

# Climate Smart Risk Reduction in Urban areas: A Review of factors for integrating Disaster Risk Reduction and Climate Change Adaptation within the context of urban Resilience

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## Abstract

In recent years, the drawbacks of parallel systems in Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) have been acknowledged in professional and academic communities, where the need for integration of the two fields in connection to development has been stressed. In this regard, the concept of resilience as an antithesis of risks has also been considered. In this study, a scoping study identified and summarized the challenges and facilitating measures for improving the integration of DRR and CCA in support of urban resilience. As the main measures facilitating the integration of DRR and CCA, the results indicated different aspects, including developing a shared policy vision, developing multi-level, cross-sectoral collaboration, as well as developing communication channels and flexible funding mechanisms and legislation. The results also revealed the lack of a coherent perspective and definition on the integration of DRR and CCA. Further, the findings of the scoping study were used as an analytical lens and basis for a content analysis of a guiding document and six city resilience strategies developed in the 100 Resilient Cities movement. The content analysis found that many of the measures for integration were considered in the cities' resilience strategies. However, there is a need to put more focus on the legislation and funding mechanisms in strategies. Moreover, the generic property of the measures makes them relevant for integration of various fields and could not be considered as specific to DRR and CCA integration. The study highlighted the need to develop a nexus of relevant fields where urban planning could be a core and catalyst for the integration of DRR and CCA in support of urban resilience.

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## **Abbreviations and Acronyms**

CCA	Climate Change Adaptation
CCM	Climate Change Mitigation
CRF	City Resilience Framework
CRO	Chief Resilience Officer
CRS	City Resilience Strategy
CSDRM	Climate Smart Disaster Risk Management
DRR	Disaster Risk Reduction
DRM	Disaster Risk Management
100RC	100 Resilient Cities

## List of Figures

Figure 1: The applied search string in Scopus .....	6
Figure 2: Overview of study selection and charting data.....	8
Figure 3: Different perspectives on integration of DRR and CCA and development.....	11

## List of Tables

Table 1: Challenges to integration of DRR and CCA in urban development and facilitating factors for overcoming the challenges.....	18
Table 2: Themes for the content analysis of the 100RC documents.....	26
Table 3: Coding Questions used for the content analysis of selected city resilience strategies.....	27
Table 4: Connection between the qualities of a resilient system (based on CRF) and measures for the integration of DRR and CCA (based on scoping study).....	29
Table 5: Overview, content analysis of CRSs based on coding questions.....	30

## Contents

1. Introduction.....	1
2. Background.....	2
3. Methodology.....	5
3.1. Scoping study.....	5
3.2. Content Analysis.....	9
4. Results.....	10
4.1. Results of the Scoping Study.....	10
4.1.1. The notions of DRR and CCA integration.....	10
4.1.2. Challenges to the integration of DRR and CCA in urban areas and measures to overcome them.....	11
4.1.3. How the integration of DRR and CCA is connected to urban resilience.....	23
4.2. Results of the content analysis.....	25
4.2.1. Results of the content analysis of the CRF.....	28
4.2.2. Results of the content analysis of CRSs.....	29
5. Discussion.....	42
5.1. Discussion on the scoping study.....	42
5.1.1. Various perspectives on the integration of DRR and CCA.....	42
5.1.2. How specific are the measures for the integration of DRR and CCA?.....	42
5.1.3. Developing a nexus for integration.....	43
5.1.4. Resilience in connection to the integration of DRR and CCA.....	43
5.2. Discussion on the results of the content analysis of 100RC movement documents.....	43
5.2.1. The integration of DRR and CCA in the 100RC movement.....	43
5.2.2. The performative aspect of the city resilience strategy in connection to Multi-stakeholder collaboration.....	44
5.2.3. The stand-alone projects in a resilience strategy.....	44
5.2.4. Integration of DRR and CCA as a term for improving synergy.....	45
5.3. Limitations and validity of the study.....	45
Conclusion.....	47
References.....	49
Annex.....	54

## 1. Introduction

In recent years, academic and professional communities have stressed the need to integrate Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) (Rivera & Wamsler, 2014; Forino, Meding, Brewer, & Niekerk, 2017). A so-called Climate Smart Disaster Risk Management (CSDRM) approach has been proposed to support the integration of DRR and CCA and the development of more coherent strategies (Harris, Seballos, Silva Villanueva, & Curmi, 2012).

CCA and DRR have the common aim to reduce the impacts of climate-related hazards and to improve resilience toward risk (Solecki, Leichenko, & O'Brien, 2011). Yet, they belong to different communities, and their efforts have been developed separately (Galderisi, 2017; Solecki et al., 2011). The disconnected development of CCA and DRR bring disadvantages in terms of parallel structures, duplication of efforts and competition for limited resources (Becker, Abrahamsson, & Hagelsteen, 2013). The separated fields can also impose negative effects (like maladaptation) on each other's work in the medium and long term (Birkmann et al., 2013; Birkmann & von Teichman, 2010).

Integration of DRR and CCA in urban areas is receiving more attention. From an international standpoint, the Hyogo framework for action and Sendai framework as well as the Intergovernmental Panel on Climate Change (IPCC) encourage integrating DRR, CCA and land use planning (ISDR, 2005; O'Brien et al., 2012; United Nations, 2015). While urban planning communities are responding to climate change and disaster risk, the efforts in this field are new. Nevertheless, there seems to be a gap in knowledge regarding how urban areas may become disaster resilient from integrating DRR and CCA practices.

As a contribution to overcoming this gap, this study aims at scoping academic literature to identify factors which are instrumental for improving the integration of DRR and CCA in support of urban resilience. The thesis also encompasses an investigation of the subject in practice. The 100 Resilient Cities (100RC) movement has been selected as a study case to analyze if and in what respects the 100RC movement's framework and strategies are addressing and supporting the integration of DRR and CCA.

To address these aims, the main question of this study is: How can DRR and CCA be integrated in order to foster urban resilience? The objective to compare the practical cases with theoretical findings has also promoted the following sub-questions:

1. What is known from academic literature regarding the challenges and facilitating factors for integrating DRR and CCA in support of urban resilience?
2. Do strategies and policy documents of the 100RC movement reflect the identified success factors for the integration of DRR and CCA and, if so, in what respects?

The remainder of this thesis is structured as follows. The next section provides a summary of definitions on main concepts related to the topic of the thesis and a brief introduction on the



100RC movement. Section 3 presents the methodology underpinning the scoping study and content analysis, whilst the results of these efforts are presented in section 4. The validity, reliability, and implications of these results are discussed in section 5, whereas the main findings related to the research questions are presented in the concluding section of the thesis.

## **2. Background**

In this chapter, the main concepts related to the topic of the thesis are explained. DRR, CCA, integration, and governance, resilience and urban resilience are the main concepts which are broadly used in this thesis. A brief introduction to the 100RC movement completes this chapter.

### **Disaster Risk Reduction (DRR)**

DRR has been defined as "the concept and practice of reducing disaster risks through efforts to analyze and manage the causal factors of disasters" (UNISDR, 2009, p. 10). It aims to target different types of disaster risks, including those related to the management of land and environment, which put it in an interdisciplinary position.

### **Climate Change Adaptation (CCA)**

The IPCC defines Climate Adaptation as "a process of adjustment to actual or expected climate and its effects in order to either lessen or avoid harm or exploit beneficial opportunities" (Pachauri et al., 2014, p. 76).

Putting the concept in relation to human systems, CCA has been defined as "a process in natural systems to adjust to the actual climate, and its effects and a process in human system to adjust to the actual expected changing climate and its effects, in order to moderate harm or exploit beneficial opportunities" (Pilli-Sihvola & Väätäinen-Chimpuku, 2016, p. 461).

### **Integration**

Integration is defined as "part of a mainstreaming process, where mainstreaming involves modifications to specific, core operations in order to incorporate and indirectly act upon new aspects or topics" (Rivera & Wamsler, 2014, p. 79).

Considering cities as complex systems, integration also entails "bringing together bottom-up and top-down strategies focused on social, infrastructural and institutional targets with the knowledge that risk comes from the weakest link" (Birkmann et al., 2013, p. 190).

## **Governance**

The concept of governance is often mentioned in relation to the need and outlooks of integrating CCA and DRR. "Governance includes actors, their interactions, networks, and goals, as well as those instruments actors use to solve public issues and to create opportunities within a specific sector, area or context" (Forino, Von Meding, & Brewer, 2018, p. 259).

## **Climate Smart Risk Management approach**

As an approach supporting disaster managers and corresponding organizations, climate smart risk management approach promotes tackling disaster, poverty and adaptation through improved integration among DRR, CCA and development (Harris et al., 2012).

## **Resilience**

As an antithesis of all kinds of risks, "resilience" has been proposed as an inclusive term, encompassing DRR as well as CCA (Thomalla, Downing, Spanger-siegfried, & Han, 2006; Wamsler, Brink, & Rivera, 2013). Resilience has been defined 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" (UNISDR, 2009, p. 24).

A disaster resilient city (in relation to both disaster risks and climate change) has been defined as a city that "has managed to successfully support measures to strengthen the capacity of individuals, communities, and institutions to (a) reduce or avoid current and future hazards; (b) reduce current and future susceptibility to hazards; (c) establish functioning mechanisms and structures for disaster response; and (d) establish functioning mechanisms and structures for disaster recovery" (Wamsler et al., 2013, p. 7). The 100RC movement 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" (100 Resilient Cities, 2019).

## **The 100 Resilient Cities movement**

The Rockefeller Foundation started promoting the concept of resilient cities through the Asian Cities Climate Change Resilience Network (ACCCRN) in 2008. The ACCCRN program targeted ten small and medium-size cities in Asia to achieve capacity building, developing a network for knowledge and learning and scaling up the initiative in target countries<sup>1</sup> (The Rockefeller Foundation, 2014). In 2013, however, the Rockefeller Foundation decided to extend the program to a global scale and launched the 100RC

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<sup>1</sup> Bangladesh, India, Indonesia, the Philippines, Thailand, and Vietnam are the member countries in ACCCRN program.

movement. The selection criteria for member cities were innovative mayors, having been recent catalysts for change and experience in working in partnership with other cities. The 100RC movement supports its member cities to become more resilient to physical, social and economic challenges (100 Resilient Cities, 2019).

The movement considers four dimensions consisting of health and wellbeing, economy and society, infrastructure and environment and leadership and strategy. In each dimension, three drivers are defined as necessary for resilience. The drivers for each dimension are:

- health and wellbeing (providing basic needs, supporting livelihoods and employment, ensuring public health services)
- economy and society (cohesive and engaged communities, social stability, security and justice and economic prosperity)
- Infrastructure and environment (protective natural and human-made assets, continuity of critical services, reliable communication and mobility)
- leadership and strategy (leadership and effective management, broad range of empowered stakeholders and long-term and integrated planning) (See annex for details).

Moreover, seven qualities complement the drivers of resilience namely: flexible, inclusive, integrated, redundant, reflective, robust and resourceful.

The 100RC movement provides resources for its member cities through recruiting Chief Resilience Officers (CRO), enabling knowledge exchanges between member cities, and providing expert support for developing resilience strategies (100 Resilient Cities, 2019). In addition to supporting cities in developing their resilience strategy, the 100RC movement has developed some tools and publications regarding urban resilience. The CRO leads the development of the resilience strategy, considers bringing different stakeholders to the table, and works across government departments to develop communication among them and ensure that synergetic connections between projects are in place (Berkowitz, 2015).

In this study, six urban resilience strategies and the movement's guiding document for the development of such strategies - the city resilience framework (CRF) - are analyzed. The content analysis of the CRF and the strategies are presented in section 4.

### **3. Methodology**

This research is based on a combination of two methodologies, namely a scoping study and a content analysis. The objective of the scoping study is to extract factors that are deemed conducive for the integration of DRR and CCA in the context of developing disaster resilience in urban areas. Policy document and strategies of the 100RC movement were reviewed in an attempt to discern whether, and if so how, they reflect such identified success factors. Hence, the study comprises two different methodologies: a scoping study and a content analysis, where the former was used to extract and group factors into themes and categories, which then was used as “analytical lenses” through which the documents were scrutinized. As such, the study comprises both inductive (the identification of factors and themes) and deductive approaches (the review of the presence of those themes in documents related to the 100RC movement).

The findings of the scoping study were tested against the overall policy document of the 100RC movement – the City Resilience Framework (CRF) - and City Resilience Strategies (CRS) of six of the member cities. Amman, Athens, Bristol, New Orleans, Rotterdam and Vejle were selected to be analyzed in this study (the process of selecting cities to be part of this study is further explained in Section 3.2).

#### **3.1. Scoping study**

The scoping study applies a methodology presented by Arksey & O'Malley (2005). They have mentioned different reasons for conducting scoping studies, including to examine the extent, range and nature of research activity, to determine the value of undertaking a full systematic review, to identify the research gaps and to summarize and disseminate the findings of research regarding a topic in the existing literature (Arksey & O'Malley, 2005). The last of these reasons fits with this study, which hopes to use the method to disseminate findings regarding the integration of DRR and CCA in connection to urban resilience.

In the following section, the process of conducting the scoping study is explained. The scoping study process includes the following steps and started with a research question:

Step 1: identifying the research question

Step 2: identifying relevant studies

Step 3: study selection

Step 4: charting the data

Step 5: collating, summarizing and reporting the results

##### ***3.1.1. Identifying research question***

As already indicated, the scoping study tries to answer the first of the two research questions of this study by identifying challenges and facilitating factors for the integration of DRR and CCA in support of urban resilience. The review was conducted on academic literature.

### 3.1.2. Identifying relevant studies and selecting database

In this phase decisions for identifying relevant databases and keywords, and constructing search strings were made. An iterative trial process was considered to find the proper keywords. Due to time limitation, Scopus was the only database used for the search and other search databases were not used. Scopus was selected because it is connected to Elsevier as a popular academic information directory, and is ranked as the largest abstract and citation analysis database of peer-reviewed literature (Elsevier, 2019).

The process of delimiting the search was reviewed during the initial search process. The main keywords selected were: "integration", "disaster risk reduction", "climate change", "urban" and "resilience". However, the search string was elaborated by also including different synonyms of these keywords. The synonyms for integration were "mainstream", "synergy", "interact", "collaborate", "harmonize" and "merge". As the synonyms of "urban", the words "city" and "metropolitan" were added. The relevance of the mentioned words was examined through initial searches in Scopus. Based on these trials, "resilience" was removed from the search string, since it was reducing the number of results. In addition, it was realized that resilience was present in other parts of articles rather than in keywords or title or abstracts. Figure 1 presents the search string in Scopus, which was applied during February 2019.

