and Policing
5.4 Accessible criminal and civil justice Legal and justice
6.1 Well-managed public finances Budget
6.2 Comprehensive business continuity planning Business, Finance & Economy
6.3 Diverse economic base Business, Finance & Economy
6.4 Attractive business environment Business, Finance & Economy
6.5 Strong integration with regional and global economies Business, Finance & Economy

Infrastructure and Ecosystems

7.1 Comprehensive hazard and exposure mapping Disaster management
7.2 Appropriate codes, standards and enforcement Urban planning
7.3 Effectively managed protective ecosystems Environment
7.4 Robust protective infrastructure Protective infrastructure
8.1 Effective stewardship of ecosystems Environment
8.2 Flexible infrastructure Utilities

Health and Wellbeing

8.3 Retained spare capacity Utilities
8.4 Diligent maintenance and continuity Utilities
8.5 Adequate continuity for critical assets and services Utilities
9.1 Diverse and affordable transport networks Transport
9.2 Effective transport operation & maintenance Transport
9.3 Reliable communications technology ICT

9.4 Secure technology networks ICT

Leadership and Strategy

10.1 Appropriate government decision-making Governance
10.2 Effective co-ordination with other government bodies Governance
10.3 Proactive multi-stakeholder collaboration Governance
10.4 Comprehensive hazard monitoring and risk assessment Disaster management
10.5 Comprehensive emergency management Disaster management
11.1 Adequate education for all Education
11.2 Widespread community awareness and preparedness Disaster management
11.3 Effective mechanisms for communities to engage with government Citizen participation and awareness
12.1 Comprehensive city monitoring and data management City data
12.2 Consultative planning process Urban planning
12.3 Appropriate land use and zoning Urban planning
12.4 Robust planning approval process Urban planning

Making Cities Resilient Campaign

Essential 01: Organize for Resilience

P1.1 Does the City master plan (or relevant strategy/plan) adopt the Sendai Framework?
P1.2 Is there a multi-agency/sectoral mechanism with appropriate authority and resources to address disaster risk reduction?
P1.3 Is resilience properly integrated with other key city functions / portfolios?

Essential 02: Identify, Understand and Use Current and Future Risk Scenarios

P2.1 Does the city have knowledge of the key hazards that the city faces, and their likelihood of occurrence?
P2.2 Is there a shared understanding of risks between the city and various utility providers and other regional and national agencies that have a role in managing infrastructure such as power, water, roads and trains, of the points of stress on the system and city scale risks?
P2.3 Are their agreed scenarios setting out city-wide exposure and vulnerability from each hazard, or groups of hazards (see above)?
P2.4 Is there a collective understanding of potentially cascading failures between different city and infrastructure systems, under different scenarios?
P2.5 Do clear hazard maps and data on risk exist? Are these regularly updated?

Essential 03: Strengthen Financial Capacity for Resilience

P3.1 The city / lead agencies understand all sources of funding, and the “resilience dividends”, are well connected, understand all available routes to attract external funding and are actively pursuing funds for major resilience investments.
P3.2 Does the city have in place a specific ‘ring fenced’ (protected) budget, the necessary resources and contingency fund arrangements for local disaster risk reduction (mitigation, prevention, response and recovery)?
P3.3 What level of insurance cover exists in the city, across all sectors – business and community?
P3.4 What incentives exist for different sectors and segments of business and society to support resilience building?

Essential 04: Pursue Resilient Urban Development

P4.1 Is the city appropriately zoned considering, for example, the impact from key risk scenarios on economic activity, agricultural production, and population centres?
P4.2 Are approaches promoted through the design and development of new urban development to promote resilience?

P4.3 Do building codes or standards exist, and do they address specific known hazards and risks for the city? Are these standards regularly updated?
P4.4 Are zoning rules, building codes and standards widely applied, properly enforced and verified?

Essential 05: Safeguard Natural Buffers to Enhance the Protective Functions Offered by Natural

Ecosystems

P5.1 Beyond just an awareness of the natural assets, does the city understand the functions (or services) that this natural capital provides for the city?
P5.2 Is green and blue infrastructure being promoted on major urban development and infrastructure projects through policy?
P5.3 Is the city aware of ecosystem services being provided to the city from natural capital beyond its administrative borders? Are agreements in place with neighbouring administrations to support the protection and management of these assets?

