Collective Engagement

From disaster-prone to disaster-resilient city

Theresa Audrey O. Esteban

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FROM DISASTER-PRONE TO DISASTER-RESILIENT CITY

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Collectieve Betrokkenheid
Transformatieproces van klimaat gevoelige
naar een klimaat sensitieve stad

Thesis

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To God Almighty for giving me the mental stamina of a bull, the fire and determination of a dragon, and the grace to face adversity like a bamboo, all Glory goes to You.

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I never realized that my topic collective engagement and resilience was something that I would actually experience. Throughout this Ph.D. journey, I have faced so many trials that anybody with a weak 'adaptive capacity' and 'social network' would not be able to bear. Resilience refers to the ability to bounce back from a disturbance which has been referred to by many people as strength. I prefer to define resilience as stability, flexibility, and learning, much like what my family taught me as a child *'Be like a bamboo, it bends but does not break.'* When I learned the Dutch word for resilience *'veerkracht'*, I thought it has the same meaning as the bamboo reference especially when I separated the words *'veer'* (feather) and *'kracht'* (power) which I interpret as a gentle power in maintaining one's strength. I would like to believe that throughout this journey I was able to maintain my strength, just like a bamboo, and grace, just like a feather. The strength of bamboos comes from the fact that it grows in clusters, and just like this collective growth of bamboo, I have a collective group of people who supported, encouraged, and helped me grow, learn, and transform to become better.

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Growing up I would hear my grandfather, a lawyer, speak about rights and the rule of law, as such I grew up knowing that the knowledge of the law and your rights are powerful. I lost my voice and questioned myself when I should have pursued what was in my gut. My trust in the system and people slowly faded, and underneath my cheeriness was boiling rage. *Wasn't this taught in governance that trust is lost when stakeholders realize that the system that was supposed to protect them is only there to protect those in power?* Thanks to my friends Cristina, Marco, and Victor and all my supporters who encouraged me and showed me the way, I was able to rise back up stronger, braver, and more knowledgeable. This lesson I take with me everywhere and I will make sure that no one will have their voice shut.

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SUMMARY

According to the United Nations' 2018 Revision of World Urbanization Prospects report, 68 percent of the world's population will be living in cities by 2050 (UN, 2018). Increasing urbanization exacerbates social and ecological issues in cities, which are amplified by climate change and natural hazards. Flooding is the most common natural hazard in cities around the world, and its frequency and severity have increased in recent decades. In the past, flood risk and disaster management were tackled head-on with infrastructure, preventive, and mitigation measures; however, more adaptive measures have been introduced in recent decades, especially with the increasing number of studies on climate change adaptation. Understanding the role of stakeholders in disaster management strategies is one example. The citizens' capabilities and networks complement the government's efforts to resolve disasters through systemic interventions. As a result, the government and non-government stakeholders need to work together to make their city disaster-resilient.

Cities are complex, multi-sectoral, multi-dimensional, and dynamic socio-ecological systems composed of human, social, environmental, institutional, and economic capitals. In order to plan a resilient city, these complex and dynamic interrelationships must be recognized. Resilience has been defined as a measure of the ecosystem's ability to absorb, persist and return to its equilibrium after a temporary disturbance (Holling, 1973). This capability is related to the capacities of cities, in this case, the aforementioned capitals, which are considered drivers of resilience. The drivers of resilience characterize a city's ability to return to a state of equilibrium, adjust, adapt, and evolve following a disaster. The dissertation is about building urban resilience through collective engagement, with a particular interest in flood-prone cities and their efforts to become disaster-resilient. It looks into the interrelationship, the vertical, horizontal, and transversal, between collective engagement and urban resilience, how collective engagement takes place in cities, and what role it plays in transforming disaster-prone cities to disaster-resilient cities.

Specifically, the research seeks to answer the question, ***How does collective engagement contribute to building urban resilience in disaster-prone cities in the Netherlands and Philippines?*** To answer the main question it needs to be unpacked using the sub-questions: What are the drivers of resilience and how do you build urban resilience? What is the role of collective engagement in the process of building urban resilience and how does the process of collective engagement unfold from the government approach and self-organization approach? What elements of collective engagement is present in the four city cases and how does it relate to the type of urban resilience experienced? What are the areas of convergence and divergence in the process of collective engagement and urban resilience between the Netherlands and the Philippine cases?

The research looks at four city cases, Rotterdam and Dordrecht in The Netherlands, Marikina, and Malabon in The Philippines. These four cities are all working on building and strengthening disaster resilience. The cases were chosen based on the cities' geographic characteristics and climate-related risks such as sea and river level rise, and heavy rainfall, as well as their proximity to water-bodies (Rhine-Meuse-Scheldt river delta for Rotterdam, Rhine-Meuse for Dordrecht, Marikina River for Marikina, and Tullahan River for Malabon). The selection of two countries, the Netherlands and the Philippines, was deliberate to compare how flood risk management, collective engagement, and urban resilience are approached from the Global North and Global South perspectives. This can give insights on similarities and gaps that can be learned from each country and each city case. The Netherlands was selected specifically on the technical, engineering, and scientific expertise in flood risk management that has ensured the safety of the population from flooding. The country is also known for innovative climate change adaptation projects such as the Room for the River program that allows the river to overflow and flood a space without compromising the safety of the inhabitants. On the other hand, the Philippines provides an example of social resilience demonstrated by the citizens in tackling flood risk. Both countries have established flood and disaster risk management policies, with the Netherlands having a more organized and centralized approach and the Philippines taking a more decentralized approach. The Dutch cases can then provide insights into the institutional and structured city planning and disaster risk management, while the Philippine cases can illustrate how cities organize organically to maintain a level of order and resilience.

As a starting point for this research, a systematic literature review was conducted in Chapter 2 to establish relations between the socio-ecological systems (SES) framework and its application in disaster resilience and urban planning studies. The SES refers to the social (human) and ecological (biophysical, natural, and built) systems in mutual interaction (Gallopín, 2006; Gallopín, 1991). Because of its broad scope, which includes social, political, economic, physical, and natural systems, the framework aids in discussions and assessment of resilience and sustainability. Despite its broad scope, the SES framework focuses on the dynamic synergies that exist among the interdependent structures that make up cities. In the SES framework, resilience is the ability of the "system to absorb disturbance and reorganize while undergoing change" (Walker, 2004: 2). It is assumed that the system can adapt and retain the same function and structure even after the disturbance. This implies that the city, as an SES, must be able to adjust to sudden changes, such as natural disasters, and reorganize in order to continue to operate. The systematic literature review of 21 relevant articles resulted in identifying six criteria of resilient urban systems: (1) adaptive capacity and resilience to manage, adjust, learn and cope with different changes; (2) disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; (3) established enabling or supporting environments in creating a resilient city; (4) maintaining city resilience

through diversity; (5) memory-based disaster experience; and (6) social, physical and economic drivers that contribute to household, community and city resilience.

The literature reviewed in Chapter 2 presented practical experiences and policy framework analysis which resulted in developing the criteria of resilient urban systems. The systematic literature review showed that in the study of resilience and resilient cities, participation and engagement were found to be a component of each of the six criteria for assessing a resilient urban system and were critical in making the transformation effective. This helped lay out the essential groundwork in forming the components of the conceptual framework in Chapter 3 which are participation, engagement, and self-organization. Participation and engagement aid in the formation of networks within and among stakeholders, as well as providing a forum for dialogue, consensus-building, and self-organization. People have shown that when disasters strike, they appear to self-organize in order to recover. While the five capitals stressed the drivers of resilience in the systematic review, participation, engagement, and self-organization highlighted people's collective action in building resilience. Bahadur and Tanner (2014) emphasized that adaptation is rooted in engagement, however, "community involvement through established participatory methods is notoriously difficult in urban areas as the community is dynamic and heterogeneous" (p. 30). It is then important to understand that collective engagement falls under the umbrella of collaboration and collaborative processes, with the same distinction as collaborative governance which is both process- and substance-oriented.

In Chapter 3, collective engagement was further defined in the context of the research as

"A collaborative process participated in by multiple stakeholders to arrive at a solution or decision to increase urban resilience through both formal and informal means. It is the collaboration between and among stakeholders over a prolonged period with varying manners in achieving a level of resilience that contributes to a collective goal of urban resilience. Collective engagement as a collaborative process is characterized by having reciprocity, trust, and mutual respect between and among state and non-state stakeholders." (Esteban, 2020: 5)

This means that, to achieve urban resilience, a collaborative arrangement between state and non-state stakeholders is enforced, and that this arrangement is based on mutual trust and reciprocity. From this definition the collective engagement urban resilience framework was further developed. The framework recognizes that cities' adaptive cycles evolve and transform over time and that cities' transformation from disaster-prone to disaster-resilient progresses through a series of four collective dimensions: collective concern, collective action, collective efficacy, and collective security.

Each of the four collective dimensions signifies how the process of collective engagement grows and transcends based on collaborative and adaptive capacities. Collaborative

capacities are the partnerships between state and non-state stakeholders that may or may not be government-led but have a shared vision, objective, and commitment to building urban resilience. The collective engagement urban resilience framework highlight that the process of urban resilience has two approaches, the government approach the self-organization approach, which can be two different ways but both starting from a shared concern and goes through the same collective dimensions. The actions that result from the shared concern may take different pathways and timescales to achieve a level of efficacy but both lead to a level of security. Both approaches are needed to ensure the continuous process of learning and improvement which is much needed in building a resilient city.

The first dimension of collective engagement is **collective concern**. It refers to the sense of uncertainty, vulnerability, and concern that stakeholders experience when a disaster strikes. During a crisis, the concern is on the well-being of the self and the immediate network and proceeds to the concern for others, such as the neighbors, the community, and then the city. Collective concern refers to the shared concern of a group of people and brings stakeholders together as a community and the catalyst for action.

The second dimension is **collective action** which is spurred by the desire and need to work together as a network. The role of networks and the connections that bind them is explored in order to guarantee that the city learns from its past disaster experiences and applies what it has learned. When there is a mutual concern about a common problem and a shared effort among stakeholders to solve the problem and achieve an objective, collective action arises.

The third dimension is **collective efficacy** which lies in the extent of "social cohesion" among stakeholders and "their willingness to intervene on behalf of the common good" (Sampson, 2013; Sampson, et al., 1997). Although there is a thin line between collective action and collective efficacy, collective efficacy is described in this study as the point at which all stakeholders (citizens, government, private and public sectors, civil society) effectively and actively participate. This dimension is specific in that it conjures up a task-specific construct therefore a definite outcome which is the mutual agreements between stakeholders. The government's position in this dimension is crucial because it is the agent that creates an enabling environment for collective engagement and provides resources to aid development. Therefore, collective engagement relies on this mutual trust, respect, and acknowledgment of roles among the stakeholders and its social networks.

The final of the four dimensions is **collective security**, which refers to the collective security that the city and its inhabitants enjoy as a result of successful alliances and partnerships among stakeholders at all levels. In this dimension a level of security has been achieved due to a combination of hard infrastructures, either mitigative or adaptive, are already in place, and stakeholders are well-informed and educated on disaster risk

management and can prepare for and respond to disasters. Collective security entails not only that the city is safe and protected, but also that all stakeholders are disaster-risk aware. Collective security also includes the continuous review and updating of structural and non-structural disaster-response measures, as well as reforms to reinforce human, social, economic, institutional, and environmental capitals, all of which are required in maintaining urban resilience.

The collective engagement urban resilience framework highlights the adaptive cycles driven by the resilience capitals and collective engagement as the binding factor in building urban resilience. The explanatory nature of the research requires a qualitative approach to understand how each of the collective dimensions of collective engagement grows and relates to urban resilience. The study methodology presented in Chapter 4, describes the steps undertaken in the research. The research used the qualitative approach to understand the vertical and horizontal relationships in collective engagement, as well as the transversal relationships that are needed to discern a complex subject like cities and resilience. The objective is to explore the four collective dimensions of collective engagement in relation to the disaster experience and the transformation of the city in becoming resilient. In this research, it is important to understand how and why transformation occurs, as well as what contributes to resilient city transformation. The case study approach is useful in drawing up the conclusion on the transformation and allows the researcher to probe the 'hierarchy of embeddings' (Marcus and Colding, 2011) and see the interconnections, overlaps and feedback loops that is usually limited should this be done in quantitative research such as a survey.

To provide a background on the cases Chapter 5 and 6 illustrates the background of national-level policies on urban planning, disaster risk management, and flood management in the Netherlands and the Philippines. The chapters began with a look back at the post-World War II era when both countries shared some similarities in terms of the establishment of government institutions primarily concerned with the construction of human settlements and the need to repair and recover from the war's damage. The national government's role was commanding from the very beginning until the development approach became more decentralized with the introduction of policies such as the *Nota Ruimte* for the Netherlands in 2004 and the Local Government Code for the Philippines in 1991. These policies gave local governments more power and responsibilities in managing their localities.

Flood risk management for both countries revealed an emphasis on infrastructural measures and led by the Ministry of Infrastructure and Water Management (Netherlands) and the Department of Public Works and Highways (Philippines). On disaster risk management, the Philippines had an earlier start with the Presidential Decree 1566 "Strengthening the Philippine Disaster Control, Capability and Establishing the National

Program on Community Disaster Preparedness" in 1978, while the Dutch disaster risk management policy, Disasters and Major Accidents Act, came into effect in 1985. It was however the policies enacted in 2010, the Safety Regions Act (Netherlands) and Republic Act 10121 "Philippine Disaster Risk Reduction and Management Act of 2010" (Philippines), that influenced both countries' disaster risk management approach. The policies for both countries devolved the responsibility for disaster risk management to the local level. The background for each country presented in Chapters 5 and 6 were included in the four empirical chapters.

Chapters 7, 8, 9, and 10, are dedicated to each of the city cases, Rotterdam, Dordrecht, Marikina, and Malabon. Findings for each of the cases are as follows:

- City of Rotterdam - The economic focus of the city has always been its driving force with particular emphasis on the Rotterdam port. The city has a strong preventive infrastructure owing to the Deltaworks system and has a robust set of policies on climate change adaptation which have put the city on the global map as a resilient city. The government approach is robust with the number of policies, programs and projects on flood risk management, water retention and climate change adaptation. On the other hand, the self-organization approach is also flourishing with the number of civil society organizations working on community gardens in the city. While the community is aware of the city government's efforts to respond to climate change, there is little dialogue and knowledge about flood and disaster risk management. It is important to bridge the gap between these two approaches in order to work more closely on urban resilience.

- City of Dordrecht - Collective memory on the 1421 Saint Elizabeth flood is present in Dordrecht and is the foundation of the city's process of urban resilience and collective engagement. The Dordrecht case highlights that historical disaster memory and experience alone cannot create a resilient city. A combination of factors such as creating a network, risk awareness, and policies collectively understood by the stakeholders are needed to ensure the process of urban resilience. Dordrecht's approach to self-organization as an interdependent activity between stakeholders is an example of how technical and mitigation approaches to urban resilience can be combined with community engagement and learning. The city's goal is to become a *zelfredzaam* island and Dordrecht does this by maintaining an active network of actors, strengthening the peoples' disaster risk awareness to build it into their collective consciousness. The city benefits from the Deltaworks system and the compartmentalized diking system but the long-established relationship between the city government, the waterschap, and the community have made Dordrecht not only physically resilient (engineering resilience) but also institutionally and socially resilient.

- City of Marikina - The city is a valley and a catchment area which makes it flood-prone. In 1992 after experiencing heavy flooding that covered 28% of the city the then-new mayor initiated reforms to uplift Marikina from a laidback town to a progressive city. The Marikina case highlights how leadership and institution building sets the foundation for urban resilience. These factors also help in strengthening the collective engagement and mutual adaptation of the stakeholders on their roles. Marikina's transformation was spurred by the strong leadership to enforce reforms particularly the rehabilitation of the Marikina River. The approach employed was initially authoritative but was believed to have "instilled discipline" in the Mariqueños. The progress and recognition as one of the "Healthiest and Most Livable Cities" in the Asia-Pacific (ADB, 2009) has instilled pride in the Mariqueños. From being authoritarian, Marikina City's leaders changed their management style to a partnership with the stakeholders. The interaction between the city through the Marikina City Disaster Risk Reduction and Management Office and the stakeholders stimulate unity, collectiveness, and mutual adaptation of their roles.

- City of Malabon - The final case city emphasizes community resilience and how repeated flood experience has had a strong effect on building resilience. The vulnerability of the Malabon city stakeholders to flooding has made this experience a part of their lives and history, creating a "culture of disaster." Infrastructure projects have been undertaken in the past, the largest of which is the CAMANAVA Flood Control Project. The flood experienced after Habagat 2012 led the city to strengthen its flood risk management and increase disaster risk awareness and capacitate the stakeholders through information, education, and communication campaigns. Malabon partnered with non-government organizations to help in conducting training and workshops for the communities. Residents are aware of the city's shortcomings that communities resort to alternative methods such as sharing evacuation centers with neighboring barangays that do not have one and an "adopt-a-family" evacuation strategy. Malabon city stakeholders have strong social capital and this plays a big role in the social and community resilience of the city. Communities in Malabon have both strong bonding and bridging relationships that make them more resilient.

Chapter 11 presents the empirical results and cross-case analysis, describing when, how, and what motivates people to collectively participate. The four case cities showed different strengths and weaknesses but all forging ahead towards urban resilience. The Rotterdam case highlighted the engineering and economic resilience of the city but needs to build stronger social and community resilience. The Dordrecht case highlighted memory-based disaster experience but also showed engineering, environmental, institutional, and social resilience which affects how the city builds urban resilience. The Marikina case demonstrates leadership and partnership build institutional, social, and community resilience that further hones the city's collective engagement and urban resilience. Lastly,

the Malabon case focuses on the social and community resilience of the stakeholders and the national government's need to take better responsibility in providing and maintaining flood control facilities together with the local government.

The cases reveal that the cities adaptive cycles vary across timescales depending on the adaptive capacity (driver of resilience) that each city possesses. Five key points can be learned from the cases, (1) *flood experience can build knowledge but frequent flood experience can also normalize flood risk*; (2) *partnership and mutual adaptation of roles build collective engagement and adaptive capacity*; (3) *reliance on the government to take care of the population requires an organized structure on disaster risk management*; (4) *frequent flood experience builds community*; and (5) *the different perspectives of risks and resilience derived from the interview indicate how risk can be socially constructed based on experience and culture*.

The final chapter, Chapter 12, discusses collective engagement as a concept that can be incorporated into disaster risk management and urban planning, as well as recommendations for future research. The research contributes to the discourse on resilience as a continuous process of change, learning, adaptation, growth, and transformation. Numerous future areas for research can be undertaken based on the findings of this research. First, the perception of risk and resilience being social constructs can be done especially a comparison between cities in the Global North and Global South. This can provide insights into the development of policies on urban resilience and disaster risk management. Second, the study offered insights into the process of urban resilience and collective engagement; it used the drivers of resilience as a starting point for the analytical discussion, but it also illustrated that knowing the political climate of cities is important to make the results comprehensive. Finally, the collective engagement urban resilience framework showed that it can be used in any kind of disaster. The framework can be used to study crisis governance approaches which can help in creating better policies.

SAMENVATTING

De verwachting in het World Urbanization Prospects rapport van de Verenigde Naties is dat in 2050, 68 procent van de wereldbevolking in steden wonen (UN 2018). Dit proces van toenemende verstedelijking wordt mede veroorzaakt door geprojecteerde klimatologische veranderingen zoals overstromingen, extreme hitte en cyclonen waardoor een migratie van mensen wordt gestimuleerd van platteland naar stad, van klimaatgevoelige landen naar steden in landen met een betere infrastructuur op klimaat schokken op te vangen. Overstromingen zijn het meest voorkomende natuurlijke gevaar en de frequentie en ernst ervan zijn de afgelopen decennia sterk toegenomen. Het dreigend gevaar voor de negatieve aspecten van klimaatveranderingen deed vele landen besluiten meer mitigerende wetgeving in te voeren alsmede meer budgettaire voorzieningen om de infrastructuur te verbeteren. De afgelopen decennia is de aandacht voor adaptieve maatregelen sterk toegenomen, vooral door het toenemende aantal studies over aanpassing aan de klimaatverandering. Inzicht in de rol van belanghebbenden bij rampenbeheerstrategieën is een voorbeeld. De capaciteiten en netwerken van burgers vormen een aanvulling op de inspanningen van de overheid om rampen op te lossen door middel van systemische interventies. Als gevolg hiervan moet overheid en andere belanghebbenden samenwerken om hun stad rampbestendig te maken door middel van lokaal gedreven adaptie initiatieven.

Steden zijn complexe, multisectorale, multidimensionale en dynamische sociaalecologische systemen, samengesteld uit menselijke, sociale, ecologische, institutionele en economische verbanden. Om een dynamische stad in evenwicht te houden, moeten deze complexe en dynamische onderlinge verbanden worden onderkend. Dynamisch is in deze publikatie gedefinieerd als een maatstaf voor het vermogen van het ecosysteem om te absorberen, te volharden en terug te keren naar zijn evenwicht na een tijdelijke verstoring (Holling, 1973). Dit vermogen is gerelateerd aan de capaciteiten van steden die worden beschouwd als aanjagers van dynamiek. De drijvende krachten van deze dynamiek karakteriseren het vermogen van een stad om na een ramp relatief snel terug te keren naar een staat van evenwicht, zich aan te passen, aan te passen en te evolueren. Het proefschrift gaat over het opbouwen van stedelijke dynamiek door middel van collectieve betrokkenheid, met een bijzondere interesse voor steden die sensitief zijn voor overstromingen en hun collectieve inspanningen om rampbestendig te worden. Het onderzoekt de onderlinge relatie, het verticale, horizontale en transversale, tussen collectieve betrokkenheid en stedelijke veerkracht, hoe collectieve betrokkenheid plaatsvindt in steden en welke rol het speelt bij het transformeren van rampgevoelige steden naar rampbestendige steden.

Het onderzoek wil met name antwoord geven op de vraag: **hoe draagt collectieve betrokkenheid bij aan het opbouwen van burgerlijke en institutionele samenwerking in steden gevoelig voor natuur rampen in Nederland en de Filippijnen?** Om de

hoofdvraag te beantwoorden, wordt de stellingname verder opgedeeld in deelvragen zoals: Wat zijn de belangrijke randvoorwaarden van stedelijke dynamiek en hoe organiseer je dit; Wat is de rol van beoogde rol van deelnemers in het samenwerkingsverband bij het opbouwen van stedelijke dynamiek en hoe faseer je dit proces vanuit gemeentelijke instanties en het zelf organiseren vermogen van burgerlijke netwerken en instanties; Welke elementen van collectief betrokkenheid zijn aanwezig in de vier stedelijke cases die werden onderzocht; en wat zijn tot dusver de uitkomstenn? Wat zijn de verschillen en overeenkomsten in het proces van collectieve betrokkenheid en stedelijke dynamiek tussen Nederland en de Filippijnse casussen?

Het onderzoek neemt in ogenschouw vier cases, Rotterdam en Dordrecht in Nederland, en Marikina en Malabon in de Filippijnen. Deze steden zijn allemaal begonnen met het treffen van maatregelen om de weerbaarheid van deze steden tegen rampen te verhogen. De cases werden gekozen op basis van de geografische kenmerken van de steden en klimaatgerelateerde risico's zoals zee- en rivierpeilstijging en hevige regenval. Ook, hun nabijheid tot rivieren (Rijn-Maas-Schelde rivierdelta voor Rotterdam, Rijn- Maas voor Dordrecht, en de Marikina River voor Marikina en Tullahan River voor Malabon) speelde een rol in de selectie. Een andere overweging om deze 2 landen te kiezen komt voort uit het perspectief van economische ontwikkeling ook wel getypeerd als Global North (welvarend en sterke instituten) en Global South (minder welvarend en zwakke instituten) Dit kan inzicht geven in overeenkomsten en hiaten die voor elk land en elke stad bestaan. Nederland is specifiek geselecteerd op de technische, technische en wetenschappelijke expertise op het gebied van water- en risicobeheer die de veiligheid van de bevolking tegen overstromingen heeft gegarandeerd. Het land staat ook bekend om innovatieve projecten voor aanpassing aan de klimaatverandering, zoals het programma Ruimte voor de Rivier waarmee de rivier kan overstromen en een ruimte kan overstromen zonder de veiligheid van de inwoners in gevaar te brengen. Aan de andere kant zijn de Filippijnen een voorbeeld van collectieve en sociale veerkracht van burgers bij het aanpakken van overstromingsrisico's. Beide landen hebben een beleid voor overstromings- en rampenrisicobeheer opgesteld, waarbij Nederland een meer georganiseerde en gecentraliseerde aanpak heeft en de Filippijnen een meer gedecentraliseerde aanpak. De Nederlandse casus geeft inzicht in de institutionele en gestructureerde stadsplanning en rampenrisicobeheer, terwijl de Filippijnse casus illustreert hoe steden zich organisch organiseren om hun niveau van orde en veerkracht te behouden.

Als startpunt voor dit onderzoek werd in hoofdstuk 2 een systematisch literatuuronderzoek uitgevoerd om de relaties tussen het sociaalecologische systemen (SES) kader en de toepassing ervan in rampenbestendigheid en stedenbouwkundige studies vast te stellen. De SES verwijst naar de sociale (menselijke) en ecologische (biofysische, natuurlijke en gebouwde) systemen in onderlinge interactie (Gallopín, 2006; Gallopín, 1991). Vanwege de brede reikwijdte, die sociale, politieke, economische, fysieke en natuurlijke systemen omvat, helpt het SES-kader bij de discussies en beoordeling van dynamiek en duurzaamheid. De

kracht van het SES-kader komt tot uitdrukking in de aandacht voor de dynamische synergiën die bestaan tussen de onderling afhankelijke structuren van steden. In het SES-kader is veerkracht het vermogen van het "systeem om verstoringen te absorberen en te reorganiseren terwijl het veranderingen ondergaat" (Walker, 2004: 2). Aangenomen wordt dat het systeem zich ook na de verstoring kan aanpassen en dezelfde functie en structuur kan behouden. Dit houdt in dat de stad als SES moet kunnen inspelen op plotselinge veranderingen, zoals natuurrampen, en reorganiseren om te kunnen blijven functioneren. De systematische literatuurstudie van 21 relevante artikelen resulteerde in het identificeren van zes criteria voor dynamische stedelijke systemen: (1) aanpassingsvermogen en veerkracht om verschillende veranderingen te beheren, aan te passen, te leren en ermee om te gaan; (2) voorbereid op rampen, risicoperceptie en -bewustzijn en erkenning van de gevolgen van rampen op verschillende niveaus; (3) aanwezigheid van faciliterende of ondersteunende instituten; (4) aandacht voor stedelijke diversiteit; (5) aanwezigheid van lokale kennis en het lerend vermogen opgedaan tijdens eerdere rampen; en (6) sociale, fysieke en economische aanjagers die bijdragen aan de dynamiek van huishoudens, gemeenschappen en steden.

De literatuur die in hoofdstuk 2 is besproken, bevat praktische ervaringen en analyse van initiatieven die hebben geleid tot de ontwikkeling van de criteria voor veerkrachtige stedelijke systemen. Het systematische literatuuronderzoek toonde aan dat in de studie van veerkracht en veerkrachtige steden participatie en betrokkenheid een onderdeel bleken te zijn van elk van de zes criteria voor het beoordelen van een veerkrachtig stedelijk systeem en cruciaal waren voor het effectief maken van de transformatie. Dit hielp bij het leggen van de essentiële basis voor het vormen van de componenten van het conceptuele kader in hoofdstuk 3, namelijk participatie, betrokkenheid en zelf organiserend vermogen. Participatie en betrokkenheid helpen bij de vorming van netwerken binnen en tussen belanghebbenden, en bieden ook een forum voor dialoog, consensusvorming en zelf organiserend vermogen. Mensen hebben aangetoond dat wanneer zij worden geconfronteerd met rampen zij zichzelf kunnen organiseren en stappen zetten om de stad weer leefbaar te maken. De vier cases benadrukken de dynamiek van de steden, de systematische literatuur onderzoek geeft aan dat participatie, betrokkenheid en zelf organiserend vermogen van het collectief belangrijk is. Bahadur en Tanner (2014) benadrukken dat aanpassing geworteld is in betrokkenheid, maar "betrokkenheid van de gemeenschap door middel van gevestigde participatieve methoden is notoir moeilijk in stedelijke gebieden omdat de gemeenschap dynamisch en heterogeen is" (p. 30). Het is dan belangrijk om te begrijpen dat collectieve betrokkenheid binnen het domein van samenwerking en samenwerkingsprocessen valt en hetzelfde onderscheid heeft als samenwerking toezicht dat zowel proces- als inhoudsgericht is.

In hoofdstuk 3 werd collectieve betrokkenheid verder gedefinieerd in de context van het onderzoek als:

"Een samenwerkingsproces waaraan meerdere belanghebbenden hebben deelgenomen om tot een oplossing of beslissing te komen om de stedelijke veerkracht te vergroten, zowel met formele als informele middelen. Het is de samenwerking tussen en tussen betrokken over een langere periode op verschillende manieren om een mate van dynamiek te bereiken die bijdraagt aan een gezamenlijk doel van stedelijke veerkracht. Collectieve betrokkenheid als een samenwerkingsproces wordt gekenmerkt door wederkerigheid, vertrouwen en wederzijds respect tussen en tussen stedelijke en niet stedelijke belanghebbenden." (Esteban, 2020: 5)

Dit betekent dat voor het bereiken van stedelijke dynamiek een samenwerkingsarrangement tussen stedelijke en niet stedelijke belanghebbenden wordt afgedwongen, en dat dit arrangement gebaseerd is op wederzijds vertrouwen en wederkerigheid. Op basis van deze definitie werd het kader voor de transformatie van stedelijke dynamiek voor collectieve betrokkenheid verder ontwikkeld. Het kader erkent dat de adaptieve ontwikkeling van steden evolueren en transformeren. De transformatie van steden van rampgevoelig naar rampbestendig verloopt via een reeks van vier collectieve dimensies: collectieve zorg, collectieve actie, collectieve doeltreffendheid en collectieve veiligheid.

Elk van de vier collectieve dimensies geeft aan hoe het proces van collectieve betrokkenheid groeit en stijgt op basis van samenwerking. Samenwerkingen zijn de afspraken tussen belanghebbenden, al dan niet gefaciliteerd door de overheid, op basis van een gedeelde visie, doelstelling en inzet om de stedelijke dynamiek te verbeteren. Het kader voor collectieve betrokkenheid van stedelijke veerkracht benadrukt dat het proces van stedelijke veerkracht twee invalshoeken onderscheidt: de invalshoek van de overheid en de invalshoek van het zelf organiserend vermogen van betrokkenen. Beide invalshoeken hebben oog voor een gedeelde zorg en betrokkenheid. De acties die voortkomen uit de gedeelde zorg kunnen verschillende wegen en tijdschema's volgen om een zekere mate van doeltreffendheid te bereiken, maar beide convergeren naar een niveau van veiligheid. Beide benaderingen zijn ook nodig om het continue lerend vermogen te waarborgen dat nodig is bij het inrichten van een dynamische stad.

De eerste dimensie van collectieve betrokkenheid is **collectieve zorg**. Het verwijst naar het gevoel van onzekerheid, kwetsbaarheid en bezorgdheid die belanghebbenden ervaren wanneer zich een ramp voordoet. Tijdens een crisis gaat de zorg over het welzijn van het zelf en het directe netwerk en processen naar de zorg voor anderen, zoals de buren, de gemeenschap en vervolgens de stad. Collectieve zorg verwijst naar de gedeelde zorg van een groep mensen en brengt belanghebbenden samen als een gemeenschap en de katalysator voor actie.

De tweede dimensie is **collectieve actie** die wordt aangewakkerd door de wens om een netwerk te vormen. De rol van netwerken en de menselijke verbindingen stimuleren het lerend vermogen om lessen uit het verleden toe te passen in het heden. Wanneer er een

wederzijdse bezorgdheid is over een gemeenschappelijk probleem en een gedeelde inspanning van belanghebbenden om het probleem op te lossen en een doel te bereiken, ontstaat collectieve actie.

De derde dimensie is **collectieve doeltreffendheid**, die ligt in de mate van "sociale cohesie" tussen belanghebbenden en "hun bereidheid om in te grijpen namens het algemeen belang" (Sampson, 2013; Sampson, et al., 1997). Hoewel er een dunne lijn bestaat tussen collectieve actie en collectieve doeltreffendheid, wordt collectieve doeltreffendheid in dit onderzoek beschreven als het punt waarop alle belanghebbenden (burgers, overheid, private en publieke sector, maatschappelijke organisaties) effectief en actief deelnemen. Deze dimensie is specifiek omdat het een vakspecifieke constructie oproept en dus een definitief resultaat, namelijk de onderlinge afspraken tussen belanghebbenden. De positie van de overheid in deze constructie is cruciaal omdat zij het vermogen heeft een stimulerende omgeving te creëren voor collectieve betrokkenheid en de middelen ter beschikking kan stellen om dit proces te ondersteunen. Daarom is collectieve betrokkenheid afhankelijk van dit wederzijds vertrouwen, respect en erkenning van rollen tussen de belanghebbenden en haar sociale netwerken.

De laatste van de vier dimensies is **collectieve veiligheid**, dat verwijst naar de collectieve veiligheid die de stad en haar inwoners genieten als gevolg van succesvolle netwerken en samenwerkingsverbanden tussen belanghebbenden op alle niveaus. In deze dimensie is een beveiligingsniveau bereikt dankzij een combinatie van bestaande infrastructuren, ofwel het mitigatie of adaptief vermogen. Bestaande infrastructuren hebben belanghebbenden geïnformeerd en opgeleid over rampenrisicobeheer en kunnen daartoe zich beter voorbereiden op en reageren op rampen. Collectieve veiligheid houdt niet alleen in dat de stad veilig en beschermd is, maar ook dat alle betrokkenen goed geïnformeerd risico bewust zijn. Collectieve beveiliging omvat ook de continue beoordeling en actualisering van structurele en niet-structurele rampenbestrijding maatregelen, evenals hervormingen om menselijke, sociale, economische, institutionele en ecologische hoofdsteden te versterken, die allemaal nodig zijn om de stedelijke veerkracht te behouden.

Het kader voor de transformatie van stedelijke dynamiek voor collectieve betrokkenheid benadrukt de adaptieve ontwikkeling aangedreven door de steden en collectieve betrokkenheid als de bindende factor bij het opbouwen van stedelijke dynamiek. Het karakter van het onderzoek vraagt om een kwalitatieve benadering om te begrijpen hoe elk van de collectieve dimensies van collectieve betrokkenheid groeit en zich verhoudt tot stedelijke veerkracht. De onderzoeksmethodologie die in Hoofdstuk 4 wordt gepresenteerd, beschrijft de stappen die in het onderzoek zijn ondernomen. Het onderzoek gebruikte de kwalitatieve benadering om de verticale en horizontale relaties in collectieve betrokkenheid te begrijpen, evenals de transversale relaties die nodig zijn om een complex onderwerp zoals steden en veerkracht te onderscheiden. Het doel is om de vier collectieve dimensies van

collectieve betrokkenheid te verkennen in relatie tot de rampervaring en de transformatie van de stad om veerkrachtig te worden. In dit onderzoek is het belangrijk om te begrijpen hoe en waarom transformatie plaatsvindt en wat bijdraagt aan stedelijke transformatie. De gekozen casestudie benadering is belangrijk bij het opstellen van de conclusies over transformatie en stelt de onderzoeker in staat om de 'hiërarchie van inbeddingen' te onderzoeken (Marcus en Colding, 2011) en de onderlinge verbanden, overlappingen en feedbacklussen te zien die gewoonlijk beperkt zijn als dit wordt gedaan in kwantitatief onderzoek zoals een enquête.

Om een achtergrond bij de casussen te geven, illustreren Hoofdstuk 5 en 6 de achtergrond van nationaal beleid op het gebied van stadsplanning, rampenrisicobeheer en overstromingsbeheer in Nederland en de Filippijnen. De hoofdstukken beginnen met een terugblik op het tijdperk van na de Tweede Wereldoorlog, toen beide landen enkele overeenkomsten deelden wat betreft de opzetten en inrichten van overheidsinstellingen die zich bezighouden met de bouw van nederzettingen en de noodzaak om de schade van de oorlog te herstellen. De rol van de nationale overheid was vanaf het begin leidend tot de ontwikkelingsaanpak meer gedecentraliseerd werd met de introductie van beleid zoals de Nota Ruimte voor Nederland in 2004 en de Local Government Code voor de Filippijnen in 1991. Dit beleid gaf lokale overheden meer macht en verantwoordelijkheden bij het beheer van hun steden.

Overstromingsrisicobeheer voor beide landen onthulde een nadruk op infrastructurele maatregelen en werd geleid door het ministerie van Infrastructuur en Waterstaat (Nederland) en het ministerie van Openbare Werken en Wegen (Filippijnen). Op het gebied van rampenrisicobeheer hadden de Filippijnen een eerdere start met het presidentiële besluit 1566 "Versterking van de Filippijnse rampenbestrijding, capaciteit en oprichting van het nationale programma voor rampenparaatheid in de gemeenschap" in 1978, terwijl het Nederlandse beleid voor rampenrisicobeheer, rampen en zware ongevallenwet, als wet in 1985 werd aangenomen. Het waren echter de wetten die in 2010 werd geintroduceerd, de Safety Regions Act (Nederland) en de Republic Act 10121 "Philippine Disaster Risk Reduction and Management Act of 2010" (Filippijnen), die leidend werden in het risico beleid van rampen. Het beleid voor beide landen delegeerde de verantwoordelijkheid voor rampenrisicobeheer naar het lokale niveau. De in de hoofdstukken 5 en 6 gepresenteerde achtergrond voor elk land is opgenomen in de vier empirische hoofdstukken.

Hoofdstukken 7, 8, 9 en 10 zijn gewijd aan elk van de stadszaken, Rotterdam, Dordrecht, Marikina en Malabon. De bevindingen voor elk van de gevallen zijn als volgt:

- Rotterdam - De economische ontwikkeling van de stad is altijd gericht geweest op het benadrukken van de infrastructuur van de Rotterdamse haven. De stad heeft een sterke preventieve infrastructuur dankzij de Deltawerken en de gevoeligheid voor rivier- en zee

overstromingen. De overheidsaanpak is gebaseerd op beleidsmaatregelen, programma's en projecten op het gebied van overstromingsrisicobeheer, waterretentie en klimaatadaptatie. Anderzijds is er ook aandacht voor het zelf organiserend vermogen door samenwerkingsverbanden met maatschappelijke organisaties die werken aan publieke tuinen in de stad. Hoewel de gemeenschap zich bewust is van de inspanningen van het stadsbestuur om te reageren op klimaatverandering, is er weinig dialoog en kennis over het beheer van overstromings- en rampenrisico's. Het is belangrijk om de kloof tussen deze twee benaderingen te overbruggen om nauwer samen te werken aan stedelijke veerkracht.

- Dordrecht - Er is een collectieve herinnering aan de Sint-Elisabethvloed van 1421 aanwezig en vormt ook de basis van het proces voor stedelijke veerkracht en collectieve betrokkenheid. Dordrecht benadrukt dat herinneringen aan rampen in het verleden geen veerkrachtige stad creëren. Een combinatie van factoren zoals het creëren van een netwerk, opvoeren van risicobewustzijn en beleid dat wordt begrepen door inwoners en belanghebbenden is nodig om het proces van stedelijke dynamiek te waarborgen. Dordrechts benadering van zelforganisatie als een onderling afhankelijke activiteit tussen belanghebbenden is een voorbeeld van hoe technische en mitigerende benaderingen van stedelijke veerkracht kunnen worden gecombineerd met maatschappelijke betrokkenheid en leren. Het doel van de stad is om een zelfredzaam eiland te worden en Dordrecht doet dit door een actief netwerk van actoren te onderhouden en het rampen risicobewustzijn van de mensen te versterken en het in hun collectieve bewustzijn in te bouwen. De stad profiteert van het Deltawerkensysteem en het verkokerde dijksysteem, maar de langdurige relatie tussen het stadsbestuur, het waterschap en de gemeenschap heeft Dordrecht niet alleen fysiek veerkrachtig gemaakt (technische veerkracht), maar ook institutioneel en sociaal veerkrachtig.

- Marikina - De stad is een vallei en een stroomgebied waardoor het overstromingsgevoelig is. In 1992 werd Marikina getroffen door zware overstromingen die ongeveer 28% van de stad onder water zette. De toen nieuwe burgemeester voerde daarop een proces van hervormingen in gang om Marikina behoeden voor meer overstromingen en economische voorspoed. De Marikina-case laat zien hoe leiderschap en institutionele opbouw de basis vormen voor stedelijke veerkracht. Deze factoren helpen ook bij het versterken van de collectieve betrokkenheid en wederzijdse aanpassing van de belanghebbenden op hun rol. De transformatie van Marikina werd gestimuleerd door het sterke leiderschap bij het afdwingen van hervormingen, met name het herstel van de Marikina-rivier. De gebruikte aanpak was aanvankelijk gezaghebbend, maar werd verondersteld dat de Mariqueños "discipline te hebben bijgebracht". De vooruitgang en erkenning als een van de "gezondste en meest leefbare steden" in Azië-Pacific (ADB, 2009) heeft de Mariqueños trots gemaakt. Van autoritair veranderden de leiders van Marikina City hun managementstijl in een partnerschap met belanghebbenden. De interactie tussen de stad

via het Marikina City Disaster Risk Reduction and Management Office en de belanghebbenden stimuleert eenheid, collectiviteit en onderlinge aanpassing van hun rollen.