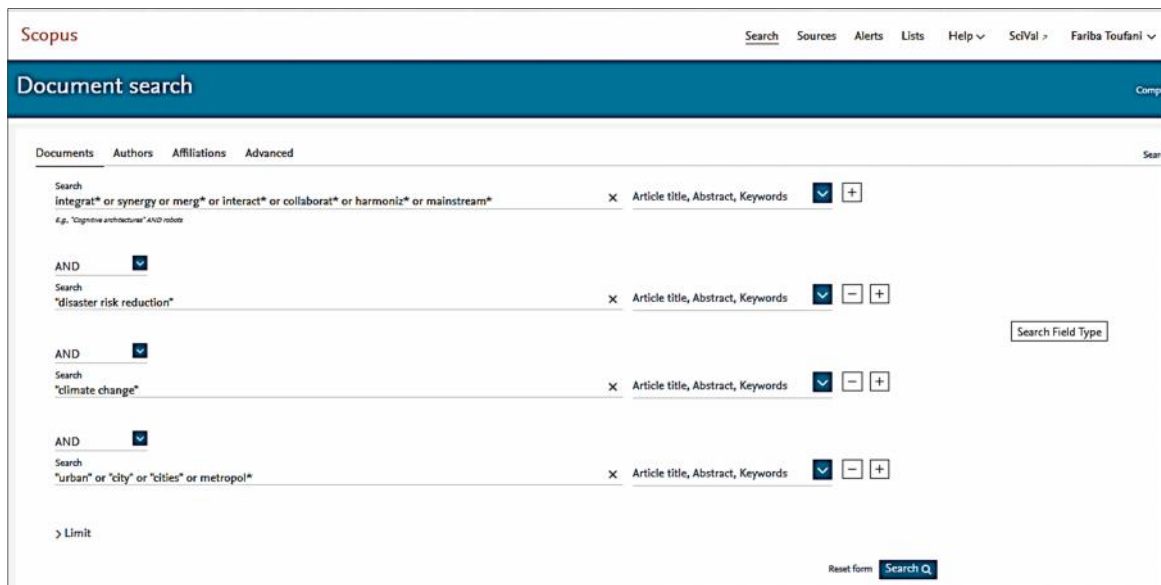


Figure 1: The applied search string of study in Scopus<sup>2</sup>

### 3.1.3. Selecting the studies

The number of results based on the search string was 69 articles. All of the primary results were analyzed based on the title and relevance of resource and abstract in the first step, and then a filtering process was done through reading abstract and conclusion to exclude irrelevant documents. 44 articles were selected based on the title and abstract analysis and

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2 TITLE-ABS-KEY (integrat\* OR synergy OR merg\* OR interact\* OR collaborat\* OR harmoniz\* OR mainstream\*) AND TITLE-ABS-KEY ("disaster risk reduction") AND TITLE-ABS-KEY ("climate change") AND TITLE-ABS-KEY ("urban" OR "city" OR "cities" OR metropol\*)

having read introductions and conclusions, the number of final articles was decreased to 20. The selected documents also contained more references of interest, which were added to the study and increased the total number of articles to 38. The 18 extra articles were added from the reference list of the reviewed articles are also academic literature highlighted in the initial group of articles. Most of them are not specifically focused on urban areas (explaining the high number of them compared to results of scopus search) but still provide suggestions for integration of DRR and CCA. Figure 2 illustrates the selection process of these articles.

#### *3.1.4. Charting the data*

In the next step, the 38 articles were read in full and their general information as well as specific information related to the research question was extracted and charted in an Excel file.

General information included name of author, year of publication, the journal the article was published in and geographical information regarding cases if such were used in the study. The specific information was extracted in the fields listed:

- The central perspective toward integrating DRR and CCA
- Challenges for integration
- Suggested measures for reducing the challenges
- Connections to the concept of resilience
- Suggested core definitions for integration or other main concepts

#### *3.1.5. Summarizing and disseminating the results*

The results of the reviewed literature were summarized where the aim was to highlight information in relation to the study's first research question, i.e. to chart challenges and success factors for integrating DRR and CCA in support of urban resilience. However, urban areas were not mentioned directly in some of the reference, wherefore the charted results entail challenges and facilitating measures for integrating DRR and CCA from both a general perspective and with focus on urban areas.

Consultation with stakeholders has been highly recommended as a parallel step in scoping studies (Arksey & O'Malley, 2005; Levac, Colquhoun, & O'Brien, 2010). Due to time limitations, the consultancy step in this study is limited to the thesis supervisor feedback on the methodology and results.

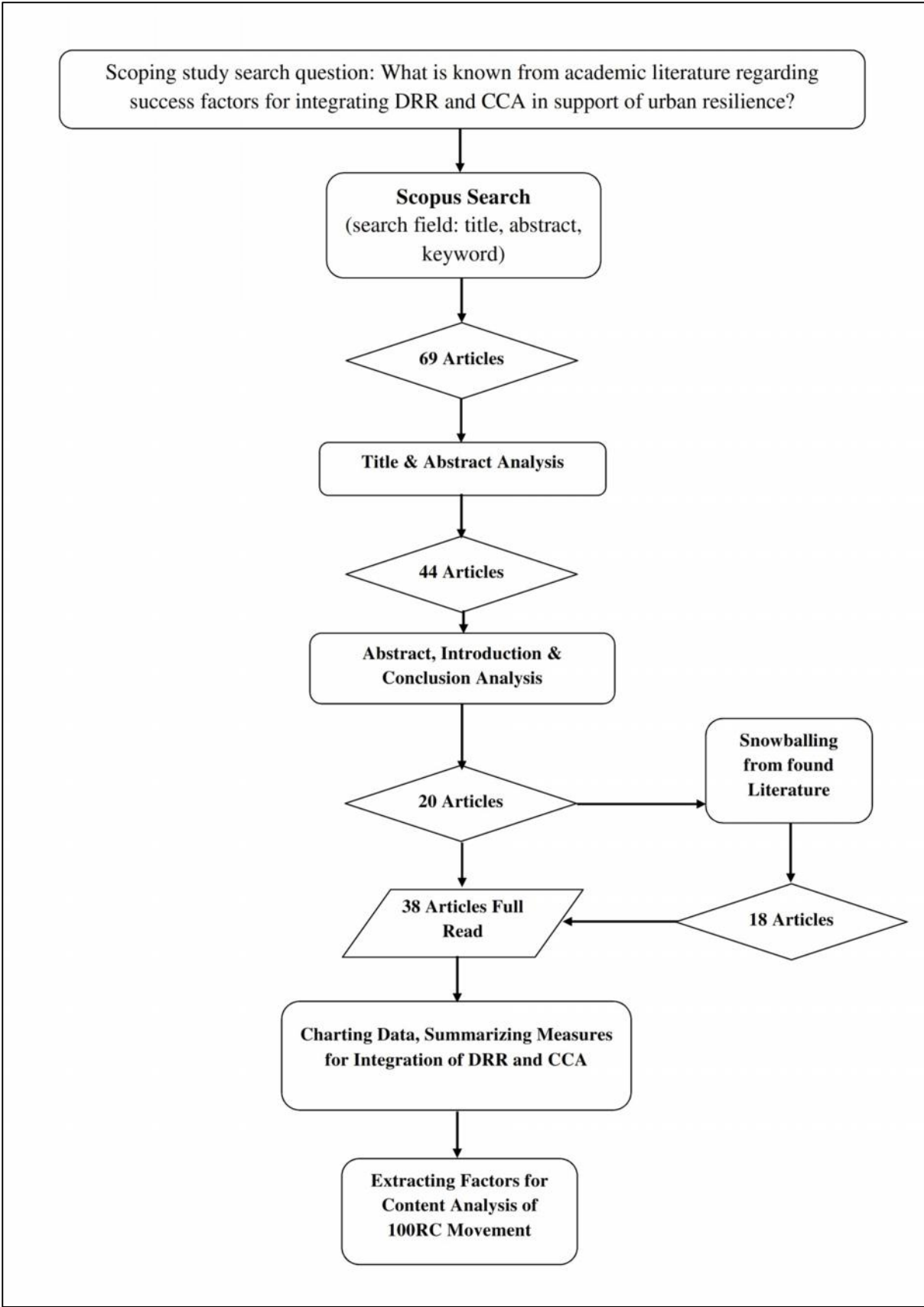


Figure 2: Overview of study selection and charting data

### 3.2. Content Analysis

Once the factors for integration of DRR and CCA in literature were extracted, the next step was performing a content analysis of the framework and strategies of cities enrolled in the 100RC movement. The content analysis tried to address the second question of this thesis on “how the integration of DRR and CCA is being conducted in practice”.

The content analysis was conducted based on the three steps presented by Elo and Kyngäs (2008) namely, preparation, organizing and reporting. In the preparation phase the CRSs of six cities and the CRF as the guidance document for developing strategies were selected to be analyzed. The 100RC movement categorizes cities based on, inter alia, their expressed exposure to or engagement with different kinds of hazards. This study was mainly interested in the 18 cities which expressed a major concern for climate change. Six of these cities were selected where the inclusion criteria was based on geographic distribution of cities in different parts of the world, having a range of small, medium, and large cities according to the population, and having climate change as a main resilience challenge. For each city a document called City Resilience Strategy (CRS) as the published output was analyzed. The documents are different regarding the extent, some are brief and others are extensive (from 65 pages to 226 pages) while all are covering the main aspects reflected in the guiding document as CRF (a 24-pages document).

The 100RC movement has developed different tools in support of the urban resilience covering aspects such as assessment, monitoring, cross-disciplinary workshops for promoting innovation, problem framing, scenario building, etc. As the overarching document outlining the process of developing strategies covering all these areas, the CRF was selected.

In the organizing step the measures were categorized into themes and the themes were translated to coding questions to be followed up in the CRSs and CRF (the themes and coding questions are revealed by Table 3). The themes were developed by categorizing the identified measures in academic literature where the categorization draws heavily on aspects that has been promoted as conducive for climate change adaptation in the Climate Smart Disaster Risk Management (CSDRM) guiding document<sup>3</sup>. In this process the measures found through the scoping study were categorized to broader groups to make them normalized and also to restrict the number of them. Once the coding questions were developed, the CRSs were qualitatively analyzed using Nvivo<sup>4</sup>. Corresponding to the coding questions, nodes were built and the connected sections of documents were coded in the relevant node. The last step of analysis was reporting, which is presented in Section 4.2 along with further elaboration on the themes and coding questions.

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<sup>3</sup> “Changing Climate, Changing Disasters: pathways to integration” is a document developed by the Strengthening Climate Resilience consortium. The CSDRM provides guidance for organizations to address integration of DRR, CCA and development.

<sup>4</sup> “Nvivo is software is used for gaining richer insights from qualitative data. It is a tool gives a place to organize, store and retrieve data so you can work more efficiently, save time and rigorously back up findings with evidence” (Nvivo,2019) (see <https://www.qsrinternational.com/nvivo/what-is-nvivo>).



## 4. Results

### 4.1. Results of the Scoping Study

This section presents success factors for integrating DRR and CCA in support of urban resilience. It is divided into three parts. In the first part, the main aspects regarding the integration of DRR and CCA will be presented. The second part elaborates on the challenges to integrate CCA and DRR and facilitating measures to overcome those challenges with the main focus on urban areas. The last part discusses how the reviewed literature has addressed the concept of urban resilience in connection to DRR and CCA integration.

#### 4.1.1. The notions of DRR and CCA integration

The notion of integrating DRR and CCA has received great attention in recent years. However, a scrutiny of the issue reveals a blurred picture. Putting the concepts of DRR and CCA in connection to (urban) development, the discussion around the integration of CCA and DRR follows two main research streams, which sometimes are dissolved.

One line of research focusses on how DRR and CCA may be integrated with the third field (development) rather than on the integration between DRR and CCA. Regarding this viewpoint, Galderisi refers to the adaptation planning process as a way for mainstreaming DRR and CCA into urban planning (Galderisi, 2014). From the same standpoint, Wamsler mentions seven complementary layers of strategies to guide the integration of Risk Reduction (RR) and CCA into development plans (Wamsler, 2009).

The other group puts more focus on integrating the fields of DRR and CCA per se and highlights potential advantages of improving the connection between them. Despite some discussion on which field is in the dominant position<sup>5</sup> (Birkmann & von Teichman, 2010; Serrao-Neumann et al., 2015), in general CCA has been seen as a part of DRR, DRM and resilience building (Howes et al., 2015). Aside from this argument, all researchers seem to agree that the parallel structures and actions in the fields of DRR and CCA lead to a waste of resources and potential conflicts which may impede efforts in both fields (Birkmann & von Teichman, 2010; Forino, von Meding, & Brewer, 2015). However, there are two different perspectives regarding how closely connected the two fields should be. Some literature stress the need of retaining their independence whilst striving to obtain synergies and a complementary balance between them (Schipper, Thomalla, Vulturius, Davis, & Johnson, 2016; Vachette, 2017), while others discuss merging one into the other (Kelman & Gaillard, 2010). The mentioned perspectives on integration of DRR and CCA in urban development are illustrated in Figure 3.

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<sup>5</sup> Some argue that CCA is a subset of DRR and some put DRR as a subset of CCA (Serrao-Neumann et al., 2015).

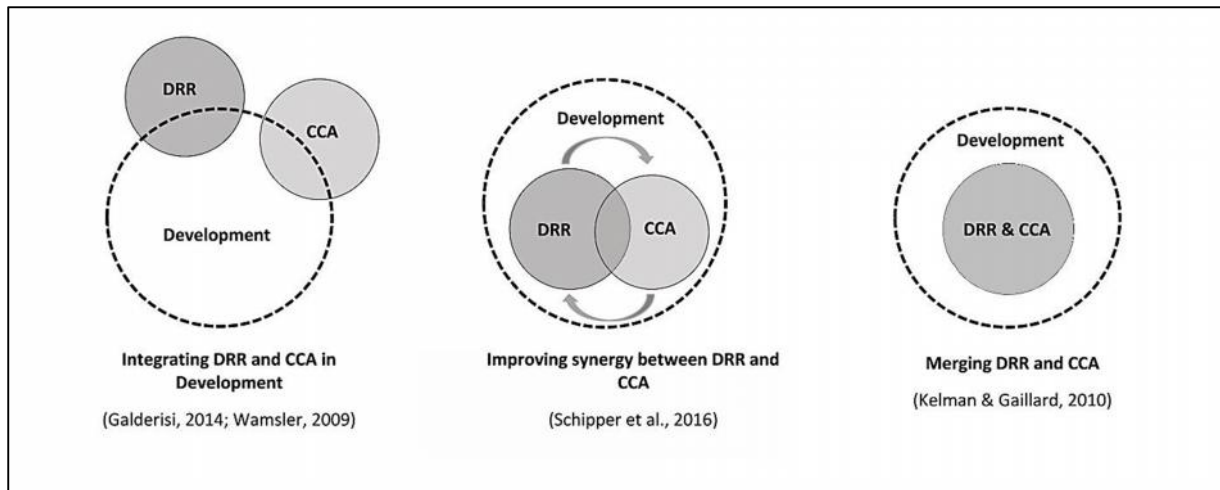


Figure 3: Different perspectives on integration of DRR and CCA and development

In the reviewed literature, the exact definition for integration was mainly connected to mainstreaming. "Mainstreaming" is connected to the concept of integration and is defined as building on the existing structure through the “modification of a specific type of core work (such as urban planning) in order to take a new aspect or topic (such as CCA) into account”(Rivera, 2014, p. 2) . Similarly, Wisner has also discussed the concept of integration within disaster risk management and claims that it implies "doing existing activities differently, in a risk-aware manner" (Wisner, 2011, p. 2).