Essential 06: Strengthen Institutional Capacity for Resilience

P6.1 Does the city have clear access to all the skills and experience it believes it would need to respond to reduce risks and respond to identified disaster scenarios?
P6.2 Does a co-ordinated public relations and education campaign exist, with structured messaging and channels to ensure hazard, risk and disaster information (that can be understood and used) are properly disseminated to the public?
P6.3 Extent to which data on the city's resilience context is shared with other organizations involved with the city's resilience.
P6.4 Are there training courses covering risk and resilience issues offered to all sectors of the city including government, business, NGOs and community?
P6.5 Are training materials available in the majority of languages in common use in the city?
P6.6 Is the city proactively seeking to exchange knowledge and learn from other cities facing similar challenges?

Essential 07: Understand and Strengthen Societal Capacity for Resilience

P7.1 Are "grassroots" or community organizations participating in risk reduction and post-event response for each neighbourhood in the city?
P7.2 Are there regular training programmes provided to the most vulnerable populations in the city?
P7.3 What proportion of businesses have a documented business continuity plan that has been reviewed within the last 18 months?
P7.4 How effective is the city at citizen engagement and communications in relation to DRR?

Essential 08: Increase Infrastructure Resilience

P8.1 Is critical infrastructure resilience a city priority, does the city own and implement a critical infrastructure plan or strategy?
P8.2 Is existing protective infrastructure well-designed and well-built based on risk information?
P8.3 Would a significant loss of service for these two essential services be expected for a significant proportion of the city under the agreed disaster scenarios?
P8.4 Would a significant loss of service be expected for a significant proportion of the city in the 'worst case' scenario event? In the event of failure would energy infrastructure corridors remain safe (i.e. free from risk of leaks, electrocution hazards etc.)?
P8.5 Would a significant loss of service be expected for a significant proportion of the city in the 'worst case' scenario event? In the event of failure would transport

infrastructure corridors remain safe (i.e. free from risk of flood, shocks etc) and passable?
P8.6 Would a significant loss of service be expected for a significant proportion of the city in the 'worst case' scenario event?
P8.7 Would there be sufficient acute healthcare capabilities to deal with expected major injuries in 'worst case' scenario?
P8.8 % of education structures at risk of damage from "most probable" and "most severe" scenarios
P8.9 Will there be sufficient first responder equipment, with military or civilian back up as required?

Essential 09: Ensure Effective Disaster Response

P9.1 Does the city have a plan or standard operating procedure to act on early warnings and forecasts? What proportion of the population is reachable by early warning system?
P9.2 Is there a disaster management / preparedness / emergency response plan outlining city mitigation, preparedness and response to local emergencies?
P9.3 Does the responsible disaster management authority have sufficient staffing capacity to support first responder duties in surge event scenario?
P9.4 Are equipment and supply needs, as well as the availability of equipment, clearly defined?
P9.5 Would the city be able to continue to feed and shelter its population postevent?
P9.6 Is there an emergency operations centre, with participation from all agencies, automating standard operating procedures specifically designed to deal with "most probable" and "most severe" scenarios?
P9.7 Do practices and drills involve both the public and professionals?

Essential 10: Expedite Recovery and Build Back Better

P10.1 Is there a strategy or process in place for post-event recovery and reconstruction, including economic reboot, societal aspects etc.?
P10.2 Do post-event assessment processes incorporate failure analyses and the ability to capture lessons learned that then feed into design and delivery of rebuilding projects?

Making Cities Resilient Campaign - extended

Essential 01: Organize for Resilience

1.1.1 Risk consideration in plan making.
1.1.2 Consultation in plan making.
1.1.3 Review of strategic plans.
1.2.1 Pre-event planning and preparation.
1.2.2 Co-ordination of event response.
1.2.3 City resources for managing organisation, co-ordination and participation.
1.2.4 Identification of physical contributions.
1.3.1 Integration of disaster resilience with other initiatives.
1.4.1 Extent to which data on the city's resilience position is shared with other organizations involved with the city's resilience.