- Malabon – Deze stad laat zien dat de dynamiek van de gemeenschap ertoe hebben geleid dat regelmatig wederkerende overstromingen een sterk positief effect hebben gehad op het opbouwen van burgerlijke dynamiek. De sensitiviteit van betrokkenen op overstromingen heeft ervoor gezorgd dat de ervaring een deel van hun dagelijkse leven is geworden, waardoor een 'cultuur van rampen' is ontstaan. In het verleden zijn infrastructuurprojecten uitgevoerd, waarvan het grootste het CAMANAVA Flood Control-project is. De overstroming die zich na Habagat 2012 voordeed, bracht de stad ertoe haar overstromingsrisicobeheer te versterken en het bewustzijn van rampenrisico's te vergroten en de belanghebbenden door middel van informatie, educatie en communicatiecampagnes te verbeteren. Malabon werkte samen met maatschappelijke organisaties om te helpen bij het geven van trainingen en workshops voor de gemeenschappen. Bewoners zijn zich bewust van de tekortkomingen en moeten werken aan oplossingen die veiligheid bieden zoals het delen van evacuatiecentra met naburige barangays (zelf besturende dorpsgemeenten of wijken) zonder evacuatie plaats door middel van een "Adopteer-een-familie" strategie. Belanghebbenden in de stad Malabon hebben een sterk sociaal verbondenheid en spelen een grote rol in de sociale en economische dynamiek van de stad. Wijken in Malabon hebben zowel sterke bindings- als overbruggingsrelaties die hen veerkrachtiger maken.

Hoofdstuk 11 presenteert de empirische resultaten van een analyse, waarin wordt beschreven wanneer, hoe en wat mensen motiveert om collectief deel te nemen in klimaat verbeter trajecten. De vier steden in het onderzoek vertoonden verschillen en overeenkomsten in beleids-aanpak. De Rotterdamse casus benadrukte de technische en economische veerkracht van de stad, maar ook de noodzaak om een sterkere sociale en maatschappelijke veerkracht op te bouwen. De casus Dordrecht benadrukte op herinneringen gebaseerde rampenervaringen, maar toonde ook technische, ecologische, institutionele en sociale dynamiek die van invloed was hoe de stad zichzelf weer oprichtte. De Marikina-case toont aan dat leiderschap en partnerschap bij het opbouwen van institutionele, sociale en gemeenschapsveerkracht de collectieve betrokkenheid en stedelijke dynamiek de stad verbeterde. Ten slotte richten de Malabon zich op de sociale en weerbaarheid van de samenleving van de belanghebbenden en de noodzaak van de overheid om samen met de lokale overheid meer verantwoordelijkheid te nemen bij het nemen en onderhouden van voorzieningen voor waterbeheersing.

De cases laten zien dat de adaptieve ontwikkeling van steden afhankelijk zijn van tijd en van het adaptieve vermogen (aanjager van veerkracht) die elke stad bezit. Uit de cases kunnen vijf belangrijke lessen worden vastgesteld: (1) *ervaring met overstromingen kan kennis opbouwen,*

maar frequente ervaring met overstromingen kan ook het overstromingsrisico normaliseren; (2) *partnerschap en wederzijdse aanpassing van rollen bouwen aan collectieve betrokkenheid en aanpassingsvermogen*; (3) *het vertrouwen op de overheid om voor de bevolking te zorgen vereist een georganiseerde structuur voor rampenrisicobeheer*; (4) *frequente overstromingservaringen bouwen gemeenschap op*; en (5) *de verschillende perspectieven van risico's en veerkracht die uit het interview zijn afgeleid, geven aan hoe risico's sociaal kunnen worden geconstrueerd op basis van ervaring en cultuur*.

Het laatste hoofdstuk, hoofdstuk 12, bespreekt collectieve betrokkenheid als een concept dat kan worden opgenomen in rampenrisicobeheer en stadsplanning, evenals aanbevelingen voor toekomstig onderzoek. Het onderzoek draagt bij aan de discussie over dynamiek als een continu proces van verandering, leren, aanpassing, groei en transformatie. Op basis van de bevindingen van dit onderzoek kunnen tal van toekomstige vervolgonderzoeken worden ondernomen. Ten eerste kan de perceptie van risico en veerkracht van sociale constructies worden onderzocht, met name een vergelijking tussen steden in het mondiale noorden en het mondiale zuiden. Dit kan inzicht verschaffen in de ontwikkeling van beleid op het gebied van stedelijke veerkracht en risicobeheer. Ten tweede biedt de studie inzichten in het proces van stedelijke veerkracht en collectieve betrokkenheid; het gebruik van aanjagers als uitgangspunt voor de analytische discussie, maar het illustreerde ook dat kennis van het politieke klimaat van steden belangrijk is om de resultaten volledig eigen te maken. Ten slotte laat het kader voor collectieve betrokkenheid van stedelijke dynamiek zien dat dit kan worden toegepast als model risicobeleid. Het kader kan worden gebruikt om benaderingen van crisisbeheer te toetsen en kunne worden toegepast bij het creëren van beter stedelijk risico beleid.

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LIST OF ABBREVIATIONS

ATS	Alternative Temporary Shelter
BDRRM	Barangay Disaster Risk Reduction and Management
BFP	Bureau of Fire Protection
CAMANAVA	Caloocan, Malabon, Navotas, and Valenzuela
CBDRM	Community-based disaster risk management
CBS	Central Bureau of Statistics
CDRRMO	City Disaster Risk Reduction and Management Office
CEMO	City Environmental Management Office
CENRO	City Environmental and Natural Resources Office
CMP	Community Mortgage Program
CNDR	Corporate Network for Disaster Response
COA	Commission on Audit
CoPI	Command site incident
CRF	City Resilience Framework
CRI	City Resilience Index
DMO	Disaster Management Office
DOST	Department of Science and Technology
DPWH	Department of Public Works and Highways
DRM	Disaster risk management
DRRM	Disaster Risk Reduction and Management
GBT	Municipal policy team
GOP	Government of the Philippines
GRIP	Gecoördineerde Regionale Incidentenbestrijdings Procedure
HOA	Homeowners association
ICS	Incident command system
ICT	Information and communication technology
IEC	Information, education and communication

IRA	Internal Revenue Allotment
JBIC	Japan Bank for International Cooperation
KII	Key informants interview
LAA	Learning and action alliance
LGU	Local government unit
MARE	Managing Adaptive Responses to changing flood risk in the North Sea Region
MCDRRMO	Marikina City Disaster Risk Reduction and Management Office
MDRRMO	Malabon Disaster Risk Reduction and Management Office
MLS	Multi-layer safety
MMDA	Metro Manila Development Authority
MOA	Memorandum of agreement
MRPA	Marikina River Park Authority
MSO	Marikina Settlements Office
MTDP	Medium Term Development Plan
NAP	Netherlands Amsterdam Pile
NCR	National Capital Region
NDRRMC	National Disaster Risk Reduction and Management Council
NGO	Non-government organization
NPC	National Planning Commission
NUPC	National Urban Planning Commission
OCD	Office of Civil Defense
OECD	Organization for Economic Co-operation and Development
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PD	Presidential Decree
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PHP	Philippine Peso
PIO	Public Information Office
PLM	Pamantasan ng Lungsod ng Marikina

PNP	Philippine National Police
RA	Republic Act
RBT	Regional policy team
RCI	Rotterdam Climate Initiative
RCP	Rotterdam Climate Proof
ROT	Regional operational team
UFM	Urban Flood Management
UNISDR	United Nations International Strategy for Disaster Reduction
VINEX	Vierde Nota Ruimtelijke Ordening Extra
VROM	Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieu (Ministry of Housing, Spatial Planning and the Environment)
WMO	Waste Management Office

CHAPTER ONE

CHAPTER ONE: SETTING THE SCENE

1.0 INTRODUCTION

As the world becomes increasingly urbanized, populations also become increasingly vulnerable to disasters. The city's growing population amounts to compounded social and ecological problems further aggravated by the onset of changing climatic patterns and natural disasters. Flooding is the most common type of disaster and its incidence and intensity has increased in the past decades. Data from EM-DAT showed that from 2000 to 2020, there was a total of 3,457 floods that happened all over the world (see Table 1.1). This takes up 40% of all types of natural disasters and on average 173 flooding disasters per year in the given period. Table 1.1 further reveals that during the past twenty years there were 8,629 natural disasters recorded, killing a total of 1.3 million people, with 4.1 billion people affected. The data further shows that for the past two decades 110,838 people were killed due to flooding or 8% of the total deaths based on the type of natural disaster, but the number of affected people is at 1.6 billion (40% of the global total). This means that the global total of affected population caused by flooding far exceeds the global total mortality caused by this type of disaster, suggesting not just human loss but also property loss.

Table 1.1: Natural disasters from 2000 to 2020 globally

Type of natural disaster	Asia	Africa	Americas	Europe	Oceania	Total
Geophysical	**424**	**40**	**131**	**51**	**41**	**687**
Volcanic activity	*38*	*8*	*40*	*3*	*17*	*106*
Mass movement (dry)	*7*	*1*	*3*	*1*	*1*	*13*
Earthquake	*379*	*31*	*88*	*47*	*23*	*568*
Meteorological	**1,032**	**195**	**744**	**501**	**135**	**2,607**
Extreme temperature	*122*	*15*	*66*	*230*	*4*	*437*
Storm	*910*	*180*	*678*	*271*	*131*	*2,170*
Hydrological	**1,656**	**878**	**780**	**443**	**95**	**3,852**
Landslide	*250*	*48*	*73*	*14*	*10*	*395*
Flood	*1,406*	*830*	*707*	*429*	*85*	*3,457*
Climatological	**117**	**158**	**190**	**89**	**36**	**590**
Wildfire	*32*	*20*	*102*	*69*	*23*	*246*
Drought	*85*	*138*	*88*	*20*	*13*	*344*
Biological	**172**	**590**	**81**	**27**	**23**	**893**
Epidemic	*169*	*567*	*80*	*26*	*21*	*863*
Insect infestation	*3*	*22*	*1*	*1*	*2*	*29*
Animal accident	*0*	*1*	*0*	*0*	*0*	*1*
Total	**3,401**	**1,861**	**1,926**	**1,111**	**330**	**8,629**
Total deaths (natural disaster)	***794,292***	***133,919***	***271,396***	***156,222***	***2,715***	***1,358,544***
Total affected (natural disaster)	***3,492,511,561***	***344,826,232***	***275,450,359***	***15,095,499***	***6,964,027***	***4,134,847,678***
Total flood deaths	***78,961***	***16,460***	***13,250***	***1,933***	***234***	***110,838***
Total population affected by floods	***1,555,425,938***	***62,493,512***	***53,134,673***	***6,861,822***	***837,009***	***1,678,752,954***

Source: EM-DAT, 2021; https://public.emdat.be/data

In general, flood risk management entails structural measures such as the construction of dikes, levees, dams, and flood barriers. These preventive infrastructures help mitigate floods and prevent damages to life and property. Damages to property especially for the least developed or developing countries are particularly daunting where many of the population are already in a vulnerable economic state. This is especially problematic in rapidly urbanizing developing countries that have yet to develop capacities to address their own risks and vulnerabilities, contrary to more economically advanced cities that have the capacity to also include disaster resilience in their urban plans. Most of these economically advanced cities invest in disaster-resilient infrastructure and spatial disaster preparedness measures. Nevertheless, this focus on the structural measures in making cities resilient occasionally shrouds the non-structural measures that are equally if not more relevant to sustaining a resilient city.

Non-structural measures refer to policies, laws, and regulations in support of disaster risk mitigation and resiliency, these also include awareness-raising and education. Primarily, non-structural measures seek to strengthen the city's institutional and social capitals in doing so it creates an environment where citizens become involved. Citizen engagement in disasters is critical; disaster resilience studies have shown that citizens are often the first responders to a disaster. In addition, social capital has also been identified in disaster studies to be a factor that makes a community or network resilient after a disaster experience (Dynes, 2002; Aldrich, 2012; Meyer, 2013; Esteban, 2017). These studies suggest that the citizens' level of capacities and networks, supplements the governments' efforts on structural measures to address disaster events. Therefore, it is important to explore how government and non-government stakeholders can collaborate in transforming their disaster-prone city into a disaster-resilient city.

This research is about building urban resilience through collective engagement, with a particular interest in flood-prone cities and their efforts to become disaster-resilient. The aim is to go beyond the structural measures applied in flood and disaster risk management and go deeper into how disaster-prone cities are moving towards becoming disaster-resilient. It is not seeking to compare whether structural or non-structural measures is a better approach in managing flood risk and vulnerabilities, rather it looks into the interrelationship, the vertical, horizontal, and transversal, between collective engagement and urban resilience, how collective engagement takes place in cities and what role it plays in transforming disaster-prone cities to disaster-resilient cities.

Four cities working on building and strengthening disaster resilience will be analyzed (Rotterdam and Dordrecht, the Netherlands; and Marikina and Malabon City, The Philippines). The Netherlands and the Philippines are both in the top 20 countries highly exposed to natural hazards according to the World Risk Index 2020, but even with the high exposure of the Netherlands (rank 16), it is among the least vulnerable while the Philippines (rank 8) is among the countries that are highly vulnerable (Behlert, et al.,

2020). This similarity of having high exposure to natural hazards but the difference in terms of vulnerability is interesting to compare how the Global North and Global South approach flood and disaster risk management and urban resilience. This will offer insightful learnings into parallels and differences from each of the cases.

The Netherlands is known globally for the masterfully designed Deltaworks system that secured the country from flooding for decades. This engineering resilience is one of the reasons why the Netherlands while highly exposed to natural hazards is among the least vulnerable countries. The Philippines on the other hand do not have large-scale flood preventive infrastructures and is faced with flood threats brought by typhoons, storms, and tropical cyclones. But the people of the Philippines have demonstrated social resilience in handling flood disasters throughout its history. Historically, both countries created policies on flood risk and water management, and rely on infrastructure development and their respective national agencies on infrastructure to deal with flood risk management. Disaster risk management policies of both countries are also well established. In 2010, both countries released policies on disaster risk management that have influenced how a crisis is managed. The Netherlands released the Safety Regions Act dividing the country into 25 security regions responsible for emergency and crisis management, while the Philippines adopted the Philippine Disaster Risk Reduction and Management Act 2010 (RA 10121) putting the responsibility to local government units (from city level to community level). These mandates devolved disaster risk management to local governments, but the difference is that the Safety Region in the Netherlands controls overall management and designates to accountable units the emergency or crisis based on the hierarchy of emergencies, while in the Philippines, the role is delegated to local governments units, specifically, city and municipal governments.

While there are similarities, there are also some variations in the institutional and policy backgrounds of the cases. In the Netherlands, the development of the "system of disaster management . . . is characterized by all kinds of leadership authority" (Scholtens, 2008: 196). The top-down command structure is prevalent in the Netherlands, disaster management and collaboration with the stakeholders is considered as 'managed collaboration' focusing on management and leadership (Scholtens, 2008). The Dutch cases then can provide insights on the institutional and organized structuring of city planning and disaster risk management including the adherence of the city governments in implementing policies. On the other hand, the Philippine cases can provide examples of how cities organically organize to reach a level of order and resilience. The Philippines also pushed a community-based disaster risk management (CBDRM) schema owing to RA 10121 mandating its establishment. The reasoning behind the establishment of CBDRM is also due to the high frequency of natural disasters in the country, which necessitates immediate response to disasters and crises at the community level.

The four cities, Rotterdam, Dordrecht, Marikina, and Malabon, offer different stories of urban resilience, risk, and collective engagement. The cities adhere to their respective countries' policy frameworks and have historical flood disaster memory and experience, but each city approaches city planning and disaster risk management in its own unique way. Rotterdam's experience in flooding and water has made the city a pioneer in adapting to risks. The city is vulnerable to river flooding and sea-level rise yet it is the safest delta city because of engineering works. The Rotterdam Climate Change Adaptation Strategy together with Rotterdam's Climate Initiative combines approaches on climate change mitigation and adaptation into a comprehensive plan to address the challenges in dealing with climate change and to develop the city into a green and resilient city. Rotterdam is also part of the 100 Resilient Cities of the Rockefeller Foundation which gave the city resources to advance the resilient city agenda by providing a platform to exchange knowledge and experience. The economic and human capitals in Rotterdam remain as the city's main drivers that policies and development strategies are geared towards making the city an attractive place to live and work. However, the city's social and community resilience have taken a backseat making one wonder how did Rotterdam's mantra *"sterker door strijd",* refers to the collective struggle and rebuilding, have watered down. The case examines Rotterdam's urban resilience process by following its main drivers, economic, human, and environmental capitals, in order to comprehend the city's collective struggle, how it fractured over time, and what this means for urban resilience.

On the other hand, Dordrecht's collective memory on the historic flooding serves as the foundation on how the city strives to become a *zelfredzaam* (self-reliant) island. However, reliance on its collective memory is not enough that Dordrecht engaged in several programs and projects that involve the city and regional governments, academe, and the community. One of the projects was the Managing Adaptive Responses (MARE) project that developed and demonstrated a transnational approach to local Flood Risk Management (European Climate Adaptation Platform, 2018). The MARE program also set up a Learning and Action Alliance (LAA) which is a network to exchange learning and develop innovative flood risk management (van Herk et al., 2012). The LAA is an interactive process that includes the involvement of the stakeholders in discussions and the identification of design solutions. The Dordrecht case demonstrates that historical disaster memory alone is insufficient to build a resilient city. The urban resilience process in this island city explores a combination of factors, including the creation of a network, risk awareness, and inclusive policies.

Marikina's journey to urban resilience started with leadership and institution-building. It is a unique case in the sense that before RA 10121 came into effect in the Philippines, the city already has its local disaster risk management system. The city started its reforms in 1992 when the newly elected mayor came up with the "Save the Marikina River" project as a solution to the flood problem of the city. The Marikina River was rehabilitated to allow

the natural flow of the water to flow to connected water bodies and into the sea. Improvements on the drainage system were also done to unclog the water networks (river, canals, and creeks) which greatly reduced flooding in the city. From resisting the initial reforms implemented with draconian measures residents began to appreciate the improvements and became cooperative and participative. The case examines how mutual adaptation of stakeholders' roles can facilitate urban resilience building.

The last case, Malabon, looks into community resilience and how a "culture of disaster" is working towards a "culture of resilience." The residents of Malabon have lived with flooding for centuries being a tidal land that this flood experience has been ingrained into daily life. Flood mitigation measures in the earlier part of the city's history were done through band-aid measures until the national government stepped-in in the late 1990s when the CAMANAVA Flood Control Project was initiated. However, the process and the construction of this flood control facility have been less than satisfactory for the people of Malabon. It was the RA 10121 and the flood experience after *Habagat* (southwest monsoon) 2012 that led to Malabon's proactive stance on disaster risk management. The case illustrates how repeated flood experiences have had a significant impact on collective engagement and community resilience.

The four cities offer unique stories on the role of collective engagement in urban resilience. It is particularly interesting because cities are both social and ecological systems that are complex and multidimensional. This complexity recognizes the social (human) and ecological (biophysical, natural, and built) systems in mutual interaction (Gallopín, 2006; Gallopín, 1991) and its influence on the city's composition and function. Looking at cities as a socio-ecological system allows understanding each of their components rather than just the spatial elements with which urban planning has traditionally been associated with.

1.1 BACKGROUND ON THE SOCIO-ECOLOGICAL SYSTEMS FRAMEWORK

The term socio-ecological systems in urban planning and development has not been used as prominently compared to its use in environmental and ecological studies. Early urban planning theories like Boudeville and Perroux's Growth Pole Theory and Walter Christaller's Central Place Theory were strongly influenced by economics and geography. Conceivably, the urban theory closest to the socio-ecological systems framework is the Concentric Zone Theory (also known as the Chicago model) conceptualized by the sociologist Ernest W. Burgess of the University of Chicago in 1925. Burgess, together with Robert E. Park and Roderick D. McKenzie, conceived the Chicago model to understand the urban organization and patterned change (Vasishth, 2008; Grove and Burch, 1997). It was the first theory to associate the social and ecological systems into a spatial pattern. Burgess interpreted the city as radially expanding from the center to form a series of concentric

zones similar to Chicago. These radial patterns begin in the middle of the city, called the central business district, and radiate outwards to varying characteristics of human settlements. The radial patterns are based on income and rent patterns and are associated with social groups across the urban areas.

The Concentric Zone Theory regards physical patterns of cities as corresponding to socially driven forces such as land values and zoning. It looks at how human settlements are influenced by human behavior. The theory, however, is not without criticisms, critics of the theory perceive the model as an idealized approach to the study of society and cities (Vashisth, 2008), as attribution to Charles Darwin's survival of the fittest (Grove and Burch, 1997), and as social structures and behavior that cannot be drawn from animal ecology and biology (Grove and Burch, 1997; Alihan, 1938) since humans have culture (Hollingshead, 1947), and the ability and desire to control their environment (Alihan, 1938) differentiating them from animals. Critics of the Chicago School such as Milla Alihan, August Hollingshead, and W.E. Getty admonished that the Chicago model lacks the empirical evidence to differentiate which human behavior is biotic or cultural (Schwab, 1992). Others raised the lack of statistical grounds (Schwab, 1992), while some further question its applicability in other states in America. Despite the criticisms, the Chicago School has certainly stirred the pot in the study of ecology by viewing cities and human settlements as interrelated and introducing the concept of human ecology.

Later, urban planning theories took an utopian turn, constructing "ideal cities," but they also reverted to focusing on spatial design, such as Le Corbusier's high-rise living and working space and Frank Lloyd Wright's low-density city of single-family housing units on one-acre lots. The Broadacre City was a plan that kept the city decentralized, dispersed, and dependent on transportation networks and lacked the ideas of neighborhood social interactions. While the designs of Le Corbusier and Wright did not come to fruition in their original form, glimpses of their ideas can be seen in city plans with high rise buildings surrounded by parks and green spaces, as well as suburban areas (especially in the United States) where single-detached houses sit on an acre lot or more and the dependency on motor vehicles.

This structural component of urban planning organized in a hierarchical structure appears to have no interaction with other elements of the city as a whole. Christopher Alexander, an architect and mathematician, in his 1965 essay "A city is not a tree" described cities as having spatial patterns to form an interactive system between the inhabitants and the physical elements of the city. While the essay is not a plan, Alexander proposed that the spatial patterns of cities follow a tree diagram or a semi-lattice[1]. He pointed out that the organization of cities is similar to a semi-lattice where each point is connected to another

[1] A semi-lattice is a mathematical structure defined as a "partially ordered set [that is either] an upper semi-lattice (or a joint semi-lattice or a $\vee$-semi-lattice)" for any nonempty finite subset or "[a] lower semi-lattice . . . or a meet semi-lattice or a $\wedge$-semi-lattice" for any nonempty finite subset (Encyclopedia of Mathematics, 2016).

point, creating units within the city. Structuring the cities as a semi-lattice means understanding that the city has a collection of units, sets, and subsets that are overlapping and belong to one or more sets. Although he confessed in his essay that he cannot show plans or sketches of what a city would look like as a semi-lattice, he described cities as brought together by society. He saw the units as connected or joined and able to be broken down and grouped in sets of related elements. While he did not expound much on the functions of the city, his examples of human interaction with its built environment show a dynamic socio-ecological relation.

In later decades, the socio-ecological approach was introduced specifically as a socio-ecological model by Urie Bronfenbrenner. The model, which was first published in the book Ecology of Human Development in 1979, suggests that human development can be understood by analyzing the child's development and the environmental factors surrounding the child throughout their growth. According to Bronfenbrenner, "development is defined as the person's evolving conception of the ecological environment, and his relation to it, as well as the person's capacity to discover, sustain, or alter its properties" (Bronfenbrenner, 1979: 9). Bronfenbrenner's socio-ecological model was mainly used as a theory in developmental psychology focusing on environmental and social influences that affect a child's development.

Most studies using Bronfenbrenner's socio-ecological model can be seen in the health sector where researchers often look at the behaviors of individuals and their environment vis-a-vis the individuals' health and health promotion. Two prominent researchers, Kenneth McLeroy and Daniel Stokols, used Bronfenbrenner's socio-ecological model in understanding health behavior and promotion. McLeroy, et. al., (1988) proposed an ecological model for health promotion by analyzing five factors - intrapersonal, interpersonal, organizational, community, and public policy - that determine behaviors. The study was geared towards understanding the importance of interventions to change behavioral patterns that promote unhealthy behaviors or lifestyles. It assumed "appropriate changes in the social environment will produce changes in individuals, and that the support of individuals in the population is essential for implementing environmental changes" (McLeroy, et al., 1988: 351). Stokols' study (1996), on the other hand, compared three complementary theoretical perspectives on health promotion, which are behavioral change, environmental enhancement, and social ecological models. The study resulted in the identification of the core principles of social ecological theory which were used to establish criteria for developing and reviewing health promotion programs. Later on, Stokols used the socio-ecological model in resilience, a shift from his initial research thematic area on health promotion.

In 2007, Elinor Ostrom who was a Nobel Prize in Economics winner introduced the socio-ecological systems framework as an extensive multitiered hierarchy of variables relevant to the analysis of ecosystem management (Ostrom, 2007; McGinnis and Ostrom, 2014;

Binder, et al., 2013). The socio-ecological systems framework was mainly used in the study of ecosystem services and management of ecological resources such as water and forest resources and use. It has four main variables, the resource systems, resource units (generated by the resource systems), governance system, and actors. These four main variables provide inputs to the actions that jointly affect the outcomes or the actions produced through direct or indirect interactions within the socio-ecological systems (Ostrom, 2007). Ostrom's socio-ecological systems framework was created to understand the complex interactions of natural resources, governance under different socio-ecological conditions (Epstein et al., 2013; del Mar Delgado-Serrano and Ramos, 2015) and "based on [the] theories [of] collective choice, common-pool resources and natural resource management" (Binder, et al., 2013: 6). The socio-ecological systems framework is found to assess the "social and ecological systems in almost equal depth" and "provide[s] a frame for developing different degrees of specificity in different tiers" (Binder, et al., 2013: 16). For this reason, Ostrom's socio-ecological systems framework has been one of the most widely used and cited socio-ecological systems frameworks by social and political scientists (Cole, et al. 2014).

The application of the socio-ecological approach to a variety of societal issues demonstrates how intertwined social and ecological systems are. This research uses the socio-ecological systems framework to encompass the complex and dynamic interplay of the physical, social, institutional, economic, and natural components of the city. The framework comprises various disciplines in understanding city development and conditions of urban resilience. This dissertation sees that using the socio-ecological systems can elucidate the role of collective engagement in the process of urban resilience holistically rather than in silos. The study seeks to distill critical conditions and patterns of resilience of the four flood-prone cities working towards becoming a resilient city using the socio-ecological systems approach as the basis for analysis. The intentions are to (i) identify whether the disaster experience of disaster-prone cities have prompted collective engagement among stakeholders in working towards becoming resilient; (ii) determine the conditions and variables for this collective engagement; and (iii) understand these variables apropos the transformation process of the city from disaster-prone to resilient city.

1.2 PROBLEM STATEMENT

In the last 10 to 15 years more city governments and managers are recognizing that the way to address disasters is through increasing the cities overall resilience. As such the word resilience and the concept of resilient city have become increasingly used in international development especially after the launch of the Hyogo Framework for Action 2005-2015 in 2005 and the UNISDR campaign "Making Cities Resilient" in 2010. The UNISDR campaign specifically tackled the need for the local governments, citizens, and

private sector to take action to build disaster-resilient cities. The campaign resulted in more than 1,000 cities and local governments affirming to improve their cities' resilience to disasters through sharing knowledge and best practices on various disaster-related challenges and solutions (UNISDR, 2012).

Following the Hyogo Framework, the Sendai Framework for Disaster Risk Reduction 2015-2030 was launched to ensure continuity of the work on disaster risk management and to promote and build this across all sectors and levels of government (UNISDR, 2015a). The Sendai Framework emphasizes cooperation, coordination, engagement, and inclusivity in the guiding principles. The new framework accedes to the amalgamation of the economic, physical, social, cultural, and environmental assets at all levels to improve people's well-being. The new framework further emphasizes the stakeholders and their contribution to disaster risk reduction and management.

Shortly after, organizations such as the Rockefeller Foundation and the Organisation for Economic Co-operation and Development (OECD) created their resilient city frameworks identifying the social, institutional, economic, and environment as driving forces for building a resilient city. Both frameworks stress adaptation as well as the interaction of these driving forces in maintaining stability in facing disasters. Lastly, both frameworks also underscore the importance of the collective participation of stakeholders in ensuring city resilience. Despite the focus on inclusiveness and participation of stakeholders, understanding how cities that are disaster-prone and/or have experienced a disaster transform to reach a level of resiliency and the role collective engagement plays in this process have not been exhausted. Furthermore, privately funded initiatives like the Rockefeller Foundation's 100 Resilient Cities while useful in bringing the resilient city agenda to the forefront, may also be self-serving, lack accountability, and promote an ambiguous framework for cities to model.

This research deals with two concepts, urban resilience and collective engagement. The research analyses the interrelationship between government and non-government stakeholders at the vertical and horizontal levels, and charts this interrelationships and actions transversely across periods of time. It assesses the processes of collective engagement and the role it plays in urban resilience, whether this collective engagement contributes to urban resilience and on what aspect of urban resilience. Further, the research explores under what economic, social, institutional, and environmental circumstances can a city transform into a resilient city. The research also looks into the different perspectives of risk and resilience that motivates the way government and non-government stakeholders collaborate. This contributes to an in-depth analyses into the process each of the four case cities go through in building urban resilience.

1.2.1 Urban resilience and complex systems

The first concept explored in this research, urban resilience, is analyzed through the distinct patterns of each case city's process of learning, transforming, and improving following a flood disaster. Cities, hence urban, have been discussed in the previous section as both social and ecological systems, resilience offers the same complexity. The concept of resilience was first introduced by Crawford Stanley Holling (C.S. Holling) an ecologist, who studied ecology and evolution and contributed much knowledge on resilience and adaptive management. As such, most studies on disaster resilience and human resilience would often cite Holling's extensive work in this aspect.

C.S. Holling's first definition of resilience, as the "measure of the persistence of systems and their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables" (Holling, 1973: 14), offers a look at his observation of organisms' evolution. However, he later redefined resilience as the "magnitude of [the] disturbance that can be absorbed before the system . . . restructure[s] with different controlling variables and processes" (Gunderson, et. al., 2002: 4; Holling, et al., 1997; Mayunga, 1995; Berry, 2013). In this second definition, resilience is understood as the system's capacity to withstand disruption and maintain its equilibrium. Holling asserted that resilience should be interpreted as having multiple-equilibria rather than seen as a single-equilibrium (Holling, et al., 1997; Sharifi and Yamagata, 2016). A single-equilibrium interpretation of resilience means that after a disaster the system bounces back to the pre-disaster phase. This interpretation is also referred to as engineering resilience (Gunderson and Holling, 2002; Andavarapu and Arefi, 2016) and implies that 'equilibrium' or stability will only refer to reverting to the pre-disaster phase through recovery (Gall, 2013). On the other hand, multiple-equilibria infer that resilience is earned over time[2] and that the ecosystems' multi-stable behavior is influenced by the variability of the temporal and spatial scales (Folke, 2006).

There are three conceptions of resilience (Folke, 2006; Sharifi and Yamagata, 2016). First, engineering resilience, which was already mentioned in the discussion above, is the efficiency and rapid recovery of the system after a disturbance. Engineering resilience is interpreted as having a single equilibrium. Second, ecological or ecosystem resilience and social resilience, which refers to the buffer capacity or ability of the system to absorb disturbances, but still maintain its function. It recognizes that systems have multiple equilibria and have the capacity to thrive and persist. The last concept, social-ecological resilience, is the interrelationship of disturbance and reorganization within the socio-ecological system. It refers to the system having an adaptive capacity to transform, learn

[2] This notion is supported by Holling's personal correspondence quoted in Folke (2006), where it was pointed out that a "multi-stable behavior can only be interpreted . . . with at least three (but probably not more than five variables), that differ qualitatively in speed".

and innovate. The system in this concept has an integrated feedback mechanism and cross-scale dynamic interactions that allow the system to sustain and develop.

This last concept fits into the urban resilience sphere, because this multiple-equilibria interpretation of resilience compliments the multidisciplinary and complex thinking inherent in the socio-ecological systems approach. Moreover, within this idea, socio-ecological systems such as cities are assumed to have the capacity to adapt, are dynamic and complex at both temporal and spatial scales. Supportive of this interpretation, Elmqvist (2014: 5) defined resilience as a "multidisciplinary concept that explores persistence, recovery, and the adaptive and transformative capacities of interlinked social and ecological systems and subsystems". In his definition, Elmqvist offered to extend the resilience concept by stating that resilience is not just recovering from a single disturbance but also refers to the capacity of a system to adapt and transform. This adaptive capacity has been identified as one of the salient characteristics of a resilient system (Holling, 1973; Gunderson and Holling, 2002; Folke, 2006; Gall, 2013).

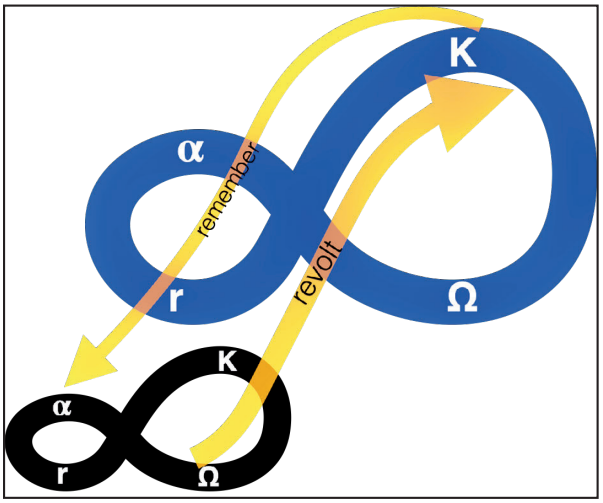
Understanding adaptive capacities, adaptive cycles as concepts to use in analyzing interaction across scales

In this research, the adaptive capacities of cities refer to the economic, social, human, institutional, and environmental capitals that help cities adapt and transform following a disturbance. Resilient city frameworks, including the Hyogo and Sendai Frameworks, refer to these as driving forces and assets that contribute to the improvement of the city and people's well-being. Since the interest of the research lies in the ability of the city as a complex socio-ecological system to transform into a disaster-resilient city, how adaptive capacities help this transformation requires further exploration. Holling, et al. (2002) extended the concept of resilience to include the term "panarchy" which is an organizing framework for interpreting the complex interactions of natural and social systems across scales. It describes the natural and social systems interactions and interlinkages and its cycles of adaptation (adaptive cycles), growth, and restructuring or reorganization (Gunderson and Holling, 2002). The panarchy framework assumes that the series of adaptive cycles are structured in dynamic hierarchies across temporal and spatial scales and proceeds through varying phases of interaction (Gunderson and Holling, 2002; Du Plessis, 2008; Gall, 2013; Carpenter, 2013).

Figure 1.1 illustrates the panarchy framework, where adaptive cycles can be seen to go through four phases of development, exploitation/growth (r), conservation (K), creative destruction/release (Ω), and renewal or reorganization (**α**) (Gunderson and Holling, 2002; Andavarapu and Arefi, 2016; Berkes, et al., 2008; Walker, et al., 2004). The four phases go through two spatial and temporal stages. The first stage allows the system to generate long and slow capacities to conserve and transform (Sage, et al, 2015; Holling, 2001). At this stage, the system proceeds from exploitation slowly to conservation (Berkes, et al., 2008)

where systems at different temporal scales tolerate changes occurring at lower scales (Sage, et al., 2015; Holling, 2001; Walker, et al., 2004). The second stage is a sequence of rapid change with shorter periods of innovation and reorganization (Folke, 2006; Sage, et al., 2015). This last stage which includes the last two phases of the adaptive cycle is where the "back loop" interaction takes place. In this stage, the release and renewal phases create a dynamic interaction where opportunities for learning, adaptation, and re-organization happen. This complex interaction and back loop process emphasizes the transition or transformation cycles a system undergoes to regenerate after experiencing systemic shocks. Figure 1.1 shows the panarchy framework and adaptive cycles in a series of lemniscate patterns or an infinity symbol (∞) where short and long loops and cycles can be observed.

Figure 1.1: Panarchy framework adapted from Gunderson and Holling (2002)



The panarchy primarily focuses on continuous adjustment and evolution in order to maintain a level of functionality (Seeliger and Turok, 2013). This research, probes that the adaptive capacities reach a level of equilibrium after a disaster, yet continue to adjust, adapt, and evolve. This process allows the system to transform to be able to function as a system and anticipate sudden disturbances. Transformation may not be the most obvious terminology to use in describing the behavior of a resilient system. However, as discussed in the previous sections, transformation is essential for a system to become resilient. Going back to the adaptive cycle, the last two phases refer to the release and renewal or reorganization of a system under stress. The interaction between the two phases goes through a back loop process whereby the system experiences short rapid changes instigated by disturbances or shocks. That back loop process enables the system to learn to transform its functions to adapt to the disturbances and maintain the function of the

system as a whole. An interesting point in the adaptive cycle is the "back loop" interaction which can be interpreted as the collaborative element in this complex interactive process. This point serves as the jump-off to the second concept to be dealt with in this research, collective engagement.

1.2.2 Collective engagement, resilience and transformation

Cities take shape in diverse settings, where a range of stakeholders collectively organize for urban growth and resolve urban challenges. Recognizing that cities are complex multi-sectoral and multi-dimensional socio-ecological systems shift one's perception from seeing cities as just built, physical systems to seeing cities as dynamic interrelated physical, economic, environmental, social, and institutional systems that work together at varying degrees to help cities grow and thrive. Urban resilience takes on a similar multi-dimensionality as discussed in the previous section, and takes shape after experiencing a disturbance. As has been described, resilience is a measure of the ecosystem's ability to absorb, persist and return to its equilibrium after a temporary disturbance (Holling, 1973). For cities to reach equilibrium the process of urban resilience presupposes that the city goes through dimensions of collective engagement where interaction between and among interconnected systems take place. The approach in which these collective actions are done can be through the government or self-organizations and driven by factors that spur transformation from one dimension to another until the city reaches a level of resiliency.

The research follows the idea that adaptation and transformation are elements that are important in the process of reaching urban resilience. However, resilience definitions given by policy making bodies are sometimes one dimensional, such as the definition given by United Nations International Strategy for Disaster Reduction (UNISDR) which is "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: 24). By adding the word "resist", the UNISDR definition contradicts Holling's definition which specifies the ability of the system to adapt and transform. Even with the inclusion of the words "absorb" and "accommodate" implying adaptation, it fails to address adaptation and the multiple levels of transformation of a system to become resilient. The UNISDR's definition appears to be a concept of engineering resilience whereby the only way to become resilient is to go back to the previous phase (pre-disaster phase). The definition overlooks that resilience has multiple equilibria which are essential in resilience thinking. This structural, physical and engineering focus may cloud the perception of governments, national, regional and local alike, that resilience only depends on infrastructure.

On the other hand, Marcus and Colding (2011) in their paper "Towards a spatial morphology of urban social-ecological systems", considered four main attributes in developing resilience in socio-ecological systems, disturbance, diversity, self-organization, and learning. Disturbance, in resilience terms, refers to the natural and necessary opportunity for renewal for both social and ecological systems (Marcus and Colding, 2011: 12). It catalyzes action or inaction depending on the existing adaptive capacity present in the urban system. Diversity, the second attribute in developing resilience, promotes the ability of the social and ecological system to identify multiple disaster rebuilding strategies. Marcus and Colding (2011) defined diversity as being directly connected to the concept of spatial capacity, and the creation of multiple spaces to support and develop differences in information, people, and biota (Marcus and Colding, 2011: 14; Marcus, 2008). Self-organization, as a key attribute of resilience, is perhaps the most connected to social networks, as it refers to the ability of social systems to react and influence reform in a positive manner (Marcus and Colding, 2011). Lastly, learning, which is closely linked to self-organization, is the ability of the system to learn from the disturbance and use knowledge to adapt to the changes experienced and being experienced. These attributes place a focus on both spatial and non-spatial elements that aid in the growth of urban resilience. It emphasizes the spatial and social diversity and adaptability to changes and learning in resilience and disaster rebuilding (Marcus and Colding, 2011).

Although transformation was not mentioned in the four main attributes above, it can be inferred that through learning from experience and adaptation to changes, the system eventually transforms to a better state. Adaptability refers to the ability of the stakeholders to influence resilience (Folke, et al., 2010). It is the "collective capacity of the human actors in the [socio-ecological] system to manage resilience" (Walker, et al., 2004: 7). While, transformation is the "capacity to create a fundamentally new system when ecological, economic, or social (including political) conditions make the existing system untenable"(Walker, et al., 2004: 7). Transformation is the ability of the system to shift from its current normal state to another development or improved state (Sharifi and Yamagata, 2016). Therefore, transformation can be defined as the result of system improvement during the adaptation process.

In this research, the role of collective engagement in the (adaptation) process of building urban resilience in the four case cities is assumed to go through multiple levels and sectors. However, deconstructing resilience does not always provide clarity into how it can be implemented or operationalized (Collier, et al., 2013; Davoudi, 2012). Transformation of a disaster-prone city to a disaster-resilient city requires an exploration of the interactions among the different levels and components of the city. This includes deconstructing who is involved, to what extent, for what purpose, and for whom these actions (collective or otherwise) are intended.