The main aim of this research is to explore the success factors for the integration of CCA and DRR in urban areas. The study, reviewed academic literature focused on all of the above mentioned perspectives.

#### 4.1.2. Challenges to the integration of DRR and CCA in urban areas and measures to overcome them

This section presents the results regarding challenges to integration and measures overcome them. An overview of the results is provided by Table 1 where challenges and facilitating measures have been matched. The first column of the table contains the challenges represented by (C) in each row; the next column addresses the references each challenge has been extracted from. The measures connected to each challenge (M) and the references for each measure are presented in the last columns. The key to navigate the challenges and measures and their connected references are based on the numbers where (C<sub>x</sub>) is used for challenges, the same number (x) is used for the connected reference, and (M<sub>x</sub>) represents the measure connected to the reference with the same number (x). The same indices are used in the running text, where challenges and measures are further explained.

The narrative is categorized into groups in order to give a cohesive picture of the results.

#### Root challenges

Fragmentation of existing Disaster Risk Management (DRM) systems has been discussed as one of the root challenges for integrating CCA with DRR (C1). Considering the importance

of including DRR and CCA in day-to-day life of development, the level of integration within the current systems (DRM or CCA or Urban Planning) is fundamental (Rivera, Tehler, & Wamsler, 2015; Wisner, 2011). As a result, identifying the systematic challenges of DRM functions and process has been suggested as a way to increase the likelihood of integration of CCA into DRR (M1).

### **Isolated communities of DRR and CCA**

The sectoral structure of governments and the time difference between the emergence of the two fields of DRR and CCA has put them in different organizations and institutions (C2). The sectoral isolation imposes different pathways and triggers competing interests among sectors. Moreover, low interaction and coordination amongst national, regional and local levels impede opportunities to create harmony between policy and practice among levels and sectors (C3). In some countries, like the UK and Australia, the issue of involving local governments in DRR and CCA is also identified as a challenge (Dias, Amaratunga, & Haigh, 2018).

Overcoming the aforementioned challenge, requires efforts from sectors at different levels. Adopting multi-level approaches (M2), developing a shared policy vision and adopting multi-level and integrated planning for implementing the shared vision (M7) could help to coordinate efforts among sectors and levels in governments. Identifying stakeholders from the market and civil society and establishing arrangements that enable public-private partnerships, private-social partnership and co-management between state and social communities will promote governance of DRR and CCA integration (M5).

From a practical point of view, initiatives like developing agreements between DRR and CCA sectors to work together in harmony (M8), or establishing coordinating organizations and platforms, can improve the culture of networking across sectors (M9) and can support “breaking the silos”.

Zooming into DRR and CCA integration in urban areas, adopting a nexus approach among urban planning, DRR and CCA (aside from the ecosystem management and climate change mitigation) and assigning a core role for land use planning, is proposed in support of integrating CCA, DRR and urban development (M3).

Establishing cooperation among relevant sectors requires guiding standards (M6) and a communication technique to reach a common understanding of barriers, values, and needs in support of them (M4).

International organizations and donors working with both DRR and CCA in developing contexts have the opportunity to strengthen cross-sector collaboration (M13). On the local level, participation with local stakeholders through adaptive management in local governments and Community Based Initiatives (CBIs) will promote integrating CCA into DRR (M11, M12). The importance of the connection between local and national levels requires defining communication channels between them (M10).

### **Communicating knowledge and information amongst science, policy and practice**

Integration of CCA into DRR and urban development requires close collaboration between communities regarding the information and knowledge utilized. It is discussed that there are some gaps between the two fields which are rooted in different terminologies (C7) and a lack of interaction between science, practice, and policy communities in both fields (C4). Lack of understanding regarding climate change and its impacts (C5) and unclear relations between DRR and CCA are other challenges that have to be overcome to improve integration between the two fields (C6). The unclear relationship between DRR and CCA also makes the issue of integration distorted (C6), especially for the group of authors who believes in embedding one of the fields into the other. In some articles, lack of political will to consider DRR or CCA or their integration is mentioned as a challenge (C5).

Integrating policymakers in the development of climate change scenarios (M14) and employing climate scientists in local governments (M16) can help close the gaps between policy, science and practice. Improving awareness regarding climate change and the impacts of DRR and CCA for future hazards (M17), as well as developing a common terminology through workshops with professionals (M18) can mend the knowledge gap regarding DRR and CCA and facilitate their integration. In connection to urban development, promoting a safety culture in urban planning through including DRR and CCA in urban planner's education and training is believed to be effective (M15).

### **Harmonizing the scale mismatches**

Integration of CCA and DRR is subject to scale challenges regarding spatial, temporal and knowledge mismatches between the two fields (C8). Despite attempts to include long-term perspectives into risk reduction measures, it is discussed that there is a difference between long-term and short-term perspectives in the two fields wherein CCA has a long-term perspective compared to DRR (O'Brien et al., 2012). Climate change information and models are mainly developed on the global scale and rarely attributed to the local level, while DRR addresses vulnerabilities and hazards in specific areas. The spatial mismatch also refers to the issue that the areas or countries that trigger climate change and the areas that tolerate the burden of impacts are not the same (Birkmann & von Teichman, 2010). The scale mismatch also brings challenges for integrated risk assessment, where climate change projections need to be considered in risk assessment (Dias et al., 2018).

In order to overcome scale mismatches, reframing spatial scale and approaches can support the integration of DRR and CCA. CCA strategies have been developed in national and global levels, while DRR has put more focus on local level. Defining a meso-level in sub-national level for management can facilitate the mentioned scale mismatch between the two fields (M21). Besides improving management at the meso-level, establishing local climate task groups brings opportunities for local stakeholders to contribute knowledge and expertise in CCA and DRR (M22). Moving from project-based approaches to program-based approaches provides a broader perspective to integrate CCA with DRR and also for integration of DRR and CCA into urban development (M24). Program-based approaches address integration of DRR and CCA in organizations and sectors' programming rather than focus on integration in a specific project. In line with the program-based approach, integrating CCA into disaster

cycle<sup>6</sup> in urban areas provides opportunities for integration of DRR and CCA. Efforts for recovery and reconstruction after disasters can use the “betterment approach” to consider future impacts of climate change (M23). Betterment is proposed as a complementary point to building back after disasters where “under a betterment approach reconstruction must also add ‘value beyond what existed before the disaster’ ” (Serrao-Neumann et al., 2015, p. 48).

While an ongoing comprehensive vulnerability and risk assessment at smaller scales can complement harmonizing spatial and temporal mismatches (M19), such an assessment requires support by the national level to provide guidelines on how to include climate change scenarios in disaster risk assessment (M20). Using a combination of local and scientific knowledge can reduce the challenges regarding scale mismatches (M25). In this regard community based initiatives and local knowledge in the lack of power and resources require supports from supra-local actors to lead and manage integration of DRR and CCA (Forino, von Meding, & Brewer, 2019). Overcoming the challenges regarding scale mismatches also requires resolving challenges regarding uncertainty about climate change and CCA impacts (C14) and a lack of downscaled data and information on the subject of climate change (C13).

The process of gathering and producing scientific data and disseminating them to policy and practice should start with defining the required risk information (M41). Gathering disaggregated information<sup>7</sup> related to risk factors (M42) provides precise information for risk assessment. Risk assessment based on climate scenarios and in-depth studies of the local level (M43) can support aggregated risk assessment (M44) which can improve links between DRR and CCA. Translating scientific terms into more accessible concepts at the local level by climate professionals (M16) and sharing the information through smart tools<sup>8</sup> (M45) are also promising measures for the integration of DRR and CCA fields.

Uncertainty regarding climate change impacts and the effectiveness of adaptation measures calls for the consideration of the wide range of future possibilities in assessment scenarios (M46). Moreover, flexibility is a measure addressing uncertainty through updating risk assumptions (M47), applying flexible no-regret DRR and CCA measures (M48), and outlining flexible adaptation processes which provide space to consider new challenges (M49).

### **The disjunction between two fields regarding norms, policies, and legislations**

The two fields of DRR and CCA are usually affiliated with different organizations and institutions, and as a result, they follow different norms and policies. Different norms and policies oppose efforts for integration of CCA and DRR (C9), where there is a lack of legal

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<sup>6</sup> Birkmann defines disaster cycle as the phases of “mitigation, preparedness, and response, as well as recovery and reconstruction” (Birkmann & von Teichman, 2010).

<sup>7</sup> Disaggregate information on risk factors entails information regarding hazard, exposure and vulnerabilities (Galderisi, 2014, p. 553).

<sup>8</sup> The initiatives like PLACARD Connectivity Hub (PLAtform for Climate Adaptation and Risk reduction) led by the Stockholm Environment Institute or ESPREsSO project (Enhancing Synergies for disaster PREvention in the EurOpean Union) are examples of projects trying to address the challenges to integration of CCA and DRR regarding information and data.

requisites or policies asking for integration between the two fields (C10). In urban areas, mainstreaming DRR and CCA in policies and legislation of urban planning is another part of the challenge.

The process of integrating CCA with DRR could start by establishing a legal base for DRR and CCA (M26). After legal endorsements, the next milestone is developing a shared policy vision among multi-level government organizations and sectors responsible for CCA and DRR (M7). Developing consistent legislation which also underpins strategies, policies, and plans, and provides clear objectives and appropriate directions for them is another facilitator for integration of DRR and CCA (M27).

Starting from the global scale, recommendations in international policies can provide a primary guide to how DRR and CCA ought to be integrated (M30). Identifying where DRR and CCA may be integrated into national policies and legislation, can help closing the gaps in policies and legislation between the two fields (M30).

At the national level, the linkage between DRR and CCA can be improved in strategies, policies, and plans, like a national adaptation program of action or strategic national action plans (M29). In urban areas, systematic review and assessment of policies and regulatory frameworks and an executive legislation agenda of urban planning can support the development of policies which enable DRR and CCA integration (M28). In the Philippines, the integration of CCA into DRR in assessment step and integration of resulting assessments and strategies has been done simultaneously (M28). Based on a case in the Philippines, integration of CCA into DRR and mainstreaming integrated CCA and DRR into urban planning has been conducted in the process of developing a comprehensive urban plan (Florano, 2015).

### **Practical guidance for the integration of CCA and DRR**

Lack of practical tools to guide the integration has been highlighted as a challenge to the integration of DRR and CCA into urban planning (C11) and also integrating CCA into DRR in urban planning (C12) (see first and third models in Figure 3).

The academic literature has suggested measures for addressing the lack of guidance on integrating CCA into DRR in urban planning in different aspects of planning and practice. Some have introduced nexus approaches to focus on main contributors regarding risks in urban areas, consisting of urban planning, DRR, CCA, Climate Change Mitigation (CCM), and ecosystem management. Land use planning has been assigned as the core of the nexus to promote the links among main domains (M3). The general perspective on planning approaches has mentioned spatial planning, cross-sectoral planning, social and community planning and long term strategic planning as enablers of DRR and CCA integration in urban areas (M40).

Moving from planning to implementation, multi-objective measures like ecosystem-based measures and strategies (M39), and assessing pros and cons of land use choices (M38) are

introduced as measures for overcoming the challenge of DRR and CCA integration in urban areas.

Experience in the Philippines has highlighted the main steps toward implementation of CCA and DRR integration in the following steps:

- Assessment and updating of local development plans, visions and development goals and objectives (M37)
- Conducting an integrated vulnerability risk assessment (M35)
- Identifying and prioritizing integrated DRR/CCA strategies based on integrated risk and vulnerability assessment and considering those strategies in development plans (M36)

Since disasters are complex and context-specific, some authors claim that there is "no one off-the-shelf solution or approach" (Rivera et al., 2015, p. 454) to foster an integration of DRR and CCA (M34). There is similar discussion regarding CCA in urban planning (Galderisi, 2014).

Some studies have provided thoughts for integrating DRR and CCA into urban planning or development regardless of integrating the two fields. Wamsler (2009) has developed seven complementary layers of strategies to guide the integration of Risk Reduction (RR) and CCA into development plans (M31).

In a framework consisting of three 'A's,' awareness raising regarding climate change, assessment of its impacts and measures, and action have been introduced as a guiding tool for integrating CCA in urban planning (M32). As the last point connected to operational guides for integration, revising urban planning tools is suggested as a facilitating measure for integrating DRR and CCA in urban planning (M33).

### **Competition for funding**

Separated communities of DRR and CCA as well as limited resources trigger competition for funding. Moreover, there is a lack of agreement on investing funds and resources between the two fields (C15). Designing a flexible funding mechanism that promises a long-term perspective on mainstreaming DRR and CCA to programming and policy-making organizations (M50), is considered a primary solution for funding competitions.

Establishing a cooperative funding mechanism allows the utilization of funds for flexible periods and supports cooperation and coordination between development and humanitarian communities (M51). Revising the funding mechanism is also connected to governance<sup>9</sup> of DRR and CCA integration, which promotes the development of shared policy visions, the

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<sup>9</sup> " A governance perspective for CCA and DRR integration contributes therefore to identify roles, power, relationships and accountability of actors in managing disaster risk related to climate- and climate change-associated hazards" (Forino et al., 2018, p. 259).

adoption of multi-level planning and integrated legislation, and improved cultures of collaboration (Howes et al., 2015).

Market and social domains and their bridging networks can support DRR and CCA integration in regard to funding, through different tools, including Corporate Social responsibility (CSR)<sup>10</sup>, risk insurance mechanisms and fundraising campaigns for risk sensitization (Forino et al., 2015).

### **Monitoring and evaluation**

Methodologies and indicators for monitoring adaptation plans are limited (C16). Also, there are no concrete norms or indicators for monitoring how CCA may be integrated with other programs (C17). Developing indicators and quality criteria for the Monitoring and Evaluation (M&E) of the linkage between DRR and CCA and avoiding maladaptation are required to resolve the challenge (M53).