Essential 02: Identify, Understand and Use Current and Future Risk Scenarios

2.1.1 Knowledge of hazards (also called perils, or shocks and stresses) that the city faces, and their likelihood.
2.2.1 Knowledge of exposure and vulnerability.
2.2.2 Damage and loss estimation.
2.3.1 Understanding of critical assets and the linkages between these.
2.4.1 Hazard maps.
2.5.1 Update process.

Essential 03: Strengthen Financial Capacity for Resilience

3.1.1 Awareness and knowledge of all possible methods of financing and funding, as
3.2.1 Adequacy of financial planning for all actions necessary for disaster resilience.
3.2.2 Capital funding for long run engineering and other works that address scenarios and critical assets identified in Essentials 2 and 8.
3.2.3 Operating funding to meet all operating costs of disaster resilience activities.
3.2.4 Contingency fund(s) for post disaster recovery (may be referred to as a “rainyday fund”).
3.3.1 Domestic insurance coverage.
3.3.2 Non-domestic insurance coverage.
3.4.1 Incentives to businesses organizations to improve disaster resilience – disaster plans, premises etc.
3.4.2 Incentives to non-profit organizations to improve disaster resilience – disaster plans, premises etc.
3.4.3 Incentives to homeowners to improve disaster resilience – disaster plans, premises etc.

Essential 04: Pursue Resilient Urban Development

4.1.1 Potential population displacement.
4.1.2 Economic activity at risk.
4.1.2. 1 Economic activity at risk.
4.1.3 Agricultural land at risk.
4.2.1 New urban development.
4.3.1 Existence of building codes designed to address risks identified in Essential 2.
4.3.2 Updates to building codes.
4.3.3 Sustainable building design standards.
4.4.1 Application of land use zoning.
4.4.2 Application of building codes.
5.1.1 Awareness of the role that ecosystem services may play in the city’s disaster resilience.
5.1.2 Ecosystem health.
5.2.1 Impact of land use and other policies on ecosystem services.
5.2.2 Green and blue infrastructure is routinely embedded into city projects.
5.3.1 Identification of critical environmental assets.
5.3.2 Transboundary agreements.

Essential 06: Strengthen Institutional Capacity for Resilience

6.1.1 Availability of skills and experience in disaster resilience – risk identification, mitigation, planning, response and post event response.
6.1.2 Private sector links.
6.1.3 Engagement of the insurance sector.
6.1.4 Civil society links.
6.2.1 Exposure of public to education and awareness materials/messaging.
6.2.1.1 Exposure of public to education and awareness materials/messaging.
6.3.1 Extent to which data on the city’s resilience position is shared with other organizations involved with the city’s resilience.
6.3.2 Extent to which data on the city’s resilience position is shared with the community organizations and public.
6.4.1 Availability, take-up of training focussed on Risk and Resilience (Professional Training).
6.4.1.1 Availability, take-up of training focussed on Risk and Resilience (Professional Training).
6.4.2 System / process for updating relevant training.
6.5.1 Accessibility of education and training to all linguistic groups in the city.

6.6.1 Effort taken to learn from what other cities, states and countries (and companies) do to increase resilience.

Essential 07: Understand and Strengthen Societal Capacity for Resilience

7.1.1 Coverage of community or “grass roots” organization(s) throughout the city.
7.1.2 Effectiveness of community network.
7.1.2.1 Effectiveness of community network.
7.2.1 Social connectedness and neighbourhood cohesion.
7.2.2 Engagement of vulnerable groups of the population.
7.3.1 Extent to which employers act as a channel with employees.
7.3.2 Business continuity planning.
7.4.1 Frequency of engagement.

Essential 05: Safeguard Natural Buffers to Enhance the Protective Functions Offered by Natural Ecosystems

7.4.2 Use of mobile and e-mail “systems of engagement” to enable citizens to receive and give updates before and after a disaster.
7.4.3 Validation of effectiveness of education.