Transformation, like adaptation, necessitates an understanding of the roles that each stakeholder plays in the overall function of the city. Stakeholder engagement happens not only through formal state and government-led participatory processes, but it also happens, more often than not, through community groups, networks, and social movements (Gaventa and Barrett, 2012; Collier, et al., 2013; Edwards, 2009). Self-organization has always been an important facet in resilience building (Marcus and Colding, 2011; Davoudi, 2012; Walker, et al., 2004; Adger, 2000; Wilkinson, 2012; Gotham and Campanella, 2011) and this emphasis on citizens and communities are argued to be the "true source of resilience" (Edwards, 2009, back matter, para. 3). Self-organizations does have a role in resilience building as it taps on to the capacities of the community to better organize for their well-being. However, as Davoudi (2012) points out, putting self-organization into a social context gives it an ideological overtone of self-reliance, implying that governments should surrender their duties allowing communities to take over. This is much like the advocacy "resilience relies on citizens and communities, not the institutions of state" (Edwards, 2009, front matter). Stakeholder engagement and self-organization may facilitate adaptive and transformative processes in resilience, but these are not substitutes for government response and accountability (Davoudi, 2012).

Resilience cannot be reached by self-organization alone, it calls for collective engagement, a collaborative process among and between stakeholders to co-produce or co-create a resilient city that is tenable for all stakeholders, government and non-government alike. A systematic review done on co-production and co-creation indicate that many studies use these terms interchangeably (Voorberg, et al., 2015) both however refer to citizen engagement in public services (Voorberg, et al., 2015; Sicilia, et al., 2016; Sorrentino, et al., 2018). Voorberg, et al. (2015) extended clarifications on co-production and co-creation based on the degree of citizen involvement as co-implementer, co-designer, and initiator, where co-creation falls under co-initiator and co-designer, while co-production is the involvement of citizens in the co-implementation of public services. Apart from the degree of citizen involvement, an important aspect in co-production is defining who is involved in the production or creation. Sorrentino, et al. (2018) referred to two types of participants who are part of the 'co' in co-production as the state actors and lay actors. Simply put the state actors are the government which includes the national, regional, provincial, local governments, line agencies who in their capacity direct the planning and execution of public services, while the lay actors are the non-state or non-government stakeholders who may or may not have direct interaction with the government.

There are three types of co-production, the individual co-production refers to individual acts that are inherently for personal benefits (Sorrentino, et al., 2018; Sicilia, et al., 2015; Brudney and England, 1983), group co-production includes the larger community and volunteers however this type of co-production is limited in the sense that the benefits may only be for a select few (Brudney and England, 1983), and collective co-production refers

to the collective action of governments and citizens in the delivery of services that benefits the community collectively (Sorrentino, et al., 2018; Brudney and England, 1983). In collective co-production, there is an emphasis on citizen involvement and is not constrained as to who is involved in the service delivery process.

The individual and group co-production typologies can be taken both as the government and self-organization approach that are working separately on the delivery of services, whereas the collective co-production can be interpreted as the collective engagement of both the government and self-organization approaches in mutual adaptation. In this research, the role of collective engagement in the process of building urban resilience is the main area of inquiry. Specifically, this research seeks to investigate how flood-prone cities' experiences have led these cities to work towards becoming resilient.

1.3 RESEARCH QUESTIONS

The research aims to distill critical conditions and patterns of urban resilience vis-a-vis collective engagement in four flood-prone cities in the Netherlands and the Philippines. It seeks to answer the questions what kinds of actions, who responded, how, and why it was treated the way it was to resolve the disturbance. It looks at both the degree of stakeholder involvement, who is involved in building urban resilience and the type of resilience that evolved in the process of building urban resilience. Given this premise, the main research question is: ***How does collective engagement contribute to building urban resilience in disaster-prone cities in the Netherlands and Philippines?***

In this research, the government and self-organization approaches are assumed to take place in the four cities, whether these approaches work towards the same vision for the city is part of the puzzle to be unfolded in the research. As such, to answer the main question it needs to be unpacked using the sub-questions below.

1. What are the drivers of resilience and how do these drivers build urban resilience?

   This sub-question is the anchor point where the characteristics of urban resilience are explored. It helps define the criteria for assessing urban resilience and in relating this to existing policy frameworks adopted by cities in practice. It also provides an understanding of the process of urban resilience which is important in the next sub-question.

2. What is the role of collective engagement in the process of building urban resilience and how does the process of collective engagement unfold from the government approach and self-organization approach?

In this sub-question, collective engagement is defined and seeks further the roles of the stakeholders such as who is involved in the government approach and self-organization approach, whether it is in line with building urban resilience, and what kind of interactions are present between the two approaches.

3. What role do the drivers of resilience play in collective engagement and how does it relate to the type of urban resilience experienced?

   This question traces the collective engagement process in relation to building urban resilience. The research looks at different dimensions of collective engagement arguing that each level has a form of a trigger that sparks action. The research seeks to identify when, how, and what makes stakeholders take purposive behavior collectively. It investigates the factors that complement (or fragment) both collective engagement and urban resilience.

4. What are the areas of convergence and divergence in the process of collective engagement and urban resilience between the Netherlands and the Philippine cases?

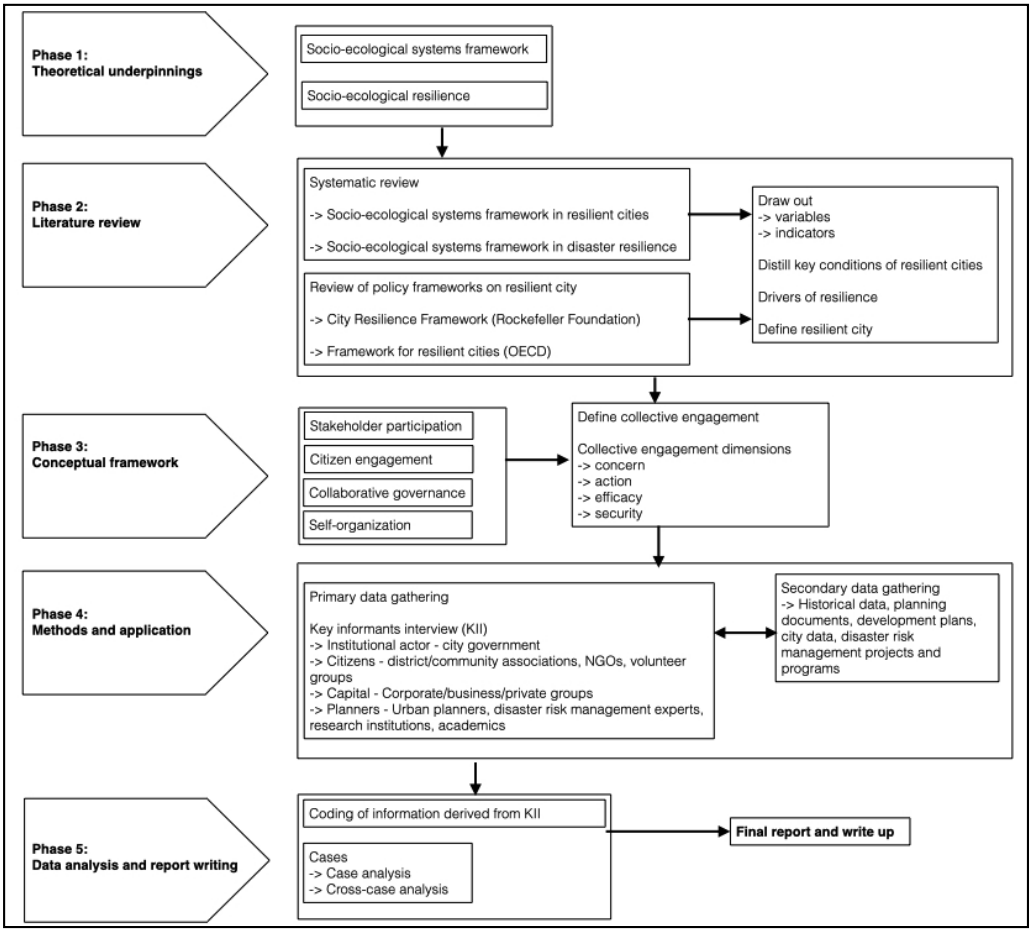
   This sub-question leads to the comparative case analysis aspect of the research. It identifies similarities and differences in the patterns of collective engagement and urban resilience building in each of the city cases. It also investigates the different perceptions of risks and resilience and how this affects collective engagement and urban resilience.

1.4 METHODOLOGICAL APPROACH

Two primary theoretical underpinnings drove this research, first is the socio-ecological systems framework which was the basis for the literature review, and second stakeholder participation and self-organization which forms the basis on the discussion and conceptualization of collective engagement in the conceptual framework.

The research was done in five phases (Figure 1.2 Research framework). The first phase is the theoretical underpinnings which entail the introduction of the socio-ecological systems framework and its significance in the resilience discourse. Phase two was the in-depth literature review using the systematic review of academic journals to identify studies that used the socio-ecological systems framework in urban planning and disaster studies. A review of policy frameworks on resilient cities was also conducted. The result of this phase was the identification of variables and indicators used in the conceptual framework which is the third phase of the research.

Figure 1.2: Research Phases and Methods



The formulation of the conceptual framework involved the review of literature on stakeholder participation and self-organization which contributed in constructing the definition of collective engagement in the third phase. The literature review phase compliments the conceptual framework phase as the variables and indicators derived from the review forms part of the conceptual framework.

The fourth phase of the research is the research methods and application. This phase aims to explore the sequence and/or patterns of events in four flood-prone cities. This was done by looking back at the disaster experience of the cities and their current work on building disaster resiliency. Secondary data were gathered reviewing historical accounts, policies, disaster risk management data, city data including statistics such as demography, economics which contribute to the growth of the city. Primary data was sought through key informants' interviews of city government officials, urban planners, disaster risk management experts, and other stakeholders.

The final phase was the triangulation of findings and processing of the data from the previous phase. The qualitative data gathered in the previous phase were collated, reviewed, and processed. Qualitative interview results were processed using the Atlasti software.

1.5 CONTENT AND OUTLINE OF THE BOOK

Chapter 1 of the research gives an overview of the research setting and some cursory introduction on the socio-ecological systems framework and the concept of collective engagement. It provides the problem statement, and objectives of the dissertation.

Chapter 2, literature review, defines the socio-ecological systems framework linking its usage in disaster resilience and urban planning studies. The chapter aims to identify synergies within the socio-ecological systems that mutually influence collective engagement and city transformation. This chapter drew out variables to be used in the analysis of the five capitals in relation to city resilience and collective engagement.

Drawing from the previous chapter, Chapter 3 frames the concept of collective engagement on the socio-ecological systems framework lenses. This chapter defines the collective engagement dimensions - collective concern, collective action, collective efficacy, and collective security. It describes the drivers of resilience, criteria of a resilient urban system, and each of the collective dimensions that contribute to transformation using empirical data.

Chapter 4 draws out the methodology to be undertaken in the study. The research requires a methodology that will allow the exploration of how each of the collective dimensions of collective engagement grows. Since it has been established in the previous chapter that participation and self-organization contribute to the formation of collective engagement, how then does this process of collective engagement from the stakeholders translate to action and the city government's plan? With this in mind, it is then important to bring a qualitative method in this research to understand the vertical and horizontal relationships, experiences to create a robust picture of the effectiveness of collective engagement in bringing the city to a level of resiliency.

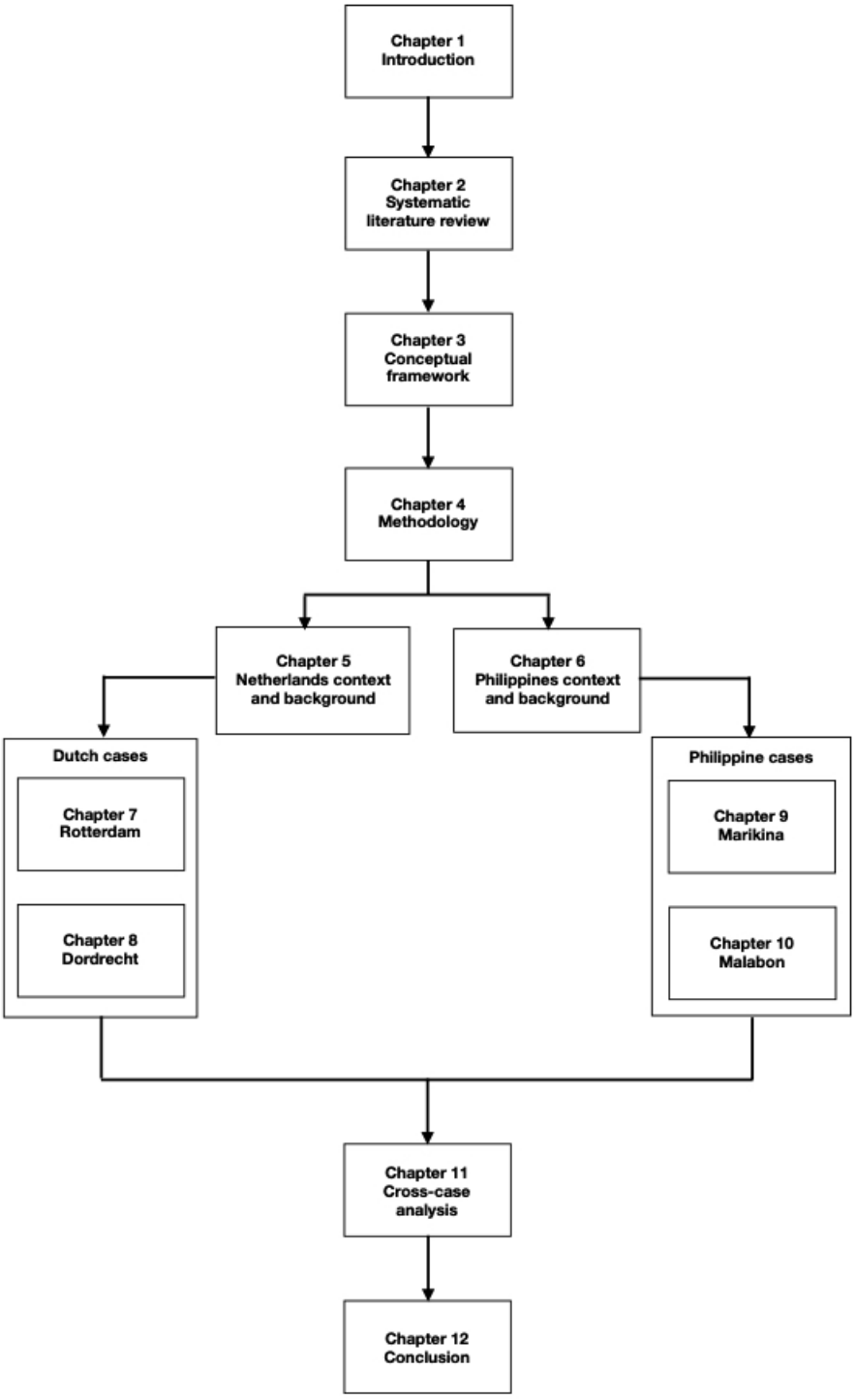
Chapters 5 and 6 outlines the national-level policies in the Netherlands and the Philippines to give a background on the mandates and procedures on urban planning, disaster risk management, and flood management. This gives an overview of the evolution of the policies at the national level and how these policies are adopted by the city cases. Specific policies at the city level are also drawn out to give a contextual background for each city case.

The succeeding four chapters specifically analyzed findings in each case study. Each of the four chapters is dedicated to each of the city cases, Rotterdam, Dordrecht, Marikina, and Malabon. Each of the four chapters discussed the transformation using the collective engagement urban resilience framework. The chapters drew out the cities' flood and disaster experiences, the interventions that transpired to restore and rebound from these experiences, the efficacy of collective action, and the analysis of the city's transformation to become resilient. This includes looking at both the structural and non-structural disaster risk management measures that have been put in place.

Chapter 11 puts together the findings narrated in the previous chapters to draw out the process of transformation. It further described the when, how, and what makes people take purposive actions collectively. This chapter culminated with a comparison of the degrees of collective engagement in each case city, and how each is transforming to become resilient.

Finally, Chapter 12 concludes with a discussion of collective engagement as a concept that can be integrated into disaster risk management and urban planning and provides recommendations for future studies.

Figure 1.3: Structure of the thesis



CHAPTER TWO

CHAPTER TWO: UNDERSTANDING SOCIO-ECOLOGICAL SYSTEMS IN URBAN RESILIENCE AND DISASTER

2.0 INTRODUCTION

The socio-ecological systems framework is drawn from systems theory which presumes that the advancement of complex systems is dependent on the strong capacities of individuals, institutions, or organizations to function as linked systems. As such, the framework "emphasizes the interdependence of environmental conditions within particular settings and the interconnections between multiple settings and life domains" (Stokols, 1996: 286; Stokols, et al., 2013). These interconnections are assumed to guarantee the survival of the socio-ecological system, and that the failure to consider the interdependence and interconnections result in fragmentation. This broad scope of the socio-ecological systems framework drawn from complex systems theory makes it useful in the resilience discourse (Stokols, et al., 2013) as presented in the introductory chapter. The adaptive and transformative capacity of the socio-ecological system was highlighted in the discussion as factors that influence collective engagement and urban resilience building.

This chapter attempts to narrow the broad scope of the socio-ecological systems specific to the areas of inquiry in this research. The aim is to build knowledge on the application of the socio-ecological systems framework in the disaster and urban planning discourse and to identify synergies within the socio-ecological system that influence the transformation of cities to become resilient. In identifying the synergies, variables contributing to this dynamic relationship can be determined, and in so doing, establish a general framework for how a disaster-prone city transforms itself into a disaster-resilient city through collective engagement. The chapter begins with a systematic literature review to find how the socio-ecological systems approach is used in urban planning and disaster resilience, and to draw characteristics of a resilient urban system. Thereafter, current policy frameworks on resilient city, including a comparison of these frameworks are done to identify salient features, similarities, and differences in relation to the socio-ecological systems. This contributes to the section on describing and distinguishing resilient city indicators. The chapter will conclude by identifying the gaps and requirements that can be developed in the next chapter's formulation of the research conceptual framework.

2.1 SOCIO-ECOLOGICAL SYSTEMS APPROACH USAGE IN URBAN PLANNING, TRANSFORMATION AND DISASTER RESILIENCE

This section highlights the results of the desktop research done between March and May 2017 on the usage of the socio-ecological systems approach in urban planning and disaster

resilience. The specific review questions are: (i) what is the definition of disaster resilience?; (ii) what key terminologies in the resilience concept are used?; (iii) what are the main criteria for assessing urban resilience or a resilient city?; and (iv) what variables are used in reference to the criteria?

A systematic review of the following databases was conducted: SCOPUS and Google Scholar. The combination of search terms used in the SCOPUS database search led to five combinations of search criteria. The combinations were extracted to identify redundant hits (documents that appear in more than one search criteria). The combinations yielded a total of 164 hits with 12 redundant hits spread across the five combinations[3] within the SCOPUS search. For the Google Scholar database search, the search terms used were "urban" OR "city" OR "resilient city" AND "disaster" AND "resilience" AND "socio-ecological*" with a custom range of documents published between 2000 and 2017. The first 200 hits in Google Scholar were extracted and the same process of identifying redundant hits was done opposite the SCOPUS hits. The Google Scholar search yielded 22 redundant hits.

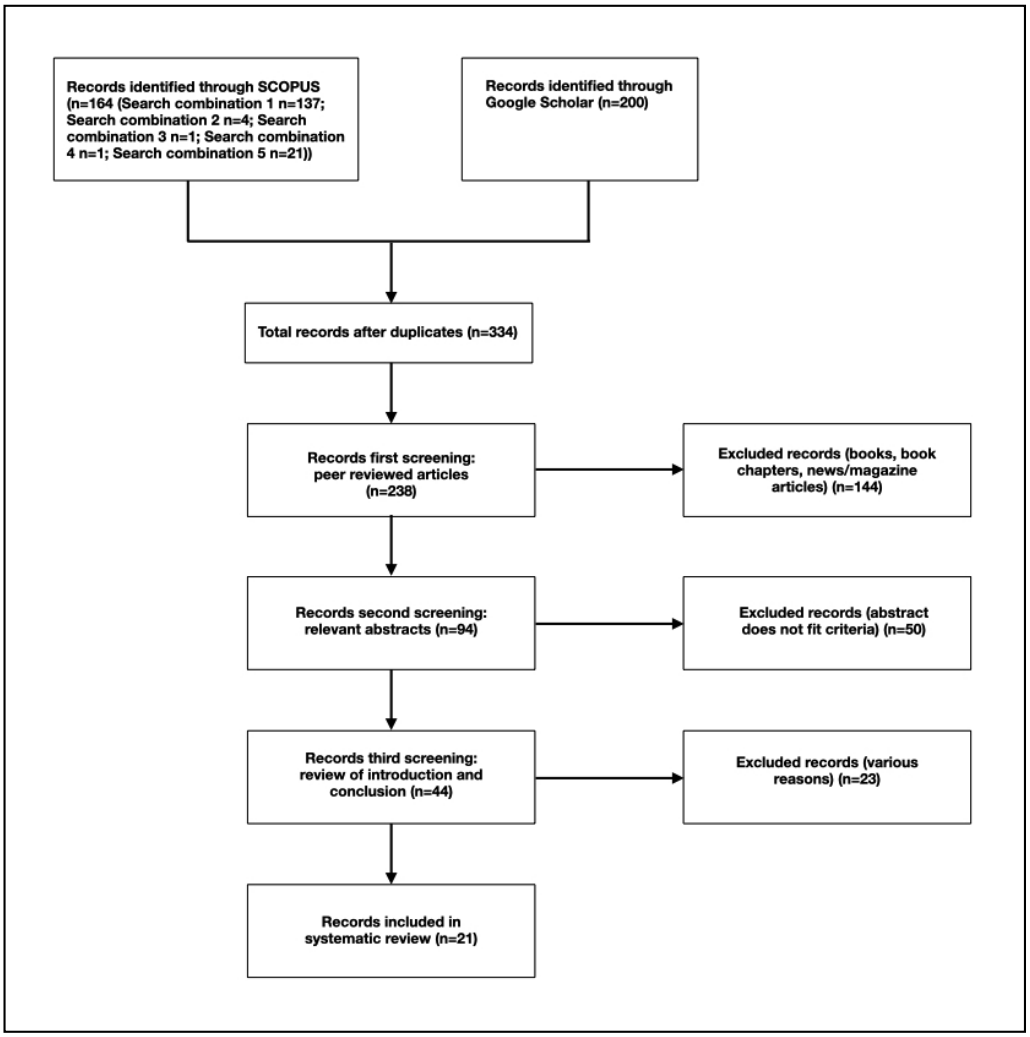
The screening process for the documents was done in three levels. First, only peer-reviewed journal articles were selected to ensure that the documents were screened by experts in the field. Second, the abstracts were reviewed to identify key elements of the research, and a quick search to find the following keywords: socio-ecological, urban or city, resilient city, disaster, resilience, transformation or transition, and collective engagement or community participation. Any document with four or more keywords was selected as relevant for the study. Lastly, to ensure that the selected documents were indeed relevant, the documents were further screened and weeded out by skimming through the introduction and conclusion parts to check its relevance to the questions. A total of 21 relevant articles were selected. Figure 2.1 shows the flow diagram of the systematic review.

2.1.1 Data extraction and analysis

Analysis of the literature was done in three steps. First, the application and key resilience terminologies used in the literature were identified. The literature was reviewed to identify the (i) subjects of application, (ii) key resilience terminologies related to socio-ecological systems approach, (iii) locational areas of application, (iv) disaster phase, and (v) future

[3] SCOPUS search combinations (1) "socio-ecological framework" OR "socio-ecological model" OR "socio-ecological system" AND "urban OR city OR cities" AND LIMIT-TO (SUBJECT AREA "environmental sciences") OR LIMIT-TO (SUBJECT AREA "social sciences"); (2) "socio-ecological framework" OR "socio-ecological model" OR "socio-ecological system" AND "urban OR city OR cities" AND "disaster resilience" AND "disaster management"; (3) "socio-ecological framework" OR "socio-ecological model" OR "socio-ecological system" AND "urban OR city OR cities" AND "disaster resilience AND disaster management" AND "resilient city"; (4) "socio-ecological framework" OR "socio-ecological model" OR "socio-ecological system" AND "disaster resilience AND disaster management" AND "resilient city"; (5) "socio-ecological framework" OR "socio-ecological model" OR "socio-ecological system" AND "disaster resilience AND disaster management"

Figure 2.1: Systematic literature review flow diagram



planning. Table 2.1 shows the application and key resilience terminologies used in the systematic review. Results show four main subject areas of application common in the literature, natural disasters, climate change, governance and policies, and transformation and/or transition. Since the concern of this dissertation research is the socio-ecological systems approach, the key resilience terminologies were further culled out and identified per literature to identify similar terminologies used (Table 2.2). This resulted in the identification of nine (9) key terminologies on resilience and socio-ecological systems used in the literature. The term adaptive capacity and adaptive cycles were mostly used as the

Table 2.1: Application and key resilience terminologies used in the studies

Key sources	Date	Subject of application	Key resilience terminologies (socio-ecological systems related)	Area of application				Disaster Phase		Future planning
				Community	City	Rural	National	Pre-disaster	Post-disaster (Rebuilding and recovery)	
Gunderson L.	2010	Natural disasters (flooding and hurricane)	ecological resilience; adaptive cycles; panarchy	☐	✓	☐	☐	✓	✓	✓
Wilkinson, C.	2011	Governance and general planning theory	socio-ecological resilience, adaptive capacity	☐	✓	☐	☐	✓	☐	✓
Ainuddin and Routray	2012	Natural disaster (earthquake), community resilience	community resilience, risks and vulnerabilities	✓	☐	☐	☐	✓	☐	✓
Gotham and Campanella	2011	Natural disaster, Hurricane Katrina, New Orleans	panarchy	☐	✓	☐	☐	✓	✓	☐
Bahadur and Tanner	2013	Climate change, urban policy environment	adaptive cycles, panarchy, socio-ecological systems resilience	✓	✓	☐	✓	☐	☐	✓
Chelleri, et al.	2015	Climate change adaptation, urban resilience	adaptive cycles	✓	✓	✓	✓	✓	✓	✓
Baud and Hordijk	2009	Urban governance, risk, resilience, vulnerability	panarchy, adaptive renewal cycles, resilience thinking	✓	✓	✓	✓	✓	✓	✓
Steiner, F.	2014	Urban ecology, urban planning	engineering resilience, ecological resilience	☐	✓	☐	☐	☐	☐	✓
Djalante and Thomalla	2010	Analysis of disaster resilience frameworks	engineering resilience, ecological resilience, risk, vulnerability	✓	✓	✓	✓	✓	✓	✓
Picket, et al.	2013	Urbanization, transformation	adaptive capacity, panarchy, adaptive cycles	☐	✓	☐	✓	✓	☐	✓
Seeliger and Turok	2013	Sustainable cities, vulnerability, transition	transition theory, engineering resilience, socio-ecological resilience, panarchy, adaptive cycles	☐	✓	☐	☐	☐	☐	✓
Bhattacharya-Mis and Lamond	2014	Flood memory, system memory	adaptive capacity	✓	☐	☐	✓	✓	✓	✓
Romero-Lankao and Gnatz	2013	Urban transformation, power relations, governance	adaptive capacity, transformation, transition	☐	✓	☐	☐	☐	✓	✓
McSweeney and Coomes	2011	Climate-related disasters, indigenous peoples	adaptive capacity	☐	☐	✓	✓	☐	✓	✓
Takeuchi et al.	2014	Socio-ecological resilience	social resilience, socio-ecological resilience, resilience thinking	☐	☐	☐	✓	☐	✓	✓
Schwarz et al.	2011	Climate change adaptation	complexity	✓	☐	☐	✓	✓	☐	✓
Hooli, L.J.	2015	Disaster risk reduction, natural disaster (flooding)	socio-ecological resilience, adaptive capacity	✓	☐	☐	☐	✓	✓	✓
Mehmood, A.	2015	Urban resilience	engineering resilience, ecological resilience, social resilience, adaptive capacity	☐	✓	☐	✓	☐	☐	✓
Wolfram, M.	2016	Urban transformative capacity	sustainability transition, transformative capacity	☐	✓	☐	☐	☐	☐	✓
Wagner et al.	2014	Disaster risk management, climate change adaptation	adaptive capacity	☐	✓	☐	☐	✓	✓	✓
Sharifi and Yamagata	2016	Urban energy resilience	engineering resilience, ecological resilience, adaptive resilience	☐	✓	☐	☐	☐	☐	✓

Table 2.2: Key resilience terminologies in relation to the socio-ecological systems framework

Key sources	Date	Subject	Key resilience terminologies in relation to the socio-ecological systems framework								
			Ecological Resilience	Socio-ecological resilience	Engineering resilience	Social resilience	Adaptive cycles, adaptive capacity	Panarchy	Community resilience	Risks and vulnerabilities	Transformation, transition
Gunderson L.	2010	ND	✓	☐	☐	☐	✓	✓	☐	☐	☐
Wilkinson, C.	2011	GOV, PLAN	☐	✓	☐	☐	✓	☐	☐	☐	☐
Ainuddin and Routray	2012	ND	☐	☐	☐	☐	☐	☐	✓	✓	☐
Gotham and Campanella	2011	ND	☐	☐	☐	☐	☐	✓	☐	☐	✓
Bahadur and Tanner	2013	CC, URB POL	☐	✓	☐	☐	✓	✓	☐	☐	☐
Chelleri, et al.	2015	CC	☐	☐	☐	☐	✓	☐	☐	☐	☐
Baud and Hordijk	2009	GOV, URB POL, RRV	☐	☐	☐	☐	✓	✓	☐	☐	☐
Steiner, F.	2014	URB ECO, URB PLAN	✓	☐	✓	☐	☐	☐	☐	☐	☐
Djalante and Thomalla	2010	FRAME	✓	☐	✓	☐	☐	☐	☐	✓	☐
Picket, et al.	2013	URB, TRANS	☐	☐	☐	☐	✓	✓	☐	☐	☐
Seeliger and Turok	2013	URB, RRV, TRANS	☐	✓	✓	☐	✓	✓	☐	☐	✓
Bhattacharya-Mis and Lamond	2014	MEM, ND	☐	☐	☐	☐	✓	☐	☐	☐	☐
Romero-Lankao and Gnatz	2013	URB, TRANS, GOV	☐	☐	☐	☐	✓	☐	☐	☐	✓
McSweeney and Coomes	2011	CC	☐	☐	☐	☐	✓	☐	☐	☐	☐
Takeuchi et al.	2014	SES RES	☐	✓	☐	✓	☐	☐	☐	☐	☐
Schwarz et al.	2011	CC	☐	✓	☐	☐	☐	☐	☐	☐	☐
Hooli, L.J.	2015	DRR, ND	☐	✓	☐	☐	✓	☐	☐	☐	☐
Mehmood, A.	2015	SES RES	✓	☐	✓	✓	✓	☐	☐	☐	☐
Wolfram, M.	2016	TRANS	☐	☐	☐	☐	☐	☐	☐	☐	✓
Wagner et al.	2014	DRR, CC	☐	☐	☐	☐	✓	☐	☐	☐	☐
Sharifi and Yamagata	2016	SES RES	✓	☐	✓	☐	✓	☐	☐	☐	☐

Notes: ND - natural disaster, GOV - governance, PLAN - general planning, urban planning, CC - climate change, URB POL - urban policy, governance, RRV - risk, resilience and vulnerability, URB ECO - urban ecology, URB PLAN - urban planning, FRAME - frameworks, URB - urban, cities, urbanization, TRANS - transformation, transition, MEM - memory (flood memory, system memory), SES RES - socio-ecological resilience, DRR - disaster risk reduction

key terminology on resilience in the literature, this was followed by panarchy and socio-ecological resilience.

Second, the resilience perspective and resilience definitions were identified. Lastly, criteria for assessing urban resilience and corresponding variables were extracted. Since each of the literature has its criteria and variables possible associations were identified and laid out. Once the associations were identified indicators were derived from the variables. Results of this analysis are presented in the next sections.

2.1.2 Resilience perspective

The influence that C.S. Holling has on the concept of resilience is palpable in the literature reviewed. Many of the authors based their resilience definition on the 1973 definition given by Holling and have moved on to improve or adjust this according to their usage. Resilience in general has been defined as the ability of the system to adjust to internal and external disturbances while remaining fully functional. In the systematic review five main resilience perspectives were used, ecological resilience, engineering resilience, socio-ecological resilience, social resilience, and community resilience. Each of these resilience perspectives is defined in Table 2.3.

Table 2.3: Resilience perspective and definition

Resilience perspective	Resilience Definition	Key sources
Ecological resilience	The ability of the system to adapt to a disturbance and to return to its functioning capacity. It assumes multiple equilibria that assists systems in transcending from one state to another after a disturbance.	Gunderson L. (2010), Hooli (2015), Mehmood (2015), Wagner, et al. (2014), Sharifi and Yamagata (2016)
Engineering resilience	The ability and time it takes a system to bounce back, rebound or return to equilibrium after a disturbance. It requires rapid recovery and assumes single equilibrium.	Steiner (2014), Hooli (2015), Mehmood (2015), Sharifi and Yamagata (2016)
Socio-ecological resilience	The ability of the system to withstand disturbances, reorganize, evolve, adjust and retain the same function and structure. Adaptation is the key in socio-ecological resilience where the system is seen to have multiple equilibria that adapt to disturbances at different times yet still retain its function.	Wilkinson, C. (2011), Ainuddin and Routray (2012), Gotham and Campanella (2011), Bahadur and Tanner (2013), Chelleri, et al. (2015), Baud and Hordijk (2009), Djalante and Thomalla (2010), Picket, et al (2010), Seeliger and Turok (2013), Bhattacharya-Mis and Lamond (2014), Romero-Lankao and Gnatz (2013), Schwarz et al. (2011), Sharifi and Yamagata (2016)
Social resilience	"The ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change" (Adger, 2000: 347).	Takeuchi et al. (2014), Mehmood (2015)
Community resilience	The community's capacity to rebound and rebuild from a disaster.	Ainuddin and Routray (2012), Djalante and Thomalla (2010)

Ecological resilience is the ability of a system to cope with a disturbance and be able to return to its functioning state. It assumes that a system undergoes multiple levels of equilibrium but still retains its structure and function (Sharifi and Yamagata, 2016; Holling, 1973; Folke, 2006). This means that a system upon a disturbance absorbs these changes yet persists to function in the same capacity as before the disturbance.

Engineering resilience as the name suggests has a more rigid perspective on resilience. It is the ability and time of a system to bounce back after a disturbance. It looks at the system's recovery time to return to its normal or previous state. Under this resilience perspective, disturbances or disasters are assumed to be predictable and forecasting methods are reliable sources of information (Sharifi and Yamagata, 2016). Engineering resilience adheres to having a single equilibrium state which is the pre-disaster or pre-disturbance state.

Socio-ecological resilience is similar to ecological resilience which recognizes that systems have multiple equilibria that facilitate the systems ability to absorb and adapt to disturbances. It recognizes the system's capability to reorganize and transform to another state (equilibrium). Socio-ecological resilience is also known as adaptive resilience which stemmed from recognizing "cities as complex and dynamic socio-ecological systems" (Sharifi and Yamagata, 2016: 1662). It follows the panarchy framework, with a short-term coping and a long-term adaptation process, a process by which complex systems regain their functioning capacity while transitioning to another state.

Social resilience was defined in both articles in Table 2.3 using the definition of Adger (2000: 347) which is "the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change". Most of the work on social resilience was based on prevention, preparation, and response to natural disasters and the management of natural resources (Keck and Sakdapolrak, 2013; Takeuchi et al., 2014; Mehmood, 2015). Community resilience is the last of the resilience perspectives identified in the literature, and it refers to a community's ability to bounce back from a disaster. This terminology is often used in disaster management work specifically in rebuilding and reconstruction.

2.1.3 Criteria for assessing a resilient urban system

There are six criteria for assessing a resilient urban system derived from the literature. Each criterion contains variables that have corresponding indicators. Appendix 1 shows the compilation of variables and indicators drawn from the systematic review. As previously discussed, cities are complex socio-ecological systems, hence the variables and indicators in the list are not confined to a single criterion. Discussion on the six criteria is in the succeeding sections.

1. Adaptive capacity and resilience to manage, adjust, learn and cope with different changes

A resilient urban system has the adaptive capacity to adjust, learn and cope with disturbances. Under this criterion are eight variables, alternative scenarios, types of knowledge, coping capacity on past and future threats, adaptive co-management, integrated governance structures, capacity to adapt to external changes, self-organization, and transformability and innovation.

Developing alternative scenarios is a strategic planning method to describe different possible strategies for development. It is shaped by the social, ecological, economic, and technological characteristics of the urban system (Wolfram, 2015). It includes a wider and flexible array of strategies, projects, and programs that can adapt and respond to the changes that may arise during the development and implementation process. A clear vision developed together with the stakeholders is a necessary precondition in alternative scenario development. The involvement of the stakeholders ensures that their social needs are considered in each of the alternatives.

To adapt to changes and uncertainty, stakeholders with disaster experience should share the different types of knowledge learned. These different types of knowledge and learning range from experiential knowledge, local and community-based knowledge, to more technical knowledge, such as technological and structural advancements. Learnings gained through experiential and cultural knowledge tend to be retained much longer as it is usually embedded in the psyche of the individual and the culture of a certain group. Knowledge derived from social and collaborative learning is utilized and transferred through organizations and helps bridge connections among these different organizations and/or networks. Technological knowledge helps in preparing for unexpected disturbances such as developing technology for forecasting and constructing infrastructure to ensure a resilient urban system.

The ability of the city at various organizational or institutional levels to adapt and cope with external and internal changes exemplifies resiliency. During a disaster, communities that can rebuild and recover efficiently and effectively have a faster chance to successfully go back to their normal daily activity. Communities that have learned from disaster experiences and successfully rebuilt and recovered from these experiences are equipped with experiential knowledge to help cope better from disasters that may arise in the future. Similarly, communities can build on this experiential knowledge and disaster awareness to self-organize and engage in cross-scale interactions and collaboration with the government, private and public sectors, civil society, and other city stakeholders in managing the city.

2. Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales

A resilient urban system not only looks at its adaptability to disasters and disturbances but also its ability to prepare for disasters. Three variables were drawn from the literature on disaster preparedness, risk perception, and awareness, coping ability to risks and hazards, and long-term planning. Recognizing risks and hazards and their potential impacts on the city at different scales entails the use of different knowledge and information. This knowledge and information are translated to risk and hazard profiling that can further be developed into an action plan or disaster preparedness plan. The ability to cope with risks and hazards requires support from and coordination of the government, the private and public sectors, civil society, and other stakeholders. In addition, funding support is important to ensure that resources and services are present to fully prepare for disasters. However, this is just one of the means to become prepared, the social capital and networks present within and outside of the city are equally important to support disaster preparation. Strong social capital ensures the safety of the people within and outside their networks. This has been mainly observed in disaster-affected communities that have rapidly rebuilt or recovered from the disaster experience due to the help of the various networks present in the community. Strengthening local capacities in disaster planning and building a resilient city is a long-term process. Building these networks and ensuring trust among the actors involved requires time and constant collaboration.

3. Established enabling or supporting environments in creating a resilient city

Strong enabling environments spawn opportunities for learning, cooperation, and networks. Eight variables fall under this criterion, bridging connections (linkages), built and natural capital, engineering and technical solutions, interdisciplinary approach, institutional and governance conditions, social development, economic development, and conditions for recovery and renewal.

In building resilient cities emphasis is given to the vertical and horizontal linkages between and among different scale levels of organizations. These linkages can be between local governments, civil society organizations, private and public organizations that contribute to effective governance (Baud and Hordijk, 2009), provide feedback, and enable informed decision-making (Sharifi and Yamagata, 2016). Strong vertical and horizontal linkages where local communities and stakeholders are proactively involved facilitate resilience building.

The city's built and natural environments contribute to determining its resilience and security from disasters. It can be used in prevention and preparation for possible disturbances and building resilience. Understanding the dynamics between humans and the environment provides a clear description of how to reduce and manage the impact of a

disaster. In disaster resilience, sustainable, efficient, effective infrastructures for the purpose of mitigation and adaptation must be able to withstand natural disasters and ensure the safety of the residents.

This interdisciplinary approach to addressing planning challenges covers the social, economic, environmental, and organizational dimensions of urban resilience and spatial planning (Mehmood, 2015). The approach can benefit from participation of stakeholders in decisions that will affect the development of the city as well as their day-to-day living. Allocating appropriate spaces and infrastructures in the city to mitigate natural disasters coupled with improvements in the social, environmental and economic services increases resilience.

The institutional and governance conditions of the city determine whether the previous approaches will be followed. Governments can create supportive regulatory frameworks that recognize the role of the stakeholders as contributors to creating a resilient city. Including the concepts of adaptive capacity or adaptive co-management in the city's policies can result in transformative acts.