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<sup>10</sup> United Nations defines SCR as responsibility of private sector that “concerns the relationships of a company not just with its clients, suppliers and employees, but also with other groups, and with the needs, values and goals of the society in which it operates”(Twigg, 2001, p. 5).



Table 1: Challenges to integration of DRR and CCA in urban development and facilitating factors for overcoming the challenges

Main Heading in the text	Challenge	Source	Facilitating factors	Source
Root challenges	<b>C1:</b> Fragmented DRM functions and process	(Rivera, Tehler, & Wamsler, 2015)	<b>M1:</b> Identifying the systematic challenges of DRM functions and process in order to increase likelihood of integration of CCA into DRR	<b>M1:</b> (Rivera, Tehler, & Wamsler, 2015)
Isolated communities of DRR and CCA	<b>C2:</b> Isolated communities and institutions	(Galderisi, 2014; Galderisi, 2017; DasGupta & Shaw, 2017; Birkmann et al., 2013; Florano, 2015; Klima & Jerolleman, 2017; Solecki, Leichenko, & O'Brien, 2011; Forino, von Meding, & Brewer, 2019)	<b>M2:</b> Developing multi-level (whole of government) and integrated (multi hazard) policy and approaches with clear structure of competencies and duties and identifying climate sensitiveness among sectors	<b>M2:</b> (Galderisi, 2014; Birkmann & von Teichman, 2010; Forino et al., 2017; Forino, von Meding, & Brewer, 2015; Galderisi, 2017; Prabhakar, Srinivasan, & Shaw, 2009)
			<b>M3:</b> Adaptation of nexus approach and assigning land use planning in the core	<b>M3:</b> (Galderisi, 2017; Florano, 2015; O'Brien, K., et al., 2012)
			<b>M4:</b> Applying a communication technique to reach a common understanding of values, barriers, the needs of audience and the end goal	<b>M4:</b> (Klima & Jerolleman, 2017)
			<b>M5:</b> Governing DRR and CCA integration through identifying actors in three domains of state, market, and social and their bridging arrangements	<b>M5:</b> (Forino, von Meding, & Brewer, 2015; Birkmann et al., 2013)
			<b>M6:</b> Developing guiding standards for cooperation between actors	<b>M6:</b> (Birkmann & von Teichman, 2010)
			<b>M7:</b> Developing a shared policy vision and adopting multi-level and integrated planning for implementing the shared vision	<b>M7:</b> (Forino et al., 2017; Howes et al., 2015; Begum et al., 2014)
			<b>M8:</b> Developing coordination organizations and platforms and building culture of networks among organizations and sectors	<b>M8:</b> (Forino, von Meding, & Brewer, 2015; Forino et al., 2017; Forino, von Meding, & Brewer, 2019; Mysiak et al., 2018)
			<b>M9:</b> Developing a national agreement between two communities to incorporate in each other's action plans	<b>M9:</b> (Florano, 2015)
			<b>M10:</b> Defining communication channels between national and local levels	<b>M10:</b> (Rivera, Tehler, & Wamsler, 2015)
			<b>M11:</b> Adaptive management in local government to work in concert with other aspects and actors regarding risks in cities	<b>M11:</b> (Struggles, 2016)
<b>M12:</b> Establishing partnerships with local stakeholders and using community based initiatives	<b>M12:</b> (Forino, Jason Von Meding, 2018; Forino, von Meding, & Brewer, 2019)			
<b>M13:</b> Taking benefit of international organizations in promoting synergistic management between DRR and CCA	<b>M13:</b> (Djalante, Thomalla, Sinapoy, & Carnegie, 2012)			
	<b>C3:</b> Lack of cross-sectoral and cross-level coordination and partnership among relevant communities	(Galderisi, 2014; Rivera, Tehler, & Wamsler, 2015; Galderisi, 2017; Birkmann et al., 2013; Ghimire, Vu, & Thuy, 2018; Forino, Jason Von Meding, 2018)	<b>M2, M3, M4, M5, M6, M7, M8, M9, M10, M11, M12, M13</b>	<b>M2, M3, M4, M5, M6, M7, M8, M9, M10, M11, M12, M13</b>

Main Heading in the text	Challenge	Source	Facilitating factors	Source
Knowledge and information communication	C4: Communication breakdown among practice, policy research	(Galderisi, 2014; Forino, Jason Von Meding, 2018)	M14: Designing communication strategies between the scientific community working on CCA and other non-scientific actors like involving policymakers in developing climate change scenarios	M14:(Rivera, 2014)
			M15: Integrating disaster risk reduction into urban planner education and training, and promoting safety culture in urban planning field to consider risk informed decision making	M15: (Galderisi, 2017; Begum et al., 2014; Rivera, 2014; Ghimire, Vu, & Thuy, 2018)
			M16: Employing climate professionals in local government to translate the scientific terms into more accessible concepts	M16:(Forino, Jason Von Meding, 2018; Forino, von Meding, & Brewer, 2015)
			M17: Awareness raising for policymakers, practitioners, and community about the impacts of climate change and influence of DRM measures for future hazards	M17: (Galderisi, 2014; Rivera, Tehler, & Wamsler, 2015; Rivera, 2014; Serrao-Neumann et al., 2015; Birkmann & von Teichman, 2010; Mysiak et al., 2018)
	C5: Lack of understanding about climate change and low willingness to consider integrated DRR and CCA	(Rivera, 2014; Ghimire, Vu, & Thuy, 2018; Wijaya, 2018; Wamsler, 2009)	M14, M15, M16, M17	M14, M15, M16, M17
	C6: Conceptual division and unclear relationship between DRR and CCA	(Birkmann & von Teichman, 2010; Serrao-Neumann, Crick, Harman, Schuch, & Choy, 2015)	M14, M15, M16, M17	M14, M15, M16, M17
	C7: Different terminology	(Solecki, Leichenko, & O'Brien, 2011; Klima & Jerolleman, 2017)	M18: Building common terminology through professional workshops	M18: (Klima & Jerolleman, 2017; Solecki, Leichenko, & O'Brien, 2011)

Main Heading in the text	Challenge	Source	Facilitating factors	Source
Harmonizing the scale mismatches	C8: Spatial, temporal and knowledge mismatch between the two fields	(Serrao-Neumann et al., 2015; O'Brien et al., 2012; Birkmann & von Teichman, 2010)	M19: Conducting ongoing and updated comprehensive vulnerability and risk assessment	M19: (Birkmann & von Teichman, 2010; Florano, 2015)
			M20: Developing national guidelines to incorporate CC scenarios, sectoral impacts and vulnerabilities into disaster risk assessment	M20: (Birkmann & von Teichman, 2010; Florano, 2015)
			M21: Identifying a meso-scale (local government) for management of DRR and CCA	M21: (Forino, Jason Von Meding, 2018; Birkmann & von Teichman, 2010; Forino et al., 2017; Galderisi, 2014)
			M22: Establishing local climate task group	M22: (Prabhakar, Srinivasan, & Shaw, 2009)
			M23: Integrating CCA in disaster management cycle (for instance pre-planning for recovery and reconstruction in urban areas)	M23: (Serrao-Neumann et al., 2015; Birkmann & von Teichman, 2010)
			M24: Reframing approaches from project-based to program-based	M24: (Birkmann & von Teichman, 2010; Wamsler, 2009)
			M25: Considering a balanced combination of local knowledge and community based initiatives and scientific knowledge and information	M25: (Birkmann & von Teichman, 2010; Forino, von Meding, & Brewer, 2019)
Disjunction between two fields regarding norms, policies, and legislations	C9: different norms and policies in two communities	(Rivera & Wamsler, 2014; Florano, 2015; Serrao-Neumann, et al., 2015; Wijaya 2018; Birkmann & von Teichman, 2010; Begum et al., 2014)	M26: Establishing legal endorsement for both DRR and CCA	M26: (Rahayu, Haigh, & Amaratunga, 2018)
			M27: Developing a consistent legislation which also underpins strategies, policies, and plans, and provides clear objectives and appropriate directions	M27: (Forino et al., 2017; Howes et al., 2015)
			M7	M7
			M28: Creating, improving, assessing, and performing a systematic review of policies and regulatory frameworks and executive legislation agenda in urban planning to ensure DRR and CCA are integrated into them	M28: (Rivera, 2014; Rivera & Wamsler, 2014; Florano, 2015)
			M29: Including DRR and CCA in strategies, policies and plans, like including DRR in national adaptation programs of action and strategic national action plans	M29: (Forino, von Meding, & Brewer, 2015)
	M30: Utilizing the recommendations in international policies and identifying potential national policies and regulations to integrate DRR and CCA	M30: (Rivera & Wamsler, 2014)		
	C10: Lack of policy and official enforcement for integration of two fields	(Wijaya, 2018; Birkmann et al., 2013; Howes et al., 2015)	M24, M25, M26, M27, M28, M29	M24, M25, M26, M27, M28, M29

Main Heading in the text	Challenge	Source	Facilitating factors	Source
Practical guidance for integration	C11: Lack of operational tools and instruments to integrate DRR and CCA into urban planning	(Wamsler, 2009; Ghimire, Vu, & Thuy, 2018; Rivera, 2014)	M31: Considering different strategies to integrate DRR and CCA into urban planning through integrating them	M31: (Wamsler, 2009)
			M32: Applying Awareness-Assessment-Action Framework to integrate climate change adaptation in land use planning.	M32: (Ghimire, Vu, & Thuy, 2018)
			M33: Revising and improving urban planning tools to include DRR and CCA	M33: (Rivera, 2014)
	C12: Insufficient guidance on how to integrate CCA into DRR in urban planning	(Rivera, 2014)	M34: there is no single solution	M34: (Rivera, Tehler, & Wamsler, 2015; Wisner, 2011)
			M35: Integrated vulnerability and risk assessment	M35: (Florano, 2015; Mysiak et al., 2018)
			M36: Identifying and prioritizing integrated DRR/CCA strategies based on integrated disaster risk assessment	M36,37: (Florano, 2015)
			M37: Assessment and updating of local development plans, visions and development goals and objectives	
			M38: Assessing pros and cons of alternative land use choices	M38: (Galderisi, 2017)
			M38: Developing multi-objective strategies and measures (ecosystem based measures)	M38: (Galderisi, 2014; Mysiak et al., 2018)
			M40: Using enablers for improving synergies between the two fields: spatial planning, cross-sectoral planning, social/community planning, strategic long-term planning	M40: (Serrao-Neumann, et al., 2015)
M3	M3			
Harmonizing the scale mismatches	C13: Gathering, producing, disseminating and downscaling scientific data to policy and practice	(Galderisi, 2014; Galderisi, 2017; Rivera, Tehler, & Wamsler, 2015)	M16	M16
			M41: Defining required risk information	M41: (Rivera, Tehler, & Wamsler, 2015)
			M42: Gathering disaggregate information related to vulnerability features of exposed elements and systems	M42, M43, M44: (Galderisi, 2014)
			M43: Assessment of climate related hazards on an urban scale, based on large-scale scenarios and in-depth studies at local level	
			M44: Conducting aggregated risk assessment	
	M45: Using smart tools and improving communication skills in order to collect and disseminate knowledge and information	M45: (Galderisi, 2014; Forino, Jason Von Meding, 2018)		
	C14: Uncertainty regarding climate change adaptation	(Galderisi, 2014; O'Brien et al., 2012; Giuseppe Forino, Jason Von Meding, 2018; Prabhakar, Srinivasan, & Shaw, 2009)	M46: Considering the wide range of possible futures in assessment scenarios	M46: (O'Brien, K., et al, 2012)
			M47: Reviewing and updating the disaster planning assumptions in cities regularly	M47: (Solecki, Leichenko, & O'Brien, 2011)
M48: Using flexible, reversible and no-regret DRR and CCA measures			M48: (O'Brien et al., 2012; Prabhakar, Srinivasan, & Shaw, 2009)	
M49: Outlining dynamic and flexible adaptation process			M49: (Galderisi, 2014)	

Main Heading in the text	Challenge	Source	Facilitating factors	Source
Competition for funding	C15: Lack of financial resources and lack of agreement on investment and funds	(Florano, 2015; Ghimire, Vu, & Thuy, 2018; Wamsler, 2009; Begum et al., 2014)	M50: Revising the funding mechanism and developing flexible funding for long- term projects	M50: (Forino, von Meding, & Brewer, 2015; Birkmann & von Teichman, 2010; Begum et al., 2014)
			M51: Establishing a cooperative funding mechanism for DRR and CCA	M51: (Howes et al., 2015; Forino et al., 2017; Mysiak et al., 2018)
			M52: Role of market and social domains in risk insurance and corporate social responsibility (CSR)	M52: (Forino, von Meding, & Brewer, 2015; Mysiak et al., 2018)
Monitoring and evaluation	C16: Limited methodologies and indicators for monitoring and evaluation of adaptation plans	(Galderisi, 2014)	M53: Developing indicators and quality criteria for monitoring and evaluation of linkage between DRR and CCA and avoiding maladaptation	M53: (Galderisi, 2014; Birkmann & von Teichman, 2010)
	C17: Lack of indicators and quality criteria on monitoring how to integrate CCA in other programs	(Birkmann & von Teichman, 2010)	M53	M53

#### 4.1.3. How the integration of DRR and CCA is connected to urban resilience

In this section, the perspectives toward improving urban resilience, in connection to DRR and CCA integration is investigated. In the reviewed articles the concept of resilience was not always present.

From an international perspective, the Rio+20 Declaration has highlighted the integration between DRR, resilience and climate risks in urban planning as an opportunity for cities and communities to access financial resources and to reduce potential conflicts between climate change issues and other local priorities (Galderisi, 2014). As frequently stated in the reviewed literature, improving (urban) resilience and reducing vulnerability to the impacts of climate change are common goals of both DRR and CCA (Forino et al., 2018; Forino et al., 2015; Rivera, 2014; Solecki et al., 2011).

Integration of DRR and CCA has been stated as a cause for - and sometimes as a result of - improved resilience. Building resilience and adaptive capacity have been introduced as an arena for linking DRR and CCA strategies (Solecki et al., 2011). In some sources, integration of DRR and CCA and their integration in (urban) development have been stated as one of the tools or sometimes as a process facilitating improved resilience (Wijaya, 2018). The measures for the integration of CCA and DRR and urban planning (like the revision of urban planning tools) have also been seen as a way to protect cities and design resilient cities (Rivera, 2014).