Essential 08: Increase Infrastructure Resilience

8.1.1 Adequacy of protective infrastructure (Ecosystems can offer a natural buffer – see Essential 5).
8.1.2 Effectiveness of maintenance.
8.2.1 Customer service days at risk of loss.
8.2.2 Designated critical asset service days (for example, service to hospitals or other critical assets) at risk of loss from water or sanitation failure.
8.2.3 Cost of restoration of service.
8.3.1 Customer service days at risk of loss.
8.3.2 Designated critical asset service days at risk of loss from energy failure.
8.3.3 Cost of restoration.
8.4.1 Safety and integrity of gas system (if applicable).
8.4.2 Customer service days at risk of loss.
8.4.3 Designated critical asset service days at risk of loss from gas supply failure.
8.4.4 Cost of restoration of service.
8.5.1 Road – service from road system at risk of loss.
8.5.2 Road – survival of critical access and evacuation routes.
8.5.3 Rail/metro (if applicable) – service from rail system at risk of loss.
8.5.4 Air (if applicable).
8.5.5 River/Sea (if applicable).
8.5.6 Other public transport (if applicable).
8.5.7 Cost of restoration of service (all transport routes).
8.6.1 Service days at risk of loss.
8.6.2 Designated critical asset service days at risk of loss from communications failure.
8.6.3 Cost of restoration.
8.7.1 Structural safety and disaster resilience of health care and emergency facilities (Staffing/ first responders – see Essential 9).
8.7.1.1 Structural safety and disaster resilience of health care and emergency facilities (Staffing/ first responders – see Essential 9).
8.7.2 Health records and data.
8.7.3 Availability of emergency healthcare including facilities and urgent medical supplies for acute needs.
8.8.1 Structural safety of education facilities.
8.8.2 Loss of teaching time.
8.8.3 Education data.
8.9.1 Disaster resilience of prison system.

8.10.1 Assurance of continuity of all critical administration functions.
8.11.1 Assurance of continuity of computer systems and data critical to government continuity.
8.11.2 Assurance of continuity of computer systems and data critical to any of the above infrastructure.

Essential 09: Ensure Effective Disaster Response
9.1.1 Existence and effectiveness of early warning systems.
9.1.1.1 Reach of warning .
9.2.1 Existence of emergency response plans that integrate professional responders and community organizations (For post-event response - see Essential 10).
9.3.1 "Surge" capacity of police also to support first responder duties.
9.3.2 Definition of other first responder and other staffing needs, and availability.
9.4.1 Definition of equipment and supply needs, and availability of equipment.
9.4.1.1 Definition of equipment and supply needs, and availability of equipment.
9.5.1 Likely ability to continue to feed population.
9.5.2 Likely ability to meet needs for shelter/safe places.
9.5.2.1 Likely ability to meet needs for shelter/safe places.
9.5.3 Ability to meet likely needs for staple goods.
9.5.4 Likely availability of fuel.
9.6.1 Interoperability with neighbouring cities/states and other levels of government of critical systems and procedures.
9.6.2 Emergency operations centre.
9.6.3 Coordination of post event recovery.
9.7.1 Practices and rehearsals – involving both the public and professionals.
9.7.2 Effectiveness of drills and training.

Essential 10: Expedite Recovery and Build Back Better
10.1.1 Planning for post event recovery and economic reboot.
10.1.2 Extent to which there has been stakeholder consultation around the 'event recovery and reboot' plans.
10.1.3 Shadow financial arrangements for processing incoming aid and disbursing funds.
10.2.1 Learning loops.

Buenos Aires

Pillars
1 Diversity, gender and coexistence
2 Innovation, Talent and opportunities
3 Environment and sustainability
4 Social and Urban integration
5 Security and Risk Management, which is aligned to the Sendai Framework.

5.1 Know Buenos Aires
5.1.1 Number of communication actions related to climate change and risk management.
5.1.2 Number of neighbours who participated in activities related to raising awareness of floods.