4. Maintaining city resilience through diversity

Diversity is one of the most common criteria identified in the literature. The literature suggests that diversity, which includes spatial diversity (Chelleri et al., 2015; Bahadur and Tanner, 2013; Baud and Hordijk, 2009; Sharifi and Yamagata, 2016), economic diversity (Takeuchi et al., 2014; Gunderson, 2010; Ainuddin and Routray, 2012; Baud and Hordijk, 2009; Djalante and Thomalla, 2010; Sharifi and Yamagata, 2016), social diversity (Baud and Hordijk, 2009; Takeuchi et al., 2014; Wolfram, 2015; Sharifi and Yamagata, 2016), and ecological diversity (Baud and Hordijk, 2009; Takeuchi et al., 2014; Gunderson, 2010), foster resilience. Diversity in this regard is referred to as having diverse spatial uses as in land uses, zoning, diverse economic functions or activities, diverse social backgrounds, and diverse ecological uses and resources.

Encouraging diversity across the complex urban system allows flexibility, movement, and inclusiveness contributing to resiliency. In addition, diverse economies contribute to a city's economic strength and help communities prepare for and bounce back from a disaster (Djalante and Thomalla, 2010). This allows cities options for livelihoods that will help communities rebuild and recover. Apart from economic diversity, social diversity also helps in providing opportunities for all stakeholders, regardless of age, culture, and social status, to participate in creating strategies to support recovery and rebuilding initiatives. Takeuchi et al. (2014) narrated that the revitalization of the two rural territorial and coastal landscapes in the Tohoku region, Japan following the 2011 earthquake and tsunami entailed strengthening the "local traditions and providing opportunities for all ages to participate" in creating strategies to revitalize the region (Takeuchi et al., 2014: 523).

Reinforcing social and cultural diversity facilitates socio-economic diversity and biodiversity (Takeuchi, et al., 2014) that in turn helps social and economic development. In general, diversity offers a range of options for dealing with disruptions, which makes it more likely for the urban environment to continue to function (Sharifi and Yamagata, 2016).

5. Memory based disaster experience

Memory-based disaster experience can be the starting point in building knowledge on disasters. People who experienced disasters can provide experiential knowledge in dealing with disasters in the future. Those who experience disasters on a more regular basis usually have more built-in memory and knowledge. However, it should also be noted that the risk in relying on memory is that people may have different perceptions of what happened as such it is best to convert that knowledge or memory right after the disaster event to social learning (Bhattacharya-Mis and Lamond, 2014). In this way, the memory, observation, and experiences can be shared and documented. Building memories from past experiences can help create adaptive environments and mitigating measures for future disasters (Hooli, 2015).

6. Social, physical and economic drivers that contribute to household, community, and city resilience

There are three main variables under this criterion, economic capital, social capital, and physical (natural and built) capital. The three capitals contribute to resilience at all levels in the urban system. A stable economic environment allows cities the financial mechanism to build the necessary infrastructure that will create a resilient city. It also provides stakeholders access to resources and options that will give them alternatives in the event of a disaster.

The role of social development has been mentioned under the criterion enabling environment. Weak social capital contributes to the vulnerability of a community and a city. If the community or the city does not have strong networks and linkages within and outside their system, rebuilding and recovery from the disaster will most likely be delayed. Strengthening social capital through encouraging participation, networks and linkages allows stakeholders to learn from each other, build ties that will in the end prove useful in facing and recovering from disasters. Building a disaster-resilient city is a long-term process, the social, economic, physical (natural and built) capitals play significant roles in the process. Embedding these three capitals into the city's socio-ecological system help build urban resilience.

The complex nature of a city as a socio-ecological system means that transforming a city from a disaster-prone city to a disaster-resilient city will take time due to the involvement of various sectors in the process. Building a resilient city requires coordination and growth

from different actors and sectors. Disturbances also happen within these sectors that affect or disturb the city in general. Understanding that cities are complex socio-ecological systems allows the government, urban planners, private and public sector, and the stakeholders, sagacity that change is a long-term and continuous process.

2.2 RESILIENT CITY BEGINNINGS

A resilient city has been defined as "a sustainable network of physical systems and human communities" (Godschalk, 2003: 137). This definition positively relates to how cities are conceived as socio-ecological systems since the definition of physical systems applies to both built and natural environments (ecological systems) and human communities as social and institutional components (social systems) (Godschalk, 2003; Baud and Hordijk, 2009). A resilient city has multiple interrelated and interdependent networks (Gunderson, 2010; Wilkinson, 2011; Gotham and Campanella, 2011; Baud and Hordijk, 2009; Djalante and Thomalla, 2010; Mehmood, 2015; Wolfram, 2015), and diverse social, ecological, economic, and physical components (Vale and Campanella, 2005; Picket et al., 2013; Gunderson, 2010; Wilkinson, 2011; Ainuddin and Routray, 2012; Takeuchi et al., 2014; Sharifi and Yamagata, 2016) that prepare the city from disturbances.

In January 2005, the Hyogo Framework for Action 2005-2015 was launched to reduce disaster losses and make countries safer and more secure from natural hazards (UNISDR, 2005). In 2015, the successor of the Hyogo Framework, the Sendai Framework for Disaster Risk Reduction 2015-2030 was launched and adopted by 187 UN member countries (PreventionWeb, 2017; UNISDR, 2015a). It aims to direct multi-hazard disaster risk management at all levels and across sectors (UNISDR, 2015b). The Sendai Framework ensures continuity of the disaster risk management work and also supports the 2010 UNISDR Making Cities Resilient campaign. The aim of the campaign is to raise awareness about the value of reducing urban risks, engaging in disaster risk reduction programs, integrating disaster risk reduction into participatory urban development planning process, and protecting critical infrastructure (UNISDR, 2010). The campaign which was initially planned to run only until 2015 will now run until 2030 to further support the Sendai Framework.

The Sendai Framework proceeds along the same lines as its predecessor, which is to acknowledge that resilience should be encouraged and developed across sectors and at all levels of government. The role of the stakeholders at all levels is highlighted in the guiding principles of the Sendai Framework acknowledging that coordination, engagement, partnerships and inclusivity are essential in addressing disaster risks. The Sendai Framework emphasizes strengthening the capacities of the stakeholders to become effective partners and decision-makers in disaster management. It does not solely focus on

city resiliency rather it offers a broader policy framework in addressing disaster risks. It is a valuable starting point in discussing succeeding city resilience frameworks and indices.

Following the international developments and policy frameworks set by the UNISDR and the growing need to build disaster-resilient cities, two frameworks have been developed in recent time. First, the Rockefeller Foundation launched the 100 Resilient Cities initiative in 2013 "to help more cities build resilience to the physical, social, and economic challenges that are a growing part of the 21st century" (The Rockefeller Foundation, 2021). Cities under this initiative are provided access to "resilience-building tools and services supplied by a carefully selected platform of partners from the private, public, academic, and non-profit sectors" (World Urban Campaign, 2021). The Rockefeller Foundation partnered with ARUP[4] and developed the City Resilience Framework (CRF) and City Resilience Index (CRI) in 2014.

The Rockefeller Foundation and ARUP, defined city resilience as "the capacity of cities to function, so that the people living and working in cities - particularly the poor and vulnerable - survive and thrive no matter what stresses or shocks they encounter" (The Rockefeller Foundation and ARUP, 2014: 3). The definition emphasized the poor and vulnerable groups since these groups suffer the most from the impacts of disasters or disturbances. These vulnerable groups are likewise the beneficiaries of most projects financed by the Rockefeller Foundation.

The second framework was developed in 2016 by the Organization for Economic Co-operation and Development (OECD). In support of the Sendai Framework for Disaster Risk Reduction and the 2030 Agenda for Sustainable Development, the OECD produced the preliminary version of the Resilient Cities report in 2016. The report assessed ten city case studies in terms of their capacity to "absorb, adapt, transform, and prepare for future shocks" and stresses to "promote sustainable development, well-being and inclusive growth"(OECD, 2021; OECD, 2016a: 3). The report was anchored on the concluding discussion on how to achieve "resilient economies and inclusive societies" at the OECD 2014 Ministerial Council Meeting (OECD, 2021a; OECD, 2016). The report also featured the Framework for Resilient Cities which included parameters and indicators that can be tested in various cities.

The OECD defined resilient cities in a similar socio-ecological systems and resilience perspective by stating that, "resilient cities as those which are able to absorb, adapt, transform and prepare for the past and future impact of economic, environmental and social shocks or stresses, in order to promote sustainable development, well-being and inclusive growth" (OECD, 2016b; as also quoted by Linkov, 2017). As an international development organization, it is clear in the definition that their main goal in having a

[4] ARUP is an independent and private firm with technical expertise on engineering, urban design and planning.

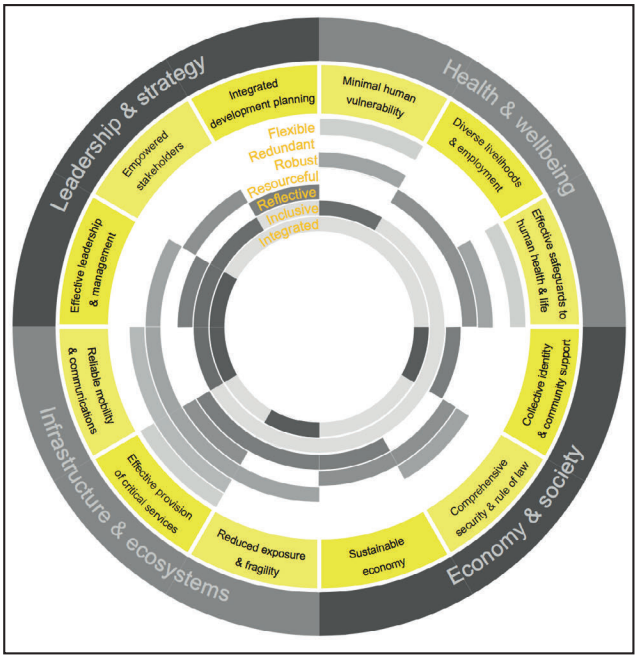
resilient city is the promotion of sustainable development (as adapted from the UN Sustainable Development Goals), the well-being of the citizens, and inclusive growth of all sectors within the city.

The next sections describes the two frameworks of resilient cities in more detail.

2.2.1 The City Resilience Framework and City Resilience Index

The City Resilience Framework (CRF) suggests that city resilience is built on four dimensions (see Figure 2.2). First, a resilient city ensures the **health and well-being** of the people living and working in the city (The Rockefeller Foundation and ARUP, 2014). Second, the **economy and society** enables the people to live peacefully, and act collectively (The Rockefeller Foundation and ARUP, 2014). The **infrastructure and environment** both man-made and natural systems provide critical services, protect and connect the people (The Rockefeller Foundation and ARUP, 2014). And lastly, **leadership and strategy** which is needed for an informed, inclusive, integrated and iterative decision making (The Rockefeller Foundation and ARUP, 2014).

Figure 2.2: City Resilience Framework



Source: The Rockefeller Foundation and ARUP, 2015a

Under the four dimensions are a total of twelve goals, three in each dimension, that guides the city in improving its functions to become resilient. These twelve goals are supported by

52 indicators. The indicators were developed to integrate the seven qualities of resilient systems. The seven qualities of resilient systems are namely, reflective, robust, redundant, flexible, resourceful, inclusive, and integrated.

Reflective systems reflect on past experiences and use these experiences to adapt and adjust standards and norms to address the disturbances. It is a continuous process of evolution rather than a permanent solution to the city's problem (The Rockefeller Foundation and ARUP, 2015). This quality is comparable to the socio-ecological systems resilience thinking and panarchy model that resilience is a continuous process of transformation and stability. As new disturbances occur a system transforms and adapts anew to be able to function like before.

Robust systems refer to the built infrastructure that can predict, anticipate and forestall disasters or disturbances and still maintain its function. Redundant systems as the name suggests are the spare capacity purposely created within the system (The Rockefeller Foundation and ARUP, 2015). A system with redundant properties is similar to having a back up plan. It has a variety of methods for fulfilling a need or performing a function. However, redundant properties should not be considered as an afterthought rather as part of the general conception of the city plan.

Flexible systems have the ability to transform and adapt to changes. This quality of the resilient system refers to the management of the physical, ecological, and social structures. It underscores the introduction of new knowledge and technologies, and incorporating indigenous or traditional knowledge and practices (The Rockefeller Foundation and ARUP, 2015).

Resilient systems are considered to be resourceful in trying to meet their goals and needs during a disaster (The Rockefeller Foundation and ARUP, 2015). This means stakeholders which includes individuals, organizations, institutions, both public and private sectors can actively seek ingenious ways to recover from disasters and reinforce the system function. Aside from being resourceful, a resilient system is inclusive which means that all stakeholders such as those previously mentioned are included in community consultations and are engaged in community activities. The CRF emphasized the inclusion of all groups and sectors, especially of the vulnerable groups to avoid isolating or segregating members of society and to contribute to a sense of ownership and vision for creating a resilient city (The Rockefeller Foundation and ARUP, 2015).

Last of the quality of resilient systems is an integrated system. Integrated systems refer to the ability of the system to share and exchange information, services and resources rapidly and efficiently at all scale levels. The CRF and CRI were developed based on the perspective that a city is a system in itself and that a resilient city has different

components at different levels and scales that are interdependent (The Rockefeller Foundation and ARUP, 2015).

The City Resilience Index (CRI) was developed based on the CRF's four dimensions, health and well-being, economy and society, infrastructure and environment, and leadership and strategy, and drawn from the twelve goals of resilient systems. The first of the four dimensions, health and well-being concerns people. The three goals that fall under this dimension are minimal human vulnerability, diverse livelihoods and employment, and effective safeguards to human health and life. Minimal human vulnerability refers to the city's ability to provide basic needs to all stakeholders. Indicators under this goal are provision of safe and affordable housing, sufficient and affordable energy supply, access to adequate and safe drinking water, safe, reliable and affordable sanitation, and sufficient and affordable supply of food (The Rockefeller Foundation and ARUP, 2015).

Diverse livelihoods and employment to maintain the economic productivity of stakeholders during and after a disaster help make a city resilient. Diverse and inclusive economic and financial options for stakeholders also prepare stakeholders from disasters and lowers the shock or surprise factor following a disaster. Among the indicators identified under this goal are inclusive labor policies and standards, relevant skills and training to match the skills of stakeholders to appropriate employment, development of local businesses, business innovation, supportive financing mechanisms to help businesses adapt to changes and disruptions, and comprehensive support for livelihoods after experiencing a disturbance or shock (The Rockefeller Foundation and ARUP, 2015).

To protect human health and life, the city needs reliable facilities and effective emergency services. Reliable health and emergency services and providers are needed by the stakeholders for them to have a sense of security in the city especially in times of disasters. Indicators identified under effective safeguards to human health and life are "robust public health systems, adequate access to quality healthcare, emergency medical care" and "effective emergency response services" (The Rockefeller Foundation and ARUP, 2015a; The Rockefeller Foundation and ARUP, 2014).

The second dimension economy and society refers mainly to the organization of cities which includes the community, rule of law, and fiscal management (The Rockefeller Foundation and ARUP, 2015). Collective identity and community support can be seen through the active engagement and participation of the stakeholders. Social capital is the driver within this goal since indicators mainly refer to having a socially integrated community with strong networks.

Comprehensive security and rule of law can be measured through having "effective systems to deter crime, proactive corruption prevention, competent policing, and

accessible criminal and civil justice" (The Rockefeller Foundation and ARUP, 2015a). Rule of law builds trust among stakeholders which is important in a resilient city. Stakeholders trust in the system determines their level of engagement with the government that affects their day to day living.

The last goal under this dimension is sustainable economy. This refers to the governments' ability to manage public finances, engage both public and private sectors in business continuity planning, encourage diverse economic base, create an attractive business environment, and integrate with regional and global economies (The Rockefeller Foundation and ARUP, 2015a). A prosperous and stable economy makes it also easier for the city to allocate funding for emergencies and disturbances that may arise as well as the funding for rebuilding after a disaster.

The infrastructure and ecosystems refer to the physical environment or place, in short the city itself as the spatial and physical environment. The provision of adequate spatial services is important to connect the stakeholders who in turn also provide goods and services. One of the goals under this dimension is to reduce the exposure and fragility of the stakeholders from disasters. To achieve this goal, a thorough understanding of the city's vulnerability to hazards and threats is required to address these concerns. Indicators under this goal include "comprehensive hazard and exposure mapping, appropriate codes, standards, and enforcement, effectively managed protective ecosystems, and robust protective infrastructure" (The Rockefeller Foundation and ARUP, 2015a).

Apart from understanding the city's vulnerabilities, the effective provision of critical services to manage and maintain both physical and natural environments prepares the city from disasters. This goal can be assessed by measuring the effective stewardship of ecosystems to see how much it benefits the stakeholders. Two other measures are flexible infrastructure and retained spare capacity which refers to having the appropriate and flexible infrastructure to provide critical services and resources. The last two indicators under this goal are the diligent maintenance and continuity of the critical services, and the adequate continuity for critical assets and services. Both of the last indicators refer to maintenance functions with the latter referring mostly to the continuity of the services and assets during an emergency.

Dependable transportation and communications contribute to the overall functioning of a resilient city. Transportation and information and communication technology (ICT) networks are the important sectors under this goal. The ease of traveling and communicating allows people to become more productive thereby also contributing to the city's economy. Indicators under this goal are the "diverse and affordable multi-modal transport systems and information and communication technology (ICT) networks, and contingency planning" (The Rockefeller Foundation and ARUP, 2015a: 7).

The last of the four dimensions is leadership and strategy which is mainly anchored on knowledge and learning from past experiences (The Rockefeller Foundation and ARUP, 2015). The goal under this dimension is to create effective leadership and management which requires the involvement of stakeholders in the consultation and decision-making process. Indicators include appropriate government decision-making which means the government must be transparent, inclusive, and integrated, "effective coordination with other government bodies, proactive multi-stakeholder collaboration, comprehensive hazard monitoring, and risk assessment, and comprehensive government emergency management" (The Rockefeller Foundation and ARUP, 2015a).

Supportive of the previous goal is having empowered stakeholders. To achieve this, the city must be able to provide adequate and accessible education to all, extensive community awareness and preparedness, and efficient communication and engagement between communities and the government. A resilient city has a proactive government that acknowledges the role of its stakeholders in creating a resilient city through equipping them with knowledge and information.

Finally, the last goal is integrated development planning. A city, in general, must have a vision, strategy, and plan of action. A resilient city puts this vision into the strategies and city development plans. This integrated development plan must be accompanied by comprehensive city monitoring and data management, effective land use and zoning, and an efficient planning approval process (The Rockefeller Foundation and ARUP, 2015a). Transparency, integration, and flexibility are the main characteristics found in these indicators. Table 2.4 shows the dimensions and goals of a resilient city and its supporting indicators.

2.2.2 Framework for Resilient Cities

The OECD framework for resilient cities has four drivers of resilience, economy, society, environment, and institutions. The **economy** as a driver of resilience must be diverse and innovative to spur competitiveness (OECD, 2016a). The cities' rich and diverse economy can harness productivity and potential to expand beyond its national borders. A diverse and strong economy allows the city to maintain its function even if one economic sector has been affected by a disruption.

Society is a driver of resilience if there is a harmonized economic and social policy that enhances the citizens' social capital. This statement presupposes that the government must see society as an ally and tool for change and capacitating them acts as the lever to push them into action. The change that cities go through is aided by their ability to embrace inclusiveness and provide access to employment and education.

Table 2.4: Qualities of resilient systems

Dimensions	Goals	Indicators
Health and well-being	Minimal human vulnerability	Safe and affordable housing Adequate affordable energy supply Inclusive access to safe drinking water Effective sanitation Sufficient affordable food supply
	Diverse livelihoods and employment	Inclusive labour policies Relevant skills and training Dynamic local business development and innovation Supportive financing mechanisms Diverse protection of livelihoods following a shock
	Effective safeguards to human health and life	Robust public health systems Adequate access to quality healthcare Emergency medical care Effective emergency response services
Economy and society	Collective identity and community support	Local community support Cohesive communities Strong city-wide identity and culture Actively engaged citizens
	Comprehensive security and rule of law	Effective systems to deter crime Proactive corruption prevention Competent policing Accessible criminal and civil justice
	Sustainable economy	Well-managed public finances Comprehensive business continuity planning Diverse economic base Attractive business environment Strong integration with regional and global economies
Infrastructure and ecosystems	Reduced exposure and fragility	Comprehensive hazard and exposure mapping Appropriate codes, standards and enforcement Effectively managed protective ecosystems Robust protective infrastructure
	Effective provision of critical services	Effective stewardship of ecosystems Flexible infrastructure services Retained spare capacity Diligent maintenance and continuity Adequate continuity for critical assets and services
	Reliable mobility and communications	Diverse and affordable transport networks Effective transport operation and maintenance Reliable communications technology Secure technology networks
Leadership and strategy	Effective leadership and management	Appropriate government decision-making Effective co-ordination with other government bodies Proactive multi-stakeholder collaboration Comprehensive hazard monitoring and risk assessment Comprehensive government emergency management
	Empowered stakeholders	Adequate education for all Widespread community awareness and preparedness Effective mechanisms for communities to engage with government
	Integrated development planning	Comprehensive city monitoring and data management Consultative planning process Appropriate land use and zoning Robust planning approval process

Source: Adapted from The Rockefeller Foundation and ARUP, 2015a b; The Rockefeller Foundation and ARUP, 2014

Environmental resilience in the urban setting considers both the built and natural environments. The framework recognizes that cities are at risk of natural hazards due to its dense population, concentrated land use patterns, and degraded natural resources (OECD, 2016a). The last driver of resilience, **institutions**, refer to having open, transparent, and inclusive policy-making (OECD, 2016a). Institutions are important in building urban resilience since institutions have the power to create and enact policies that will affect all stakeholders and the future of cities.

It can be noticed from the discussion above that the four drivers of resilience are all interrelated and interdependent. This interdependence stresses the complexity in dealing with cities since one driver affects another. The four drivers of resilience are also supported by sub-drivers enumerated in Table 2.5. The same table, adapted from OECD (2016a), shows the relationship between drivers and the building blocks of resilient cities. These building blocks are the same as the seven qualities of resilient systems identified in the City Resilience Framework.

Table 2.5 Building blocks of resilient cities

Drivers	Sub-drivers	Building blocks						
		Adaptive	Robust	Redundant	Flexible	Resourceful	Inclusive	Integrated
Economy	Industries are diverse and generate growth		■		■			
	Innovation takes place and leads the economy	■				■		
	The workforce has diverse skills						■	
	Infrastructure supports economic activities		■	■				
Society	Society is inclusive and cohesive						■	
	Citizen networks in communities are active						■	
	People have access to public services						■	
Environment	Urban development is sustainable	■						
	Adequate and reliable infrastructure is available		■	■				
	Adequate natural resources are available			■		■		
Institutions	Leadership and long-term vision are clear				■			
	The public sector has proper resources					■		
	Collaboration with other governments takes place							■
	Government is open and citizens' participation takes place						■	■

Source: Adapted from OECD, 2016

Under each of the four drivers are a total of eleven sub-drivers. Economy as a driver of resilience has four sub-drivers, diverse industries, innovation, diverse skills of workforce, and existing infrastructure support for economic activities. Diverse industries provide the basis for a resilient urban economy (OECD, 2016a). It is believed that having a diverse economy spreads the risk in case of an emergency or a disruption allowing the city to adapt or bounce back.

Innovation is a driver of economic growth (OECD, 2016a). Creativity and innovation go hand in hand in creating diverse economies and competitiveness. A workforce with diverse

skills and knowledge has the capacity to innovate. A skilled workforce makes the economy flexible and responsive to change (OECD, 2016a). The diverse skills of the workforce stem from having a strong human capital. The higher the human capital of the city's workforce the more creative and productive they become.

The last of the sub-drivers of economy is the infrastructure support. Adequate and reliable infrastructure to support the economy is the foundation of development. Infrastructure support to provide services and needs to the stakeholders make a resilient city. Infrastructure affects not just the economic function of the city but also its social development. In order to be resilient, infrastructures are needed since this is the first line of defense in case of a disaster and also serves as the physical networks where goods and services can be transported.

Societies form social networks and linkages that are crucial in strengthening their social capital. These social networks are necessary for building resilient cities. Cities with high levels of social capital, strong and cohesive networks are better equipped in overcoming shocks (OECD, 2016a). An inclusive and cohesive society improves the functioning of a city. Inequality and segregation reduce the ability of the city to become resilient since this fosters insecurity and uncertainty not just among members of the society but on the institution. Cohesion and collective action are necessary for promoting resilience thus, the second sub-driver under the driver society is having an active community network. An active community network builds trust among members. Trust and cooperation are helpful during disasters especially because the community are often the first responders. The last sub-driver of society is access to services. The stakeholders' access to physical and economic services means opportunities for education, health, transportation, employment, etc. Accessibility to these services enhances social capital and thus nurtures resilience.

The third driver, environment, refers to the natural and built environments supported by urban infrastructure (OECD, 2016a). The environment is an important driver of resilience as the built infrastructure of a city contributes to how the city mitigates or adapts to the changing climatic conditions and sudden occurrence of natural hazards. The status of the natural environment should likewise be taken into consideration since pollution affects the well-being of stakeholders and pose risks and hazards. It is therefore critical to recognize efforts to protect and conserve the natural environment.

The last driver of resilient cities is the institution. A strong public institution is key in guiding the previous three drivers towards becoming resilient. This can be achieved by creating policies that support each of the drivers attain the collective vision of having a resilient city. Leadership and long-term vision are the primary sub-driver under institutions. The leaders' political will and openness to collaboration with the stakeholders to achieve the long-term vision of a resilient city will determine how the rest of the drivers' economic, society and environment will succeed. Similarly, this openness and collaboration

allow the institutions to work with other levels of government. Coordination with other levels of government is necessary to plan coordinated strategies including funding for public services and infrastructure. Collaboration with stakeholders through citizen engagement brings the gap between the government and the citizens closer. Closing the gap means trust-building, transparency, and therefore, working together towards the same resilient vision.

Institutions with appropriate financial and human resources thrive in a more stable field. Human resources in public institutions should be adequate in both numbers and capability (OECD, 2016a). Capable human resources help develop and implement strategies for the city. Institutions that allocate financial resources to anticipate and meet the impact of disasters help cities prepare for and bounce back from a disaster.

The drivers and sub-drivers can further be described through a set of parameters and possible indicators as shown in Table 2.6. However, in the Resilient Cities report it is also suggested that cities that intend to develop their indicators based on the indicators in the report should also consider exploring and developing more detailed indicators relevant to the type of shocks and stress the city goes through (OECD, 2016a).

2.3 EVALUATION OF RESILIENT CITY FRAMEWORKS

In this section, the similarities and differences of the resilient city frameworks and indicators developed by OECD and the Rockefeller Foundation are assessed. The intention is to feature possible synergies and gaps between the two by assessing the associations between the definitions of resilient city given in the two frameworks concerning the three resilience concepts ecological resilience, engineering resilience, and socio-ecological resilience (Folke, 2006; Sharifi and Yamagata, 2016), and the compatibility of the frameworks on the socio-ecological systems approach.

2.3.1 Comparison of resilient city definitions and frameworks

The OECD and Rockefeller Foundation definitions of a resilient city coincide with the socio-ecological resilience perspective definition which is the ability of the system to withstand disturbances, reorganize, evolve, adjust and retain the same function and structure. The OECD defined resilient cities as cities that are able "to absorb, adapt, transform and prepare for past and future impact of economic, environmental and social shocks" (OECD, 2016 as quoted by Linkov, 2017), whereas the Rockefeller definition emphasizes the capacity of the city to function, survive and thrive regardless of the type of stress. Breaking up the definition of the two frameworks, it can be observed that both follow the main premise of socio-ecological resilience which is to absorb and adapt to

Table 2.6 Parameters and possible indicators for resilient cities

Drivers	Sub-drivers	Potential parameters	Possible indicators (examples)
Economy	***Industries are diverse***	Diversity of economic structure	- GDP by industry
			- Employment by industry
		Links to value chain	- Contribution of GDP in national value
			- Contribution of employment in national value
	Innovation takes place	Entrepreneurialism	- Business demography (the number of start-up companies, initiation and closure of companies)
		Research and development (R&D)	- Patent applications
			- R&D expenditure
	Workforce has diverse skills	Access to education	- Employment by education
	Infrastructure supports economic activities	Fulfills expected purpose	- Back-up plans
			- Long-term maintenance plans
			- Anti-disaster structure
Society	***Society is inclusive and cohesive***	Demographic change	- Population (inflow/outflow)
			- Immigrants
		Income	- Household income
			- Poverty level
			- GINI coefficient
		Safety	- Perceived safety
			- Crime rate
	Citizens' networks in communities are active	Citizens' network	- Number of community associations
	People have access to services	Access to services	- Accessibility to public services (hospitals)
			- Accessibility to public transport
Environment	***Urban development is sustainable***	Aligns with long-term urban development strategy	- Long-term strategies (i.e. compact city policies, etc.)
			- Risk-based land-use strategy
	Adequate and reliable infrastructure is available	Performs the expected function	- Back-up plans
			- Long-term maintenance plans
			- Anti-disaster structure
	Adequate natural resources are available	Pollution/emissions	- Air, water and green space quality
			- Air, water and green space quantity
		Energy	- Energy consumption and production, smart energy management
Institutions	***Leadership and long-term vision are clear***	Long-term vision and leadership	- Long-term vision of the city
	The public sector has proper resources	Financial resources	- City's revenue by sources
			- Capability to increase revenue
		Human resources	- Number of public officials
			- Expenditure on training
	Collaboration with other levels of government takes place	Collaboration with the national government	- Coordinated planning with the national government
		Collaboration with the neighboring cities	Coordination mechanisms with neighboring cities
	Government is open and citizen's participation takes place	Open government and open data policies	- Open government data
		Active citizen engagement	- Number of citizens engaged in participatory programs
			- Voting rate

Source: Adapted from OECD, 2016

disturbances or changes and maintain the same function and structure while changing. However, only the OECD definition referred to transforming and preparing for past and future impacts which is related to the ability of the system to reorganize. Table 2.7 shows the relation of the resilience concepts with the resilient city definitions.

Both frameworks identified seven qualities of resilient cities that support the transformation of the city in becoming resilient. These qualities determine the city's strength and/or weakness that affect the level and speed of transformation. These seven qualities, which were introduced in Section 2.5.1 under the City Resilience Framework, are reflective/adaptive, robust, redundant, flexible, resourceful, inclusive, and integrated. Table 2.8 shows a summary of the relationship of the qualities of resilient cities with the resilient city frameworks developed by OECD and the Rockefeller Foundation. The table suggests that while the seven qualities cut across the four dimensions or drivers in both frameworks it is apparent that there are dominant qualities in each of the frameworks. Based on the table, the dominant quality in the Framework for Resilient Cities is reflective/adaptive, while in the City Resilient Framework the dominant qualities are inclusive and integrated.

The difference between the two frameworks in terms of the dominant qualities of resilient cities significantly highlights the priority areas of the institutions from where the frameworks were developed. The Rockefeller Foundation's main goal is to promote humanity's well-being across the world by pursuing greater resilience and more inclusive economies. As such it is reasonable that in the framework the qualities inclusive and integrated were given more emphasis. In Table 2.6 it can be noted that the dimensions identified under the CRF are closely linked with one or two sectors. This is also shown in the goals and indicators under each of the dimensions.

The OECD, on the other hand, is an intergovernmental organization whose goal is to promote policies that enhance economic and social well-being around the world, with an emphasis on partnering with governments to exchange experiences and identify solutions to economic, social, and environmental challenges. The OECD during the 2014 Ministerial Council Meeting emphasized that "being resilient involves understanding the sources of risks and opportunities and learning to cope with uncertainty" (OECD, 2016a). OECD (2013, 2016) "defined resilience as the ability to withstand and recover from external, adverse shocks through adjustment processes that re-establish or enhance the previous state of the system". This definition was derived from the extensive studies done by OECD on resilience and resilience approaches, in particular the L'Aquila earthquake in Italy. In the L'Aquila earthquake study, OECD (2017) identified eight recommendations to build a resilient region after a natural disaster which included the strengthening of the local

Table 2.7: Resilience concepts and perspectives vis-a-vis resilient city frameworks concepts

Resilient City Frameworks	OECD	Rockefeller Foundation
Resilience concepts		
Ecological resilience		
Ability of the system to cope with a disturbance	✓	✓
Return to its capacity to function		
Engineering resilience		
Ability and time it takes a system to bounce back, rebound or return to equilibrium after a disturbance		
Requires rapid recovery		
Socio-ecological resilience		
Ability of the system to absorb disturbances	✓	✓
Reorganize while undergoing change	✓	
Adapt and retain the same function and structure	✓	✓

Table 2.8: Summary relationship of the qualities of resilient cities with the resilient city frameworks

	Resilient City Frameworks																								
Seven qualities/ building blocks of resilient systems	Framework for Resilient Cities (OECD)														City Resilience Framework (The Rockefeller Foundation & ARUP)										
	Economy				Society			Environment			Institutions				Health & wellbeing			Economy & society			Infrastructure & ecosystems			Leadership & strategy		
	EC1	EC2	EC3	EC4	S1	S2	S3	EN1	EN2	EN3	I1	I2	I3	I4	HW1	HW2	HW3	ES1	ES2	ES3	IE1	IE2	IE3	LS1	LS2	LS3
Reflective/Adaptive	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓		✓		✓
Robust	✓			✓		✓			✓	✓					✓		✓		✓			✓	✓	✓		
Redundant				✓				✓	✓	✓		✓										✓	✓			
Flexible	✓	✓	✓				✓				✓	✓		✓	✓		✓					✓				
Resourceful		✓	✓	✓			✓		✓	✓		✓	✓	✓		✓	✓		✓	✓		✓			✓	
Inclusive			✓		✓	✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Integrated				✓	✓	✓		✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Framework for Resilient Cities: (1) Economy - Industries are divers and generate growth (EC1), Innovation takes place and leads the economy (EC2), The workforce has diverse skills (EC3), Infrastructure supports economic activities (EC4); (2) Society - Society is inclusive and cohesive (S1), Citizen networks in communities are active (S2), People have access to public services (S3); (3) Environment - Urban development is sustainable (EN1), Adequate and reliable infrastructure is available (EN2), Adequate natural resources are available (EN3); (3) Institutions - Leadership and long-term vision are clear (I1), The public sector has proper resources (I2), Collaboration with other governments takes place (I3), Government is open and citizens' participation takes place (I4)

City Resilience Framework: (1) Health and wellbeing - Minimal human vulnerability (HW1), Diverse livelihoods and employment (HW2), Effective safeguards to human health and life (HW3); (2) Economy and society - Collective identity and community support (ES1), Comprehensive security and rule of law (ES2), Sustainable economy (ES3); (3) Infrastructure and ecosystems - Reduced exposure and fragility (IE1), Effective provision of critical services (IE2), Reliable mobility and communications (IE3); (4) Leadership and strategy - Effective leadership and management (LS1), Empowered stakeholders (LS2), Integrated development planning (LS3)

economic base, identifying social and economic drivers, and facilitating participation and locally-led developments. From these recommendations, it can be drawn three important drivers of resilience - social capital, economic capital, and institutional capital. Results of the study indicated that an integrated regional development strategy helps a community to become more secure in facing external shocks. Further, the definition and the findings in the OECD studies have strengthened the organizations' resolve that adjustment to process

or adaptation should be highlighted in the policy framework. This focus on adaptive and reflective systems is also shown in Table 2.8. The table also reveals that the OECD drivers have more balance on the qualities of resilient systems. At least five of the OECD drivers satisfy a given quality compared to the Rockefeller Foundation's CRF.

2.3.2 Assessing the drivers of the resilient city frameworks vis-a-vis the socio-ecological systems framework drivers

The socio-ecological systems framework is driven by the interconnections between the social (human and social organizations and networks), environment (both built and natural), institutional, and economic systems. Table 2.9 presents the summary relationship of the SES approach drivers with the resilient city frameworks. Under this table, each of the sub-drivers, potential parameters, and indicators were assessed and classified according to the SES approach drivers. Assessing the drivers of the resilient city frameworks vis-a-vis the SES approach drivers show differences between the two frameworks in terms of focus. The OECD framework has a straightforward approach by specifying that the cities' social, environmental, institutional, and economic drivers stir the city into the resilient city direction.

Table 2.9: Summary relationship of the socio-ecological systems framework with the resilient city frameworks

	Resilient City Frameworks																								
Five interacting systems within the socio-ecological systems framework	Framework for Resilient Cities (OECD)														City Resilience Framework (The Rockefeller Foundation & ARUP)										
	Economy				Society			Environment			Institutions				Health & wellbeing			Economy & society			Infrastructure & ecosystems			Leadership & strategy		
	EC1	EC2	EC3	EC4	S1	S2	S3	EN1	EN2	EN3	I1	I2	I3	I4	HW1	HW2	HW3	ES1	ES2	ES3	IE1	IE2	IE3	LS1	LS2	LS3
Human	☐	☐	✓	☐	☐	✓	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	✓	☐
Social	☐	☐	✓	☐	✓	✓	✓	☐	☐	☐	☐	✓	✓	✓	✓	☐	✓	✓	☐	☐	☐	☐	☐	☐	✓	☐
Environmental	☐	☐	☐	✓	☐	☐	☐	✓	✓	✓	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	✓	✓	✓	☐	☐	☐
Institutional	☐	☐	☐	☐	☐	☐	☐	✓	☐	☐	✓	✓	✓	✓	☐	✓	✓	☐	✓	☐	☐	☐	☐	✓	☐	✓
Economic	✓	✓	✓	✓	☐	☐	☐	☐	☐	☐	☐	✓	☐	☐	☐	✓	☐	☐	☐	✓	☐	☐	☐	☐	☐	☐

Framework for Resilient Cities: (1) Economy - Industries are divers and generate growth (EC1), Innovation takes place and leads the economy (EC2), The workforce has diverse skills (EC3), Infrastructure supports economic activities (EC4); (2) Society - Society is inclusive and cohesive (S1), Citizen networks in communities are active (S2), People have access to public services (S3); (3) Environment - Urban development is sustainable (EN1), Adequate and reliable infrastructure is available (EN2), Adequate natural resources are available (EN3); (3) Institutions - Leadership and long-term vision are clear (I1), The public sector has proper resources (I2), Collaboration with other governments takes place (I3), Government is open and citizens' participation takes place (I4)

City Resilience Framework: (1) Health and wellbeing - Minimal human vulnerability (HW1), Diverse livelihoods and employment (HW2), Effective safeguards to human health and life (HW3); (2) Economy and society - Collective identity and community support (ES1), Comprehensive security and rule of law (ES2), Sustainable economy (ES3); (3) Infrastructure and ecosystems - Reduced exposure and fragility (IE1), Effective provision of critical services (IE2), Reliable mobility and communications (IE3); (4) Leadership and strategy - Effective leadership and management (LS1), Empowered stakeholders (LS2), Integrated development planning (LS3)

In contrast to the OECD framework whose drivers and sub-drivers create a more robust and sector-focused framework of a resilient city, the Rockefeller Foundation's CRF dimensions are more interspersed. This can be due to their intention to make the framework more inclusive and integrated. On the one hand, integration and inclusiveness promote resilience, but on the other hand, these qualities of a resilient system can be demonstrated much better through understanding how each of the sectors in the city function and contributes to the whole system. There is value in strengthening the drivers

of resilient cities as sector-specific constructs that can contribute to other sectors and eventually to the entire systems' functioning.

The OECD focuses on creating development policies designed to improve people's quality of life. These policies help stir governments towards this direction. As an intergovernmental organization, the OECD has the advantage to work with similar organizations within its network, which includes international development organizations and institutions, to push forward the resilient city agenda. Unlike the Rockefeller Foundation which is a private foundation answerable only to its board members and private donors, the OECD is committed to its member countries and developing countries throughout the world. The partnerships OECD has with other international organizations as equal players in international development work emphasize strength in the cross-fertilization of ideas and strategies to put development policies into practice.

Moreover, the drivers and sub-drivers identified in the OECD Framework for Resilient Cities fit into the criteria for assessing a resilient urban system developed under the systematic review (section 2.4.3). Comparison between the two resilient city frameworks and the criteria for assessing a resilient urban system show that the Framework for Resilient Cities conforms to the criteria more than the City Resilient Framework (see Table 2.10). The comparison shows that the Framework for Resilient Cities satisfies three of the seven criteria, with the driver environment satisfying all criteria except for the memory-based disaster experience.

Table 2.10: Frameworks and drivers relationship with the criteria for assessing a resilient urban system

Frameworks and Drivers	Criteria for assessing a resilient urban system					
	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales	Established enabling or supporting environments in creating a resilient city	Maintaining city resilience through diversity	Memory based disaster experience	Social, physical and economic drivers that contribute to household, community, and city resilience
City Resilience Framework						
- Health and well-being						
- Economy and society						
- Infrastructure and ecosystems						
- Leadership and strategy						
Framework for Resilient Cities						
- Economy						
- Society						
- Environment						
- Institutions						

Further, the potential parameters and possible indicators under the Framework for Resilient Cities also allow specific data sets that can be used to test the drivers against the criteria (see Table 2.6). Whereas the indicators in the City Resilient Framework and City Resilient Indicators (see Table 2.5) can be considered more as a concept rather than indicators that still need to be converted into operational and measurable terms. In addition, the indicators under the CRF and CRI are so varied that it may be difficult to measure its relevance to the dimensions or drivers of a resilient city.