While some argue that the integration of DRR and CCA could promote building resilience, it is also mentioned that the concept of resilience is being applied as a guiding principle to DRR and adaptation issues (O'Brien et al., 2012). Another viewpoint is that DRR and CCA integration can support moving beyond vulnerability and resilience towards a vision of DRR that ends the separation between the two fields and promotes working together towards simultaneous and common goals (Forino et al., 2015).

Some of the articles have focused only on adaptation in connection to resilience. The adaptation process has been introduced as a way to establish local strategies for enhancing urban resilience in the face of unavoidable climate impacts and their costs (Galderisi, 2014). In this regard, the integration of CCA into land use planning is considered one of the determinants of urban resilience (Ghimire, Vu, & Thuy, 2018). The other viewpoint recognizes DRR and resilience-building as important options to support adaptation to hazards modified and influenced by climate change (Birkmann & von Teichman, 2010).

Including DRR, sustainability goals, CCA and climate change mitigation in local government decision-making can support urban resilience (Struggles, 2016). Efforts to establish formal linkages between DRR and CCA through governance of their integration<sup>11</sup> has also been mentioned in support of community resilience (Begum, Sarkar, Jaafar, & Pereira, 2014). It is

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<sup>11</sup> Identifying different actors from NGO's, market and state domain and their bridging networks, are considered measures of governance (Forino et al., 2015).

argued that resilient thinking can add a new dimension to urban planning through providing a metaphor for the dynamics of change in socio-ecological systems and a frame for analysis and the adaptive governance for planning (Wilkinson, Porter, & Colding, 2010).

Examples of initiatives regarding the integration of DRR and CCA in connection to resilience have been mentioned in articles. Resilient-oriented projects, such as London Resilience Partnership (2002) or the Barcelona Resilience Group (2008) have been considered projects that supported a cooperative partnership among sectors and across scales (Galderisi, 2017).

At the national level, the Australian government has put efforts into developing an institutional arrangement labeled with resilience<sup>12</sup> to pursue a multi-level collaborative approach which is identified as a fundamental approach in DRR and CCA integration (Forino et al., 2015). However, it is discussed that the initiative has not had a clear definition for resilience or indicators for the assessment of urban resilience (Galderisi, 2014). The challenge has been identified, and the need for precisely defining concepts like resilience is highlighted to support the combination of CCA and DRR strategies (Birkmann & von Teichman, 2010). Howes et al. (2015) have also stressed the need for a renewed focus on resilience under DRR and CCA integration governance. The lack of a clear definition for (urban) resilience could also be a reason behind contradicting ideas in connecting resilience to DRR and CCA integration in urban areas.

Birkmann et al. (2013) have also mentioned resilience as a concept for the conceptualization of integrated systems. Resilience as a proper approach in extreme situation provides a holistic framework to evaluate hazards in social-ecological systems; emphasizes on the capacities to deal with hazard or disturbance; explores options for dealing with uncertainty and future changes; and identifies enabling factors to create proactive responses (O'Brien et al., 2012).

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<sup>12</sup> "The mentioned institutional arrangements include the National Partnership Agreement on Natural Disaster Resilience (2009), the National Emergency Risk Assessment Guidelines (2010), and the National Strategy for Disaster Resilience (2011)" (Forino et al., 2015, p. 375).

## 4.2. Results of the content analysis

This section presents the results of the content analysis of the documents from the 100RC movement. The first steps of analysis were outlined in the methodology section, where the process of developing the themes and coding questions as well as selecting documents for analysis were explained. In this section, the themes and coding question are initially presented, followed by the results of the analysis.

As it was explained in the methodology section, in order to develop the themes for the content analysis of selected documents, the identified measures for the integration of DRR and CCA (M)s, are categorized in the broader groups. It was also explained that the guiding documents like CSDRM were used in developing the themes. Table 2 presents the themes in the first column, whereas the measures matched to these themes are presented in the second column. The (Mx) s, are the indices presented in Table 1 as facilitating measures for the integration of DRR and CCA.

Collaboration, assessment, integrating and informing are the themes addressing how the changing risks and uncertainty could be considered in efforts to integrate DRR and CCA. Enhancing the capacity of involved stakeholders is also highlighted through themes regarding learning, experimenting, planning, and flexibility in the plans and policies. Funding mechanisms and legal endorsement of strategies are the other points needed to be considered. Social aspects regarding empowering vulnerable groups and enhancing equity are also considered. The explanation for each theme is also presented in Table 2.

Finally, Table 2 was used as the matrix to analyze the CRF and the results of the analysis are reported in Section 4.2.1. In the next step, the themes were used as basis for coding questions used in the content analyses of the CRSs. The questions are presented in Table 3, and the results of the analysis on CRSs are reported in Section 4.2.2.



Table 2: Themes for the content analysis of the 100RC documents

Themes for analysis	Facilitating factors for integration of DRR and CCA ( see Table 1)
Collaboration/Strengthening collaboration and integration between diverse stakeholders working on disasters, climate and development	M2, M3, M5, M6, M8, M11, M12, M13
Assessment/Periodically assessing effects of climate change on current and future disaster risks and uncertainties	M19, M32, M33, M35, M38, M43, M44, M53
Integration/Integrating knowledge of changing risks and uncertainties into planning, policy and program	M7, M9, M14, M16, M20, M29, M3, M16
Informing/increasing access of all stakeholders to information and support services concerning changing disaster risks, uncertainties and broader climate impacts	M4, M10, M14, M18, M41, M42, M45
Experiment/ Strengthening the ability of people, organizations and networks to experiment and innovate	M24, M31
Learning/ Promoting regular learning and reflection	M1, M15, M17, M30, M32
Flexibility/ Ensure flexibility of policies and practices to tackle changing disaster risk	M22, M28, M33, M37, M48, M49
Planning/ Plan for uncertainty and unexpected events	M23, M29, M36, M46, M47, M40
Challenging/ Promoting socially just and equitable economic systems	M52, M40
Empowering/ Empower communities and local authorities to influence the decisions of national governments	M25, M40
Development/ Promote environmental sustainability	M38, M39
Legal endorsement and legislation of policies and strategies	M26, M27
Funding mechanisms	M50, M51, M52

Table 3: Coding Questions used for the content analysis of selected city resilience strategies

Themes for content analysis	Measures for integration of DRR and CCA (scoping study)	Coding Questions
Collaboration	M2, M3, M5, M6, M8, M11, M12, M13	Q1: Which organizations, sectors or projects are connected to DRR and CCA in the case city?
		Q2: How were the involved stakeholders and projects involved in the development of CRS? What was their input to CRS?
		Q3: How were the involved stakeholders and projects coordinated?
		Q4: How was land-use planning or urban planning involved in the strategy?
Assessment	M19, M32, M33, M35, M38, M43, M44, M53	Q5: How was the risk and vulnerability assessment conducted in CRS?
		Q6: Was there any consideration for assessment of the existing urban development, DRR and CCA plans?
		How were climate change impacts considered in the assessment?
		Was there any integrated risk assessment considering both disaster risks and climate risks in developing the strategy?
		Q7: What is the mechanism for monitoring and evaluation and updating of CRS?
Integration	M7, M9, M14, M16, M20, M29, M3, M16	Q8: Are DRR and CCA contributing to the vision, goals and actions in CRS?
		Q9: How is CCA integrated into DRR and urban development in the goals or actions of CRS?
		Q10: Are climate professionals considered as a part of the developing strategy?
		Q4
Informing	M4, M10, M14, M18, M41, M42, M45	Q11: Are there any communication platforms or channels for informing, regarding DRR and CCA actions in CRS?
Experiment	M24, M31	Q12: How has learning and training for establishing a common understanding (on DRR, CCA, and resilience) been considered in CRS?
Learning	M1, M15, M17, M30, M32	Q12, Q13
Flexibility	M22, M28, M33, M37, M48, M49	Q7
Planning	M23, M29, M36, M46, M47, M40	Q4
		Q13: How is uncertainty regarding climate disasters considered in the CRS?
Challenging	M52, M40	Q14: How have social justice and cohesion been addressed in DRR and CCA interventions of CRS?
Empowering	M25, M40	Q15: How are local communities and vulnerable groups included in measures for addressing DRR and CCA integration in CRS?
Development	M38, M39	Q16: How are CCM and environmental management considered in the CRS?
Legislation	M26, M27	Q17: How has legal endorsement of CRS been addressed?
Funding	M50, M51, M52	Q18: How are funding considerations reflected in CRS?

#### 4.2.1. Results of the content analysis of the CRF

CRF is a guiding document, defining the concept of resilience through seven qualities: flexible, inclusive, integrated, redundant, reflective, robust and resourceful. As illustrated by Table 4, those qualities were matched to the results of the scoping study. There was a close correlation between the qualities promoted through the CRF and the measures identified in the scoping study.

In the primary comparison based on Table 4, not all of the qualities and measures for integration were matched. For instance, the measures introducing assessment as a factor for integration were matched to none of the qualities of a resilient system. It was the same for legal and funding aspects, establishing a meso-level in the subnational and also regional levels to support the integration of DRR and CCA and promoting program-based approaches. From the measures mentioned above, the establishment of a meso-level for the integration of DRR and CCA and the use of program-based approaches are connected to the 100RC movement aim, though they are not connected to the qualities and drivers of a resilient city as defined by the CRF. The 100RC initiative is launched at the municipal level and has created a network of cities for knowledge sharing and learning. The development of the strategies spans from local to international and sometimes regional levels and is thus in line with what is recommended in the literature as meso-levels of management and planning which can bridge the global, national and local levels. The other point, regarding the program-based approach, is directly connected to the process of developing city resilience, which seek to ensure that the strategies are coherent and sustainable in place of fragmented and ad-hoc initiatives.

The legal and funding aspects, which were not matched to the qualities of a resilient system, were investigated more through comparing them to the drivers of resilience. The investigation showed that both measures are considered as general points in the drivers of a resilient<sup>13</sup> system, without addressing how the strategy as such should be implemented from a legal and financial point of view. As it was mentioned in the assumptions of analysis in the methodology section, the latent factors are not the main target of this content analysis. For instance, the resourcefulness as the quality of a resilient system can entail financial aspects linked to the implementation of strategies, but since it is not mentioned in the definition of that quality, the connection was not built into the matrix. The same point is valid in comparing assessment measure against the quality of reflectiveness; wherein assessment is a prerequisite for improving the reflectiveness.

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<sup>13</sup> In the drivers of resilience in the CRF, the drivers focusing on fostering economic prosperity of a city and ensuring social stability, security and justice have considered the financial and legal aspects in the general view and not directly connected to the CRSs (see Annex).

Table 4: Connection between the qualities of a resilient system (based on CRF) and measures for the integration of DRR and CCA (based on scoping study)

Themes for content analysis	Measures for the integration of DRR and CCA	Qualities of a resilient system in CRF
Collaboration	M2, M3, M5, M6, M8, M11, M12, M13	Inclusive, Integrated
Assessment	M19, M32, M33, M35, M38, M43, M44, M53	—————
Integration	M7, M9, M14, M16, M20, M29, M3, M16	Integrated, Robust
Informing	M4, M10, M14, M18, M41, M42, M45	Reflective
Experiment	M24, M31	Reflective
Learning	M1, M15, M17, M30, M32	Reflective
Flexibility	M22, M28, M33, M37, M48, M49	Flexible
Planning	M23, M29, M36, M46, M47, M40	Resourceful, Redundant and Robust
Challenging	M52, M40	Inclusive
Empowering	M25, M40	Inclusive
Development	M38, M39	—————
Legislation	M26, M27	—————
Funding	M50, M51, M52	—————

#### 4.2.2. Results of the content analysis of CRSs

In this section, the results of the content analysis of CRSs are elaborated based on the answers in relation to the coding questions as presented in Table 3. The structure of the narrative follows the main themes regarding integration extracted from the CSDRM as presented in the first column of Table 3.

The objective of the content analysis of the CRSs was not to compare or rank them. Rather, the analysis aimed to collect the experience of different cities in the operationalization of measures for the integration of DRR and CCA. In Table 5, the cities addressing an answer to each coding question have been checked, whereas the subsequent text offers more details on the contents of Table 5. In the running text, the parts addressing each of the questions are easy to navigate through the number of question (Qx) at the end of each paragraph. However, it needs to be mentioned that only the most interesting points answering each question are reflected in the narrative text.

Table 5: Overview, content analysis of CRSs based on coding questions

Themes for content analysis	Coding Questions	Cities					
		Amman	Athens	Bristol	New Orleans	Rotterdam	Vejle
Collaboration	Q1: Which organizations, sectors or projects are connected to DRR and CCA in the case city?		*	*	*	*	*
	Q2: How were the involved stakeholders and projects involved in the development of CRS? What was their input to CRS?		*	*	*	*	*
	Q3: How were the involved stakeholders and projects coordinated?	*	*	*	*	*	*
	Q4: How was land-use planning or urban planning involved in the strategy?	*	*		*	*	*
Assessment	Q5: How was the risk and vulnerability assessment conducted in CRS?	*	*	*	*	*	*
	Q6: Was there any consideration for assessment of the existing urban development, DRR and CCA plans?	*	*		*		*
	How were climate change impacts considered in the assessment?		*	*		*	*
	Was there any integrated risk assessment considering both disaster risks and climate risks in developing the strategy?						*
	Q7: What is the mechanism for monitoring and evaluation and updating the CRS?	*	*	*	*	*	*
Integration	Q8: Are DRR and CCA contributing to the vision, goals and actions in CRS?	*	*	*	*	*	*
	Q9: How is CCA integrated into DRR and urban development in the goals or actions of CRS?	*	*	*	*	*	*
	Q10: Are climate professionals considered as a part of the developing strategy?		*				
Informing	Q11: Are there any communication platforms or channels for informing, regarding DRR and CCA actions in CRS?	*	*	*	*	*	*
Experiment	Q12: How has learning and training for establishing a common understanding (on DRR, CCA, and resilience) been considered in CRS?	*	*	*	*	*	*
Learning	Q12, Q13						
Flexibility	Q7						
Planning	Q13: How is uncertainty regarding climate disasters considered in the CRS?			*	*	*	*
Challenging	Q14: How have social justice and cohesion been addressed in DRR and CCA interventions of CRS?				*		
Empowering	Q15: How are local communities and vulnerable groups included in measures for addressing DRR and CCA integration in CRS?	*	*	*	*	*	*
Development	Q16: How are CCM and environmental management considered in the CRS?	*	*	*	*	*	*
Legislation	Q17: How has legal endorsement of CRS been addressed?	*	*	*			
Funding	Q18: How are funding considerations reflected in CRS?		*	*	*	*	

## *Collaboration*

Multi-stakeholder collaborations across societal sectors and administrative levels are highlighted in the academic literature as means for improving the integration of DRR and CCA (Birkmann & von Teichman, 2010; Galderisi, 2014, 2017; Prabhakar et al., 2009). The analysis of the CRF and CRSs revealed that collaboration between actors from the governmental, private and social domains is emphasized in the 100RC movement too. However, the content analysis of CRSs also showed that collaboration between actors that so far have focused on either DRR or CCA is not highlighted in all of the strategies. Nevertheless, both the concepts of DRR and CCA are reflected in all of the CRSs. The process of developing resilience strategy stresses the need to conduct multi-stakeholder workshops as an initial part of developing resilience strategies.