5.2 Schools get ready
5.2.1 Number of schools where the program was implemented.
5.2.2 Number of children who participated in the workshop.
5.2.3 Number of teachers trained in risk management basic knowledge

5.3 Network of residents in the face of climate change
5.3.1 Number of volunteer resident members of the Network.

5.3.2 Number of trained volunteer residents.

5.4 Hydraulic plan
5.4.1 New linear km of rainwater piping.
5.4.2 Percentage of Maximum Flooded Area over total City area.

Essentials (MCRC)
1 Organise for disaster resilience
2 Identify, understand and use current and future risk scenarios.
3 Strengthen financial capacity for resilience.
4 Pursue resilient urban development and design.
5 Safeguard natural buffers to enhance the protective functions offered by natural ecosystems.
6 Strengthen institutional capacity for resilience
7 Understand and strengthen societal capacity for resilience.
8 Increase infrastructure resilience.
9 Ensure effective preparedness and disaster response.
10 Expedite recovery and build back better.

Vulnerability
1 Number of people with disabilities,
2 Levels of access to health services,
3 Levels of access to education, and
4 Employment.

Success indicators
1 Decision makers actively involved in the whole process.
2 Leadership.
3 High level of participation from the different sectors.
4 Budget according to the challenges.
5 A training programme in place covering all sectors and levels.
6 From nothing to have a well level of management and important tools to be more effective saving lives and protecting critical infrastructure.
7 Early warning systems installed and generating important reports.
8 More awareness created across different sectors of the community.
9 Active involvement of local authorities.

Dakar

Community involvement
1 Keeping communities at the heart of solutions to reduce and manage disasters.
2 Ensuring the creation of awareness working at grassroots local and national levels.
3 Investing in capacity building.
4 Exchanges between local actors and the experiences acquired as one of the Advocate of the UNDRR MCR global Campaign.
5 Involving communities in decision-making, project management and implementation.

Mexico City

Pillars
1 Foster regional coordination
2 Promote water resilience as a new paradigm to manage water in the Mexico bassin
3 Plan for urban and regional resilience
4 Improve mobilite through an integrated, safe, and sustainable system
5 Develop innovation and adaptive capacity

Dimensions measured

1 **Health and wellbeing:**
1.1 Minimal human vulnerability
1.2 Diverse livelihoods and employment
1.3 Effective safeguards to human health and life

2 **Economy and Society**
2.1 Collective identity and community support
2.2 Comprehensive security and the rule of law
2.3 Sustainable economy

3 **Infrastructure and ecosystems**
3.1 Reduce exposure and fragility
3.2 Effective provision of critical services
3.3 Reliable mobility and communications

4 **Leadership and Strategy**
4.1 Effective leadership and management
4.2 Empowered stakeholders
4.3 Integrated development planning

Montevideo

Resilience Indicators

1 Coordination and central articulation of the DRR policy among central level institutions (Ministries). Example of an indicator on this area; Number of Ministries integrating DRR policies transversally.
2 Definition of sectoral responsibilities, including other entities in charge of basic public services like water, energy, etc. Example; Progress on the development of water resilience infrastructure.
3 Definition of territorial responsibilities (including the regional and local level) Example; Number of Regions and Municipalities with a DRR Action plan in place.
4 Evidence of progress in implementation. Example; Number of actions executed from the plans.
5 Control, accountability and participation. Example; Number of sectors participating in each region in the process to build resilient communities.

Panama City

Pillars

1 Access to Opportunities
2 Infrastructure of neighbourhoods
3 Rediscovering our wetland city
4 Comprehensive risk management
5 Joint responsibility when building the city

Pillar 1: Access to Opportunities

1.1 Number of km2 built since the completion of the design of the Non-Motorized Mobility Master Plan / year.
1.2 Number of people transported from the last mile to the stops and subway stations associated with the neighbourhoods.
1.3 Number of suppliers entering the system.
1.4 Arrival time for users from the shuttle bus system to their destination.
1.5 Number of reports on traffic violations applied.
1.6 Users' perception of the transportation system.
1.7 Number of regulations reviewed.
1.8 Number of regulations to be implemented.