2.4 DEFINING RESILIENT CITY AND INDICATORS OF RESILIENT CITY

Drawing from the systematic literature review, a resilient city can be defined as a city that has the human, social, economic, institutional, and environmental capacity to adapt to and prepare for disturbances. Past disaster experiences serve as catalysts to improve and become a resilient urban system. Cities can adjust, sustain, and maintain their functions through learning from experience, becoming mindful of the risk of disasters, anticipating and planning for disasters, and building and reinforcing a diverse social, economic, institutional, and physical environment.

A resilient city goes through multiple equilibria which means that the city adapts and transforms over several periods of disturbance. This experience of adaptation and transformation allows the city a period of stability and learning to earn resilience over time. Having this multiple equilibria characteristic means that both the social system and ecological system of the city join in bringing the city to a functioning form after a disturbance. Holling in his correspondence with Folke (2006) indicated that this characteristic can be interpreted with at least three but not more than five variables. This fits into the concept of the socio-ecological systems framework and the above definition of a resilient city which is driven by the human, social, economic, institutional, and environmental capitals.

The research will use the OECD Framework for Resilient Cities together with the indicators derived from the systematic review. In merging the two, the driver human capital can be included as a separate variable noting that in the OECD framework only the four capitals were identified (economic, social, environment, and institution). Moreover, in the OECD framework, the parameters and indicators provided were marked as potential parameters and possible indicators. This suggests that these parameters and indicators may or may not be used. In addition, the OECD also suggested *exploring and developing more detailed indicators relevant to the type of shocks and stress the city goes through* (OECD, 2016a).

Agreeably, the research will use the drivers human, social, institutional, economic, and environmental capitals as independent variables that lead to creating a resilient city (dependent variable). There are three criteria for selecting the indicators for each of the

drivers. The indicators must be measurable at different levels of analysis, that is at the community, city, national, and regional levels. The indicators must be relevant to the type of disaster being investigated, in this research flooding. Lastly, the indicators must be able to include elements of the criteria for assessing a resilient city.

The indicators derived from the systematic review and OECD Framework for Resilient Cities were reviewed against the criteria and classified according to the drivers. The indicators from both the systematic review and Framework for Resilient Cities were then merged and further reviewed in terms of possible data sources. There were cases that the indicators identified overlap with another, in such cases, the indicators were combined. In the final analysis, five indicators were selected per driver to fit within the range of variables recommended by Holling in the analysis for socio-ecological systems. Appendix 2 and 3 show the first level classification of the variables and indicators from the systematic review and the OECD Framework for Resilient Cities vis-a-vis criteria for selecting indicators, respectively, while Appendix 4 shows the merged indicators.

The final selected indicators together with the possible data sources are shown in Table 2.11. Indicators under the driver human capital were derived from the variables memory pathways and demographic profiles. Memory has been identified to affect people's perception and reaction towards disasters, therefore, the relevant indicator to test is the local and experiential knowledge, and resilience measures adopted by those disaster-affected individuals and communities. This will give a gauge on the ability of the population to adapt and prepare for a disaster and eventually transform and function after a disaster. The demographic profile of the population is a standard measure of human capital this includes age, education, life stage, population growth which affects the city's human capacity as well as gauge human vulnerability to disasters.

Social capital variables identified refer mostly to the strengths of the networks and linkages. These networks and linkages build up both the human and social capitals of the city and increase their resilience. Indicators identified under this driver range from the disaster experience and ability to conduct rebuilding work, multi-scale networks, horizontal and vertical connections of these networks which is a good measure of how the social networks work in the city. Access to services as an indicator under social capital is also an important measure of the capacity of the stakeholders to bounce back from a disaster.

The variables under the driver institutional capital are geared mostly on the adaptive co-management of the city. This means that the institutions are equipped with the resources to address disaster management strategies as well as support the engagement and participation of stakeholders. Indicators identified include multi-level collaboration and multi-stakeholder participation and engagement in disaster risk reduction activities,

Table 2.11: Selected variables and indicators with data sources

Drivers	Variables	Indicators	Sub-indicators	Data Sources
Human capital	Memory pathways	Resistance or resilience measures adopted by flood affected populations	# of disaster risk management initiatives adopted by the affected population	National, city and community level data from disaster risk management offices; primary data - surveys, interviews, focus group discussions
	People (demographics)	Age	% population between above 15 and below 65	National, city and community level data from statistics offices
		Life stage	% of population classified according to age ranges - youth, working, senior	National, city and community level data from statistics offices
		Education	literacy rate	National, city and community level data from statistics offices
		Population	growth rate; Population (inflow/outflow); Immigrants	National, city and community level data from statistics offices
Social capital	Capacity to adapt to external changes	Ability to conduct rebuilding work	% of households provided assistance to rebuild; % of households that were able to rebuild; type and source of assistance; % households rebuilt; % households trained to build back better; % households aware of disaster risk management; % households rebuilt; % communities/ villages within the city rebuilt	National, city and community level data from disaster risk management offices; primary data - surveys, interviews, focus group discussions
	Self-organization	Multi-scale networks and connectivity	# of organizations with complementary functions on disaster recovery, rebuilding, management, and urban planning	Regional, national, city and community level data; primary data - key informant interviews
		Broad horizontal and vertical organizational ties which results to robust feedback mechanisms and allow informed decision-making.	# of organizations with direct partnership with communities, city government, private entities, public entities, academe	Regional, national, city and community level data; primary data - key informant interviews
	Bridging connections to create opportunities of learning and cooperations	Rapid mobilization of resources for a timely recovery upon a disturbance	# of disaster assistance mobilized by type within 3 days; 1 week; 1 month from disaster event	National, city and community level data from disaster risk management offices; primary data key informant interviews
	People's access to services	Access to services	Accessibility to public services which include health, education, crisis management, economic	National, city and community level data; primary data - surveys, interviews, focus group discussions
			Accessibility to public transport	National, city and community level data; primary data - surveys, interviews, focus group discussions
Institutional capital	Adaptive co-management and cross-scale interactions	Multi-level collaboration and multi-stakeholder participation and engagement in disaster risk reduction activities	% feedback received by government services from stakeholders; % government satisfaction rating; # of collaborative activities and initiatives between stakeholders and government; between stakeholders and private institutions and organizations; between stakeholders, the private institutions and organizations, and the government; # of multi-level capacity development: public, private, civil society sectors at the individual, household, organizational levels provided by the government; % participation of stakeholders in these activities	National, city and community level data; primary data - survey, interviews, focus group discussions, key informant interviews
	Learning from disaster experience	Adapt institutional, legal and policy change to include adaptive capacity to build resilient cities	# of informal, creative, and sustainable solutions developed to address disaster risk (flooding)	Regional, national, city and community level data; primary data - survey, interviews, focus group discussions, key informant interviews
		Disaster risk reduction integrated in government investments and priorities	# of new policies or approaches to solve problems created after a disaster event; % policies based on previous disaster experience	National, city and community level data from disaster risk management offices; primary data key informant interviews

Table 2.11: Selected variables and indicators with data sources (continuation)

Drivers	Variables	Indicators	Sub-indicators	Data Sources
	Adequate resources	Financial resources; Know and allocate or access funding flows for dealing with risks; National government provides organized support for local governments	Capability to increase revenue; Allocated budget for disaster risk management, including reconstruction and rebuilding (disaster risk insurance) at the community, city, and national levels; % of local funds for disaster management acquired from national budget; linkage between national and local government on disaster risk management	National, city and community level data from planning offices
	Openness of the government to citizen's participation	Active citizen engagement	Voting rate	National, city and community level data
Economic capital	Economic capital	Economic strength	GDP, GNP; Number and type of economic activities	National and city level data from economic offices and from statistics and census
		Number of employed residents by industry type	Number of employed residents by industry type	National, city and community level data from statistics and census
	Diverse industries and economy	Diversity of economic structure	Employment by industry	National, city and community level data from statistics and census
	Innovative industries, economy	Entrepreneuralism	Business demography (the number of start-up companies, initiation and closure of companies	National, city and community level data from statistics and census and economic offices
	Diverse workforce with diverse skills	Access to education and training	Employment by education	National, city and community level data from statistics and census
Environmental capital	Built- and natural-capital	Natural resources sourced sustainably	% of natural resources available compared to 10 years, 15 years, 20 years ago; Type of natural resources available by %; Number and types natural resources;	National, city and community level data from environment offices
		Development of physical structures or engineering techniques to reduce or avoid disaster impacts	Available climate and disaster proof infrastructures; Includes both built and designed elements and natural features;	National, city and community level data from planning and environmentt offices
	Engineering/technical solutions	Long-term structural transformation (transitions)	Number of pipelined structural/engineering solutions; Number of actual structural/engineering solutions built	National, city and community level data from environment, infrastructure offices
		Support for the use of green infrastructure (environmental conditions; social relations; economic incentives and constraints; political and regulatory systems)	Percent and types of green infrastructures in the city	National, city and community level data from environment, infrastructure offices
	Sustainable urban environment	Aligns with long-term sustainable urban development strategy	Long-term strategies (i.e. compact city policies, etc.)	National, city and community level data from planning offices
		Pollution/emissions	Air, water and green space quality	National, city and community level data from environment, infrastructure offices
			Air, water and green space quantity	National, city and community level data from environment, infrastructure offices

Source: Adapted from The Rockefeller Foundation and ARUP, and OECD Resilient City frameworks and indicators

adoption of policies on building resilient cities, and allocation of adequate funding and investments in disaster risk reduction and management.

Economic capital variables refer mostly to two aspects, the economic strength of the city and diversity. It has been discussed that resilience can be gauged on the ability of the city to continue functioning even after a disturbance. A city with a strong economy and diverse types of industries and businesses ensures that the city will have the resources to function as well as ensures that the stakeholders can cope with the disaster. Indicators under economic capital include measures of economic strength such as gross domestic products and gross national product, employment, and diversity of economic structure.

Lastly, variables under environmental capital are a combination of the built and natural environments that help in mitigating or adapting to both natural and man-made disasters. Indicators identified are the availability of natural resources and whether these natural resources are sourced sustainably, technical engineering solutions to adapt or mitigate disasters, availability and support for green infrastructures, and level of pollution.

2.5 CHAPTER CONCLUSION

Cities are constantly evolving and growing. They can grow economically in terms of gross domestic product growth, demographically in terms of population growth, spatially in terms of urbanization, or a combination of all these types of growth. On top of this, there are sudden changes that can affect the evolution and growth of cities like natural disasters and similar disturbances that can either delay or obviate a city's growth. Understanding how cities transform from disaster-prone to disaster-resilient requires recognizing cities as complex socio-ecological systems that continue to learn and transform. Socio-ecological systems are seen to have four key conditions, namely adaptive, transformative, diverse, and dynamic. These key conditions affect how cities adapt to a disturbance and transform to become resilient and function as it did or better before the disturbance.

The concept of socio-ecological resilience brings forward a way to address both disturbance and resilience in a manner that is more adaptive and transformative. However, these conditions have likewise been critiqued as difficult to operationalize and even considered as imprecise (Walker, et al., 2004). Marcus and Colding (2011) approached developing resilient urban socio-ecological systems by looking at four key attributes (1) disturbance which incites change and opportunity for renewal in the system, (2) diversity which is connected to spatial capacity and creation of multiple spaces to support diverse uses and users, (3) self-organization which is the capacity of the social networks to organize to address and shape their environment, and (4) learning which is both the use of knowledge to adapt to changes and knowledge acquired from the disaster experience. This last attribute is linked with transformation as it is through the knowledge gained from

formal or informal sources and experiences that the city can transform to a better state. These four key attributes can be found in the systematic review of the literature and are present in the variables and criteria of resilient urban systems derived from the systematic review.

The multi-dimensional interaction of both the social and ecological systems affects the behavior of the stakeholders and the overall function of the city. This is much more evident in times of disturbances or disasters when the resilience of a city is tested. In the socio-ecological systems approach, resilience is the ability of the "system to absorb disturbance and reorganize while undergoing change" (Walker, 2004: 2). It is assumed that the system can adapt and retain the same function and structure even after the disturbance. This infers that the city as a socio-ecological system must have the adaptive capacity to absorb sudden changes such as natural disasters and reorganize to maintain its function. From the systematic review six criteria of resilient urban systems were extracted, these are:

1. Adaptive capacity and resilience to manage, adjust, learn and cope with different changes

2. Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales

3. Established enabling or supporting environments in creating a resilient city

4. Maintaining city resilience through diversity

5. Memory based disaster experience

6. Social, physical and economic drivers that contribute to household, community and city resilience

Notably, these criteria are related to the seven qualities of resilient systems used in the resilient city frameworks developed by the Rockefeller Foundation and OECD. However, compared to the qualities of resilient systems, the criteria derived from the systematic review introduce specific parameters that can be investigated. Listing down the qualities of resilient systems sans measurable parameters runs the risk of looking at these qualities myopically. Such criteria for resilient urban systems as derived from the systematic review will be further explored in the conceptual framework and in the methodology.

Further, a comparison between the City Resilience Framework (Rockefeller Foundation) and Framework for Resilient Cities (OECD) suggests that the OECD framework satisfies the four key conditions of SES and Marcus and Colding's four key attributes of resilient urban SES. The OECD drivers likewise encapsulate the social, ecological, economic, and institutional systems within a city. Consequently, the OECD framework including the

parameters and indicators, and the criteria for resilient urban systems both provide good starting points in developing a conceptual framework.

In the systematic review, five emerging drivers of resilience can be observed, human capital, social capital, economic capital, institutional capital, and environmental capital. This is closely related to the drivers presented in the OECD framework. The variables taken from the criteria of resilient urban systems can be used for each of the five emerging drivers of resilience. In Table 2.11 these variables are classified under each of the drivers and tracked as to the criteria of a resilient urban system. In this way, each criterion is satisfied while each of the variables is classified according to the drivers of resilience. Using the five emerging drivers of resilience from the systematic review and the drivers in the OECD framework the parameters and indicators for the conceptual framework will be developed and expounded in the next chapter.

CHAPTER THREE

CHAPTER THREE: CONCEPTUAL FRAMEWORK[5]

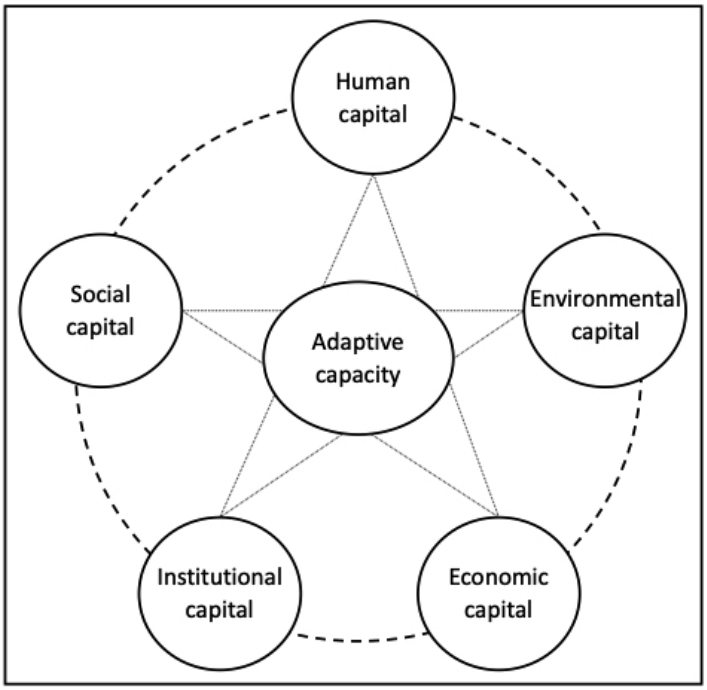
3.0 INTRODUCTION

The results of the systematic literature review revealed three main points. First, the functioning of cities involves the interaction of the human, social, institutional, economic, and environmental capitals as part of a complex socio-ecological system. These capitals defined as drivers of resilience were identified through a review of policy frameworks. These capitals were further associated with the socio-ecological systems framework, in which the capitals are viewed as individual systems that interconnect to form a whole system, in this research the city (Figure 3.1). Each of the drivers of resilience contributes to the city's ability to function. Similarly, these five capitals have been used in international development as the five capitals of sustainability or five capitals model to show the stock and flows of resources in a sustainable society and economy (KCX Consulting, 2017; Forum for the future, 2018). In the drivers of resilience, economic capital fall under the financial and produced capital referred to in the five capitals model, while environmental capital, which has two components the built and natural environments, refers to natural capital in the model. In the drivers of resilience, institutional capital is included to highlight the importance of creating an enabling environment that supports the building of urban resilience.

The use of the term "capital" is useful from an economic perspective since it refers to resources that provide economically desirable outputs (Goodwin, 2003). It is important to frame it as such especially in this research wherein the five drivers of resilience (capitals) provide the necessary and beneficial input for the city to reach a level of resilience (output). This brings the discussion to the next point derived from the systematic literature review, socio-ecological resilience and adaptive capacity. Socio-ecological resilience refers to having an adaptive capacity to transform, learn and innovate. In the panarchy framework of Gunderson and Holling (2002) adaptive capacity was expanded to refer to the continuous cycle of adaptation, growth, and restructuring. This means that the pattern towards building the resilience of complex socio-ecological systems such as cities varies. As such, cities follow their own unique pace and timeline in reaching a level of resilience. In Figure 3.1, this adaptive capacity is placed in the middle of the five drivers of resilience indicating that the capitals fuel the adaptive capacity of a city.

[5] To obtain further feedback on the conceptual framework for this dissertation, a draft and synopsis was presented at the Constructing an urban future: The sustainability and resilience of cities conference on 18 to 19 March 2018 at the Abu Dhabi University, United Arab Emirates. The conference paper was published in the Architecture_MPS (2020) issue 17 (1). This chapter improves on the draft and the concept of collective engagement urban resilience framework by providing background on public participation and self-organization.

Figure 3.1: Five drivers of resilience



Source: Author adaptation, 2020

The last point in the systematic literature review goes to how cities then transform using this adaptive capacity. Here it is essential to return to the four key attributes in developing resilient urban socio-ecological systems presented by Marcus and Colding (2011). The four key attributes, disturbance, diversity, self-organization, and learning reconcile with the main inquiry of this research which is how collective engagement contributes to building urban resilience. According to Marcus and Colding (2011) disturbance incites change and opportunity for renewal, diversity is the spatial capacity and creation of multiple spaces for diverse uses and users, self-organization is the capacity of the social networks to organize, address, and shape their environment, and learning is the use of knowledge to adapt to changes and knowledge acquired from disaster experience. All these attributes combined lead to how knowledge and experience gained from formal and informal resources transform a city to become resilient.

The systematic literature review provided a robust and useful amount of knowledge where the six criteria for assessing a resilient urban system were extracted. These criteria provide the basis for identifying the attributes of a city's adaptive capacity. Moreover, the six criteria for assessing a resilient urban system each have a component of participation, engagement, and self-organization. Participation and engagement help in creating networks within and among stakeholders and provides a venue for dialogue and

consensus-building. Both provide opportunities and support self-organization (Woodhill, 2010; Wolfram, 2016). The onset of disasters has proven that people tend to self-organize for them to rebuild from the disaster. While the five capitals as shown in the systematic review highlight the drivers of resilience, participation, engagement, and self-organization highlight the collective action of people towards building resilience. Bahadur and Tanner (2014) emphasized that adaptation is rooted in engagement, however, "community involvement through established participatory methods is notoriously difficult in urban areas as the community is dynamic and heterogeneous" (p. 30). It is then important to understand the different levels of participation and the city as a system.

This chapter focuses on collective engagement, where the three above-mentioned components, participation, engagement, and self-organization will be discussed. The first section discusses participation and self-organization to establish the distinction of these components from collective engagement. The second section builds on the previous discussion to bring forward the definition of collective engagement in this research and its relevance in disaster risk management and urban resilience. The third section will use the previous discussion that includes the criteria of resilient urban systems derived from Chapter 2 to lay out the essential groundwork in forming the components of the conceptual framework. The last section wraps up the entire chapter.

3.1 PARTICIPATION AND SELF-ORGANIZATION

The World Bank (1996) defined participation as a "process through which stakeholders influence and share control over development initiatives and the decisions and resources which affect them" (p. xi). Accordingly, stakeholder participation is acknowledged as the participation of all relevant stakeholders in the development process (World Bank, 1996). It is the coming together of stakeholders who are either individuals or groups, that may be "organi[z]ed or unorgani[z]ed [sharing] a common interest or stake in a particular issue or system" (Grimble and Wellard, 1997: 175) and have the ability to influence or impact, directly or indirectly, (Engi and Glicken, 1995) an issue. Similarly, the International Finance Corporation (IFC) defined stakeholder engagement as "a broader, more inclusive, and continuous process between a company and those potentially impacted that encompass a range of activities and approaches, and spans the entire life of a project" (Sequieria and Warner, 2007: 2). This definition emphasizes an organization or company's engagement with its stakeholders to attain mutually beneficial outcomes. In all of the three definitions, the common factor is that the end product of participation and engagement between an institution and its stakeholders has an impact on both entities. Ideally, this impact should benefit all stakeholders.

The various forms of participation and engagement in the debates on public management and good governance reveal the divergence of participation and engagement in actual

practice. It also reflects on the current needs and wants of citizens and the type of stakeholders engaged in the process. Involving stakeholders in the planning and development process is an exercise of democracy (Momeni and Taghinia, 2011) and is "essentially the democratization of the planning process" (Oduwaye, 2006: 43). Citizen participation empowers stakeholders to demand better and more services from the government. It helps shape collective identity and achieve social justice and equality (Moon, et al. 2006). Stakeholder involvement in the planning process helps in tailoring solutions that fit their needs. It helps in creating not just better plans but strengthening the commitment of stakeholders in having these plans implemented.

Within the context of urban planning and development, the direct involvement of stakeholders in planning and developing solutions allow different sectors and stakeholder groups to discuss, design, and create innovative strategies geared towards a common good. There is a concern that if the urban development planning process is not driven by a multi-stakeholder participatory approach, issues concerning marginalized sectors will be glossed over by a single and more powerful entity. This perception does not come as a surprise since the government-initiated participatory approaches have been criticized to be stirred towards an already pre-decided plan of action. This reflects on the first of the three general levels of Arnstein's ladder of citizen participation called non-participation.

The level of non-participation is where "powerholders [aim] to "educate" or "cure"" (Arnstein, 2019: 43) stakeholders by allowing them to participate in the planning process mainly as an audience. This means that communication is one way and there is no real dialogue between the stakeholders. This type of participation is more passive where stakeholders participate by being provided with information without gathering responses from the stakeholders. This unilateral information sharing mainly provides stakeholders with general information on particular topics, but the actual decision has already been made or predetermined.

In the second level, the degrees of tokenism, stakeholders have the opportunity to hear and be heard. Active participation is expected from stakeholders throughout the decision-making process. This can be in the form of attending workshops, consultations, meetings, and engaging in the discussions. Although within the degrees of tokenism stakeholders can voice their opinion these views still have no definitive bearing on any decision. The exercise also runs the risk of having the elites dominate the participatory dialogues and initiatives (Fung and Wright, 2001; Shrestha and Ojha, 2017) given that they have the resources to do so. The degree of tokenism is a mix of passive and active participation since stakeholders participate in the discussions on a given issue yet the final decision remains with the power holders or decision-makers.

A successful participative process leads to a consensual decision among all stakeholders. The last level, degrees of citizen power, refer to stakeholders' increasing ability to influence

decisions that affect their well-being. At this level, the deliberative type of participation is in place involving "judicious argument, critical listening, and earnest decision making" (Gastil, 2000: 22) among stakeholders. It is a way for individual stakeholders to come together to form strategies, decisions, and actions collectively. The support of decision-makers and responsiveness of public officials are essential in making this deliberative participation successful making the process collaborative which is important in consensus building (Collier, et al., 2013; Delli-Carpini, et al., 2004).

Critics however noted that deliberation does not exactly equate to consensus rather it is instrumental in having an open discussion that helps in changing minds and transforming opinions (Chambers, 2003). As Gundersen (1995) has stated "Democratic deliberation occurs anytime a citizen either actively justifies her views (even to herself) or defends them against a challenge (even from herself)" (p. 199). This presupposes that stakeholders involved in deliberative participation, process information critically, weigh opinions on the issue at hand, and analyzes options to address these issues. However, this also assumes that the stakeholders are well-informed and have adequate knowledge on the issues for them to be able to engage in the discussion and form educated opinions. The importance of deliberative participation lies in the ability to debate the issue and to come up with a solution that is acceptable to all.

Deliberative participation provides an avenue where stakeholders actively engage in discussing issues and expressing their opinions to arrive at an acceptable solution. This solution may or may not be a 100% consensual decision but the process of collectively arriving at a generally acceptable solution is what deliberation is all about. Nevertheless, there are still some issues that may interfere in arriving at this collective decision such as the fact that participation has largely been perceived as a top-down government-initiated process and that participants involved in this participatory process occupy a certain segment of society (i.e. power holders, elites) that have the necessary resources to push their agendas and overshadow less powerful participants (Fung and Wright, 2001; Cernea, 1993). When such issues arise, less powerful stakeholders may feel disenfranchised. Day (1997) criticized Arnstein's citizen power asserting that there is very little actual practice and the final authority is often reserved for elected officials. Such dissatisfaction and mistrust may result in stakeholders departing from the entire government-initiated participatory process. At some point, stakeholders depart and behave apathetically while in some instances stakeholders take the initiative to come up with their own solutions on unresolved development issues that affect them.

In this instance, self-organization takes place when local stakeholders feel the need to organize themselves without the help or guidance of an institution such as the local government. The self-organizing power of civil society is often associated with the civic initiatives that civil society entered into in order to pursue common interests and purpose (Edelenbos, et al., 2018). Self-organization is based on close networks within the

community as part of an urban system that can function without external guidance. It is the "initiatives for spatial interventions that originate in civil society itself, via autonomous community-based networks of citizens, outside government control" (Boonstra and Boelens, 2011: 100).

Studies done on self-organization have mentioned the interplay of the top-down and bottom-up approach as a factor for its emergence (Partanen, 2015; Nederhand, et al., 2014; Hasanov and Zuidema, 2018). Other studies indicate that self-organization is a response to co-development and co-management (Ayers and Kittinger, 2014; Euler and Heldt, 2018). Boonstra and Boelens (2011) distinguished self-organization as an initiative of the citizens initially independent of government policies. Self-organization then stems from a certain trigger or catalyst (Nederhand, et al., 2014; Eigen and Schuster, 1977). Eigen and Schuster (1977) explained through their study on genetics and molecular biology that molecules when subjected to reactants form a reactant cycle which in itself is a catalytic cycle leading to the transformation of the molecular system. This catalytic cycle is the system's process of self-organization and goes through a series of hierarchical cycles. Eigen and Schuster (1977) used the Darwinian principle in their analysis and saw that the "essential requirement for a system to be self-selective is that it has to stabilize certain structures at the expense of others" (Eigen and Schuster, 1977: 547). They further identified three principles in the transformation, (1) metabolism, the ability of the system to utilize energy, (2) self-reproduction, the ability of the system to instruct their own synthesis, and (3) mutability, the ability of the system to find the threshold-relationship to successfully evolve.

This brings forth the idea that self-organization emerges from the notion of a need or want of the citizens for services that are not currently being met. This is evident in disaster situations when the community needs to re-group and re-organize in order to respond and rescue immediately. Immediacy may well be the foremost factor in self-organizing in disasters. Chaos triggers a need for order which translates to organizing or congregating to act on a goal to reach a level of order and stability. This simplistic description associates self-organization as a process of adaptation, a process similar to Eigen and Schuster's molecular biology observation.

Self-organization brings with it a form of order in an otherwise disorganized system. It is defined in the natural sciences as the spontaneous emergence of order from local interactions (Nederhand, et al., 2014; Kauffman, 1992) and is associated with complexity theories and complex adaptive systems (Partanen, 2015; Leino, 2012; Hasanov and Zuidema, 2018; Boonstra and Boelens, 2011; Comfort, 1994). Self-organization is often referred to as operating "on or near the threshold of instability, implying a complex, 'edge of chaos' behavior" (Partanen, 2015: 954) such that chaos becomes a catalyst for systems to self-organize.

The distinction between participation and self-organization is often marred with skepticism. Self-organization and decision-making are important facets of the participatory process (Euler and Heldt, 2018). Horelli, et al. (2015) further claims that "self-organization as participation complements and stands up to the formal top-down processes" (p. 300). On the other hand, Boonstra and Boelens (2011) provided the distinction of participation and self-organization by stating that "participation refers to goals set by government bodies on which citizens can exert influence through procedures set by these government regimes themselves, resulting in . . . inclusion", while "self-organization stands for the actual motives, networks, communities, processes and objectives of citizens themselves . . . initially independent of government policies and detached from participatory planning procedures" (p. 109). Participation then is a government initiative, while self-organization is a civil society and private sector initiative (Boonstra and Boelens, 2011).

3.2 DEFINING COLLECTIVE ENGAGEMENT

Most of the time collective engagement is equated to civic engagement and there have been few attempts at defining or differentiating it from each other. One definition or concept of collective engagement is "[d]evelopment efforts should be concerted from local to global levels. National and international interests have to be harmonized or balanced to ensure that tension in terms of interpretation and implementation of sustainable development is reduced" (Ilon and Kantini, 2013: p.145). This definition puts collective engagement within the broad scope of sustainable development yet fails to define how these interests will be harmonized or balanced nor did it identify the actors involved. Another attempt to put collective engagement in the context of sustainable development is World Bank's definition of civic engagement which is "the participation of private actors in the public sphere, conducted through direct and indirect interactions of civil society organizations and citizens-at-large with government, multilateral institutions and business establishments to influence decision making or pursue common goals" (World Bank, 2003). In this definition, the actors involved in civic engagement were broadly identified but still, their roles were not specified including how civic engagement at the different levels will be organized or implemented. These definitions fall short of completely capturing the concept of collaborative engagement.

From the previous section, it has been distinguished that participation is considered to be government-led while self-organization refers to civic initiatives. They are brought about by a level of dissatisfaction in the process of participation or government services. Yet it was also mentioned that self-organization is an initiative that is initially independent from the government. This assumes that at some point self-organization will need to seek

support from the government to sustain their self-organized activities. This point is where the idea of collaboration begins which is the heart of collective engagement.

From the given definitions of stakeholder engagement, civic engagement, and collective engagement, three important ideas emerge. The idea that engagement (1) is inclusive and continuous, (2) is a guide for stakeholders in developing an integrated solution to meet a common goal, and (3) is consensual and balances the interests of the local, national, and international players. These three ideas influenced the definition of collective engagement Esteban (2017) used in the study of three disaster-affected communities in Tacloban City, The Philippines that went through rebuilding and rehabilitation after Typhoon Haiyan. In this study, Esteban (2017) defined collective engagement as,

"The active collaboration of citizens in general on societal or communal issues affecting their community (town or city), developing active relationships with different actors in the community, and engaging in debate and finding solutions to these issues. Collective engagement further means the collaboration of the different actors in the community at the local, regional, national, and global levels. It is the ability to engage these actors successfully and positively, over a prolonged period rather than on a project-by-project basis, to attain a balance of opinions and actions to improve the community, whether this be at the local or national level." (Esteban, 2017: 221)

In this definition collaboration between and among actors at different institutional levels is given emphasis. While the definition is apropos of the study on recovery and rehabilitation, there is a need to revisit this definition for the purpose of this research. In this research what is being investigated is the transformation of a disaster-prone city to a disaster-resilient city. In the preceding sections, two types of "citizen action" were discussed, participation and self-organization. Participation is interpreted as the government's effort to educate, advise, and encourage people to participate in decision-making processes, while self-organization is described as citizen initiative. The question is whether collaboration between the government and stakeholders develops urban resilience, if an institutional and organized structure alone facilitates urban resilience, or whether a smaller, more autonomous system promotes urban resilience better.

Collaboration is a critical component in disaster and resilience studies. There are two views in disaster management on this, one that sees that command and control systems are more appropriate in dealing with disasters usually taken during a disaster, and another that sees that collaboration is necessary to ensure that efforts towards building resilience have continuity. Collaboration is the way to bring all stakeholders to work toward a common goal. This cross-sector collaboration entails stakeholders working in partnership through informal and formal means across sectors and organizations to achieve mutual goals (Bryson et al., 2006; Ansell and Gash, 2008; Simo and Bies, 2007). Cross-sector collaboration between the public and private actors helps in solving wicked problems.

In public management such collaboration has been described as the "process of facilitating and operating in multi–organizational arrangement in order to remedy problems that cannot be solved—or solved easily—by single organizations" (McGuire, 2006: 33; Bingham, et al., 2014). Bingham, et al. (2014) further emphasized in their definition of collaborative public management that collaboration is "to co-labor, to achieve common goals, often working across boundaries and in multisector and multiactor relationships. Collaboration is based on the value of reciprocity" (p. 3). Collaboration is required in a complex urban system with multiple actors and sectors. This helps in recognizing their individual and sectoral shortcomings and capabilities that contribute to a particular urban issue, as well as providing the essential contribution to the general improvement of the city. This adheres to the idea of deliberative participatory processes, which emphasizes that stakeholders are not just consulted, but are also a part of the decision-making process (Ansell and Gash, 2008).

Reciprocity results in people gaining mutual benefits from a helpful act (Ostrom, 2014), building trust (Ostrom, 2014; Esteban, 2017; Ulibarri and Scott, 2016), and cooperating to contribute to a collective good (Ostrom, 2014). In a study on disaster recovery and rebuilding conducted by Esteban (2017), it was discovered that reciprocity among networks builds trust among disaster-affected households and communities, resulting in higher levels of participation and collective decision-making and action, culminating in overall efficiency and effectiveness in the rebuilding efforts. Oliver (2018) sees reciprocity as an important way in strengthening reputation but is not equated to basic human motivation in policy design. Reciprocity however is crucial to human cooperation. Governance and public management discussions assert that issues and actions can be discussed and negotiated through networks characterized by relationships of mutual interaction (Ulibarri and Scott, 2016), codependence, and reciprocity (Newman, et al., 2004).

Collective engagement is not another term for participation rather it is within the realm of collaboration and collaborative processes. Collective engagement, like collaborative public management, is a process in which multiple stakeholders from different sectors and networks engage in collective decision-making and action. However, unlike collaborative public management, the vertical and horizontal interrelationships and interactions in collective engagement can both be formal or informal as long as there is a mutually agreed goal. Kapucu, et al. (2009) pointed out that collaborative public management refers to the "coordination among various [government agencies], collaboration amongst various organizations across the jurisdictional and sectoral lines, and cooperation with private citizens and neighborhood associations" (p. 50). The concentration is on network management and localities focusing on issues that cannot be dealt with by a single organization whereas collaborative governance looks at issues on democracy and the "public's role in shared decisions, both process, and substance" (Kapucu, et. al., 2009: 58).

This distinction on collaborative governance as a process and substance-oriented is appropriate in developing the concept of collective engagement.

Collaborative governance just like collaborative public management has no definite conceptual definition (Kapucu, et. al, 2009). Ansell and Gash (2008) defined collaborative governance as "a governing arrangement where one or more public agencies directly engage non-state stakeholders in a collective decision-making process that is formal, consensus-oriented, and deliberative and that aims to make or implement public policy or manage public programs or assets" (p. 544). The definition takes on a more government-initiated collaboration in engaging non-state actors in making shared decisions on public policies and public management. Emerson, et al. (2012) defined collaborative governance as "the processes and structures of public policy decision making and management that engage people constructively across the boundaries of public agencies, levels of government, and/or the public, private and civic spheres in order to carry out a public purpose that could not otherwise be accomplished" (p. 2). This definition is rather close to the definition of collaborative public management, which acknowledges the need for collaboration to address a problem or issue that cannot be solved by a single entity. Collaborative governance refers to a more structured approach to collaborative decision-making (Ansell and Gash, 2008).

From this discussion, collective engagement in relation to urban resilience and disaster management is defined as,

"A collaborative process participated in by multiple stakeholders to arrive at a solution or decision to increase urban resilience through both formal and informal means. It is the collaboration between and among stakeholders over a prolonged period with varying manners in achieving a level of resilience that contributes to a collective goal of urban resilience. Collective engagement as a collaborative process is characterized by having reciprocity, trust, and mutual respect between and among state and non-state stakeholders." (Esteban, 2020: 5)

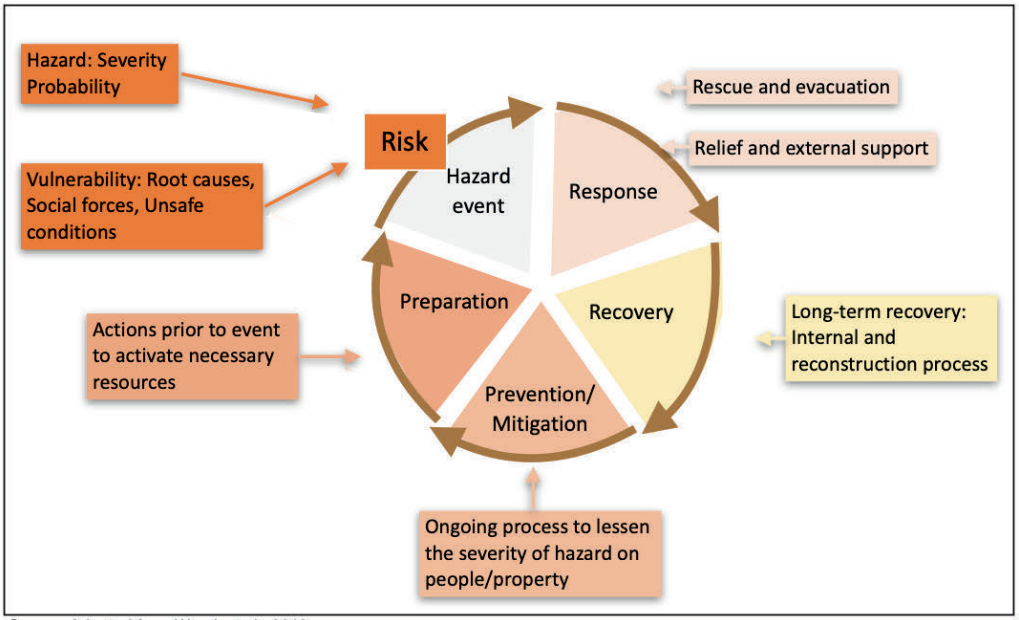
Given the above definition, the succeeding sections will discuss collective engagement in relation to disaster management including areas of collaboration (participation and self-organization), and transformative roles, responsibilities, and actions of stakeholders in disaster management (building urban resilience).

3.2.1 Collective engagement and disasters

The disaster management phases have been illustrated as a cyclical pattern starting from preparation, response, recovery, and prevention/mitigation (see Figure 3.2) by which individuals, communities, and organizations plan for, adapt to, and recover from disasters (Wood, et al., 2013). The first of the four phases, preparation, applies to emergency or disaster preparedness planning. This can be done through activities such as the

deployment of early warning systems, development of community recovery plans, and preparation of household emergency kits (Wood, et al., 2013). The response phase which begins right after a disaster prioritizes search and rescue operations, evacuation, emergency provisions and medical assistance, relocation, and the building of makeshift shelters. The third phase, recovery and rehabilitation, are actions undertaken to restore, rehabilitate, and rebuild the disaster-affected community with the objective to improve their life and well-being after the disaster (Bosher and Chmutina, 2017). The fourth and final step of disaster risk management is prevention and mitigation, which includes measures to prevent and mitigate future disasters. Bosher and Chmutina (2017) refer to this as mitigative adaptations, which in disaster risk management are the structural and non-structural measures conducted to prevent, mitigate and/or adapt to disaster events.

Figure 3.2: Disaster management cycle



Source: Adapted from Wood, et al., 2013

Bosher and Chmutina (2017) described this disaster management cycle as a myopic illustration of disaster management that arise from the disaster event and leads to another disaster event. They see that the four phases in disaster risk management are interlinked where the disaster impact is not required to instigate the action (Bosher and Chmutina, 2017). However, this is not necessarily the case since the concept is cyclical and the starting point may vary (Wood, et al., 2013) depending on the area of disaster management being studied, planned, or implemented. In this research, the starting point is the onset of the disaster, which is the same starting point taken by Wood, et al. (2013) in their study on social capital and disaster management. This disaster event is taken as a

starting point because it is where social capital, participation, and self-organization are obvious.

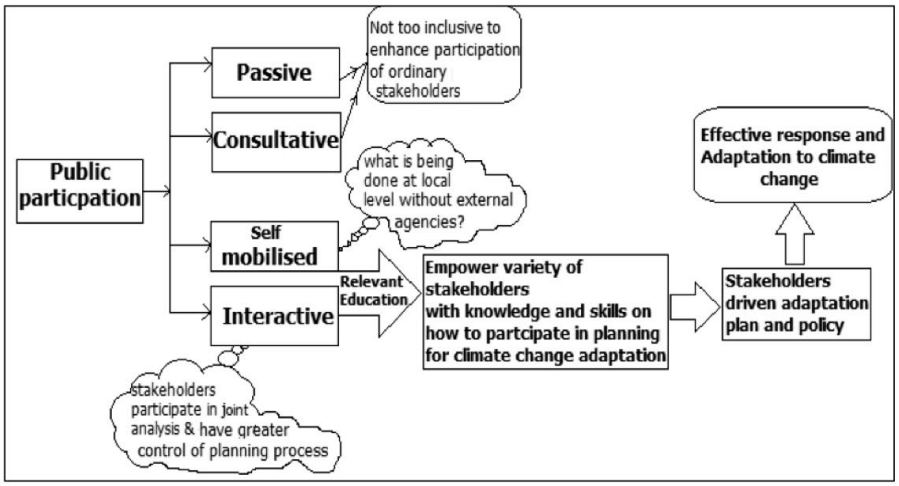
A disaster event is often a catalyst in the formation of self-organizing systems consistent to the 'edge of chaos' behavior (Partanen, 2015; Nederhand, et al., 2014). Disaster-affected communities spontaneously engage in recovery and rebuilding activities largely due to a need. Communities in the wake of a disaster self-organize mainly to recover and get on with their lives. Two elements of disaster resilience are apparent in this situation social capital and collective efficacy (Meyer, 2013). The social capital of disaster-affected communities influences how meaningful partnerships among key actors are formed and determines their ability to facilitate rebuilding and reconstruction efforts. In this context, it can be considered that stakeholders in disaster situations collectively engage and jump six rungs up in Arnstein's ladder of citizen participation to reach the partnership rung. Partnerships, according to Arnstein (1969), perform well in organized communities with a strong power-base, when leaders are held accountable, and where resources, both financial and otherwise, are available. This suggests that the increasing degrees and levels of participation are formed not just intrinsically but also through external influences that sharpen the decisional aspect of participation.