In Amman, in the absence of previous initiatives on DRR and CCA, CRS proposes to develop a climate change action plan for the city. However, the Ministry of Environment is the only partner of the mentioned action, which makes it stand-alone. Amman's CRS has more focus on collaboration in support of CCA at the international level rather than national and local levels (100 Resilient Cities, 2017a) (Q1,2).

In other cities, CCA and DRR involvement in the development of CRS is considered through two main aspects. In some cases, ongoing or existing projects connected to DRR and CCA are integrated into the CRS. The contribution of the mentioned projects includes different aspects from the integration of the risk assessment studies of the projects to the integration of whole project in the goals and actions of the CRS. The contribution of stakeholders from DRR and CCA sectors in the steering and working groups is the other aspect of the involvement of the two fields in CRS (Q1, 2).

While Athens is integrating the existing relevant plans<sup>14</sup> to the CRS, in Rotterdam, revising the plans to be integrated into the CRS is highlighted. In Rotterdam's CRS, the action titled "embedding climate adaptation into the urban fabric of the city" will develop and enhance existing programs aiming to prepare the city for the impacts of climate change (100 Resilient Cities, 2016b). The other action in Rotterdam's CRS will take the results of pilot studies addressing climate resilience development<sup>15</sup> in the region (Ibid). There is a similar reference to the municipality's "Climate-proof and Adaptation strategy," in proposing floating buildings in CRS (Ibid) (Q1, 2, 4).

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<sup>14</sup> In Athens, several documents, including Athens climate change adaptation, climate change mitigation action plans, and the existing strategic and operational plans were integrated to the CRS. Climate change adaptation and mitigation action plans are integrated into one of the goals of strategy called "integrate natural systems into the urban fabric"(100 Resilient Cities, 2017b).

<sup>15</sup> The pilot studies as part of the Rotterdam Adaptation Strategy focused on climate resilient development include "Pilot Noordereiland, Pilot Botlek, Pilot Feijenoord, Pilot Crisis management and flooding " (100 Resilient Cities, 2016b, p. 87).

Vejele's resilience strategy is connected to plans<sup>16</sup> related to CCA and DRR as well as stakeholders who are active in those fields. In Vejele and Bristol, stakeholders from DRR and CCA are highlighted as main actors in the development of the CRS. Among the steering and working committees in developing Vejele's resilience strategy, Housing Policy Steering Group is mentioned as an active body in finding solutions to the challenges of urbanization, climate change, and flooding (100 Resilient Cities, 2016c) (Q1,2). In Bristol, stakeholders from climate change and disaster management and urban planning are among those mentioned as the members of the resilience sounding board<sup>17</sup> (100 Resilient Cities, 2016a). In Athens, cross-departmental and cross-sectoral working groups focusing on Urban Heat Island (UHI) and the nature-based infrastructures are involved in the process of developing the CRS (100 Resilient Cities, 2017b) (Q3,4).

Coordinating the organizations and sectors working with DRR and CCA, through developing knowledge portals was highlighted in the reviewed literature (Forino et al., 2017; Forino et al., 2018; Mysiak et al., 2018). Cross-sectoral and cross-departmental coordination were also considered in the process of CRSs development through establishing coordination offices. Chief Resilience Officers (CRO)s are the main coordinators in CRSs, and the specific offices for coordination in municipalities support CROs. In some of the strategies, DRR, CCA, and urban development sectors are the highlighted sectors in connection to the coordination office. For instance, it is mentioned in New Orleans where the Mayor's Office of Resilience and sustainability and CRO as coordinator of strategy will work with the "City Planning Commission and Hazard Mitigation Office to ensure consistency with the City's Master Plan and Hazard Mitigation Plan" (100 Resilient Cities, 2015, p. 26). In Rotterdam, as a part of coordinated support, identifying the co-benefits and synergies among actions is highlighted (100 Resilient Cities, 2016b) (Q3,4).

Assigning land-use planning as a core in the nexus of DRR and CCA was another finding from scoping study regarding the integration of the two fields (Galderisi, 2017). Involvement of urban planning through the integration of existing urban plans is addressed in CRSs in New Orleans, Vejele, and Rotterdam. In Athens' CRS is mentioned "We mapped our pillars, goals, and actions to the Sustainable Urban Development Plan, NSRF<sup>18</sup> funding Axis and Integrated Urban Development Plan (SOAP) to understand the interdependencies between the resilience strategy and the other plans in the city" (100 Resilient Cities, 2017b, p. 34). Amman has a different pathway where finalizing the strategic master plan of the city and developing a strategic plan for Amman's sprawl area are proposed as actions in the CRS, in support of institutionalizing planning (100 Resilient Cities, 2017a) (Q4).

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<sup>16</sup> Vejele's Climate Change Adaptation Plan (2014) and Risk Management Plan are used in the development of CRS (100 Resilient Cities, 2016c).

<sup>17</sup> The sounding board which was created to support CRS, includes a range of experts in different aspects.

<sup>18</sup> National Strategic Reference Framework

### *Assessment and flexibility*

Assessment is considered as a measure to integrate DRR and CCA in the academic literature, where several studies stress the need of conducting ongoing comprehensive and integrated vulnerability and risk assessments (Birkmann & von Teichman, 2010; Florano, 2015), assessing pros and cons of land use choices (Galderisi, 2017) and ensure that urban planning tools have included DRR and CCA in their considerations (Rivera, 2014).

Assessments were part of the initial steps of developing the CRSs, where cities conducted diagnostic work through a Preliminary Resilience Assessment (PRA). PRA supports cities “to understand how the city is currently performing, to identify potential risks and vulnerabilities, gaps in knowledge, and opportunities for collaboration and strategic action” (100 Resilient Cities, 2017a, p. 17). Some of the cities used the risk assessments in the existing or ongoing projects in their CRSs. Contribution of climate change to achieve an integrated risk assessment was not referenced clearly by all of the cities, and the assessment of existing plans is only addressed in some of the strategies (Q5).

Bristol has stressed increasing uncertainty about the changing climate in the CRS and has considered climate change as a variable in designing resilience scenarios (100 Resilient Cities, 2016a) (Q13). In New Orleans, aside from the integrated PRA, a disaggregated risk assessment on the critical infrastructure and a survey of building conditions are proposed. The mentioned assessments support a goal in the CRS, namely to “invest in pre-disaster for post-disaster recovery” (100 Resilient Cities, 2015, p. 29), which could improve the integration of DRR and CCA (Q5,6).

Rotterdam’s CRS highlights the need for considering impacts of climate change and uncertainty in actions and projects, but it is not mentioned how those factors are considered in the risk and vulnerability assessment (Q13). Vejle has addressed the risk and vulnerability assessment in its CRS in two levels. At the city level, CRS used the risk assessment information from existing projects, wherein it is mentioned that climate risks have been integrated into assessments<sup>19</sup> (100 Resilient Cities, 2016c). At the regional level, Vejle is working on an EU project (Smart Mature Resilience (SMR)) to develop guidelines on resilience assessment and implementation to increase Europe’s resilience to shocks and stresses (Ibid) (Q6).

Assessing and updating existing plans in the fields of DRR, CCA and urban development were determined as facilitating factors for the integration of DRR and CCA in the academic literature (Florano, 2015; Galderisi, 2017). The CRSs generate revisions of

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<sup>19</sup> In Vejle’s strategy, it is mentioned that climate risks are considered in the risk assessments of the city’s hydrological conditions and the drainage system.



some of the plans, but a structured assessment of existing plans is not considered in any of the strategies.

Vejle highlights the need for revising existing plans in order to improve their value as catalysts for resilience. Conducting a societal resilience evaluation is another action in Vejle's CRS, in order to assess the impacts of urban development on high-risk assets (100 Resilient Cities, 2016c). In Vejle's CRS it is stated: "We want to develop and apply a dynamic tool and model to assess the effects a future urban development might have for high-risk companies or sensitive assets. The method allows for an improved balance between the growth in urban development and risk assessment" (100 Resilient Cities, 2016c, p. 80). In the CRS produced by New Orleans, the revision to the comprehensive zoning ordinance of the city in order to include new stormwater regulations is considered (100 Resilient Cities, 2015). Amman considers updating and revising some of the city's plans<sup>20</sup> from another viewpoint, to support walkability in support of climate change mitigation (100 Resilient Cities, 2017a) (Q6).

### *Learning, training and experiment*

Awareness raising for policymakers, practitioners, and community about DRR and CCA and improving the culture of safety for risk-informed decision making have been introduced as measures for promoting integration of DRR and CCA (Begum et al., 2014; Birkmann & von Teichman, 2010; Galderisi, 2014, 2017; Ghimire et al., 2018; Rivera, 2014; Rivera et al., 2015; Serrao-Neumann et al., 2015). The qualities of a resilient system, as being reflective and flexible, provide opportunities for involved stakeholders to learn and adapt to new knowledge.

Aside from the process of developing CRSs through different workshops, working groups and networking among the member cities, some of the strategies have proposed specific actions in support of training and improving capacity of professionals and citizens. Amman proposes institutionalizing planning as a goal and considers establishing an urban resilience research center to this end. The center would improve the capacity of community councils and communities in disaster preparedness and climate actions. It would also provide a possibility for increased networking between private and public actors through joint training courses and awareness programs (100 Resilient Cities, 2017a) (Q12).

Bristol proposes developing a guidance and management framework within the 100RC network for executives with responsibility for different resilience themes. As an outcome of a knowledge sharing network, Bristol developed its climate action plan, based on the learning from the CRO network (100 Resilient Cities, 2016a). New Orleans highlights resilience thinking in its strategy for all residents and proposed to create a culture of environmental awareness, supported by actions like the creation of a leadership development program for

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<sup>20</sup> Amman proposes to revise the street manuals to promote walkability and to update Amman Green Growth plan to align it with the new national green growth plan.

city resilience and the establishment of a resilience center (100 Resilient Cities, 2015). In Rotterdam, different actions for knowledge sharing regarding different aspects of resilience at national and international levels are considered<sup>21</sup>. Vejle addresses the learning aspect by organizing an annual resilience festival to share knowledge and case studies related to different topics on resilience and urban development. The 'Resilient Vejle' committee would also share knowledge regarding resilience across different sectors (100 Resilient Cities, 2016c). The mentioned initiatives in the strategies, which are promoting the capacity of stakeholders regarding resilience, could also support the integration of DRR and CCA through enhanced awareness and knowledge (Q12).

Alongside regular training activities, most CRSs include provisions for the continuous monitoring of the implementation of their strategies. This monitoring is instrumental for detecting whether activities produce desired results and provide a basis for adjustments if necessary. As such, the monitoring is also a crucial part of learning. Monitoring and evaluating linkages between DRR and CCA is also an aspect highlighted in the literature (Birkmann & von Teichman, 2010; Galderisi, 2014) (Q7).

The Mayor's Office of Resilience and Sustainability in New Orleans will evaluate programs and policies to mitigate the impacts of future threats and adapt to changes across the region. The Municipality of Vejle will partner with housing, business, and educational organizations to establish 'a Resilient' Vejle committee responsible for monitoring the implementation of the strategy (100 Resilient Cities, 2016c). The monitoring and evaluation process in the selected cities covers different measures such as developing metrics, indicators, and offices which have the potential for identifying the duplication of actions. However, the issue of overlapped efforts was not considered in the indicators of monitoring in CRSs. For instance, in Athens, the key performance indicators in M&E are quantitative for evaluation based on the number of measures related to each action (e.g., the number of trees planted) (100 Resilient Cities, 2017b) (Q7).

Moreover, In 2015, the 100RC movement released an index called City Resilience Index (CRI) to provide cities with a basis for assessment and monitoring and to support them in decision making on investments to further strengthen their resilience (The Rockefeller Foundation & Arup, 2015). The selected cities in this study released their CRSs in 2015-2017. Among them, Amman and New Orleans were in the pilot group which used the CRI for the first time (Q7).

Aside from the CRI, Amman's strategy mentions that the existing Key Performance Indicators (KPIs)<sup>22</sup> in the municipality will be used to monitor and evaluate the

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<sup>21</sup> Hosting an international architecture biennale (2016-2020) with focus on different aspects like adaptation to climate change and water issues as well as establishing the Rotterdam center for resilience delta cities, national city deal climate adaptation and Resilience Rotterdam- the Hague metropolitan area are some of the actions for knowledge sharing (100 Resilient Cities, 2016b).

<sup>22</sup> "The KPIs are divided into 7 themes; institutional performance, financial management, infrastructure, city branding, society, urban planning and investment, and environment and health. Relevant GAM KPIs have been selected to monitor, review and evaluate Amman resilience strategy"(100 Resilient Cities, 2017a, p. 128).

implementation progress of actions proposed in CRS (100 Resilient Cities, 2017a). Some of the themes in KPIs may convey disaster risks and climate change impacts, but there is no information regarding the details of each one. Bristol proposes to develop a resilience impact assessment to assess the impact of initiatives and projects and to capture an integrated and systemic view of risks and impacts associated with city interventions (100 Resilient Cities, 2016a). Bristol's CRS also highlights the review process in New Orleans where New Orleans has established a Resilience Design Review Committee for regular reviews of their CRS (Ibid) (Q7).

### *Integration and planning*

The reviewed academic literature has considered developing shared policy visions across sectors and including DRR and CCA into the policies and the strategies of other relevant fields (such as urban planning), which in turn may help to integrate the fields of DRR and CCA as well (Begum et al., 2014; Forino et al., 2017; Forino et al., 2015; Howes et al., 2015). Integrating climate professionals and enhancing the communication between policy, practice, and science is the other measure in support of DRR and CCA integration (Forino et al., 2018; Forino et al., 2015; Rivera, 2014). Developing the capacity of local stakeholders and their contributions to planning through local task groups is also considered (Prabhakar et al., 2009).

In this part, the study was seeking to establish how DRR and CCA were integrated into the vision, goals, and actions of CRSs, and how CRSs have considered DRR and CCA integration. The strategies approach the integration of DRR and CCA by including them in a variety of ways. In some of the strategies, climate change and disaster risks are directly included in visions and goals. The strategies also define multi-objective measures addressing DRR, CCA, CCM and urban development as part of the proposed actions which can support the integration of aforementioned fields (Q8).