1.9 Number of consolidation and logistic distribution centres.
1.10 Number of truck parking spaces implemented.
1.11 Number of large-scale trucks found in times of peak vehicle congestion.
1.12 Number of small-scale vehicles found in times of peak vehicle congestion.
1.13 Percentage of progress in the making of an action plan for the design of Metrocable.
1.14 Percentage of progress in the implementation of the plan.

Pillar 2: Infrastructure of neighbourhoods

2.1 Number of buildings identified and refurbished.
2.2 Number of cultural centres built.
2.3 Number of sports fields/courts built.
2.4 Number of people using the infrastructures built or refurbished.
2.5 Number of new social infrastructure projects identified (mobility in neighborhoods, culture, sports, education, healthcare and basic utilities).
2.6 Number of joint processes and actions among centres.
2.7 Number of women served.
2.8 Number of women benefited from the strengthening plans and social rescue.
2.9 Percentage of progress in the construction of healthcare infrastructure for Ernesto Cordoba.
2.10 Percentage of progress in refurbishment of the healthcare centre for Tocumen.
2.11 Number of healthcare centres built.
2.12 Number of healthcare centres refurbished.
2.13 Number of houses benefited from the water supply.
2.14 Number of households benefited from the sustainable electric power systems (solar panels).
2.15 Number of systems implemented.
2.16 Percentage of progress in the infrastructure for water, clean-up and electric power supply.
2.17 Number of storm-water drainage systems maintained.
2.18 Square meters of sidewalks and streets built.
2.19 Number of streetlights fitted. Number of people modifying their means of transport and using the new infrastructure.
2.20 Infrastructure areas for disabled people.

Pillar 3: Rediscovering our wetland city

3.1 Percentage of progress in the implementation of the green infrastructure pilot projects.
3.2 Percentage of flood areas for monitoring effectiveness.
3.3 Retention volume in damping areas during the interventions.
3.4 Annual percentage of progress in the maintenance of green infrastructure.
3.5 Number of pieces of equipment and properties affected by floods.
3.6 Percentage of progress in project execution.
3.7 Coverage area of restored and recovered wetlands.
3.8 Number of people annually benefiting from landscape resource.
3.9 Percentage of progress in clean-up infrastructure.
3.10 Percentage of progress in the making of analyses and maps.
3.11 Number of properties affected by floods.
3.12 Number of proposals of interventions for shock mitigation.
3.13 Number of regulations reviewed and implemented with the technical support of the assessment.
3.14 Number of Environmental Impact Assessments approved for the Tocumen area.
3.15 Percentage of progress in the making of the Municipal Integral Waste Disposal Plan.
3.16 Percentage of execution of the Zero Trash Program.
3.17 Percentage of progress in the implementation of the local plan.
3.18 Number of regulations bound to reduce waste in final disposal.

Pillar 4: Comprehensive risk management

4.1 Percentage of progress in the development of the platform.
4.2 Percentage of progress in the feasibility study and opportunities to apply the system.
4.3 SIG territory coverage percentage of District of Panama
4.4 Number of workshops organized for builders.
4.5 Number of workshops organized for instructors.
4.6 Number of households whose infrastructure has been evaluated.
4.7 Number of inhabitants of the communities participating in the training programs.
4.8 Percentage of progress in pilot programs and making of the Action Plan.
4.9 Number of meetings of the intermunicipal work round table.
4.10 Number of people participating in training and awareness programs on the risks of mudslides and other vulnerabilities.
4.11 Percentage of progress in designing the communications and education plan.
4.12 Percentage of progress in the implementation of the communications and education plan.
4.13 Number of people participating in awareness activities.
4.14 Number of schools and educational centres incorporating risk management in their curricula.
4.15 Percentage of progress in development of the SAT community program.
4.16 Number of level measuring systems installed in basins.
4.17 Number of tools for the SATs applied in mudslide zones.
4.18 Number of technology and surveillance tools prioritized for zones with a higher potential of seismic risk.