Three degrees of participation were identified, passive, active, and deliberative at the beginning of this section. Passive participation is dependent on the information provided by the decision-makers (the government). Often information is shared with stakeholders but their opinion and response are not included (The Brookings Institution, 2008; Pimbert and Pretty, 1997). Membership in various organizations can also be considered as passive participation since stakeholders can be interested and are curious to be part of a group or an organization without really taking an active role within the organization. Muchanga (2012) revealed in his study on public participation in climate change adaptation in Lusaka, Zambia that passive and consultative participation is not inclusive and does not enhance participation. He found self-mobilization and interactive approaches strengthen the stakeholders' capacity to effectively participate in climate change adaptation planning and suggested how public participation can be improved in the process using the illustration in Figure 3.3.

The illustration highlights the need to empower stakeholders by equipping them with knowledge and skills for them to actively participate. Genuine and meaningful engagement necessitates stakeholders' active participation in the decision-making process (Few, et al., 2007; The Brookings Institution, 2008). Active participation means that suggestions gathered are taken into account in the decisions and actions. On the other hand, deliberative participation allows both the stakeholders and the government to undergo an extensive analysis of issues, develop solutions and thereafter reach better and informed decision. These three types of participation are evident in the different phases of the

disaster management cycle (Jahangiri, et al., 2011) and vary in use, applicability, and effectiveness.

Figure 3.3: Conceptual framework for pragmatic and effective public participation[6]



Source: Muchanga, 2012

The study done by Jahangiri, et al. (2011) revealed that active participation produces a more effective outcome of intervention during the pre-disaster and post-disaster phases. The opposite was found on the immediate disaster phase and rapid response where "it is necessary for the untrained people to stay more passive in order not to add to the chaos and disorder" (Jahangiri, et al., 2011: 87). This is understandable since the onset of a disaster requires a level of command and control approach from the government in terms of maintaining order in responding to the disaster event. This necessitates governments preparing strategies to successfully carry out disaster response such as rescue operations, identifying immediate evacuation and relocation areas, and enforcing other relief measures. Disaster-affected stakeholders can actively engage in disaster response during this phase by volunteering, engaging, and partnering with other individuals, non-government organizations (NGOs), or homeowners associations (HOAs). However, since the disaster response and recovery phases may have security concerns that need to be directed and managed from the top, activities have to be arranged with the local government to ensure order and safety.

People thrust in disaster situations naturally gravitate to work together in rebuilding their lives and communities. Disaster studies indicate that households in disaster-affected communities show different coping strategies for them to live and survive. If the local

[6] The full title of Muchanga's figure is "Conceptual framework for pragmatic and effective public participation in planning for climate change adaptation", and based on Few, R., Brown, K. and Tompkins, E.L. (2006). Public Participation and Climate Change Adaptation. Working paper No. 95. Norwich: Tyndall Centre for Climate Change Research.

government is unresponsive or has limited capacity to attend to the disaster-affected communities' primary needs, there is a tendency for communities to self-organize. This is not to go against the local governments but rather a necessary action especially in a disaster situation. Self-organized initiatives help in developing localized solutions in recovery such as partnering with NGOs and humanitarian aid that are already available.

The intrinsic need and concern of disaster-affected communities to rebuild and recover from the disaster experience lead to self-organization. This concern motivates the community to band together and act. The success of this self-organized recovery effort is dependent on an external influence, such as the government, a network of humanitarian workers, or international non-governmental disaster relief organizations. However, for disaster-affected communities to retain a sense of stability, self-organizations need to extend beyond the community and align with government initiatives. This process necessitates mutual adaptation of responsibilities by all stakeholders, the community and the government, to guarantee building resilience at all fronts.

Collective engagement is needed throughout the disaster management cycle in order to enhance stakeholders' capacities and the city's resilience. To eliminate or minimize the impact of hazard, technological, engineering, climate- and disaster-proofing measures are often performed during the prevention, mitigation, and adaptation processes. These procedures combined with awareness raising activities keep stakeholders informed and educated thereby reducing their vulnerability. As shown in the illustration of Muchanga, the increased knowledge and skills of the stakeholders empowers them and translate to the effective adaptation and implementation of plans. This brings the theoretical expectation that collective engagement is effective if,

"*Strong information and education on disaster management provided to all stakeholders . . . are effective if widely shared and accessible to all.*" (Esteban, 2020: 6)

3.2.2 Collective engagement and the stakeholders

Stakeholders refer to individuals or groups of people whether "organi[z]ed or unorgani[z]ed, who share a common interest or stake in a particular issue or system" (Grimble and Wellard, 1997: 175) and has the ability to influence or impact either directly or indirectly (Engi and Glicken, 1995: 1) decisions or solutions. Freeman (2010) defined stakeholders as "groups and individuals who can affect, or are affected by, the achievement of an organization's mission" (p. 52). Mojtahedi and Oo (2017) borrowed Freeman's definition to further define stakeholders in disaster management as "individuals, groups, or organizations who may affect, be affected by, or perceive themselves to be affected by the impacts of disasters. Indeed, any kind of entity that [is] actively involved in managing disasters before, during and after events, or whose interests may be negatively affected in consequence of a disaster" (p. 40). Stakeholders can come

from any level or position in society as long as they have a shared concern on issues that affect them. This brings to the theoretical expectation that in collective engagement,

"*Stakeholders have strong social networks and are collectively involved in matters pertaining to city development. They are tied to the city and its vision to become resilient. This means that stakeholders are aware, informed, and prepared for disasters."* (Esteban, 2020: 6)

To understand the process of collective engagement in achieving urban resilience, it is necessary to discern who the stakeholders are, what their perceived stakes, and roles in disaster management are. From mapping out the stakeholders and their roles, the interrelationships of these multiple stakeholders can be identified as well as the possible points of collaboration and fragmentations in the urban socio-ecological system. A general list of stakeholders was identified in the UNISDR living document 'Strategic Approach to Capacity Development for Implementation of the Sendai Framework for Disaster Risk Reduction'. This general list has been widely used in developing disaster risk management policies and plans. The general list of the global, regional, national, and local stakeholders and a summary of their main expected roles and responsibilities in disaster risk reduction management are shown in Table 3.1.

There are different types of organizational arrangements to follow in adapting the UNISDR Sendai Framework into the local context. As an example, in Naga City, the Philippines, a disaster mitigation board was formed to organize their disaster mitigation plan. This board works closely with the office of the mayor and city administration so that disaster risk reduction management initiatives are incorporated into the overall strategy of the city. There is also a direct link between the city administrator and the *barangays* (local communities and villages) to ensure that the project is implemented up to the local level. In consultation with stakeholders, the city developed and implemented a local disaster mitigation plan that included risk assessments in existing and planned developments (ADPC, 2010). The plan also included an institutional development program focused on harmonizing government and community resources and capacities on disaster risk reduction (ADPC, 2010). This shows areas where the government take the lead and where other stakeholders (citizens, community, etc.) undertake proactive roles.

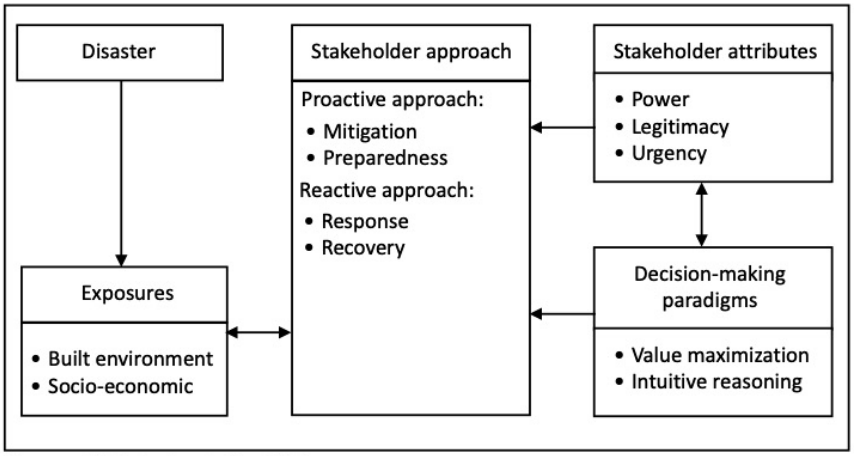
To bring the roles of the different stakeholders together, Mojtahedi and Oo (2014) proposed a "theoretical framework of stakeholders' disaster approaches in the built environment" (p. 360) shown in Figure 3.4. The framework indicates two stakeholder approaches in the disaster risk management cycle, one that is proactive and the other as reactive. This conceptualization of the participatory roles of stakeholders in disaster risk management is similar to what has been discussed in the previous section where it was highlighted that more passive participation is needed especially at the onset of the disaster to restore a level of order. During the response and recovery phases, a more reactive

Table 3.1: Stakeholders in disaster risk reduction and their main expected roles

Stakeholders	Main expected roles and responsibilities
1. National government	Holds the overall responsibility for reducing disaster risk. Establish a national strategy to direct the disaster risk reduction capability building for all stakeholders. This includes allocating funds to support research and development and capacity building activities.
2. Local and regional governments	Promote the Sendai Framework across all offices and local stakeholders, and identify local capacity development needs following the Sendai Framework priorities. Plan and incorporate local disaster risk reduction in policies and programs, and develop a disaster management plan.
3. Private sector and professional organizations	Participate and work with government and other stakeholders especially on research and innovation, as well as share and disseminate knowledge.
4. Nongovernmental and civil-society organizations	Implement projects, coordinate and capacitate communities, coordinate with local governments and agencies.
5. Academia	Increase awareness on disaster risk management and natural hazards for the benefit of the entire community. Encourage science-based policies and decision-making.
6. Individuals and households	Acknowledge responsibility to learn about risk management thereby participate in disaster risk reduction and management activities as well as remain vigilant on leaders and private sectors responsibilities.
7. Media	Help in raising awareness and disseminate accurate information on disaster risk and hazards. Support information, education and communication campaigns. Strengthen linkages with all stakeholders.
8. Regional organizations	Lead the identification of regional and cross boundary issues and strengthen regional collaboration.
9. The UN, international organizations, and international financial institutions	Support disaster response coordination, advocacy, fundraising, financing, and project implementation. Improve the quality and accountability of humanitarian aid and disaster risk reduction initiatives.

Source: UNISDR, 2018; Izumi, 2016

Figure 3.4: Stakeholders' disaster approaches in the built environment



Source: Mojtahedi and Oo, 2014

(active) participation can help fast-track response and recovery. While proactive (active, deliberative, and collaborative) participation is necessary during the prevention and mitigation, and preparation phases to ensure the continuity of learning, preparedness, and resilience.

In the discussions it is clear that there are different stakeholders involved in disaster risk management and resilience building. The general list in Table 3.1 can be categorized to bring an overview of the networks or stakeholders involved. Braun (2010) provided four general groupings of stakeholders based on different levels and sectors (see Table 3.2). Power stakeholders refer to government bodies and international agencies whose aim is to maintain public order. Citizens refer to residents, non-government organizations, and other civil society organizations. Capital stakeholders are public organizations, private agents, and enterprises tasked to maintain economic order. The last group according to Braun are the planners who are the technical professionals and the academe who provide technical know-how and support.

Table 3.2: Groups of stakeholders at different levels and sectors

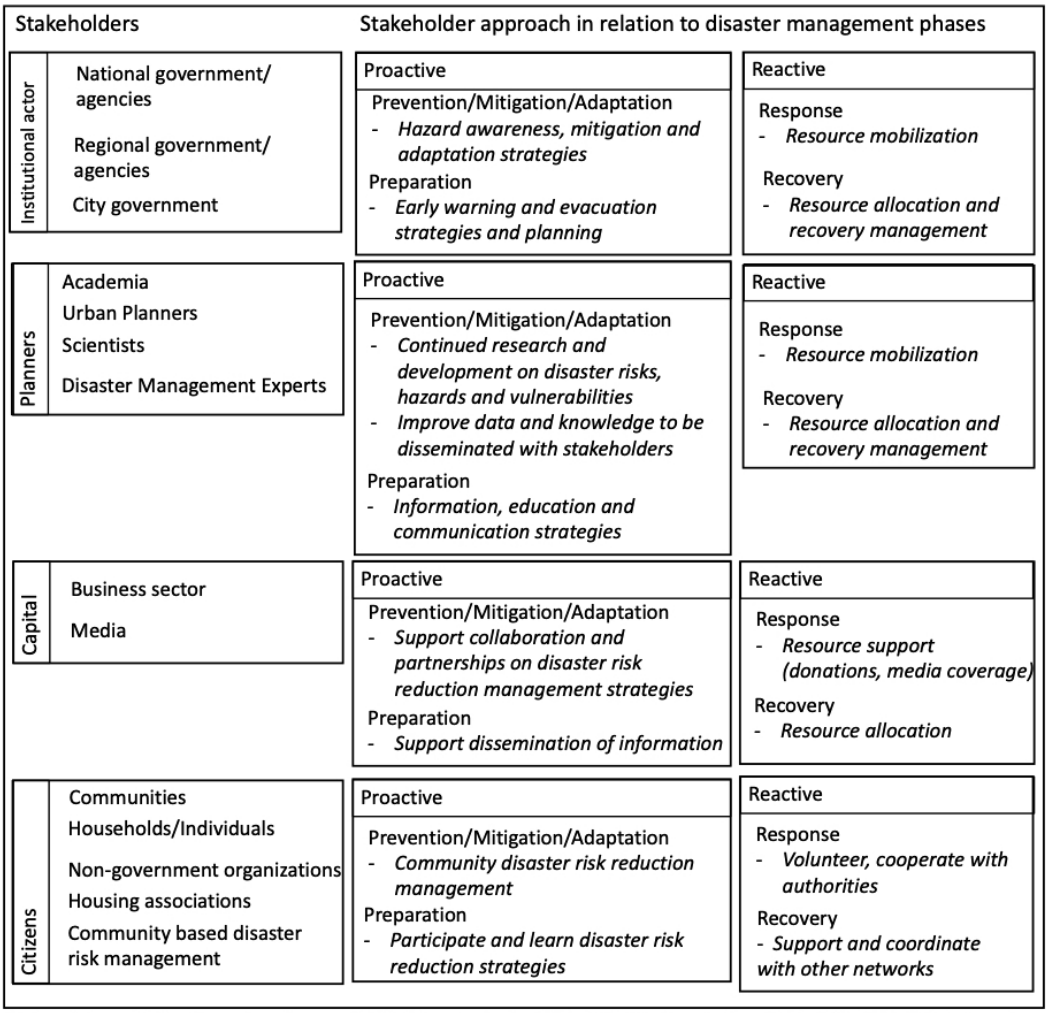
Power - public order	Citizens - civil order
Governments and international agencies Federal, state and municipal governments	Residents Entities (non-profit organizations, cultural groups, environmental groups, political parties, others)
Capital - economic order	Planners - technical order
Public organizations Private agents; land owners; private entrepreneurs; investors	Liberal professionals (private sector) Civil servants (public sector) Researchers/university professors

Source: Braun, 2010

These groups of stakeholders are present in cities and have different stakes and levels of influence. Although Braun (2010) mentioned that categorizing stakeholders risks excluding some groups in planning, this dissertation sees the value in this categorization to have a general understanding of what kind of contribution each stakeholder can provide to enact changes. Putting together the general stakeholders' list and roles in disaster management Figure 3.5 illustrate the stakeholders in city disaster management. Institutional actors take the lead in disaster risk reduction management initiatives. They undertake a more command and control responsibility during a disaster including the response and recovery phases in disaster management. The role of the planners in disaster management is to provide resources and manpower during the response and recovery phases and research and development, scientific and technological advice on disaster management that can be disseminated to all stakeholders. Collaboration and coordination

with the government are important to increase the level of knowledge and awareness. Capital stakeholders' role is to provide resource support through financing and information dissemination to help in disaster management. It is also important that capital stakeholders are informed and aware of disaster management and be active partners in research and development. Citizens' role is to stay informed, aware and participate in disaster management initiatives. This community-based disaster risk reduction management initiatives should be anchored on government policies, programs, and projects.

Figure 3.5: Stakeholders in disaster management



Author interpretation based on Braun, 2010; Wood, et al., 2013; Mojtahedi and Oo, 2014; UNISDR, 2018; Izumi, 2016

3.2.3 Collective engagement and urban resilience

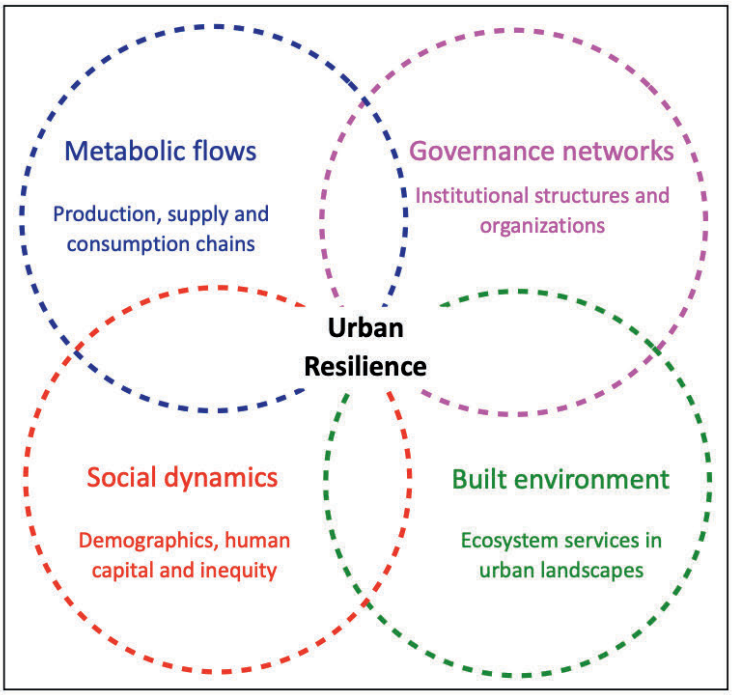
The discussion on disasters and disaster management mainly originated from practical experience mostly through humanitarian work, international development, and environmental development and management. According to Wamsler (2007) until 1970s natural disasters were perceived to be synonymous with naturally occurring events or hazards, such as earthquake, flooding, landslide, or volcanic eruptions, among others. Disasters and disaster management were under the umbrella theme of sustainability (Bosher and Chmutina, 2017) and sustainable development. The shift in perception of hazards as just a naturally occurring event to becoming a risk to the vulnerable sectors of society started in the 1980s and 1990s (Wamsler, 2007). In 2009, UNISDR defined risk as "the combination of the probability of an event and its negative consequences" (p. 25).

Accordingly, the definition of disaster risk is "the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity" (UNISDR, 2017: 10). Including vulnerability in the disaster risk equation accede to the susceptibility of people, environmental and economic assets to suffer loss and damage. Davis et al. (2004) however pointed out that in disaster risk assessment aside from assessing vulnerability it is necessary to consider a parallel assessment of capacity. Capacity is "the combination of all the strengths, attributes, and resources available within an organization, community, or society to manage and reduce disaster risks and strengthen resilience" (UNISDR, 2017: 12). This combination of strengths, attributes, and resources are the capacities, which are referred to as capitals in this dissertation (see Section 3.2). This interpretation is consistent with the collective engagement narrative in the disaster context (Esteban, 2020), which is the aim of this dissertation.

Chapter 2 showed that the complexity of the urban system and the interrelationships built around the system are important to build urban resilience. The Resilience Alliance (2007) identified four interconnected themes in urban resilience research shown in Figure 3.6. This framework underscores multilevel understanding in managing urban systems where metabolic flows are found to have an important role in sustaining urban functions, complemented with governance networks, social dynamics, and the built environment. The entire framework defines urban resilience as a combination of these thematic areas which is adjunct to the five drivers of resilience – human, social, institutional, economic, and environmental capitals.

Adaptive capacity and transformation shape the very nature of resilience. The city as a complex, multidimensional socio-ecological system experience disturbances and undergoes changes that can influence the way the city functions. Natural hazards such as flooding are one disturbance that prompt change in cities. Further, the cities disaster experience adds

Figure 3.6: Four interconnected themes in urban resilience research



Source: Resilience Alliance, 2007

to its complexity especially during the stage of rebuilding and recovery. Cities that have gone through a disaster undergo transformation at different dimensions and at various temporal and spatial scales. The ability of individuals (at different levels of social and economic status, and organizations, such as private, government, among others) to collectively act to support each other and work together is an important aspect of this transformation. This collective engagement helps the city achieve its goal or vision.

Six criteria of resilient urban systems were extracted in the systematic review done in Chapter 2. To begin, a resilient urban system must have the adaptive capacity to respond to diverse disturbances and navigate through these disturbances by learning to adjust, cope and transform. Different types of knowledge and learning contribute to the ability to adapt to disturbances such that a diverse set of stakeholders that have the experiential, cultural, and technical knowledge and information have the most adaptive capacity. Similar to the first criteria, disaster preparedness, risk perception and awareness, and recognition of disaster impacts at different levels and scales refer to knowledge and information. Support for the enhancement and dissemination of this knowledge and information is important to maintain urban resilience. This support can be done through having an established enabling or supporting environment in creating a resilient city. A resilient urban system

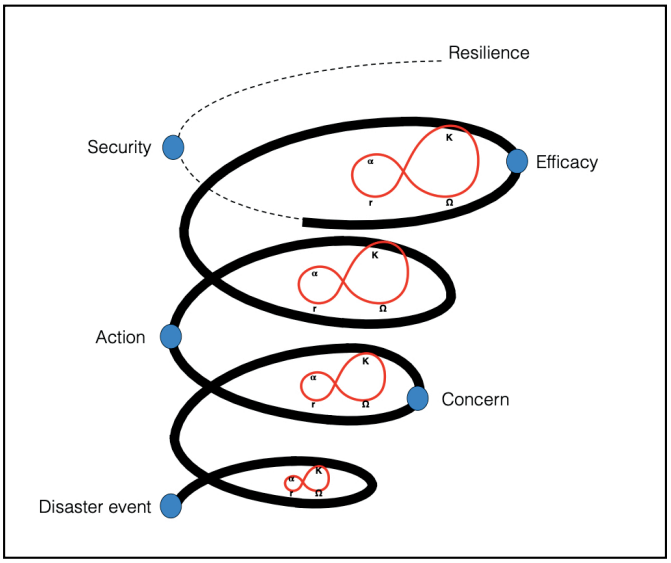
maintains its resilience through diversity. Diversity can be through economic diversity that allows economic production to continue even if one type of economy has gone array due to the disturbance. Diversity likewise calls for inclusiveness in decision-making. Another criterion of resilient urban systems is memory-based disaster experience. Disaster experience enables people to develop innovative ways of dealing with disasters. Last, is the social, physical, and economic drivers that contribute to the overall urban resilience.

Participation, knowledge, information, learning, and awareness are the common thread that goes through the six criteria of resilient urban systems. Participation allows citizens to be empowered, be included, and exercise their rights. Gaventa and Barret (2012) identified four outcomes of engagement "(a) the construction of citizenship; (b) the strengthening of practices of participation; (c) the strengthening of responsive and accountable states; and (d) the development of inclusive and cohesive societies" (p. 2399). This supports many participatory advocates on the importance of participation in the strengthening of the democratic processes and citizenship. Michels and De Graaf (2010: 480) discussed that participation has three functions in a democracy. That is to educate citizens so that they can participate in decision-making. Integrate citizens for them to have a sense of belonging and as a consequence take ownership and responsibility for public decisions. Last, to contribute to greater legitimacy of decisions.

'Resilience requires public concern' (O'Rourke, 2007: 26), and capacitating stakeholders enhances their knowledge and skills, improving their degree of participation and capacity to collaborate. People's level of knowledge and understanding affect their ability to participate, commit, and partner in transforming their city to become resilient. A deeper understanding and improved civic and political engagement and knowledge empowers citizens, increases government accountability, and creates transparency, thereby building mutual trust.

Collective engagement in urban resilience while linked to disaster experience and disaster management does not have a stringent cyclical process like the disaster management cycle. What it has is a dynamic process in reaching a level of resilience. Collective engagement in transforming disaster-prone cities into disaster-resilient cities emerges from the disaster experience. Figure 3.7 indicates that a disaster event, whether this was a recent or distant past experience, provoke city stakeholders to behave or act on this experience to improve their situation. The dynamic movement of the spiral indicates that the transformation from disaster to resilience is a complex and continuous process comprising a series of actions. This is contrary to Bosher and Chmutina's (2017) view that the disaster impact is not required to instigate the action on the four interlinked phases in disaster risk management. While it is understandable that Bosher and Chmutina look at disaster risk management as a standalone process to ensure disaster mitigation and adaptation, it cannot be denied that the reason why most cities move towards disaster resiliency is in part due to their disaster experience.

Figure 3.7: Illustration of the dynamic movement towards resilience from the disaster event



Source: Author, 2018

From the disaster experience or disaster event (as shown in Figure 3.7), there is a concern to overcome the disturbance. This leads to actions, which are usually an immediate response led by the government or self-organized at the community. Efficacy is reached when both actions whether joint or individually executed obtain the same benefits or beneficial to the majority. The benefits reflect a level of security attained, but the dotted line in the figure that leads to resilience suggests ongoing improvements and adaptation to potential disturbances.

Further, collective engagement in urban resilience should be seen as an exercise taken at two levels, the government and the citizens. Boonstra and Boelens (2011) contend that participation is often a government initiative and self-organization is often an initiative from the citizens. Decision-making in self-organization from this point of view comes from an initial organization of the community on the issues at hand and what they have to do about it with or without the help of the government. The steps in self-organizing are often more rapid and organic than the participatory process that normally takes place in cities and local governments. But while this study agrees with their claim that self-organization is a process done initially without government intervention, this study asserts that transformation to a better state is done together with the more structured and institutionalized organization of the government.

Nederhand, et al. (2014) in their analysis of self-organization and the role of government identified six conditions for self-organization. The first condition identified is self-organization requires an incentive that has a disruptive nature because it puts existing practices under pressure. Disasters are disruptions that put cities under pressure to adapt and maintain its function as normally as possible. The second condition they identified is the presence or development of trustworthy relationships. This is particularly crucial at the onset of establishing a self-organizing system where mutual trust is needed to bolster activity. The third condition is the exchange of information, knowledge, and experiences which from here the self-organized system can grow ideas from and create solutions. The fourth condition refers to "the physical and virtual location of the interaction" (Nederhand, et al., 2014: 5). A common location easily accessible to the members of the community or in general the citizens allows the wider audience to participate. The fifth condition is the boundary-spanning activities of key individuals. Nederhand, et al. (2014) described boundary-spanning activities as not only relating to linking people, ideas, and resources but also helps protect the self-organizing activities initiated at the local level in acquiring external support (political and financial support). The last condition is the mutual adaptation of actor roles. This can also be the acceptance of involved actors on the importance of each role in the holistic functioning of the system. Mutual adaptation of actor roles should also include mutual respect and cooperation. This brings to the third and last theoretical expectation on collective engagement,

"*The government and the stakeholders must understand the need to have a cohesive community in order to address disasters. Both the government and the stakeholders must be committed to the same goal of creating a resilient urban system. There should be a balance of power in terms of decision making among all actors, and this can be seen in the development and implementation of plans.*" (Esteban, 2020: 6)

In a disaster situation, collective engagement is a symbiosis of participation and empowerment in which all stakeholders are engaged in the preparation and reconstruction efforts, resulting in actual transformation. However, rebuilding a community, or a city in general, after a disaster is not the end of the path to maintaining a disaster-resilient community or city. To have an effective city disaster management the collective engagement of stakeholders must be honed from the beginning and even before an occurrence of a disaster. Stakeholders who participate in disaster risk management are more equipped with adequate disaster knowledge that they can use to prepare for future possible disasters.

3.3 COLLECTIVE ENGAGEMENT URBAN RESILIENCE TRANSFORMATION FRAMEWORK

The five drivers of resilience human capital, social capital, institutional capital, economic capital, and environmental capital, move cities into building a more resilient system (Figure 3.3). The drivers are interrelated and interdependent stressing the complexity in dealing with cities. It was discussed in chapter 2 that these drivers were derived from the literature review and the analysis of the resilient city frameworks developed separately by Rockefeller Foundation and OECD. Indicators that fall within these drivers were also culled out in the previous chapter. In this chapter, it is important to highlight that these five drivers of resilience form the independent variables of this study as such the variables and indicators must be carefully selected. In the previous chapter, the list of variables and indicators that correspond to each of the five drivers was shown in a preliminary list. Some of the variables and indicators also cross-cut with participation and self-organization which falls under the collective engagement spectrum. The indicators shown in Table 3.3 show the summary of the indicators selected for the drivers of resilience.

The five drivers of resilience which are in the form of capitals or resources provide inputs to building a resilient city (see Figure 3.8). Human capital is measured using the demographic profile of the city population. This includes age, education, life stage, population growth affecting the city's human capacity to address disasters. Social capital refers to the networks and linkages that span communities, civil societies, academia, the private and public sectors. This can be measured in terms of the services the number of social networks and community coalitions in the city. Institutional and economic capitals refer to the enabling environment of the city. Institutional capital refers to the policies and mandates that provide guidance and support for disaster risk management in the city. Economic capital provides the financial resources to implement programs and projects to ensure the resilience of the city. Lastly, environmental capital refers to two streams of environment, the built and natural environment. The resilience of a city can be determined by the strength of the environmental resource whether the built and natural environments can adapt or mitigate disasters.

If the five drivers of resilience are the inputs (independent variables) the output, in this study, is urban resilience. One of the recurring themes in this study is the complexity of cities but at the same time, it has the adaptive capacity being a socio-ecological system. Figure 3.7 shows that there are four movements towards resilience, these four are taken as dimensions in collective engagement - concern, action, efficacy, and security where each dimension grows or transcends to another based on collaborative and adaptive capacities. Collaborative capacities are the partnerships between state and non-state stakeholders that may or may not be government-led. This simply means that the collaborative initiatives

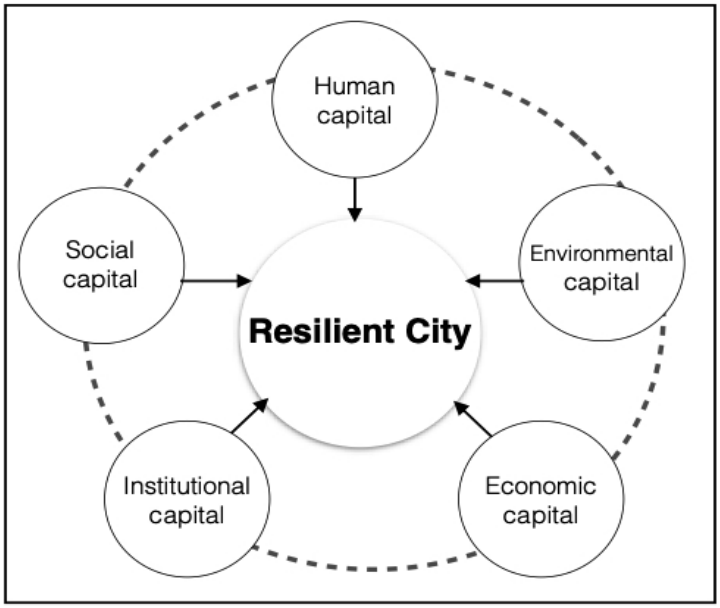
Table 3.3: Drivers of resilience and indicators

Drivers of resilience	Indicators	Sources
Human capital	Memory-based disaster experience Demographic profile - age, life stage, population, education	Bhattacharya-Mis and Lamond (2014); Wilkinson, C. (2011); Picket, et al. (2013); Schwarz et al. (2011); Mehmood, A. (2015); Ainuddin and Routray (2012); Gotham and Campanella (2011); Wolfram, M. (2015); Sharifi and Yamagata (2016); Bahadur and Tanner (2013); Hooli, L.J. (2015); Djalante and Thomalla (2010); Chelleri, et al. (2015); Romero-Lankao and Gnatz (2013); Takeuchi et al. (2014); OECD, 2016a
Social capital	Social networks Community coalitions	Bhattacharya-Mis and Lamond (2014); McSweeney and Coomes (2011); Wolfram, M. (2015); Wilkinson, C. (2011); Hooli, L.J. (2015); Sharifi and Yamagata (2016); Picket, et al. (2013); Schwarz et al. (2011); Mehmood, A. (2015); Ainuddin and Routray (2012); Gotham and Campanella (2011); Wolfram, M. (2015); Sharifi and Yamagata (2016); Bahadur and Tanner (2013); Hooli, L.J. (2015); Djalante and Thomalla (2010); Chelleri, et al. (2015); Romero-Lankao and Gnatz (2013); Takeuchi et al. (2014); OECD, 2016a
Institutional capital	Existence of disaster risk management office Disaster risk management programs and projects Disaster risk management allocated budget and resources	Gotham and Campanella (2011); Sharifi and Yamagata (2016); Bahadur and Tanner (2013); Steiner F. (2014); Djalante and Thomalla (2010); Picket, et al. (2013); McSweeney and Coomes (2011); Schwarz et al. (2011); Ainuddin and Routray (2012); Wolfram, M. (2015); Chelleri, et al. (2015); Takeuchi et al. (2014); Wagner et al. (2014); Gunderson L. (2010); Wilkinson, C. (2011); Mehmood, A. (2015); OECD, 2016a
Economic capital	Economic diversity Business demography City gross domestic product	Ainuddin and Routray (2012); Schwarz et al. (2011); Wolfram, M. (2015); Chelleri, et al. (2015); Romero-Lankao and Gnatz (2013); Takeuchi et al. (2014); Sharifi and Yamagata (2016); OECD, 2016a; Djalante and Thomalla (2010); Gunderson L. (2010), L.; Wilkinson, C. (2011)
Environmental capital	Climate and disaster proof infrastructures Built up areas Available natural resources Open space	Picket, et al. (2013); Mehmood, A. (2015); Sharifi and Yamagata (2016); Djalante and Thomalla (2010); Romero-Lankao and Gnatz (2013); Bahadur and Tanner (2013); Chelleri, et al. (2015); Steiner F. (2014); OECD, 2016a

formed can either be initiated by the city government or by the civil society themselves as a self-organized activity. In this research, these collaborative initiatives contribute to building urban resilience. This shared vision, objective, and commitment between state and non-state stakeholders creates this idea of collectivity.

The collective engagement urban resilience framework shows that the government and the self-organization approach to urban resilience can be two different ways but each going through the same collective dimensions (see Figure 3.9). The two approaches are similar

Figure 3.8: Five drivers of resilience as inputs to resilient city

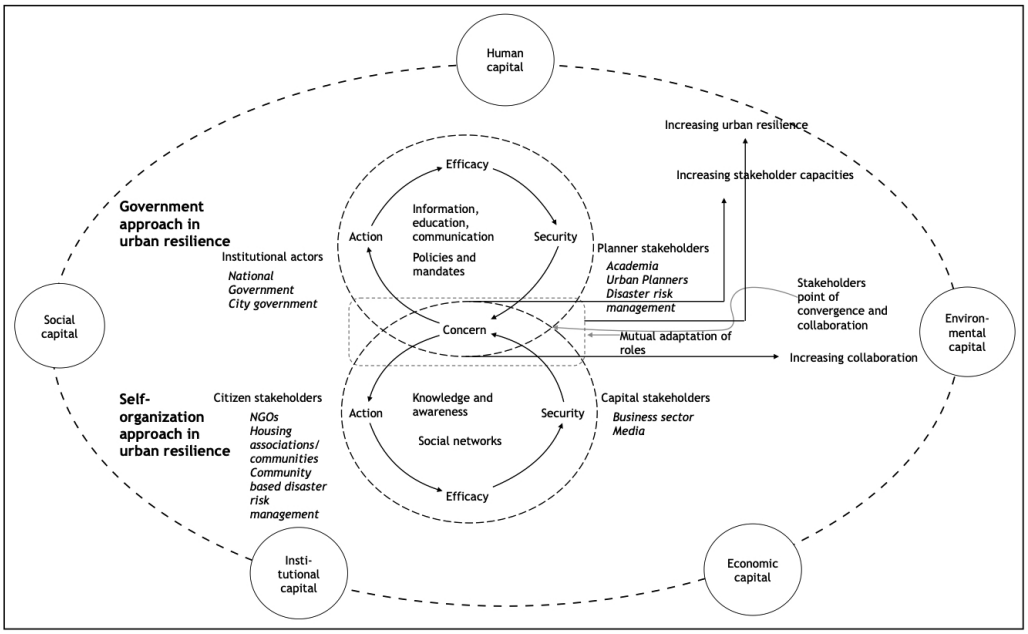


Source: Author adaptation, 2018

to individual and group co-production where individual and community initiatives are executed for the benefit of a group (Sorrentino, et al., 2018; Sicilia, et al., 2015; Brudney and England, 1983). Such that in the government and self-organization approach the initiatives may take two separate pathways. However, in collective engagement urban resilience framework these pathways of the government approach and self-organization approach (shown in Figure 3.9 as curved arrows forming circles) may be going through separate directions but merging at the same point indicating the same objective, building urban resilience. This is comparable to collective co-production, in which governments and stakeholders collaborate to deliver public services for the benefit of the whole community (Sorrentino et al., 2018; Brudney and England, 1983), regardless of who initiated the action.

In the conceptual framework shown in Figure 3.9, stakeholders in the government approach are the institutional actors and planners, while in the self-organization approach are the capital and citizen stakeholders. Institutional actors refer to the government and those that hold government positions (elected or otherwise) with the legal mandate to plan, develop, and implement city development programs and projects, this includes city planners employed as regular staff by the city government. Planners as a category of stakeholders in the framework refer to technical persons knowledgeable on urban management, disaster risk management, resilient city, who may or may not be involved in

Figure 3.9: Collective engagement urban resilience framework



Source: Author, 2018, 2021

city development planning. These people can be found in the academe or private practice such as scientists, urban planners, researchers, engineers, and disaster management experts. The institutional actors and planners in the government approach are considered the experts in the fields of disaster risk management and urban planning. Capital stakeholders are the business sector and media, and citizens are housing associations, non-government organizations, community-based disaster risk management unit members, and community associations/organizations.

The government approach usually consists of developing plans and strategies to address the disaster event. A command and control structure may first be initiated at the onset. This later evolves into the collaboration between government and planners to develop technology, design, and strategies. The level of efficacy is reached within the government approach when an enabling environment for collective engagement is fostered. On the other hand, the self-organization approach at the onset of a disaster event is formed to immediately address the situation within their community. The actions lead to a level of efficacy when the initiatives have become more organized and form wider collaboration not just within the community but also with the government. Given the three mentioned theoretical expectations in section 3.2, collective engagement is assumed to be the sum of

the individual engagement levels of various stakeholders that contribute to urban resilience.

The five drivers of resilience human, social, institutional, economic, and environmental capitals influence the overall approach towards urban resilience. Within the five capitals are the two approaches in urban resilience that both come from a shared concern. The actions that arise from a concern may diverge and proceed in different timescales and speeds in reaching a level of efficacy, but it converges to a level of security. The cycles for the government and self-organization approach form a standing lemniscate pattern or infinity symbol similar to the panarchy framework symbolizing that change, stability, collective engagement and building urban resilience is a continuous process rather than an end goal. The framework indicates the stakeholders involved in the overall process but shows the main players for the two approaches. The dashed rectangle indicates the mutual adaptation of roles of all the stakeholders, while the dashed circles indicate the increasing stakeholder capacities and increasing collaboration.

Each of the four dimensions in the two approaches go through periods of stability and change that allows learning, adaptation, adjustment and transformation to happen. According to Davies and Dart (2005), the domains of change refer to four significant changes, "changes in the quality of people's lives, changes in the nature of people's participation in development activities, changes in the sustainability of people's organizations and activities, and any other changes" (Davies and Dart, 2005: 17; Davies, 1998). These four significant changes have been used in evaluating international development programs using the "Most Significant Change technique" (Davies and Dart, 2005: 9). A similar approach was developed by Oxfam and the University of East Anglia called the contribution to change methodology. The methodology measures the change in the well-being of disaster-affected communities within a given one-year period at three or four points in time (Few, et al., 2014). These points in time are before the disaster, during the disaster event, early post-disaster (emergency period), and late post-disaster. This methodology was used in the first pilot study Contribution to Change The Philippines Appeal done in Tacloban City, Tanauan, and Dulag, The Philippines. Using the four points in time the pilot assessed the changes in the housing, livelihoods, and overall well-being in the households and the communities in relation to the intervention provided following Typhoon Haiyan (Esteban, 2015).