Creating an environmentally proactive city is one of the visions addressing climate change in Amman's CRS (100 Resilient Cities, 2017a). Whereas climate change mitigation and energy security are mentioned in Amman's strategy, it has a more reactive standpoint regarding disasters, and its proposed actions regarding climate change are not well-connected to other relevant projects (Q9, 16). Even in the actions with multi-objective measures, DRR or CCA aspects are not highlighted. For instance, one action in the stormwater drainage master plan and another action in the revitalization of the Hijazi railway (as a multi-functional asset) are not connected.

Athens addresses integration of DRR and CCA through nature-based actions. Developing green infrastructure to improve the city's microclimate and air quality will reduce the impacts that stem from an urban heat island and flooding. Athens also considers integrating CCA

measures into urban design by proposing to “design and develop shading and natural cooling solutions in urban planning and street furniture” (100 Resilient Cities, 2017b) (Q9).

Bristol considers extreme weather and disaster risks in CRS’s vision, and proposes a multi-functional green infrastructure to address DRR and CCA with regard to social aspects. The action, called “wild rainwater streets”, aims to provide the public green spaces and sustainable drainage and to decrease the heat island impacts in the city (100 Resilient Cities, 2016a). Rotterdam integrates climate adaptation and cyber resilience into its resilience vision and actions. The strategy seeks to connect the water-sensitivity to cyber-security by proposing climate-proof and cyber-proof infrastructure (100 Resilient Cities, 2016b). The strategy also considers integrating CCA with urban development through a new spatial plan that will be developed based on a regional analysis of critical infrastructure resilience to climate change. Scaling up a successful experience of the first climate proof district in Rotterdam<sup>23</sup> where climate adaptation was integrated into plans for urban development, is another goal in Rotterdam’s CRS (Ibid) (Q8,9).

The multi-objective actions in support of CCA and DRR are also considered in New Orleans. For instance, investing in the regional urban water plan will support flood risk reduction, soil subsidence mitigation, and improving public spaces. Developing clear guidance and standards for resilient designs of buildings in urban areas is another action in support of DRR and CCA (100 Resilient Cities, 2015). Multi-objective actions in Vejle varies from developing a strategic wastewater plan to developing permeable paving to improve water management and reducing flood risks during extreme rainfall (100 Resilient Cities, 2016c) (Q9).

It is mentioned in strategies that the cities utilized academics and professionals from all fields whilst developing their CRSs, though the engagement of climate professionals is only highlighted by Athens. Holding a conference on heat waves and measures for Cool Athens provided an opportunity for the contribution of climate professionals in Athens CRS (100 Resilient Cities, 2017b). Academic and administrative experts on natural and human-made disasters were also involved in the initial assessment as part of Athens CRS (Q10).

### *Informing*

Having access to and exchanging information and data regarding the DRR and CCA is considered a prerequisite for breaking the silos between the two fields (Forino et al., 2018; Galderisi, 2014; Klima & Jerolleman, 2017; Mysiak et al., 2018). The selected CRSs promote data-driven policymaking through different actions and initiatives. The development of digital information and knowledge sharing platforms can benefit resilience initiatives in all aspects of DRR and CCA. To this end, Amman proposes the development of a centralized

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<sup>23</sup> This refers to the Zoho district in Rotterdam, which has undergone a gradual urban regeneration through a climate adaptation plan implemented with a multifunctional Waterplein Benthemplein as a catalyst (100 Resilient Cities, 2016b).

GIS database to support multi-sectoral decision-making (100 Resilient Cities, 2017a). However, it is not clear if the climate disaster data are also considered in the database. Athens is addressing urban heat islands through linking “all heat-related data sources (EU projects, Central Government Institutional Info, NOAA, and other research centers data) to the Municipal Portal” (100 Resilient Cities, 2017b, p. 87) (Q11).

Bristol addresses another aspect of informing through using a knowledge exchange platform (especially in a climate preparedness theme) as a channel for connecting citizens and organizations across the city to possible funders. New Orleans uses its STAT (Short Term Assessment and Treatment) program to enable municipality departments to track and report the progress of their projects in a transparent way. Although STAT is not directly connected to DRR and CCA, it also has the potential to be used in support of these policy areas (Q11).

Rotterdam addresses information sharing with a focus on infrastructure through creating a specific database about the place and interdependencies of infrastructure. In Rotterdam, the cyber collaboration in the metropolitan area will facilitate sharing knowledge in water management and cyber resilience, wherein both of the mentioned aspects are connected to DRR and CCA. They are also working to establish such channels at the international level with other partners. Cooperation between infrastructure providers is another action proposed to ensure that they coordinate approaches and share experiences and knowledge (Q11).

### *Legislation and Funding*

Establishing legal endorsements for both DRR and CCA and developing consistent legislation for strategies and action are the points which the academic studies have offered for the integration of DRR and CCA (Forino et al., 2017; Howes et al., 2015; Rahayu, Haigh, & Amaratunga, 2018). These aspects are not considered directly in the 100RC framework, but are addressed in the CRSs in different ways.

Some strategies stress that actions should be politically and financially deliverable (e.g., Bristol), and others consider addressing legal aspects through highlighting the need for updating and enforcing laws in support of actions connected to DRR and CCA. In Amman, development, updating and enforcing environmental laws are highlighted in developing a climate change action plan. Updating and establishing acquisition law, planning law, and building law with clear responsibilities are the actions mentioned that need to be addressed in support of the CRS (100 Resilient Cities, 2017a). In Athens, undertaking the regulatory procedures for establishing new green public spaces and establishing a regulatory framework for the use of cool and sustainable materials are the points regarding the legal aspect of strategy (100 Resilient Cities, 2017b) (Q17).

Establishing flexible and cooperative funding mechanisms have been highlighted as enabling measures for the integration of DRR and CCA (Begum et al., 2014; Birkmann & von Teichman, 2010; Forino et al., 2015; Howes et al., 2015). The analyzed resilience strategies have different approaches, varying from assigning a funding resource for actions to

addressing the funding mechanism. A dynamic and multi-objective mechanism for funding is proposed in Bristol. The Natural Capital Trust (NCT), is proposed to act as a “conduit of funds from developers, and from potential beneficiaries of Payments for Ecosystem Services schemes, to support a range of projects which ensure provision of services by ecosystems, enhancing (amongst other things) resilience to the effects of climate change and of the region’s infrastructure” (100 Resilient Cities, 2016a, p. 49). Bristol also aims to enhance the flexibility of funding resources, through devolving funding and power from government to region<sup>24</sup>. “Bristol Impact Fund” is another initiative the Bristol City Council has developed to align the grant streams on Voluntary and Community Sector (VCS), through one “Prospectus” to focus on priorities and challenges. Bristol also has considered a specific financing structure to blend the public and private money on aggregated small and large scale place-based projects like flood defenses and green infrastructure, to take a long term perspective on financial return from the projects. As already mentioned, Bristol proposes to develop a platform for city knowledge exchange, which aims to connect project ideas to possible funders (Q18).

In Athens, the funding aspect was highlighted by indicating the funding source for each action. They have also mapped the actions to the “National Strategic Reference Framework” funding Axis. The action called “Athens partnership fund” aims to attract donations from foundations, businesses, and individuals (100 Resilient Cities, 2017b). Amman has a general consideration for funding issues without promoting a funding mechanism for the implementation of actions in the strategy (100 Resilient Cities, 2017a). In Rotterdam, the alternative funding model is proposed to support the development of flood defenses, through distributing the investment costs among municipalities, the national water board and developers from the private sector. The last groups will in return gain benefits due to reduced flood risk, reduced insurance and higher development values (100 Resilient Cities, 2016b) (Q18).

The City of New Orleans is working to identify the most advanced insurance coverage models to reduce exposure in the face of risks. The risk insurance is also considered in the literature for the integration of DRR and CCA (Forino et al., 2015). New Orleans has initiated to pre-fund disaster resilience of infrastructure through the transfer of risk to the private market. The strategy has considered providing “low-interest capital and a potential reduction in insurance premiums” (100 Resilient Cities, 2015) as incentives for property owners who face storming and flooding to invest in risk reduction and climate adaptation measures (Q15,18).

### *Challenging and empowering*

Empowering communities and local authorities through decision-making processes and promoting a balanced combination of community-based initiatives and scientific knowledge

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<sup>24</sup> Resilience and West of England devolution deal” is the deal proposed to address flexible funding and planning approaches in Bath, Bristol and South Gloucestershire councils (100 Resilient Cities, 2016a).

are recommended in support of DRR and CCA integration (Birkmann & von Teichman, 2010; Forino et al., 2019; Serrao-Neumann et al., 2015).

The strategies were analyzed to find out how local communities and vulnerable groups were included in resilience strategies and understanding if the engagement of social groups would support the integration of DRR and CCA. The analysis shows that CRSs address the engagement of citizens and vulnerable groups through two types of actions. The first one regards efforts to raise awareness about DRR, CCA, and environmental issues as well as empowering local communities. The next type of engagement is through including the vulnerable groups in the implementation of initiatives connected to the DRR and CCA (Q15).

In Amman, raising awareness regarding climate change and resource scarcity is carried out in support of DRR and climate change mitigation. Including research and data consolidation regarding the needs and experiences of refugees in an urban resilience research center, or harmonizing agencies working with refugees through establishing a common response for all of them, are the aspects with potential to consider DRR and CCA integration in Amman. Using urban design to achieve humanitarian goals and engaging displaced people in the city development plan are the other actions to improve the engagement of all groups (100 Resilient Cities, 2017a) (Q14,15).

In Athens, fostering collaboration and stakeholder engagement, co-creation of public spaces and empowering local communities are goals supporting local communities (100 Resilient Cities, 2017b). Studying those goals and related actions reveals that integration of DRR and CCA through the contribution of vulnerable groups and local communities have been addressed in various ways. In Athens vulnerable groups to climate risks, such as urban heat waves, have been directed to cool centers through phone and web applications (100 Resilient Cities, 2017b). Some other actions engage citizens in multifunctional actions such as enhancing small urban farming (Ibid). Facing a large number of migrants, Athens considers the development of a migrant integration action plan, and a social housing program; however, none of them addresses CCA or DRR. In the initial phases of developing Athens' CRS, citizens contributed to resilience assessment and envisioning future resilience of the city (Q15).

Bristol considers community-based adaptation and local scale funding for improving social cohesion and capacity, but both are in the general perspective and have the potential to improve integration of for DRR and CCA. Through an initiative which spans over social, economic and DRR and CCA aspects, New Orleans tries to reduce unemployment in the city by creating job opportunities connected to the water sector. "Greater New Orleans, Inc, the regional economic development alliance, is committed to further developing the emerging water and environmental services sector, with a goal of Southeast Louisiana becoming a global hub of businesses that profitably manage environmental issues and challenges" (100 Resilient Cities, 2015, p. 52). The initiative is complemented with equipping the workforce with new skills and knowledge for new industries. Proposing reconsideration in local hiring practices in support of creating local job opportunities is the other point New Orleans CRS

considers in connecting different fields to socio-economic aspects. The integrated approach also bridges the aspects regarding affordable childcare, physical and behavioral health care, and transportation to the other parts of the initiative (Q14, 15).

Investing in the financial stability of households through creating an emergency saving account program is another action in support of vulnerable groups to handle unexpected risks in New Orleans. New Orleans' CRS also proposed an action to launch a "neighborhood resilience program." Through the mentioned program, which would be implemented in a partnership with the New Orleans Redevelopment Authority, neighborhoods would be supported in assessing their resilience and addressing their challenges and risks while at the same time gaining the added value of social cohesion brought about by working together. Expanding access to safe and affordable housing is an action in support of equity, which is connected to DRR in a way. However, the safety measures connected to the housing program are not highlighted (Q14, 15).

Vejle promotes collaboration between citizens and companies surrounding flooding areas' to identify co-benefits from DRR measures for owners in lower and upstream areas. Vejle also takes benefit from an EU project entitled "Local Authorities as Drivers for Development Education and Raising Awareness" to enhance local authorities' role in making the city resilient. Developing a 'Resilience Laboratory' would promote partnerships with a focus on social cohesion, green areas, allotments, water, and flooding (100 Resilient Cities, 2016c). Rotterdam tries to integrate small scale projects led by citizens and small businesses into one of the actions called "embedding climate adaptation into the urban fabric of the city" (100 Resilient Cities, 2016b). However, it is not clear if the content of those projects is connected to DRR or CCA (Q15).

The aspects regarding climate change mitigation and environmental aspects, which were considered in the strategies, were discussed under some of the previous parts.



## **5. Discussion**

This section contains the discussion of the thesis results, which has been divided into two main parts. First, it addresses the results from the scoping study of the academic literature in connection to DRR and CCA integration in urban areas. Second, it discusses the integration of DRR and CCA in practice based on the findings from the analysis on the 100RC documents. The section will conclude with some arguments regarding the validity and limitation of the study.

### **5.1. Discussion on the scoping study**

#### **5.1.1. Various perspectives on the integration of DRR and CCA**

Despite considerable attention to the integration of DRR and CCA in urban areas, there is no coherent viewpoint on the term of integration, where two different perspectives were identified in the academic literature. One of the perspectives is proposing to merge the two fields and the other is proposing to enhance the synergic relation between the two fields (see Section 4.1.1, Figure 3). The lack of a coherent perspective on the integration of DRR and CCA has resulted in outlining the problem in different ways and in some cases, the main objective behind the integration of the two fields is overlooked. Seemingly, there is a need to further specify how and why DRR and CCA need to be integrated in the context of urban development.

Moreover, a clear definition of integration was not provided by the studies, and often one needs to read the whole articles to understand from which perspective it discusses integration. Hence, the need for defining the concept of integration seems underestimated in most studies, aside from the ones using the word “mainstream” as a correlated concept to the integration. That is why establishing a clear definition for “integration” is necessary.

#### **5.1.2. How specific are the measures for the integration of DRR and CCA?**

The reviewed articles are proposing measures for the integration of DRR and CCA based on the wide range of interviews and cases from different parts of the world. Considering the argument that there is no unique prescription for integration (Rivera et al., 2015), most of the introduced measures could be implemented in many contexts. The reason for this might be an absence of theory in the field of DRR (Alexander, 2013), where the introduced measures for the integration of DRR and CCA in connection to urban resilience may have their theoretical roots in other fields. This makes the proposed measures relevant to fields like transportation planning, infrastructure planning, land use planning, and disaster preparedness and response.