Pillar 5: Joint responsibility when building the city

5.1 Number of management reports made and shared.
5.2 Number of opinion surveys conducted.
5.3 Percentage of progress in the pilot bidding process.
5.4 Number and quality of process handbooks made.
5.5 Number of officials trained in processes.
5.6 Percentage of progress in the making of theme modules for training courses.
5.7 Percentage of progress in the drafting of the joint management guide between the Central and Local Governments with an analysis of present instruments and gaps.
5.8 Number of collaboration agreements between municipalities.
5.9 Percentage of execution of the annual work plans.

Quito

Pillars

1 Inclusive and empowered citizens:
2 Robust and Sustainable Environment
3 Integrated and Compact City
4 Resourceful and solid economy
5 Reflective and Safe Territory

Pillar 1: Inclusive and empowered citizens:

1.1 **Encourage co-responsibility between citizens and the municipality through capacity building. Associated to SDGs 1 (No Poverty), 4 (Quality Education), 5 (Gender Equality) and 10 (Reduced inequality).**
1.1.1 Designed and implemented work methodology
1.1.2 Number of identified new stakeholders that participate in the processes
1.1.3 Number of training sessions
1.1.4 Number of civil servants trained

1.2 **Develop institutional mechanisms that enable citizen participation. Associated to SDGs 5 (Gender Equality), 11 (Sustainable Cities and Communities) and 16 (Peace and justice strong institutions).**
1.2.1 Working online platform
1.2.2 Number of platform entries and participation
1.2.3 Number of neighbourhoods with a neighbourhood assembly
1.2.4 Number of neighbourhoods with a set development agenda
1.2.5 Number of participants in participatory budget process
1.2.6 Number of prioritized and completed projects

1.3 **Create quality public spaces for citizens. Associated to SDGs 5 (Gender Equality), 11 (Sustainable Cities and Communities) and 16 (Peace and justice strong institutions).**
1.3.1 Number of projects developed with participatory processes
1.3.2 Number of recovered public spaces
1.3.3 Number of activities organized
1.3.4 Number of attendees per year
1.3.5 Number of implemented campaigns
1.3.6 Number of complaints with a satisfactory response

Pillar 2: Robust and Sustainable Environment
2.1 **Manage natural and semi-natural areas and urban parks in the Metropolitan District of Quito. Associated to SDGs 6, 11, 12, 13 and 15.**
2.1.1 Management model designed and implemented
2.1.2 Number of hectares managed under the models
2.1.3 Number of training workshops
2.1.4 Number of municipal employees trained
2.1.5 Number of designed policies and programs with valued ecosystem contributions
2.1.6 Meters of decontaminated riverbed
2.1.7 Number of recovered hectares
2.2 **Promote environmental awareness. Associated to SDGs 4, 11, 12 and 13.**
2.2.1 Campaign designed and implemented
2.2.2 Audience and impact survey
2.2.3 Campaign designed and implemented
2.2.4 Tons of recycled waste diverted from landfills
2.3 **Take advantage of the benefits of nature in urban infrastructure planning. Associated to SDGs 3, 6, 11, and 13.**
2.3.1 Number of trainings
2.3.2 Number of public and private entities trained
2.3.3 Formulation of regulations on the inclusion of nature-based solutions for mobility systems
2.3.4 Number of green infrastructure projects implemented

Pillar 3: Integrated and Compact City
3.1 **Control urban sprawl. Associated to SDGs 1, 11 and 13**
3.1.1 Designed and implemented mechanisms
3.1.2 Number of projects co-managed between the Municipality and the community in the identified areas.
3.1.3 Study of the operation of land markets
3.1.4 Design and implementation of land use management policies
3.1.5 Tool developed and operational
3.1.6 Number of unregulated structures identified with the tool
3.2 **Maximize the impact of the first Quito Metro line on the city's development. Associated to SDGs 3, 5, 7, 9 and 11**
3.2.1 Developed and validated plan