The domains of change are not indicators and are "deliberately fuzzy to allow . . . different interpretations [on] what constitutes a change" (Davies and Dart, 2005: 18). In this study, the domains of change are those that influence and organize the formal and informal rules for implementing a practice (Brown, et al., 2016). Specifically, these are the stakeholders, bridges, knowledge, and boundary-spanning activities.

Bridges are 'formal or semi-formal organizations, structures, and processes that facilitate collaborations across science, policy, and industry spheres' (Brown, et al., 2016: 16). Bridges help in translating issues into opportunities for renewal. This domain of change is closely linked to bridging social capital which involves overlapping networks and inter-relationships that allow networks to share resources and open opportunities for collaboration to find solutions. In this study, these bridges may well be the disaster management units that are working with the citizens and the government in advocating disaster preparedness.

Knowledge refers to both knowledge gained through learning and experience. It is a resource stakeholders use in assessing and addressing disaster concerns. Renn, et al. (1993) in their study on 'public participation in decision-making' identified three forms of knowledge, "knowledge based on common sense and personal experience, knowledge based on technical expertise, and knowledge derived from social interests and advocacy" (p.190). Stakeholders have these forms of knowledge in varying degrees. A combination of these different forms of knowledge leads to the type and quality of decisions.

The last domain of change is the boundary spanning activities that have been used in self-organizations. Boundary-spanning activities link people, ideas, and resources (Nederhand, et al. 2014). In self-organizations, boundary-spanning activities ensure that the embryonic self-organizing activities are protected when acquiring for instance political and financial support (Nederhand, et al., 2014). This means that the idea and welfare of the self-organized groups are protected from external organizations even if the self-organization is seeking support for their cause. However, as a domain of change and an important aspect of transformation in the conceptual framework, boundary-spanning activities are activities, programs, and/or projects that link people, ideas, and resources on a common vision to increase urban resilience.

Table 3.4 shows the domains of change and the transformation states for each of the collective engagement dimensions. While Figure 3.10 is an enlargement of the collective engagement urban resilience framework to show the domains of change within the framework.

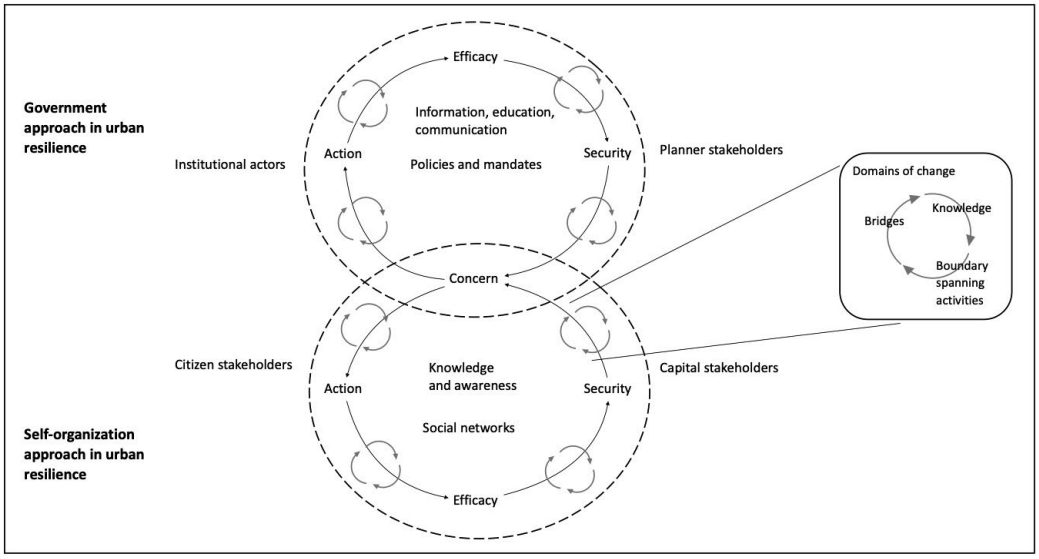
The domains of change are all present in each of the dimensions of collective engagement. The combination of the domains of change in each dimension can be treated as the elements within the city's adaptive cycles that result in the transformation from one dimension to another. The first collective engagement dimension is ***collective concern***. Concern is defined as worry or interest, however, in this case, collective concern does not refer to a "collective" worry, but rather a collective concern on how to respond, organize, and learn from the disaster experience in order to prepare for future possible disturbances.

Table 3.4: Domains of change and transformation states

Collective engagement dimensions	Domains of change			Transformation states
	Bridges	**Knowledge**	**Boundary spanning activities**	
Collective concern	Locally organized groups including volunteer groups, housing associations, community coalitions	Experiential knowledge, memory-based disaster experience, knowledge passed on to generations	Application of local adaptation measures	Remembering past disaster events, understanding and learning from past disaster events. Need to learn more and engage with networks.
Collective action	Local disaster risk management units	Experiential knowledge, common sense, technical knowledge, social interest and advocacy	Information, education and communication on disaster risk management	Awareness and understanding of disaster risks. The realization of stakeholders that collective effort is required to reach a level of resilience.
Collective efficacy	City disaster risk management office, economic diversity	Technical knowledge and expertise, social interest and advocacy	Regular disaster risk management drills and workshops, accessible IEC campaigns through social media	Informed and educated stakeholders on disaster risk management.
Collective security	National, regional, local (city) disaster risk management	Technical knowledge and expertise, social interest and advocacy, behavioral change	Information, education and communication on disaster risk management including existing climate and disaster proof infrastructures in the city	Mutual adaptation of roles of stakeholders in working towards resilience. Behavior change of people towards becoming disaster-risk aware reinforced through continuous IEC.

Adapted from Brown, et al., 2016; Renn, et al., 1993; Nederhand, et al., 2014

Figure 3.10: The domains of change within the collective engagement urban resilience framework



Source: Author, 2018

Collective concern refers to the stakeholders' experience when disaster happens which is a sense of uncertainty, vulnerability, and concern. The concern during a crisis begins with the self and the immediate family, it is the concern for one's well-being and those in their immediate network. This concern progresses to concern for others, that is the neighbors, the community, and then the city. Collective concern refers to the shared concern of a group of people, in this case, the stakeholders. This collective concern brings stakeholders together as a community and the catalyst for action.

Blumer (1971) in his study on social problems and collective behavior mentioned that if a community does not perceive, address, discuss, or take action on a social problem, then the problem is not there. However, in the case of the research, natural hazards and in particular flooding is a problem that affects everyone and cannot be ignored due to the direct physical impact on the stakeholders. Disasters threaten life, property, and business, institutional actors must see the value of addressing disasters in the overall growth of their city. Without this level of concern from the institutional actors in addressing disasters, resilience levels may not be achieved.

The disaster experience of all stakeholders all come together within this collective concern dimension. The disaster experience including the local and technological knowledge of the institutional actors, planners, capital, and citizen stakeholders is a point of interaction that also triggers transformation. Once the disaster experienced is recognized, accepted, and endorsed by the stakeholders that is the time they transcend to the next dimension. This recognition legitimizes the problem such requires action. However, there are two approaches to building resilience, the approach taken by the institutional actors driven by governments and mostly taken together with planners, and the other is self-organization taken by citizen stakeholders with some support from capital stakeholders. Collective concern is the pre-departure stage for these two approaches towards collective action.

Collective action is spurred by the desire and need to work together as a network of stakeholders. The role of networks and their linking ties are explored to ensure that the city learns from past experiences and transforms these learnings into actionable outcomes. Meinzen-Dick and Di Gregorio (2004) defined collective action as the "voluntary action taken by a group to achieve common interests" and that "members can act directly on their own or through an organization" (Meinzen-Dick and Di Gregorio, 2004, What are property rights and collective action? section, para. 2). This presupposes that collective action happens when there is a shared concern on a common issue and a shared effort among the stakeholders to solve an issue and achieve an outcome. However, "if all individuals pursue short-term, self-centered benefits, no collective benefits are achieved" (Ostrom, 2004, Understanding collective action and collective action problems section, para. 2). Wolfram (2016) argued that collective actions depends on the capacity of stakeholders to

collaborate in formal and informal decision-making platforms, the strength of the social networks, inclusivity and diversity of participation and knowledge shared.

Collective action encourages the creation of solutions by fostering cross-fertilization of knowledge and experiences. It is driven by social networks that aid in the facilitation of a required action in response to a common issue. To illustrate, community volunteers almost always instantaneously appear after a disaster to lend a hand to their communities. Recognizing and legitimizing that disaster management is an important priority area for city planning and development gives rise to collective action. This dimension reflects the "sense of community" where stakeholders can be seen to work together and draw up solutions to achieve a common goal (Esteban, 2020; Esteban, et al., 2020). It is within this dimension that mobilization to take action is initiated and where self-organization manifests.

The government-driven approach, on the other hand, has a more policy-oriented direction to ensure broader support to all stakeholders. This can be in the form of creating policies, forming a formal disaster risk management unit, providing information, education, and communication (IEC) campaigns to increase awareness and understanding of disaster risks and management.

The third dimension is ***collective efficacy*** which lies in the extent of "social cohesion" among stakeholders and "their willingness to intervene on behalf of the common good" (Sampson, 2013; Sampson, et al., 1997). Originating from Sampson, Raudenbush, and Earls' study on neighborhood crimes, collective efficacy is defined as the "process of activating or converting social ties among neighborhood residents in order to achieve collective goals" (Sampson, 2010: 804). The distinction between collective action and collective efficacy is razor-thin. The research, on the other hand, defines collective efficacy as the point at which all stakeholders (citizens, government, private and public sectors, civil society) effectively and actively engage supported by an enabling environment. It conjures up a task-specific construct that emphasizes shared expectations and mutual agreements among residents (Sampson, et.al. 1997). It illustrates stakeholder ownership and empowerment, where stakeholders are committed to participating in the city's transformation process.

Collective efficacy happens when the community is empowered and engages effectively to take part of the collective action to transform and improve. In addition, communities that are more cohesive and have higher social control can better develop collective efficacy. Aldrich (2012) study on disaster-affected communities in three cities - Kobe, Japan, Tamil Nadu, India, and New Orleans, Louisiana, USA - found that social capital proved to be the major resource in the long-term recovery of disaster-affected communities rather than the aid provided by the government and aid agencies. In the study, communities that have higher trust, active engagement, and stronger social networks recovered better than those

fragmented, isolated communities. In Aldrich's study, Kobe and Tamil Nadu were identified to have recovered faster than New Orleans owing to the communities' ability to mobilize through informal networks and build consensus. It was also identified in the study that in New Orleans, neighborhoods lacking community networks and trust stagnated as compared to neighborhoods such as the Vietnamese neighborhood of Village de L'Est, which was able to quickly recover from the disaster owing to its dense community network and high level of trust.

The government's role in this dimension as political and implementing agents is important to provide legitimacy and accountability to stakeholders (Ahmed, et. al., 2004). While collective efficacy is the result of having an empowered community, the role of the government is important under this dimension as the agent that provides a strong enabling environment for collective engagement to take place, and resources to help propagate growth. Therefore, collective engagement relies on this mutual trust, respect and acknowledgement of roles among the stakeholders and its social networks.

The last of the four dimensions is ***collective security***. The term collective security has been used in international peacekeeping policies as the banding together of nations to form an alliance against the threat of war. However, for the purpose of the research collective security shall refer to the security against disasters that the city and its citizens collectively enjoy as a result of the effective alliances and partnerships between stakeholders coming from all levels. In this dimension a level of security has been achieved due to a combination of hard infrastructures, either mitigative or adaptive, are already in place, and stakeholders are well-informed and educated on disaster risk management and can prepare and respond to disasters. Collective security not only means that the city is safe and secure spatially but more so that the stakeholders are disaster-risk aware. Collective security also entails the regular review and updating of structural and non-structural disaster-response measures, as well as reforms to strengthen human, social, economic, institutional, and environmental capitals, which are necessary drivers for maintaining urban resilience.

Engaging stakeholders in the discussion and development of solutions aids in the effective implementation of actions. However, to do this a strong and progressive government open to collaborating with the stakeholders and has the enabling environment and resources that can facilitate collective engagement and building urban resilience are needed. To illustrate, the government takes responsibility for implementing flood risk management projects such as flood control facilities, but all stakeholders must also be vigilant and accountable in managing these facilities directly or indirectly by reporting damages or preventing pollutive activities so as not to clog these facilities. Each stakeholder has a responsibility in creating a sustainable and resilient environment. This view is supported by Hall and Penning-Rowsell (2011) who identified that "modern flood risk management is people-focused. Considerable emphasis is now placed on stakeholder attitudes and

aspirations, with government and state agencies alike seeking public engagement in the decisions that affect them, decisions that require behavioural change for effective implementation" (p. 12).

Information, education, and awareness are effective strategies for helping stakeholders recognize their roles and responsibilities in flood and disaster management. The government can provide the requisite infrastructure and social services, but resilience requires a collective effort. Collective security does not end from having the physical infrastructure alone, whether this be mitigative or adaptive infrastructures. Collective security is achieved by having stakeholders that are aware, educated, engaged, and who understand the benefits of the infrastructure and the reason why there is such infrastructure. Understanding these causes and effects helps stakeholders change their behavior to become partners in building a resilient city. This entails a continuous process of partnership and collaboration to sustain collective security and urban resilience.

Table 3.5 describes the collective engagement dimensions vis-à-vis urban resilience using the indicators

Table 3.5: Collective engagement dimension vis-a-vis urban resilience

Dimensions	Description	Urban resilience level	Indicators
Collective Concern	Stakeholders remember and learn from past disaster events. Stakeholders translate this experiential knowledge to local adaptation measures and through engaging in networks.	Shared vision and concern in making the city resilient. Issues are identified, defined, and understood.	• Local adaptation measures • Volunteering
Collective Action	Stakeholders are aware of and understand the basics of disaster risk management. The city's willingness to delegate authority and resources to the local level and a working multi-sectoral structure for reducing and managing disaster risk.	Shared understanding and agreement of the issues that the city is facing and the need to find solutions and take action.	• Accessible relevant information on disaster risk reduction and management to all stakeholders • Citizen led-activities on disaster risk management
Collective Efficacy	Informed and educated stakeholders on disaster risk management. Disaster preparedness plans and contingency plans are in place. Conduct of regular training and emergency drills.	Increased knowledge and agreement among stakeholders on solutions.	• Disaster risk reduction and management are included in the school curriculum, educational materials and trainings. • Early warning systems are in place for all major hazards in the city. • Regular training and emergency drills are conducted.
Collective Security	Mutual adaptation of roles of stakeholders in working towards resilience. Behavior change of people towards becoming disaster-risk aware reinforced through continuous IEC.	High disaster risk awareness of stakeholders.	• City-wide information, education, and communication strategy exists to increase awareness and stimulate a culture of disaster resilience • Coordinated disaster risk management across levels.

Source: Author, 2018

In summary, collective engagement is the coming together of different actors at different levels working on various sectors and contributing to the functions of the city. It is the synergistic functioning of the city as an entire socio-ecological system that can adapt to disturbances or changes, which includes disaster events, yet maintain its function. Collective engagement means the awareness of all actors (government, citizens, private,

and public sector) of their responsibility and role in creating a resilient urban environment. Further, collective engagement is a continuous process of engagement among actors and adaptation to changes that inevitably lead to the improvement of the city.

Collective engagement is a continuous process and its effectiveness to attain urban resilience depends on three main elements. First, *strong information and education on disaster management are provided and accessible to all stakeholders*. Second, *strong social networks of stakeholders that are collectively involved and tied to the city and its vision to become resilient*. Lastly, *the government and the stakeholders must understand the need to have a cohesive community in order to address disasters*.

3.4 CHAPTER CONCLUSION

The transformation of a disaster-prone city to a disaster-resilient city is not straightforward. It goes through a process and in this research, the conceptual framework indicates that this is through a series of collective dimensions under the collective engagement urban resilience framework. It highlights that the city from its disaster experience moves towards becoming resilient driven by five drivers of resilience. The collective engagement urban resilience framework depicts the adaptive cycles that continuously evolve and transform. The criteria of a resilient urban system have thresholds where the participation process serves as the alpha of the transformation in collective engagement.

This chapter highlights that the move to becoming a resilient city is a continuous process of learning and improvement. The four collective dimensions which lead towards the transformation process describe the trigger points of the transformation are to be sought in this research.

CHAPTER FOUR

CHAPTER FOUR: RESEARCH DESIGN AND METHODOLOGY

4.0 INTRODUCTION

This chapter provides the background on the methodology to be applied in the study. The main objective of this dissertation is to investigate whether collective engagement contributes to building urban resilience. The research assumes that for collective engagement to work participation, self-organization, information, and education on disaster risk management are needed and stakeholders mutually adapt and respect their roles in the transformation of the city to become resilient. The explanatory nature of the research requires a qualitative approach to understand how each of the collective dimensions of collective engagement grows and relates to urban resilience. The chapter begins with an explanation of the research design which discusses the multiple case study approach and case selection. This is followed by the conceptual framework and operationalization of the variables. The chapter ends with the strategies and procedures for data collection and the approach to be undertaken in data analysis.

4.1 RESEARCH DESIGN

The objective of the research is to investigate how collective engagement contributes to building urban resilience in disaster-prone cities. As an explanatory research, it will seek to build a pattern on how cities move towards disaster resiliency through collective engagement. In this research, it is important to understand how and why transformation occurs, as well as what contributes to resilient city transformation. Further, the complexity of the dynamics within a city requires an understanding of what Marcus and Colding (2011) called 'hierarchy of embeddings' referring to spatial systems being embedded in institutional systems, which in turn are embedded in discursive systems, all of which have interconnections, overlaps, and feed-back loops. The case study approach allows the researcher to probe these hierarchies and see the interconnections, overlaps, and feedback loops that usually is limited should these be done in quantitative research such as a survey.

To be able to understand this complexity and multi-dimensionality, a multiple case study research approach will be employed to provide an in-depth understanding of this phenomenon. This multiple case study research approach is deemed an appropriate method in explaining and understanding complex real-life contexts (Simons, 2009; Thomas and Myers, 2015; Yin, 2009; Salkind, 2010). Having multiple case studies also allows case comparisons to understand areas of convergence and divergence of each case that will give broader layers of analysis on a given phenomenon. As Yin (1981b) also noted the "distinguishing characteristic of a case study is that it attempts to examine: (a) a contemporary phenomenon in its real-life context, especially when (b) the boundaries between phenomenon and context are not clearly evident" (p.59). This is useful in drawing

up the conclusion on the transformation since it is an appropriate strategy for researches seeking answers on "how" and "why" a phenomenon happens and how knowledge is utilized (Yin, 1981a; Salkind, 2010).

4.1.1 Case selection

Eisenhardt (1989: 545) suggested that the ideal number of cases should be between four and ten to build an empirically grounded case study. In this research four city cases were selected, it is also the intention of the research to investigate each of the cities transformation to become resilient following the four dimensions of collective engagement. This investigation forms cases within each of the city cases that contributes to providing an empirically grounded case study. Further, a cross-case analysis identifying overlaps and gaps for each cases contributes to analytic generalizations (Yin, 2013).

The research focuses on flood disasters and the transformation of a flood-prone city to a disaster-resilient city. Cases must show similarities in flood disaster experience as well as convergence and divergence in addressing this risk. This also means that cases must show some institutional structure in handling flood risk management at the national level and from there translation of these policy mandates at the local governments. Moreover, in practical experience in the field of urban planning, disaster risk management, and climate change, there are two approaches on this, the hard measures usually referred to as climate change mitigation measures in international development, and soft measures or climate change adaptation measures, as such, the cases selected showcase both hard- and soft-measures.

The selection of two countries, the Netherlands and the Philippines, was deliberate to compare how flood risk management, collective engagement, and urban resilience are approached from the Global North and Global South perspectives. This can give insights on similarities and gaps that can be learned from each country and each city case. Interestingly, both countries fall under the top 20 of highly exposed to natural hazards in the World Risk Index 2020, with the Netherlands ranked 16 and the Philippines ranked 8. However, while the Netherlands has high exposure to natural hazards it is among the least vulnerable while the Philippines is among the countries that are highly vulnerable (Behlert, et al., 2020).

The Netherlands was selected specifically on the grand scale of flood risk management done in the country throughout history. The Deltaworks system is known all over the world as an engineering feat that has decades of success in mitigating floods. Innovative projects on climate change adaptation are also being implemented all over the country such as the Room for the River program that allows the river to overflow and flood a space without compromising the safety of the inhabitants. On the other hand, the Philippines was selected not only because of its ranking as 9th and 8th country with the highest risk

and highest exposure, respectively but the social resilience demonstrated by the citizens in tackling flood risk. Both countries have robust policies on flood and disaster risk management with the Netherlands having an organized and centralized structure, while the Philippines have a more decentralized approach.

4.1.2 Case cities

Two cities were selected for each of the countries, Rotterdam and Dordrecht in The Netherlands, Marikina and Malabon in The Philippines. These four cities are all working on building and strengthening disaster resilience. The cases were chosen based on the cities' geographic characteristics and climate-related risks such as sea and river level rise, and heavy rainfall, as well as their proximity to water-bodies (Rhine-Meuse-Scheldt river delta for Rotterdam, Rhine-Meuse for Dordrecht, Marikina River for Marikina, and Tullahan River for Malabon).

While there are similarities of the four cases based on the geographic characteristics, flood risks and natural hazards, the four city cases also vary in terms of the institutional and policy backgrounds. In the Netherlands the development of the "system of disaster management is characterized by all kinds of leadership authority" (Scholtens, 2008: 196). The top down command structure is prevalent in the Netherlands in disaster management and collaboration with the stakeholders are considered as 'managed collaboration' focusing on management and leadership (Scholtens, 2008). The Dutch cases can then provide insights on the institutional and organized structuring of city planning and disaster risk management including the adherence of the city governments in implementing policies. On the other hand, the Philippine cases can provide examples of how cities organically organize to reach a level of order and resilience. The Philippines also pushed a community-based disaster risk management (CBDRM) schema owing to a policy mandating the establishment of CBDRM units in all cities but also in part due to the prevalence of natural disasters occurring in the country.

Each of the city cases can provide analytic generalizations to how and why their city is building urban resilience and at what stage of urban resilience their city is currently in. The explanation behind this can reveal the city's current conditions and opportunities that can help identify commonalities as well as differences between different types of cities' transformation process.

Rotterdam

The first case is the City of Rotterdam in the Netherlands. Historical accounts on the 1953 flooding in the country indicate a 3.8 meters above sea level storm surge affected the South of Holland (Keeton, 2013). After this experience, Rotterdam strengthened its dikes in Holandsche Ijssel and followed it with other structural measures such as Maeslantkering

storm surge barrier that prevents storm surges of more than 3 meters high (Jha, 2016). Rotterdam has come a long way after the flooding incident in 1953, at present the city is one of the first members of the Rockefeller Foundation's 100 Resilient Cities initiative. Rotterdam's Climate Initiative (RCI) combined approach on climate change mitigation and adaptation have placed Rotterdam as one of the leading cities addressing climate change and building a resilient city. The city is working on climate change mitigation and adaptation strategies utilizing both scientific knowledge and practical strategies that can be implemented on-ground together. The integrated approach of RCI helped build the integrated long term vision of Rotterdam as a Climate Proof City by 2025 together with its stakeholders. Supportive of this and perhaps an improvement to this vision is the Resilience Strategy the City of Rotterdam released in 2016 for the 100 Resilient Cities. The Resilience Strategy underscored seven goals geared towards a holistic vision in achieving a resilient city. The strategy not only emphasize technical, spatial and scientific strategies that are of course needed to increase resilience but it marries the social dimension into achieving a resilient city. The strategy acknowledges the challenges in changing the planning approach from top-down to community and citizen involvement. This case will bring light to the complete transformation process of the city through drawing out the historical narrative to assess the initial dimensions of collective engagement building on the current level of resiliency and security the city has so far achieved.

Dordrecht

Dordrecht is a pilot area for the Managing Adaptive Responses (MARE), it is a new case but has a rich amount of research on varying subjects on adaptation, and flood risk management. The inclusion of Dordrecht as a city case is highly relevant as it can be used as an action research case especially at this time when the city is in the process of planning for its city to become a "self-reliant island." The research can provide inputs to this plan as well as give an opportunity to test the framework spelled out in the research. As one of the cities participating in the room for the river project, Dordrecht also has a rich amount of research on varying subjects on adaptation, and flood risk management. The Dordrecht learning action alliance (LAA) and the local government have worked together for understanding the flood risk in the city. It was the LAA that was able to bring in the knowledge which resulted in innovative design solutions in the City of Dordrecht on flood risk management. The citizen engagement through the LAA helped improve the City of Dordrecht in terms of making the city more resilient. Both structural and non-structural measures have been implemented in the city in terms of flood risk mitigation and management. However, there is also a sense of complacency especially for the areas in the city where the structural measures were heavily constructed (those that are within the dike). This feeling of complacency may have been placed due to their strong belief that the city is indeed safe due to the structural measures that have been carefully integrated to ensure that the 1993 and 1995 flooding will not happen again. Scientists believe that

extreme flooding event in the city will only happen one in 10,000 years but resiliency is also understanding what to do in case of a disaster. Natural disasters may happen unexpectedly especially in this age of climate change. And here the LAA can be involved in shifting that mindset to become prepared rather than being complacent.

Marikina

Marikina City in the Philippines has been "recognized as a model of a sustainable and livable city" (Calilung, 2008: 4) and the only city in the country with an integrated bikeway. Prior to this recognition the city was known to be the area frequently flooded and highly congested. It was in 1992 after experiencing a big flood which covered 28% of the city that the city reached a turning point. That same year when the then new Mayor Bayani Fernando assumed office and committed to "uplift Marikina from mediocrity to prosperity" (Calilung, 2008). The mayor initiated the 'Save the Marikina River' project to drain and unclog the river and waterways. He effected laws that are actually already built-in in Marikina's plan and zoning ordinances like the 'no-build zones' on the riverbanks (ADB, 2008). He enforced strict laws which required factories on the riverbanks removed and the construction of Marikina's own waste and wastewater management facilities. Marikina City also pioneered in creating a disaster risk management plan for the city even before the national government created the Philippine Disaster Risk Reduction and Management Act (RA 10121). The leaders political will to implement these plans initially was received with skepticism and even anger from the stakeholders but the leaders pushed the strict implementation of these plans. From that time flooding in Marikina City was reduced and the stakeholders realized the changes and improvements that happened in the city. The improvements have also resulted in Marikina City diversifying into other businesses. Before Marikina City was only known as the Shoe Capital of the Philippines having numerous shoe factories but now the city has a thriving food industry, commercial shopping complex, hotels and convention centers. This has greatly improved the economy in the city allowing the city government to provide more social services and infrastructures. Some of these infrastructures are related to disaster risk management and adaptation. Further, Marikina City has a fully equipped disaster risk management (DRM) office including seasoned DRM staff who not only respond to rescue and response operations within Marikina but also to requests from other neighboring cities.

Malabon

The City of Malabon is situated in the northern part of Metro Manila and lies along the coast of Manila Bay. The city is low-lying and has a flat terrain traversed by the Tullahan River. The geographic location and geologic make-up of Malabon makes it prone to flooding. Most of the barangays that frequently experience flooding due to high tide are located in the south/southwest areas, while those in the east/northeast areas are mostly flooded due to heavy rainfall (City of Malabon, 2018). The city's flooding experience

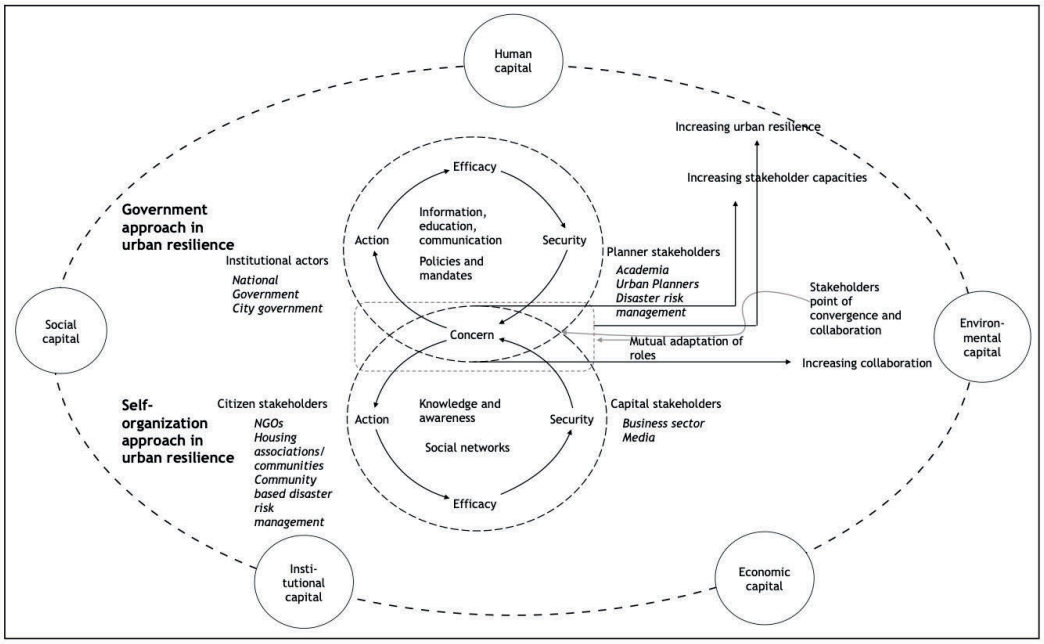
during the tropical storm Ketsana in 2009 and *Habagat* (southwest monsoon) led to studies by the Department of Environment and Natural Resources-Mines and Geosciences Bureau (DENR-MGB) on flood risk assessments. This study resulted in a flood susceptibility map, which classified parts of the city that would be most affected by low-level flooding to the worst-case scenario. Following these studies the city government implemented several programs and projects to address flooding. A Disaster Risk Reduction Management Office has also been institutionalized and equipped to strengthen their programs and projects on disaster risk reduction management.

4.2 CONCEPTUAL FRAMEWORK AND OPERATIONALIZATION OF VARIABLES

The conceptual framework presented in Chapter 3, shown here as Figure 4.1, was developed based on the literature review on urban resilience and collective engagement. The independent variables human, social, institutional, economic, and environmental capitals referred to as drivers of resilience were taken from the systematic literature review as well as from the socio-ecological systems framework. The conceptual framework highlights the main inquiry of the research which is how collective engagement contributes to urban resilience. The drivers of resilience envelope the two approaches to urban resilience via collective engagement (adaptive process). To break down and understand how to operationalize the variables, Figure 4.2 shows, the drivers of resilience as enveloping the entire process of collective engagement to urban resilience. The figure shows that the drivers of resilience (independent variable) and collective engagement with its two approaches are the intermediate variable as enveloped in the blue broken lined circle, while the dependent variable urban resilience is the green broken lined circle. The figure illustrates that the drivers of resilience have direct effects on collective engagement and urban resilience, and collective engagement on urban resilience.

In Chapter 2 the selection of indicators for each of the drivers of resilience followed three criteria (1) measurable at different levels of analysis (national, regional, city, community levels), (2) relevant to the type of disaster being investigated, and (3) includes elements of the criteria for assessing a resilient city. The preliminary selection based on the criteria and using the indicators derived from the systematic literature review and OECD Framework for Resilient Cities and 100 Resilient City are shown in Appendices 1, 2, 3, and 4. The preliminary list is shown in Table 4.1 shows the variables and indicators for the drivers of resilience.

Figure 4.1: Collective engagement urban resilience framework



Source: Author, 2018, 2021

Figure 4.2: Broken down collective engagement urban resilience framework to show independent, intermediate, and dependent variables relationships

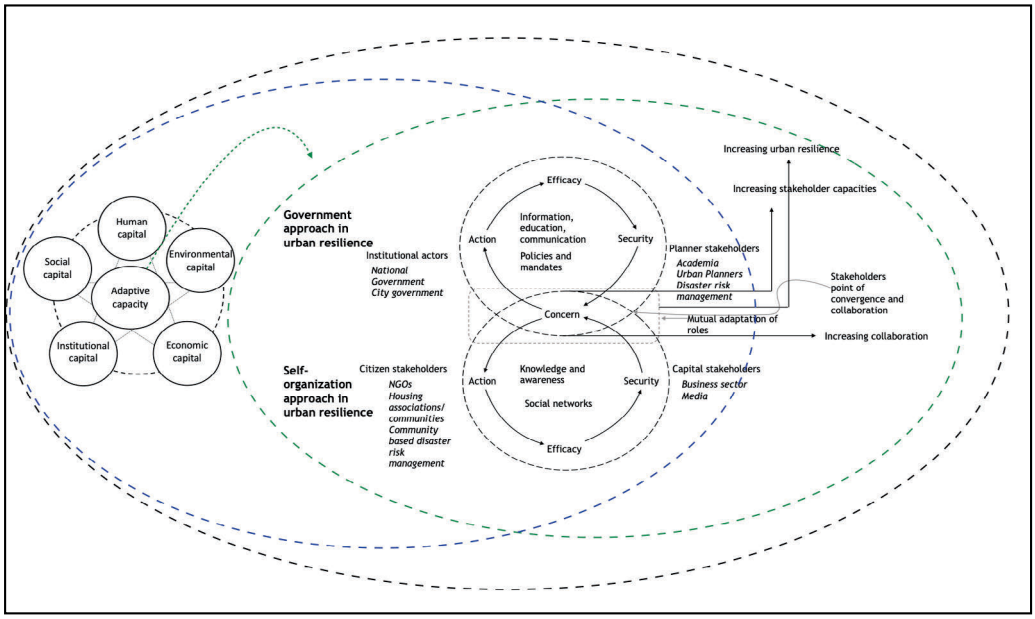


Table 4.1: Drivers of resilience selected variables and indicators

Drivers of resilience	Variables	Indicators	Sources
Human capital	Memory pathways	Resistance or resilience measures adopted by flood affected populations	Bhattacharya-Mis and Lamond (2014); Wilkinson, C. (2011); Picket, et al. (2013); Schwarz et al. (2011); Mehmood, A. (2015); Ainuddin and Routray (2012); Gotham and Campanella (2011); Wolfram, M. (2015); Sharifi and Yamagata (2016); Bahadur and Tanner (2013); Hooli, L.J. (2015); Djalante and Thomalla (2010); Chelleri, et al. (2015); Romero-Lankao and Gnatz (2013); Takeuchi et al. (2014); OECD, 2016a
	People (demographics)	Age Life stage Education Population	
Social capital	Capacity to adapt to external changes	Ability to conduct rebuilding work	Bhattacharya-Mis and Lamond (2014); McSweeney and Coomes (2011); Wolfram, M. (2015); Wilkinson, C. (2011); Hooli, L.J. (2015); Sharifi and Yamagata (2016); Picket, et al. (2013); Schwarz et al. (2011); Mehmood, A. (2015); Ainuddin and Routray (2012); Gotham and Campanella (2011); Wolfram, M. (2015); Sharifi and Yamagata (2016); Bahadur and Tanner (2013); Hooli, L.J. (2015); Djalante and Thomalla (2010); Chelleri, et al. (2015); Romero-Lankao and Gnatz (2013); Takeuchi et al. (2014); OECD, 2016a
	Self-organization	Multi-scale networks and connectivity Broad horizontal and vertical organizational ties which results to robust feedback mechanisms and allow informed decision-making.	
	Bridging connections to create opportunities of learning and cooperations	Rapid mobilization of resources for a timely recovery upon a disturbance	
	People's access to services	Access to services	
Institutional capital	Adaptive co-management and cross-scale interactions	Multi-level collaboration and multi-stakeholder participation and engagement in disaster risk reduction activities	Gotham and Campanella (2011); Sharifi and Yamagata (2016); Bahadur and Tanner (2013); Steiner F. (2014); Djalante and Thomalla (2010); Picket, et al. (2013); McSweeney and Coomes (2011); Schwarz et al. (2011); Ainuddin and Routray (2012); Wolfram, M. (2015); Chelleri, et al. (2015); Takeuchi et al. (2014); Wagner et al. (2014); Gunderson L. (2010); Wilkinson, C. (2011); Mehmood, A. (2015); OECD, 2016a
	Learning from disaster experience	Adapt institutional, legal and policy change to include adaptive capacity to build resilient cities Disaster risk reduction integrated in government investments and priorities	
	Adequate resources	Financial resources; Know and allocate or access funding flows for dealing with risks; National government provides organized support for local governments	
	Openness of the government to citizen's participation	Active citizen engagement	
Economic capital	Economic capital	Economic strength Number of employed residents by industry type	Ainuddin and Routray (2012); Schwarz et al. (2011); Wolfram, M. (2015); Chelleri, et al. (2015); Romero-Lankao and Gnatz (2013); Takeuchi et al. (2014); Sharifi and Yamagata (2016); OECD, 2016a; Djalante and Thomalla (2010); Gunderson L. (2010), L.; Wilkinson, C. (2011)
	Diverse industries and economy	Diversity of economic structure	
	Innovative industries, economy	Entrepreneuralism	
	Diverse workforce with diverse skills	Access to education and training	
Environmental capital	Built- and natural- capital	Natural resources sourced sustainably	Picket, et al. (2013); Mehmood, A. (2015); Sharifi and Yamagata (2016); Djalante and Thomalla (2010); Romero-Lankao and Gnatz (2013); Bahadur and Tanner (2013); Chelleri, et al. (2015); Steiner F. (2014); OECD, 2016a
		Development of physical structures or engineering techniques to reduce or avoid disaster impacts	
	Engineering/technical solutions	Long-term structural transformation (transitions)	
		Support for the use of green infrastructure (environmental conditions; social relations; economic incentives and constraints; political and regulatory systems)	
	Sustainable urban environment	Aligns with long-term sustainable urban development strategy	
		Pollution/emissions	

The preliminary list was pre-tested through an exploratory interview with (i) international development practitioners, and (ii) city planning officers and disaster risk management officers of the pilot pre-test cities. Formal introduction of the study and the data needs was done through a formal letter sent through email to the mayor's office of Malabon City and Marikina City (see Appendix 5 for a sample letter). The interviews done with the international development practitioners were unstructured interviews to seek opinion on which variables and indicators contribute to resilient city and collective engagement. The full preliminary list which includes the sub-indicators as shown in Chapter 2 as Table 2.11 was presented to and discussed with the interviewees. Similarly, the interviews done with the city planning officers and disaster risk management officers were unstructured but followed the main themes of the research, participation and engagement, collective concern, collective action, collective efficacy and collective security (see Table 4.2).

Table 4.2: Main themes used for the unstructured interviews (pre-test preliminary set of indicators)

Themes				
Participation and engagement	**Collective concern**	**Collective action**	**Collective efficacy**	**Collective security**
Participation of stakeholders in disaster risk management activities	Stakeholders knowledge on disaster risk management, preparedness, and evacuation	Involvement of communities, institutions in disaster risk management activities including training and/or drills	Types and frequency of disaster risk management activities	Infrastructure present in the city that help mitigate or adapt to disasters
Participation of stakeholders in urban planning activities	Stakeholders support to leaders and city development initiatives	Existence of networks of non-government organizations, civil society organizations	Leadership or political will	Manpower, equipment and facilities to address disasters
	Stakeholders initiative to take part of city development and disaster risk management	Community characteristics	Laws, mandates and plans in building a resilient city	Relocation and/or evacuation sites
		Community based disaster risk management units	Presence of the city and disaster risk management office online and social media handles	Natural resources available in the city
			Composition of the disaster risk management office	
			Economic growth of the city	
			Economic diversity	

4.2.1 Drivers of resilience

The drivers of resilience determine the pattern of collective engagement of the stakeholders. The drivers of resilience likewise indicate the adaptive capacity of the city to address a disaster or a disturbance and determines the ability of the city to adapt and transform thus build resilience. From the preliminary list of variables and indicators and results of the pre-testing of indicators, the salient indicators for the research for each of the drivers of resilience came out and were discussed in Chapter 3 and summarized in Table 4.3.

Table 4.3 is the basis for the assessment and quality of evidence scoring for the drivers of resilience which will be discussed in the next section. The table also forms the basis for

the interview questions for both collective engagement and urban resilience. Below is the explanation for each drivers of resilience.