### **5.1.3. Developing a nexus for integration**

This thesis focuses on the integration of DRR and CCA in urban areas, which also includes a third domain - urban development - in connection to this integration. Most of the reviewed studies have stressed this aspect by connecting the integration to (urban) development or sustainable development. However, due to the complexity of the urban system and the involvement of different fields in relation to it, there is a need to define an appropriate scope in the selection of the fields to be integrated. Later in this section, it will be discussed that having an integrated approach may lead to the creation of unbalanced extent of linkages between disciplines. In an attempt to define the balanced scope of fields to be integrated, we can consider the proposal of Galderisi (2017) to frame a nexus among environmental degradation, climate change (including CCA and CCM), DRR and urban development. However, while creating a nexus of the most relevant fields, it is important to avoid creating new silos which can create rather than reduce barriers to effective and efficient results. In this respect, integration of DRR and CCA without connection to CCM and environmental degradation will generate a need for extra consideration later on to connect the latter two to the synergistic connection between DRR and CCA.

### **5.1.4. Resilience in connection to the integration of DRR and CCA**

There are strong connections between the notions of resilience and the integration of DRR and CCA. The role of resilience in promoting the integration of DRR and CCA is not just based on its “transversal capacity to deal with the expected and unexpected threats” (Hernantes, Maraña, Gimenez, Sarriegi, & Labaka, 2019, p. 97). As Pelling (2010) discusses, using the concept of resilience could facilitate the possibility of attainment of funding for disaster-specific risk reduction and climate adaptation. On the other hand, integrating DRR and CCA can form the base for improving resilience.

## **5.2. Discussion on the results of the content analysis of 100RC movement documents**

### **5.2.1. The integration of DRR and CCA in the 100RC movement**

In the CRF, resilience is introduced as a concept in support of bridging the gap between DRR and CCA (The Rockefeller Foundation & ARUP, 2015a). Also, being integrated is introduced as a quality of resilient systems since it increases the chances of cohesive decision making and a multi-organizational approach toward resilience. Thus, the guiding document of the 100RC movement, promotes resilience as a lens to mainstream integrated thinking in the city among all sectors and aspects highlighted in the strategy.

Prioritization of risks to be addressed, sectors to be focused on and collaboration to be enhanced are based on the existing data and knowledge at a certain point in time. The mentioned points are prone to change which consequently require regular updating. Although updating and revising the CRSs has been considered as a part of the process, the need for identifying the most related fields to integrate could be considered in the development of the resilience strategies and help to decrease the risk of overlooking important aspects. This point

is found in some of the CRSs, where CCA is highlighted in a high extent while DRR is not addressed directly.

Establishing a core of prioritized fields facilitates the building of collaboration between that core and other aspects. New Orleans is a case in point, where the core of integrated domains consisting of urban development, hazard mitigation and climate adaptation has been connected to different aspects of the social and economic life of vulnerable groups and infrastructure development.

### **5.2.2. The performative aspect of the city resilience strategy in connection to Multi-stakeholder collaboration**

Looking at the development of the strategy as an act intertwined with the exercise of power (Kornberger & Clegg, 2011), there is a need for focusing on the legitimate dimension of CRSs and to promote a multi-stakeholder collaboration in their development and implementation. In the analyzed CRSs, legal aspects as well as multi-stakeholder collaboration across administrative levels were not included in the main focus. Although effective leadership and management and the rule of law are amongst the main goals of city resilience (The Rockefeller Foundation & ARUP, 2015a), those points were not considered as prerequisites in promoting resilience in all cases. In contrast, legal and financial aspects are considered as the main drivers for improving resilience in similar initiatives like UNISDR in “Making Cities resilient” campaign. Without a flexible funding mechanism the two fields will remain separated. The legal prerequisites can also be connected with external and internal changes (like sanctions and unjust distribution of resources). Hence, the promotion of legal and administrative prerequisites in support of integration needs to be highlighted in the strategies and framework of the 100RC movement. The same is required for funding issues, where there is a need for flexible funding mechanisms rather than assigning specific funders for each action.

### **5.2.3. The stand-alone projects in a resilience strategy**

In the analyzed cases, the value of developing resilience with a program-based (rather than project-based) approach is not evident in all of the CRSs. In contrast to the aim of a resilience strategy in mainstreaming a program-based approach, in some cases the CRS has proposed actions which are to a high extent stand-alone. The same is true for some multi-objective actions in CRSs which have not considered evident connections to DRR implications of actions. There is a concern that the networking value of the 100RC member cities lead to proposing actions that are similar in title, while different in content. Developing “climate adaptation action plans” within CRSs is an example of this, which tends to be a stand-alone project in cases like Amman. In this respect, there is a need to consider the objective of the resilience strategy in all of the proposed actions and lessons learnt from other member cities.

#### **5.2.4. Integration of DRR and CCA as a term for improving synergy**

Back to the initial point of this study, the notion of integration between DRR and CCA in connection to urban resilience frames the definition of integration as a synergic relationship between the two fields. Based on the analysis of the 100RC strategies, there is a concern that the required expertise of each field would be lost through the bringing of multiple fields under a unique term like resilience. Some authors believe that the involved fields need to be independent to constitute the required expertise (Vachette, 2017). As Schipper et al. (2016) argue, identifying the potential synergy among DRR, CCA and development are more effective than merging them into one domain. Agreeing with the view of the need for independence of fields and the synergetic relations among the relevant fields, this thesis argues that finding a balanced level of integration and independence among those fields is necessary. The analyzed CRSs in this study reflect the lack of such a balance where the low level of integration of climate professionals in the strategies and the proposed stand-alone actions could impede the integration between DRR and CCA.

#### **5.3. Limitations and validity of the study**

Having presented the results, some reflections on their validity is in order. Whereas it has been an ambition to conduct the scoping study and content analyses in a structured and transparent way, it is possible that selection of articles and the interpretation of their contents have been biased by the background and perceptions of the author. Such potential bias was hopefully counteracted by sharing ideas on the thesis with the supervisor and friends who have a different set of background knowledge than the author.

The study tried to disregard latent aspects of documents, but there is a need for further attempts to validate if the connections between e.g. the measures in articles and CRSs are critical and accurate. This study based its analysis on the points reflected in the CRS's document. The process of developing CRSs entails different steps and workshops, which may not be completely accounted for in a strategy document. A deeper analysis on how the CRSs have addressed integration of DRR and CCA requires a study of the whole process and all working documents as well as interviews with involved stakeholders. This aim can only be achieved through further investigation.

The monitoring and evaluation on the implementation of strategies in the long term also can provide insights on the extent strategies have address integration of DRR and CCA. However, in a complex system of cities it is not easy to recognize the exact impact of each strategy and action among the others.

Through this study, different initiatives in support of integration of DRR and CCA in Europe as well as a specific effort for operationalization of DRR and CCA integration in urban planning in the Philippines were identified. It is unclear whether the findings of this study are representative for other cities that focus on climate change adaptations as a means of achieving resilience. The generalizability of the results could therefore be further examined by more analyses of similar initiatives in other areas of the world. The scoping study could

also be improved through a comparative analysis between studies addressing integration in urban areas against studies that considered integration from a more general perspective.

As the final remark of discussion, the summary of recommendations regarding 100RC movement based on the discussed points is:

- There is a need to highlight the CCA and DRR and their integration in the CRSs, specifically in the cities facing to climate change. Connected to the mentioned point, developing a nexus of DRR, CCA and urban development need to be considered too.
- The CRSs need to highlight the importance of legal aspects and funding mechanisms as the prerequisites for implementation of the suggested strategies and actions.
- Developing a balanced nexus of the most relevant fields in CRS can provide a proper opportunity to build up the synergies between DRR, CCA and other aspects of a urban system.
- A deeper study on the whole process of developing CRS and interview to the key stakeholders can provide insights to improve the CRS regarding the integration of DRR and CCA.
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## Conclusion

This thesis tried to identify success factors for integrating DRR and CCA in support of urban resilience through conducting a scoping study on academic literature. The objective was met through charting data regarding challenges for integrating DRR and CCA and identifying facilitating measures to overcome those challenges. Section 4.1 presented the results of the scoping study in three main groups. First, different viewpoints on the topic of integrating DRR and CCA with urban planning were explained. Second, the challenges for integration and facilitating measures for overcoming them were outlined. Finally, the ways the analyzed research articles connected integration to city resilience were described.

Prominent measures for integrating DRR and CCA with urban development as proposed by different scholars include:

- Adopting nexus approaches and assigning land use planning in the core
- Developing a shared policy vision between the relevant fields
- Developing a consistent legislation to support the shared policy, related strategies and plans
- Adopting multi-level and cross-sectoral, integrated planning for implementing the shared vision
- Developing coordination among the relevant fields through platforms and communication channels
- Establishing partnerships with local stakeholder communities
- Assessing and updating local development plans, visions and development goals and objectives to ensure that these incorporate DRR and CCA activities
- Developing flexible funding mechanisms
- Conducting integrated and ongoing vulnerability and risk assessments
- Developing multi-objective strategies and measures
- Integrating CCA in disaster management cycle
- Developing a common understanding on the concepts of DRR and CCA among relevant stakeholders
- Developing the integration between policy, practice and science

Among the above mentioned measures most of them could be applied in many contexts. However, there were some more specific ones which require the contribution of experts for conducting aggregated risk and vulnerability assessment, downscaling climate scenarios to an urban scale and assessing pros and cons of alternative land use choices. In practice, the mentioned measures have received less consideration compared to other priorities of cities.

In order to address the second objective of the thesis regarding the integration of DRR and CCA in practice, the study analyzed the correspondence between measures found in the academic literature and measures proposed in the guiding document and strategies related to the 100RC movement (Section 4.2). The results showed that most of the measures introduced in academic literature had been addressed in the CRF and CRSs, including cross-sectoral collaboration, assessment of risk and vulnerability, assessing existing plans, applying multi-

objective measures and considering and monitoring the implementation and relevance of the CRSs. In addition, the analysis showed that the notion of resilience successfully has been used to bridge the gaps between DRR and CCA in some aspects. However, the strategies have a general perspective on integrating all the fields in the city, and their prioritizations are not always in support of a nexus of DRR, CCA and urban planning.

Whereas DRR and CCA were integrated into visions, goals and actions in the strategies, most of them did not highlight the need of including professionals from climate science when developing such strategies. The informing aspect of the activities is provided in most of the strategies through platforms for communicating information. Empowering vulnerable groups is addressed in the strategies. However, questions of social equity in connection to DRR and CCA is spelled out in one of the cases (New Orleans), whereas social justice seems to be considered out of the DRR and CCA fields in the other cases. The important aspects regarding legislation and funding mechanisms in connection to DRR and CCA are not the main focus of all of the strategies. However learning and enhancing the capacity of stakeholders and citizens toward DRR and CCA are considered in most of them.

In total, the study fulfilled the two questions of the thesis through identifying research findings on measures that might facilitate the integration of DRR and CCA in urban areas, and exploring the extent to which these measures were accounted for in guidance documents and strategies related to the 100RC movement. As a closing remark, it should be mentioned that the Rockefeller Foundation has decided to cease its support for member cities out of the US from the summer of 2019. Hence, it will be interesting to see whether the member cities are able to implement their strategies without support from the foundation and how they choose to operationalize the integration of DRR and CCA in times ahead.

It seems there are some considerations in place to address this issue from the initial steps. One of the requirements in the application for 100RC was the experience in working in partnership with other cities. Also in the process of developing resilience strategy the network to exchange of knowledge and experience among member cities was established and implemented. Both of the mentioned points can enable the cities to continue their work without direct support from Rockefeller foundation.

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## **Annex**

In this Section some of the definitions and points from 100RC movements, which were referred in the thesis are presented. The all content presented here, are from the 100RC documents.

### **City Resilience Strategy (CRS):**

The City Resilience Strategy is one of the core tools that propels 100 Resilient Cities member cities through the process of building resilience. The strategy is a product of a six-to-nine month process which unites people, projects, and priorities, and surfaces crucial new solutions so that cities can collectively act on their resilience challenges. Resilience Strategies are more than a milestone -- they are a roadmap, a call to action. (100 Resilient Cities, 2019).

### **City Resilience Framework (CRF)**

“The City Resilience Framework is a unique framework developed by Arup with support from the Rockefeller Foundation, based on extensive research” (The Rockefeller Foundation & ARUP, 2015b).

This document provides definitions for the different components of the CRF, which is comprised of four dimensions , twelve drivers and seven qualities. The dimensions and drivers of resilience system based on CRF is presented in next table. The Qualities of resilient system were described and applied in this study for analysis of CRF against the measures for integration of DRR and CCA in the academic literature.

Table: dimensions and drivers of resilience city in CRF (The Rockefeller Foundation & ARUP, 2015b)

Dimension	Driver
Health & Wellbeing	Meets Basic Needs: Provision of essential resources required to meet a person’s basic physiological needs.
	Supports Livelihoods and Employment: Livelihood opportunities & support that enable people to secure their basic needs. Opportunities might include jobs, skills training, or responsible grants & loans.
	Ensures Public Health Services: Integrated health facilities & services, & responsive emergency services. Includes physical & mental health, health monitoring & awareness of healthy living & sanitation.
Economy & Society	Promotes Cohesive and Engaged Communities: Community engagement, social networks & integration. These reinforce collective ability to improve the community & require processes that encourage civic engagement in planning & decision-making.
	Ensures Social Stability, Security and Justice: Law enforcement, crime prevention, justice, & emergency management.
	Fosters Economic Prosperity: While Driver 2 is about individual livelihoods, Driver 6 is about the economy on a wider scale. Important economic factors include contingency planning, sound management of city finances, and the ability to attract business investment, a diverse economic profile & wider linkages.
Infrastructure & Environment	Enhances and Provides Protective Natural & Man-Made Assets: Environmental stewardship, appropriate infrastructure, effective land use planning & enforcing regulations. Conservation of environmental assets preserves the natural protection afforded to cities by ecosystems.
	Ensures Continuity of Critical Services: Diversity of provision, redundancy, active management & maintenance of ecosystems & infrastructure, & contingency planning
	Provides Reliable Communication and Mobility: Diverse & affordable multi- modal transport networks & systems, ICT & contingency planning. Transport includes the network (roads, rail, signs, signals etc.), public transport options & logistics (ports, airports, freight lines etc.)
Leadership & Strategy	Promotes Leadership and Effective Management: Relating to government, business & civil society. This is recognizable in trusted individuals, multi- stakeholder consultation, & evidence-based decision-making.
	Empowers a Broad Range of Stakeholders: Education for all, access to up-to- date information, & knowledge to enable people & organizations to take appropriate action. Along with education & awareness communication is needed to ensure that knowledge is transferred between stakeholders & between cities.
	Fosters Long-Term and Integrated Planning: Holistic vision, informed by data. Strategies/plans should be integrated across sectors & land-use plans should consider & include different departments, users & uses. Building codes should create safety & remove negative impacts.