3.2.2 Metropolitan ordinances developed and implemented
3.2.3 Pilot plans implemented as part of the implementation process
3.2.4 Developed and validated plan
3.2.5 Validated ordinance
3.2.6 Number of urban operations carried out
3.2.7 Developed and validated plan
3.2.8 Approved metropolitan ordinance
3.2.9 Developed and validated plan
3.2.10 Existing regulation instrument
3.2.11 Number of projects developed with incentives
3.2.12 Campaigns implemented
3.2.13 Target audiences
3.2.14 Users' satisfaction
3.2.15 Satisfaction of users with special needs
3.3 **Achieve an integrated and efficient transportation system. Associated to SDGs 3, 7, 9, 11 and 13**
3.3.1 Number of modifications in the mobility system of the city using the evaluation table
3.3.2 Integration of the model with the mobility master plan
3.3.3 Proposed integration plan incorporated into the city mobility scheme
3.3.4 Level of user satisfaction
3.3.5 Number of buses purchased that meet environmental standards
3.4 **Promote active transportation in the city. Associated to SDGs 3, 4, 5, 11, 12 and 13.**
3.4.1 Launched contest
3.4.2 Number of projects adopted by the municipality as a base for pedestrian infrastructure improvements
3.4.3 Pilot implementation
3.4.4 User satisfaction survey
3.4.5 Designed and implemented program
3.4.6 Number of public bicycle users

Pillar 4: Resourceful and solid economy
4.1 **Create an economic environment conducive for strengthening labour supply and demand. Associated to SDGs 1, 4, 5, 8 and 10**
4.1.1 Completed study
4.1.2 Number of programs and projects that push for inclusive and quality jobs
4.1.3 Developed study
4.1.4 Number of programs and projects of capacity reinforcement
4.1.5 Completed study
4.1.6 Number of implemented job placement programs and projects
4.2 **Foster a diversified, sustainable, and innovative economy. Associated to SDGs 8, 9, 11 and 12**
4.2.1 Designed and implemented program
4.2.2 Number of circular economy entrepreneurships
4.2.3 Principles incorporated in the city's innovation agenda
4.2.4 Number of new lines of businesses with the ability to create jobs and revenue under these principles
4.2.5 Implementation of ZEDE
4.2.6 Number of companies based in the ZEDE area
4.2.7 Ordinance enactment
4.2.8 Implementation of the ordinance
4.3 **Promote the food economy as a foundation for development. Associated to SDGs 1, 2, 5, 8 and 12.**
4.3.1 Developed and implemented plan
4.3.2 Number of implemented programs to strengthen

4.3.3 the city's food system
4.3.4 Developed and implemented mechanisms
4.3.5 Tons of food produced
4.3.6 Number of people participating in urban agriculture
4.3.7 Extension of gardens
4.3.8 Development and implementation of the program
4.3.9 Number of hectares cultivated under sustainability principles

Pillar 5: Reflective and Safe Territory
5.1. **Avoid the creation of new risks. Associated to SDGs 11**
5.1.1 Platform Implemented
5.1.2 Number of points of access to the platform
5.1.3 Number of officials trained
5.1.4 Development and implementation of multisector risk reduction policies
5.1.5 Developed and implemented program
5.1.6 Number of certified builders
5.1.7 Guide developed and adopted
5.1.8 Number of recognized and improved houses
5.1.9 Implemented mobile office
5.1.10 Number of processes in mobile offices
5.1.11 Architecture and urbanism standards reformed and approved
5.1.12 Number of buildings with universal accessibility
5.1.13 Study included in the territorial management tools of the city
5.2 **Mitigate existing risks. Associated to SDGs 5 and 11**
5.2.1 Designed and developed program
5.2.2 Number of trained officials for evaluation
5.2.3 Number of buildings evaluated
5.2.4 Number of elements evaluated
5.2.5 Designed and developed program
5.2.6 Number of people trained
5.2.7 Number of reinforced buildings
5.3 **Prepare the Metropolitan District of Quito to address threats. Associated to SDGs 4, 5 and 11**
5.3.1 Designed and developed program
5.3.2 Number of neighbourhoods where the program has been implemented
5.3.3 Program designed and approved
5.3.4 Number of volunteer networks and number of registered volunteers
5.3.5 Number of campaigns carried out
5.3.6 Campaign impact survey
5.3.7 Insurance system designed
5.3.8 Number of buildings insured

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