Table 4.3: Drivers of resilience and indicators

Drivers of resilience	Indicators	Sources
Human capital	Memory-based disaster experience Demographic profile - age, life stage, population, education	Bhattacharya-Mis and Lamond (2014); Wilkinson, C. (2011); Picket, et al. (2013); Schwarz et al. (2011); Mehmood, A. (2015); Ainuddin and Routray (2012); Gotham and Campanella (2011); Wolfram, M. (2015); Sharifi and Yamagata (2016); Bahadur and Tanner (2013); Hooli, L.J. (2015); Djalante and Thomalla (2010); Chelleri, et al. (2015); Romero-Lankao and Gnatz (2013); Takeuchi et al. (2014); OECD, 2016a
Social capital	Social networks Community coalitions	Bhattacharya-Mis and Lamond (2014); McSweeney and Coomes (2011); Wolfram, M. (2015); Wilkinson, C. (2011); Hooli, L.J. (2015); Sharifi and Yamagata (2016); Picket, et al. (2013); Schwarz et al. (2011); Mehmood, A. (2015); Ainuddin and Routray (2012); Gotham and Campanella (2011); Wolfram, M. (2015); Sharifi and Yamagata (2016); Bahadur and Tanner (2013); Hooli, L.J. (2015); Djalante and Thomalla (2010); Chelleri, et al. (2015); Romero-Lankao and Gnatz (2013); Takeuchi et al. (2014); OECD, 2016a
Institutional capital	Existence of disaster risk management office Disaster risk management programs and projects Disaster risk management allocated budget and resources	Gotham and Campanella (2011); Sharifi and Yamagata (2016); Bahadur and Tanner (2013); Steiner F. (2014); Djalante and Thomalla (2010); Picket, et al. (2013); McSweeney and Coomes (2011); Schwarz et al. (2011); Ainuddin and Routray (2012); Wolfram, M. (2015); Chelleri, et al. (2015); Takeuchi et al. (2014); Wagner et al. (2014); Gunderson L. (2010); Wilkinson, C. (2011); Mehmood, A. (2015); OECD, 2016a
Economic capital	Economic diversity Business demography City gross domestic product	Ainuddin and Routray (2012); Schwarz et al. (2011); Wolfram, M. (2015); Chelleri, et al. (2015); Romero-Lankao and Gnatz (2013); Takeuchi et al. (2014); Sharifi and Yamagata (2016); OECD, 2016a; Djalante and Thomalla (2010); Gunderson L. (2010), L.; Wilkinson, C. (2011)
Environmental capital	Climate and disaster proof infrastructures Built up areas Available natural resources Open space	Picket, et al. (2013); Mehmood, A. (2015); Sharifi and Yamagata (2016); Djalante and Thomalla (2010); Romero-Lankao and Gnatz (2013); Bahadur and Tanner (2013); Chelleri, et al. (2015); Steiner F. (2014); OECD, 2016a

Human capital

Studies have shown that peoples perception of disaster risk depends on their disaster experiences and memories, this perception on risk is even more revealing on long term residents of disaster affected or disaster prone areas (Bhattacharya-Mis and Lamond, 2014; Wilkinson, C., 2011). Response to a disaster is dependent on the knowledge and understanding of the stakeholders and the community in general. Such, stakeholders respond to disasters in different ways given their experience to it. Human capital can be assessed through memory-based disaster experience, and their basic understanding of disaster risk management including risks, hazards and vulnerabilities.

Social capital

Three types of connectedness form the basis of social capital, bonding, bridging and linking ties (Putnam, 2000; OECD, 2001; Woolcock, 2001). Bonding ties exists within a group of individuals that co-identify such as ethnicity and religion (Pelling and High, 2005; Esteban, 2017). These are groups considered to be homogenous that forms filial relationships such as family, friends, and colleagues who share the same background (Esteban, 2017). Bridging ties forms the interrelationships of people with other groups within the community. It is the "social relationships of exchange . . . between people with shared interests or goals but contrasting social identity" (Pelling and High, 2005: 310). The third type of connectedness, linking social capital, has been considered as a sub-category of bridging ties (Putnam, 2000; Pelling and High, 2005; Esteban, 2017) refer to the vertical links that go beyond the boundaries of the group (Esteban, 2017).

Institutional capital

Institutions that have created a policy environment focusing on resilience and disaster risk management, participation, transparency, and communication allow action to become effective. Institutional capitals in this regard refer to the policies that mandates the city government to equip its stakeholders with the knowledge and information on disaster risk management. This includes the setup of city disaster risk management offices and its counterparts in the community, the programs and projects on disaster risk management, and the allocated budget to conduct such activities.

Economic capital

The type and level of economy gives room and resources to ensure effective action. Cities that have high economic capital have the resources to back up project and programs not just on disaster risk management but on the overall direction of the city. A diverse economy allows a city to become resilient because it is not dependent on one economic sector. It also provides employment for people in a variety of industries. A well-developed

economic environment allows the city and its stakeholders to become much more self-reliant. The city enjoying a well-developed economy have the resources to provide the necessary services to its stakeholders.

Environmental capital

Environmental capital cover both the built and natural capitals of a city. The extent to which the government has implemented disaster risk management projects is indicative to the amount of built infrastructure or structural measures constructed. The vulnerability and capacity of the city can also be measured physically through the type of infrastructure built to adapt or mitigate disasters, and the amount of natural resources available.

4.2.2 Assessing collective engagement and urban resilience

Collective engagement is defined in this study as, a collaborative process participated in by multiple stakeholders to arrive at a solution or decision to increase urban resilience, it can be done through both formal and informal means over a long period, and is characterized by reciprocity, trust and mutual respect between and among state and non-state stakeholders. In the conceptual framework of this study (collective engagement urban resilience framework) there are two approaches, the government approach and the self-organization approach. These two approaches may follow a different direction but go through the same collective dimensions.

In this research collective engagement is further emphasized as a continuous process of engagement and its effectivity to attain urban resilience depends on three main elements:

1. Strong information and education on disaster management is provided and accessible to all stakeholders;

2. Strong social networks of stakeholders that are collectively involved and tied to the city and its vision to become resilient; and

3. The government and the stakeholders must understand the need to have a cohesive community in order to address disasters.

Given the above, collective engagement includes putting together various actors at different levels and sectors contributing to the functions of the city before, during and after a disaster or disturbance. It involves making all actors (government, citizens, private and public sectors) conscious of their roles and their position in building urban resilience. Table 4.4 taken from Chapter 3 indicate that urban resilience is a process rather that an outcome. As such, the different dimensions of collective engagement show different levels of urban resilience. Based on the indicators derived from the previous

exercise and Table 4.4, the operationalization of collective engagement and urban resilience is shown in Table 4.5 and 4.6, respectively.

Table 4.4: Collective engagement dimension vis-a-vis urban resilience

Dimensions	Description	Urban resilience level	Indicators
Collective Concern	Stakeholders remember and learn from past disaster events. Stakeholders translate this experiential knowledge to local adaptation measures and through engaging in networks.	Shared vision and concern in making the city resilient. Issues are identified, defined, and understood.	• Local adaptation measures • Volunteering
Collective Action	Stakeholders are aware of and understand the basics of disaster risk management. The city's willingness to delegate authority and resources to the local level and a working multi-sectoral structure for reducing and managing disaster risk.	Shared understanding and agreement of the issues that the city is facing and the need to find solutions and take action.	• Accessible relevant information on disaster risk reduction and management to all stakeholders • Citizen led-activities on disaster risk management
Collective Efficacy	Informed and educated stakeholders on disaster risk management. Disaster preparedness plans and contingency plans are in place. Conduct of regular training and emergency drills.	Increased knowledge and agreement among stakeholders on solutions.	• Disaster risk reduction and management are included in the school curriculum, educational materials and trainings. • Early warning systems are in place for all major hazards in the city. • Regular training and emergency drills are conducted.
Collective Security	Mutual adaptation of roles of stakeholders in working towards resilience. Behavior change of people towards becoming disaster-risk aware reinforced through continuous IEC.	High disaster risk awareness of stakeholders.	• City-wide information, education, and communication strategy exists to increase awareness and stimulate a culture of disaster resilience • Coordinated disaster risk management across levels.

Source: Author, 2018

Table 4.5: Collective engagement operationalization

				Guide questions	
Collective engagement dimensions	**Descriptions**	**Variables**	**Indicators**	**Government approach**	**Self-organization approach**
Collective concern	Stakeholders remember and learn from past disaster events. Stakeholders translate this experiential knowledge to local adaptation measures and through engaging in networks.	Human capital	Memory-based disaster experience	Q1.1 What types of flooding disasters do you remember that hit the city? When did this happen?	Q3.1 What types of flooding disasters do you remember that hit the city? When did this happen?
				Q1.2 How did the disasters affect the city that time? What did the government do that time?	Q3.2 How did the disasters affect the city that time? What did the community do that time?
			Experiential knowledge	Q1.4 What are the local adaptation measures (local knowledge in managing floods) of the community?	Q3.4 What are the local adaptation measures (local knowledge in managing floods) of the community?
				Q1.5 Based on experience from past disasters, please give an example(s) of how the city now prepare for and/or respond.	Q3.5 Based on your experience from past disasters, please give an example(s) of how the community now prepare for and/or respond.
Collective action	Stakeholders are aware of and understand the basics of disaster risk management. The city's willingness to delegate authority and resources to the local level and a working multi-sectoral structure for reducing and managing disaster risk.	Social capital	Social networks and coalitions	Q1.9 Is there an organized group within the local community that work on disaster preparedness/response and management? Are these local community organized groups recognized by the city government?	Q3.9 Is there an organized group within the local community that work on disaster preparedness/response and management? Are these local community organized groups recognized by the city government?
				Q1.10 What are the locally initiated disaster preparedness/ reponse and management activities of these organized groups?	Q3.10 What are the locally initiated disaster preparedness/ reponse and management activities of these organized groups?
				Q1.11 Who within the city/communities are more involved in these activities?	Q3.11 Who within the city/communities are more involved in these activities?
			Volunteering	Q1.6 Are there volunteer groups on disaster preparedness and response in your city?	Q3.6 Are there volunteer groups on disaster preparedness and response in your city?
				Q1.7 Why do you think these volunteer groups emerged? How did they emerge?	Q3.7 Why do you think these volunteer groups emerged? How did they emerge?
				Q1.8 What kind of activities (programs and projects) in the city do the volunteers participate in?	Q3.8 What kind of activities (programs and projects) in the city do the volunteers participate in?
		Institutional capital	Existence of disaster risk management office	Q1.39 Are there community based disaster risk management units in your city?	Q3.36 Are there community based disaster risk management units in your city?
				Q1.40 Are the community based disaster risk management offices composition the same as the main DRRM office? Is there a guideline in the composition of committees and technical working group?	Q3.37 Are the community based disaster risk management offices composition the same as the main DRRM office? Is there a guideline in the composition of committees and technical working group?
				Q1.41 What are the requirements for the community based disaster risk management for each community/village?	Q3.38 What are the requirements for the community based disaster risk management for each community/village?
			Involvement of stakeholders in disaster risk management	Q1.20 Are the stakeholders involved in the decision-making process in the development of these plans? How are they involved?	Q3.18 Is your community involved in the decision-making process in the development urban plans and disaster management plans? Through which way is your community involved?
				Q1.21 How deep is their involvement in the decision-making process and in the implementation of the plans and activities?	Q3.19 Does you community coordinate with the government and other sectors (private, academe, technical experts, et. al.) to discuss these development plans? How do you coordinate?
				Q1.22 How do stakeholders coordinate with each other in the decision-making process of the plans?	Q3.21 How do different groups in your community coordinate to seek help people affected by flooding? Is there a central meeting place to coordinate assistance? Where is it and does everyone know about it?

Table 4.5: Collective engagement operationalization (continuation)

				Guide questions	
Collective engagement dimensions	**Descriptions**	**Variables**	**Indicators**	**Government approach**	**Self-organization approach**
				Q1.23 What do you see are the challenges and barriers in coordinating and communicating between government, NGOs, other stakeholders and the community? What do you think can the your city do to improve coordination and communication with your organization/institution?	Q3.22 What do you see are the challenges and barriers in coordinating and communicating between government, NGOs, other stakeholders and your community? What do you think can the government do to improve coordination and communication with your community? How about your organization? What do you think can your organization do to improve coordination and communication? Do you think you need to do something about it?
Collective efficacy	Informed and educated stakeholders on disaster risk management. Disaster preparedness plans and contingency plans are in place. Conduct of regular training and emergency drills.	Economic capital	Allocated budget for community disaster risk management	Q1.17 How much support does the city government give to the disaster risk management office and the community counterparts? What kind of support is provided to them?	Q3.17 How much support does the city government give to the disaster risk management office and the community counterparts? What kind of support is provided to them?
				Q1.18 How much is the budget allocated by the city government on the disaster risk management office and its programs and projects? Is this enough for the city/ community?	
		Human capital	Disaster knowledge	Q1.24 Aside from flooding what other disasters or dangers do you see in your city? What makes your city vulnerable to hazards?	Q3.23 Aside from flooding what other disasters or dangers do you see in your city? What makes your city vulnerable to hazards?
				Q1.25 Are people concerned with these disasters? Why do you say that? (as follow up)	Q3.24 Are people concerned with these disasters? Why do you say that? (as follow up)
				Q1.26 Is disaster management and training included in the school curriculum? Is it supported by law? What laws support this? How does the city government ensure that this is followed by the schools?	Q3.25 Is disaster management and training included in the school curriculum? Does your community follow this? Have your received information on this or attended?
				Q1.31 Aside from trainings in the communities/villages, what else are your information and communication strategies?	Q3.26 How does the community receive information about disasters or emergency situations?
Collective security	Mutual adaptation of roles of stakeholders in working towards resilience. Behavior change of people towards becoming disaster-risk aware reinforced through continuous IEC.	Institutional capital	Disaster risk management programs	Q1.33 What strategies does the city government use to maintain communication with the stakeholders? Are there any technologies, tools, social media used to support the communication between the city government and stakeholders?	Q3.30 What does the city government do to increase stakeholders awareness and preparedness on disasters?
		Environmental capital	Evacuation area	Q1.43 What infrastructure measures have your city undertaken to help prevent, mitigate or adapt to disasters?	Q3.40 Are there private property owners who allow their properties to be used as evacuation sites? Is there a regular agreement with them?

Table 4.6: Urban resilience operationalization

				Guide questions	
Collective engagement dimensions vis-a-vis urban resilience	**Descriptions**	**Variables**	**Indicators**	**Government approach**	**Self-organization approach**
Collective concern	Shared vision and concern in making the city resilient. Issues are identified, defined, and understood.	Human and social capitals	Risk and resilience perspective	Q1.3 What are the key drivers of change and threats to your city?	Q3.3 What are the key drivers of change and threats to your city?
				Q1.45 How do you define resilience? What makes a city resilient? Do you think it is necessary for a city to build resilience? Why and why not? And in what way can a city build resilience?	Q3.41 How do you define resilience? What makes a city resilient? Do you think it is necessary for a city to build resilience? Why and why not? And in what way can a city build resilience?
				Q1.46 Which factors are important to develop urban resilience?	Q3.42 Which factors are important to develop urban resilience?
				Q1.47 What do you think can urban resilience add to your city? How does it relate to urban planning and disaster risk management?	Q3.43 What do you think can urban resilience add to your city? How does it relate to urban planning and disaster risk management?
				Q1.48 What are the challenges in incorporating resilience thinking in urban development and planning? How do you think can this be overcome? Do you think that resilience thinking should even be incorporated in urban development and planning?	Q3.44 Is building resiliency an important element in your plan right now as a city? How do you see the city achieve this?
Collective action	Shared understanding and agreement of the issues that the city is facing and the need to find solutions and take action.	Social capital	Partnership and collaboration	Q1.50 How can we ensure that other stakeholders become partners in making the city resilient? What support can be given to them?	Q3.46 What role does leadership, trust, social capital, and natural and built capital play in urban resilience?
				Q1.51 What approach will be most effective to strengthen local capacity for disaster preparedness in your city?	Q3.47 What approach will be most effective to strengthen local capacity for disaster preparedness in your city?
				Q1.52 What role does leadership, trust, social capital, and natural and built capital play in urban resilience?	
Collective efficacy	Increased knowledge and agreement among stakeholders on solutions.	Institutional capital	Enabling environment	Q1.12 Do you think disaster (risks, hazards) and vulnerability influence government policies? How does it influence government policies? How do you think are policies on disaster management, urban planning and resilience influenced by economic investment and politics?	Q3.12 Do you think disaster (risks, hazards) and vulnerability influence government policies? How does it influence government policies? How do you think are policies on disaster management, urban planning and resilience influenced by economic investment and politics?
				Q1.13 Is there a national policy placing more emphasis on urban resilience or resilient city, if so, why? Has your city adopted this in your city development plans? How? Which documents?	Q3.13 Does your city focus and prioritize urban resilience and disaster risk management and planning? How do your think they do this?
				Q1.14 Is there a law from the national government mandating the creation of a disaster risk reduction management office for each city? Do you think that even without this law, your city will create a disaster risk reduction management office?	Q3.14 Who are in charge and involved in disaster risk management planning and urban planning in your city? Who has the highest authority to manage the city development plan and disaster risk management plan?
				Q1.15 What are the fundamental policy instruments on disaster risk management and planning in your city?	Q3.15 Does the community have its own policies, laws or regulations on disaster preparedness and response?
		Social capital	Available information on disaster risk management	Q1.29 How do you equip the people with the knowledge and build their resiliency? And inform them on the causes of flooding and disasters?	Q3.28 Are there IEC and ICT campaigns that your organization access on disaster management (preparedness and response)? What kinds of campaigns are these? How do you access this?
				Q1.30 What are your ICT campaigns? Who are your targets? What kinds of campaigns do you have? How is it disseminated?	Q3.29 Are the people now more aware on why there is flooding and their contribution to it? What are your campaigns on that?

Table 4.6: Urban resilience operationalization (continuation)

				Guide questions	
Collective engagement dimensions vis-a-vis urban resilience	**Descriptions**	**Variables**	**Indicators**	**Government approach**	**Self-organization approach**
Collective security	High disaster risk awareness of stakeholders.	Environmental capital	Coordinated disaster risk management	Q1.43 What infrastructure measures have your city undertaken to help prevent, mitigate or adapt to disasters?	Q3.39 Does each community based disaster risk management unit have a plan that they update annually? How is it linked to the city plan?
				Q1.44 Is your city equipped with manpower, equipment and facilities to meet flooding disasters?	
		Social capital	Awareness and preparedness	Q1.34 Do people respond to disasters depending on the magnitude of the disaster? Is their response also different based on where people live and what resources are available to them? For instance, are populations living at the edge of urban environmental boundaries (coast, rivers, cliffs, mountain slopes, forests, industrial areas) more or less resilient to shocks and surprise than those living near the urban core? Why and why not?	Q3.32 Do people respond to disasters depending on the magnitude of the disaster? Is their response also different based on where people live and what resources are available to them? For instance, are populations living at the edge of urban environmental boundaries (coast, rivers, cliffs, mountain slopes, forests, industrial areas) more or less resilient to shocks and surprise than those living near the urban core? Why and why not?
				Q1.32 Are the people now more aware on why there is flooding and their contribution to it? What are your campaigns on that?	Q3.29 Are the people now more aware on why there is flooding and their contribution to it? What are your campaigns on that?

4.3 STRATEGIES AND PROCEDURES FOR DATA COLLECTION

The explanatory nature of the research necessitated the collection of primary and secondary data to help build the story of each of the case cities' journey of collective engagement and building urban resilience. The secondary data sourced included policies, historical archives, news and media related literature, as well as project documents and evaluations. Primary data was sourced using key informants interviews (KII) of key actors in the city. The secondary and primary data collected in this research are useful in triangulating the findings and developing analytical generalizations. The succeeding sections shed light on the procedures undertaken in the data collection. 4.3.1 Secondary data gathering

Secondary data gathering is necessary at this stage to have a historical account of the experience of the city on disaster, disaster management, urban planning, and transformation to gain a general understanding of the role of the city government and the stakeholders. It is important to gather information on both the historical accounts and the current initiatives of the city to gain insight on the transformation process. Since the process of transformation based on the conceptual framework is dynamic and iterative it is important to identify points in time and factors leading to the process that falls within the collective dimensions. Further, documents derived at the secondary data gathering stage will lead to important players in city development. Analysis of the secondary data gave a general picture of process and experience of the city that can be further investigated during the primary data gathering.

4.3.2 Primary data gathering

Qualitative tool

The key informants interview (KII) was applied for the research. The KII was designed for key actors that fall within the groups of stakeholders institutional actors, capital, citizens, planners outlined in Table 3.4 in the previous chapter. These key actors are in city development, urban planning, and disaster risk management (e.g. mayor, city council, city planner, volunteer groups on disaster risk management, research institutions, etc.). As also shown in the conceptual framework the stakeholders work towards two types of approaches in urban resilience, the government approach and the self-organization approach. As such the stakeholders interviewed fall under these two categories.

The semi-structured interview guide was used for the KII and included variables under each collective dimensions to draw out collective experiences on the city's transformation process in relation to flooding disaster. The semi-structured interviews were constructed

to have open ended questions to allow interviewees to explain and provide new ideas that can be explored in the research.

Content validity and pre-testing of interview guide

The qualitative tools went through a content validity test where expert opinion from the supervisors were sought to assess each question in the semi-structured interview guide. The interview guide was pre-tested using a captive audience of graduate students and university staff, including two recent graduates outside the Netherlands interviewed via Skype. This is done prior to conducting the actual KII in the field study. After the pre-testing, the pre-test respondents opinions on clarity of the questions was sought. Comments and suggestions was also sought specifically on how to phrase the questions that appear to be unclear. These comments and suggestions helped improve the interview guide. The pre-test also helped in measuring the time needed to conduct the KII. Table 4.7 shows the results of the pre-test interview guide.

Table 4.7: Pre-test result for the interview guide

Interviewees	Medium	Time (minutes)
University staff	Face-to-face interview	19
Graduate student	Face-to-face interview	34
Recent graduate	Skype	37.47
Recent graduate	Skype	74.20
Graduate student	Face-to-face interview	63.58
Total average time		45.65
Total average time face-to-face		38.86
Total average time Skype		55.84

Field survey

After the final adjustment of the interview guide to improve the clarity of the questions, the key informants were identified based on the involvement in city development and planning, and disaster risk management expertise. The initial identified KII respondents were contacted to schedule interviews first through a formal letter sent via email and facsimile. This is similar to the steps done during the pre-testing of indicators. Constant follow-up was needed to schedule either the face-to-face or Skype interviews.

The KIIs were conducted from November 2018 to March 2019, specifically from November 2018 to February 2019 for the Rotterdam and Dordrecht cases, and November to December 2018 (remotely via Skype) and March 2019 (face-to-face key informants group interviews) for the Marikina and Malabon cases. Validation of the results of the KII was done after the interview by sending back the transcript to the respondents. Respondents were requested to review and confirm that the transcripts are in order within one week upon receipt. No response is assumed as a confirmation.

4.3.3 Sampling strategy and participants

The KII targeted key knowledgeable persons in city development and planning, and disaster risk management. A target of 13 persons for each city with a maximum of 20 persons were interviewed. Using the snowball sampling each KII respondent were asked to recommend one or two persons to be interviewed until the target of at least 13 respondents was reached. A total of 63 persons were interviewed for the four cases, 19 in Rotterdam, 14 in Dordrecht, 14 in Marikina and 16 in Malabon. Most of the interviewees were institutional actors, followed by residents and planners. Table 4.8 shows the breakdown of stakeholders interviewed in the four cases.

Table 4.8: Stakeholders interviewed in Rotterdam, Dordrecht, Marikina and Malabon

Stakeholders	Rotterdam	Dordrecht	Marikina	Malabon	Total
Institutional Actors	9	6	4	8	**27**
Capital	2	1	0	0	**3**
Citizens	6	1	6	5	**18**
Planners	2	6	4	3	**15**
Total	**19**	**14**	**14**	**16**	**63**

Institutional actors interviewed were from the city governments and other government organizations working with the city. The city government is responsible for setting the city's direction through policies and programs. They are responsible for developing strategies and solutions on urban planning, flood risk management, crisis coordination and management, climate change, communicating with stakeholders, and implementing programs and projects. Other government organizations interviewed were the *waterschap* for the Dutch cases and the Philippine National Police and the Bureau of Fire Protection for the Philippine cases. Planners interviewed are members of the academe and the *veiligsheidsregio* (Dutch case). The *veiligsheidsregio* is responsible for crisis management, disaster relief, fire brigade care and medical assistance.

The academe provides guidance on urban planning, disaster risk management and urban resilience. They also contribute valuable academic research on the city cases. Members of the academe interviewed for the Dutch cases were from TU Delft, Rotterdam University of Applied Science, UN-IHE Delft, and Erasmus University Rotterdam. For the Philippine cases academics interviewed were from the University of the Philippines and the Manila Observatory who have conducted studies on flood and climate change and urban planning in the city, and the local university in Marikina *Pamantasan ng Lungsod ng Marikina* (PLM).

Citizen stakeholders interviewed were the residents and non-government organizations in the city cases. The residents are important stakeholders since they are the direct users and beneficiaries of the development or non-development of the city. They are responsible to make sure that services are provided to the citizens and inefficiencies are addressed therefore they are responsible to take part in the city's development. At the community level residents are responsible to be vigilant and to improve the community environment. Non-government organizations are responsible for various advocacies and issues. Capital stakeholders interviewed for the Dutch cases were from the Port Authority and the architectural firms. There were no capital stakeholders interviewed in the Philippine cases because the citizen stakeholders and planners interviewed were also business owners in the city cases. Appendix 6 shows the stakeholders and their roles in the four case cities - Rotterdam, Dordrecht, Marikina and Malabon.

4.3.4 Research instruments

There are three levels of assessments in the research, (1) understanding the city's disaster experience; (2) the level of collective engagement that the city has gone through; and (3) the role of the stakeholders participation, awareness and self-organization in reaching the level of collective engagement, as such it is necessary to design the interview guides according to these main thematic areas.

The semi-structured interview guide is divided into five sections and contains open-ended questions. Careful attention was given in the sequencing of the questions according to the conceptual framework and ensuring that the variables were included in the line of questioning. Comments, suggestions and feedback from the interview guide pre-test participants were taken into consideration in the revision of the interview guide for coherence and clarity of the questions. Table 4.9 shows the general sections and selected key open-ended questions in the interview guide. Appendix 7 shows the sample interview guide for institutional actors.

Table 4.9: General sections and selected key open-ended questions in the interview guide

General sections	Questions
Disaster experience, knowledge and awareness	What types of flooding disasters do you remember that hit the city? When did this happen?
	What are your disaster risk management activities?
	Aside from flooding what other disasters or dangers do you see in your city? What makes your city vulnerable to hazards?
Self-organization and social networks	Is there an organized group within the local community that work on disaster preparedness/response and management? Are these local community organized groups recognized by the city government?
	Are there volunteer groups on disaster preparedness and response in your city?
	How involved are the city stakeholders, communities in disaster risk management activities? What do they contribute?
Policies and mandates	Do you think disaster (risks, hazards) and vulnerability influence government policies? How does it influence government policies? How do you think are policies on disaster management, urban planning and resilience influenced by economic investment and politics?
	Is there a national policy placing more emphasis on urban resilience or resilient city, if so, why? Has your city adopted this in your city development plans? How?
	How much support does the city government give to the disaster risk management office and the community counterparts? What kind of support is provided to them?
Collaboration and communication	Are the stakeholders involved in the decision-making process in the development of these plans? How are they involved?
	What strategies does the city government use to maintain communication with the stakeholders? Are there any technologies, tools, social media used to support the communication between the city government and stakeholders?
Urban resilience	How do you define resilience? What makes a city resilient? Do you think it is necessary for a city to build resilience? Why and why not? And in what way can a city build resilience?
	Which factors are important to develop urban resilience?
	How can we ensure that other stakeholders become partners in making the city resilient? What support can be given to them?

4.3.5 Data analysis and report writing

Each interviewed stakeholders were coded according to stakeholder category and interview date to maintain their anonymity. The final validated findings from the KII were cross-referenced with secondary data. The qualitative data gathered through the KII were collated, reviewed and processed using Atlasti software. Analysis of the qualitative interview results were in the form of a narrative. As mentioned at the beginning of this chapter, the research method used is a case study approach which is an appropriate

method of distilling the 'how's' and 'why's' of the phenomenon surrounding the interconnection between collective engagement and urban resilience.

Specifically, the research uses a comparative case study approach which systematically compares two or more cases (Kaarbo and Beasley, 1999) to analyze similarities and differences as well as patterns of a phenomenon. The comparative case study approach looks at "three axes [of comparison, vertical, horizontal,] and transversal" (Bartlett and Vavrus, 2017: 5). The vertical axis refer to the comparisons across levels or scales, horizontal axis refer to the unfolding of the phenomenon in the case, and transversal axis refer to the historical process. In this research, these three axes are interpreted as the linkages or relationships in the cases which is similar to the hierarchy of embeddings referred to by Marcus and Colding (2011). Using the same approach as Mookherji and LaFond (2013) the city cases went through within-case (single case) and cross-case (across cases) analysis to generate analytical generalizations. Within-case (single case) vertical comparisons looked at the policies that emanated from the disaster experience, how the national government reacted policy-wise and how these policies were translated at the city and community levels. Horizontal comparison can be done two ways, within the case city which will look at the government and self-organization approaches under the collective engagement urban resilience framework, and cross-case between the case cities within country. Lastly, transversal comparison looks at the intersections between collective engagement and urban resilience within and across case cities given the timescale.

The use of the comparative case study approach in this research allows comparisons in the areas of convergence and divergence in the process of collective engagement and urban resilience. The within-case analysis was done for each of the city cases to identify whether the drivers of resilience influenced the collective engagement in the city, and to analyze the nested hierarchies where the city as a socio-ecological system interact. The within-case analysis must be able to draw up three levels of assessments: (1) understanding the city's disaster experience; (2) the government approach in addressing flood risk management including the policies which served as the backbone on how the city worked on the preventive as well as adaptive measures; and (3) the role of the stakeholders participation, awareness and self-organization in reaching the level of collective engagement. Understandably each case will form different narratives in the process of urban resilience but there will also be some similarities. These similarities will be distilled and identified in the second phase of analytical generalization, which entails identifying repeated observations and varying interpretation across cases. The goal here is to determine the common drivers in the transformation process of the city to reach a level of urban resilience. Lastly, the results and findings from the cases will be synthesized. Each of the common drivers in the previous process may have a variety of situations that makes it a successful driver in the transformation process this will then be included in this last process. Differences of the cases will also be included to form cross-case comparisons, as

well as an assessment based on the level of urban resilience the city has achieved so far. In doing these cross-case comparisons an analysis on the causal relationship of the drivers of resilience with collective engagement can be drawn out and concluded.

4.3.6 Scoring method and empirical conclusions analysis

The empirical conclusions chapter (Chapter 11) brings together the four case cities. Using a qualitative scoring method it will analyze the relationship between the drivers of resilience and collective engagement and urban resilience. There are two levels of scoring first level is on the drivers of resilience which is scored using numeric scores 1 to 5. The rating has an equivalent qualitative score description as a main guide in finding a quality of evidence (see Table 4.10). The scores will be tallied to get the total and further classified into 3 ratings similar to the logic applied by Cesario, et. al. (2001) in using the quality of evidence rating. In this study the ratings are high, medium and low, where high represent the range 4<5 evidence or drivers of resilience show evidence on the city's adaptive capacity, medium represent 2<4 evidence or drivers of resilience show some evidence on the city's adaptive capacity, and low at 0<2 evidence or drivers of resilience show little evidence on the city's adaptive capacity (see Table 4.11).

The second level of scoring is in relation to the propositions outlined in Chapter 3, which is focused on collective engagement and urban resilience. The same qualitative scoring method will be applied using numeric scores 1 to 5 accompanied by equivalent score descriptions (see Table 4.12). The total scores will likewise be tallied and classified based on the quality of evidence rating high, medium and low. High refer to the range 4<5 evidence or collective engagement show evidence on the contribution to urban resilience, medium represent 2<4 evidence or collective engagement show some evidence on the urban resilience, and low at 0<2 evidence or collective engagement show little evidence on the urban resilience (see Table 4.11).

Table 4.10: Drivers of resilience qualitative score description

Indicator	Indicator Logic	Scores	Qualitative scoring description
Human capital			
Memory-based disaster experience	Studies revealed that people with long term residency in a disaster affected area refer to disaster experiences and memories on their perception of disaster risk (Bhattacharya-Mis and Lamond, 2014; Wilkinson, C., 2011).	5	Flood disaster experience translated to preparation and risk awareness.
		4	Flood disaster experience translated to awareness of risks and vulnerabilities.
		3	Flood disaster experience translated to some awareness of risks.
		2	Flood disaster experience normalized.
		1	Flood disaster experience remembered.
Social capital			
Social capital	Three types of connectedness form the basis of social capital, bonding, bridging and linking ties (Putnam, 2000; OECD, 2001; Woolcock, 2001).	5	Bonding, bridging and linking ties present from the community to city levels and extends to the regions.
		4	Bonding, bridging and linking ties present at the city and community levels.
		3	Bonding, bridging and linking ties present at the community level.
		2	At most two, bonding, bridging and linking ties present at the community level.
		1	None or weak presence of bonding, bridging and linking.
Institutional capital			
Policies	Institutions that have created a policy environment focusing on resilience and disaster risk management, participation, transparency, and communication allow action to become effective. Institutional capitals in this regard refer to the policies that mandates the city government to equip its stakeholders with the knowledge and information on disaster risk management.	5	Policies from the national government on disaster risk management translated/understood at all levels from national to community level.
		4	Policies on disaster risk management from the national government translated/understood to policies until the city level.
		3	Policies on disaster risk management from the national government translated/understood until regional level.
		2	Policies on disaster risk management partially present.
		1	Policies on disaster risk management not present.
Economic capital			
City gross domestic product	The gross domestic product (GDP) is the expenditure on final goods and services (OECD, 2018d) and measures the wealth of the city. The percent of the city's GDP in comparison to the country denotes the economic standing of the city in the country. The GDP of the city in comparison to the country's GDP is scored non-linearly where the narrower the gap between the two appears better.	5	The difference of the city GDP to the country GDP is less<21 in ratio/ percentage.
		4	The difference of the city GDP to the country GDP is 21<41 in ratio/ percentage.
		3	The difference of the city GDP to the country GDP is 41<61 in ratio/ percentage.
		2	The difference of the city GDP to the country GDP is 61<81 in ratio/ percentage.
		1	The difference of the city GDP to the country GDP is 81 above in ratio/ percentage.
Economic diversity	A diverse economy allows a city to become resilient because it is not dependent on one economic sector. It also provides employment for people in a variety of industries.	5	City meets expected economic diversity.
		4	City moderately meets expected economic diversity.
		3	City has an emerging diverse economy.
		2	City has more than one economic source.
		1	Single economic source.
Environmental capital			
Climate and disaster proof infrastructures	The presence of climate and disaster proof infrastructures built in the city indicate the level and type of structural measures taken to mitigate and/or adapt to impending disasters. Infrastructures with the same type of functions indicate a fail-safe level.	5	Presence of triple redundant hard preventive infrastructures and climate-adaptive measures.
		4	Presence of hard preventive infrastructures and climate-adaptive measures that the city utilizes for the benefit of all.
		3	Presence of hard preventive infrastructures.
		2	Presence of climate-adaptive measures only in pocket developments.
		1	No hard preventive infrastructures or climate-adaptive measures.
Built up area	The percent of built-up areas to the area of the city highlight the city's density and exposure to hazards. The amount of built up areas increases the exposure of the population to risks. While it is understood that quality of infrastructure can be made better by either climate or disaster proofing measures, what is being measured by this indicator is the amount of exposure of the population to risks. Built up areas are scored inversely such that the score 5 has the lowest percentage of built up area, and 1 has the highest percentage. This denotes that a lower percentage of built up area is better in terms of vulnerability and exposure to risk.	5	The percent of built-up areas to the total area of the city is 1<21.
		4	The percent of built-up areas to the total area of the city is 21<41.
		3	The percent of built-up areas to the total area of the city is 41<61.
		2	The percent of built-up areas to the total area of the city is 61<81.
		1	The percent of built-up areas to the total area of the city is 81 above.

Table 4.11: Quality of evidence rating

Rating	Range	Level 1 scoring (drivers of resilience)	Level 2 scoring (collective engagement and urban resilience
High	4<5	Drivers of resilience show evidence on the city's adaptive capacity	Collective engagement show evidence on the contribution to urban resilience
Medium	2<4	Drivers of resilience show some evidence on the city's adaptive capacity	Collective engagement show some evidence on the contribution to urban resilience
Low	0<2	Drivers of resilience show little evidence on the city's adaptive capacity	Collective engagement show little evidence on the contribution to urban resilience

Table 4.12: Collective engagement and urban resilience qualitative score descriptions

Indicator	Indicator Logic	Scores	Qualitative scoring description
Perception of risk and resilience	Perception of risk and resilience determines whether these concepts are understood and translated to disaster risk reduction and management actions.	5	Perception of risk and resilience translate to learning and improving knowledge on disaster risk reduction and management.
		4	Perception of risk and resilience translated to disaster risk reduction and management activities.
		3	Perception of risk and resilience translated to moderate understanding of disaster risk reduction and management.
		2	Perception of risk and resilience translated to some understanding of disaster risk reduction and management.
		1	Limited understanding on risks and resilience.
Influence of information and education on collective engagement and urban resilience	Information, education and communication platforms contributes to knowledge and awareness and helps in strengthen capacities for collective engagement. Strengthens local knowledge and disaster experience learning.	5	Local knowledge and local adapation measures combined with knowledge sharing within networks
		4	Demonstrable local knowledge and local adaptation measures
		3	Adequate local knowledge and local adaptation measures
		2	Some local knowledge and local adaptation measures
		1	Absence or poor local knowledge on how to address flooding
Influence of social networks on collective engagement and urban resilience	Strength and reach of social networks increase the collective engagement of stakeholders through networking and engaging in discussion and activities on DRRM.	5	Very high presence of social networks at all levels of stakeholders on DRRM. Engagement at all levels from community to city level.
		4	High presence of social networks at all levels of stakeholders on DRRM. Engagement at all levels from community to city level.
		3	Moderate presence of social networks at all levels of stakeholders on DRRM. Engagement at all levels from community to city level.
		2	Presence of social networks on DRRM. Engagement at the community level.
		1	Low presence of social networks on DRRM.
Mutual adaptation of roles in disaster risk management	Government and non-government actors recognize their mutual role in DRRM	5	Locally organized groups recognized by the government and working with local government.
		4	Presence of housing associations, community organizations and volunteers.
		3	Presence of both housing associations and community organizations
		2	Presence of organized groups such as housing or community associations.
		1	No presence or weak presence of organized groups.

4.4 CHAPTER CONCLUSION

The information derived from the KII and secondary data will paint a clearer, wholistic, and factual picture on the resilient city transformation of the case cities. The qualitative data derived from the KII will be processed using Atlasti. Secondary data will provide further support to the information derived from the KII. Three levels of analysis will be done to generate an analytical generalization of the cases. First, the within-case analysis will be done to identify the level of collective engagement of the city in relation to urban resilience. Second, the cross-case common theme identification is done to identify and distill similarities of the cases. Lastly, the cross-case synthesis will give the general overview of the transformation process and provide an assessment of the city case urban resilience level.

The end result of the analytical generalization is the main narration of evidence structured in such a way that it will answer the main aims of the research which are (1) understanding the city's disaster experience; (2) the adaptive cycles that the city has gone through; and (3) the key capacities that has driven the city to its current state. Each case must be written from the context of the flooding disaster experience and the patterns of changes and transformation that the city has undergone drawn from both the primary and secondary data gathered.

CHAPTER FIVE

CHAPTER FIVE: NETHERLANDS COUNTRY CONTEXT AND BACKGROUND ON DISASTER RISK MANAGEMENT

5.0 INTRODUCTION

This chapter provides an overview of the Dutch context for disaster risk management which includes an overview of the policy instruments on urban planning, disaster risk management, and resilience building. Secondary data such as policy documents, surveys, and government issuances was used to create this chapter. The chapter provides a timeline of the Dutch policies to see a pattern of development and growth that can be triangulated later in the empirical chapters.

5.1 DUTCH PLANNING SYSTEM

During the period between 1945 and 1970, the Netherlands introduced regulatory planning to address the need for postwar reconstruction after the Second World War (Evers, 2018). This period led to the creation of the *Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieu* (VROM) (Ministry of Housing, Spatial Planning and the Environment) in 1947. The VROM was responsible for public housing and spatial development during the regulatory planning period (Evers, 2018). The Spatial Planning Act, enacted in 1965, formed the basis for the spatial plan at three levels of government, the central, provincial, and municipal governments (Evers, 2018; Government of the Netherlands, 2013; Tomlinson, 2002). In this period the spatial planning is hierarchical and the VROM is responsible for formulating the national directives that trickle down to the provinces which provincial governments turn into provincial plans and strategies. Municipalities in turn formulate the structural vision and zoning strategy to be approved by the provincial government.

The regulatory period lasted until the early 1980s, at that time each ministry is organized by sectors operating independently with no structured coordination nor joint plans and policies with other ministries. Tisma and Meijer (2018) indicated that this led to problems because spatial planning is interdisciplinary and requires cross-sector coordination. Policies in the 1980s shifted from promoting urban development to improving living quality by connecting green spaces of the countryside (Evers, 2018; Lodder, et al., 2014). By the late 1980s to early 1990s, spatial policies became more development-oriented wherein the aim was to strengthen international competitiveness. The Fourth National Policy on Spatial Planning, enacted in 1988, focused on infrastructure to promote economic development. The primary focus was the growing main ports, Schipol Airport and Port of Rotterdam, as global gateways, infrastructure connections with Belgium and Germany, and urban nodes in selected cities (Government of the Netherlands, 2013; Evers, 2018; Lodder, et al., 2014). In 1991 an accompanying supplement to the Fourth National

Policy Document on Spatial Planning called the *Vierde Nota Ruimtelijke Ordening Extra* (VINEX) was released. The VINEX aimed at improving environmental quality and confronting the growing urbanization in the country for 10 years (1995-2005) (Government of the Netherlands, 2013). The VINEX focused on market-based quality housing stock at the edge of the city. Cities competed to develop VINEX areas to qualify for the subsidies from the national government.

The period between 1991 and 2000 saw the growth of ecological networks which the VINEX program has likewise contributed to through the spread of the "VINEX-locations". However, there were some criticisms of the VINEX policy especially the lack of density, urban character, diversity, and dependence on automobiles (Dulski and van Straaten, 2016; Dieleman and Hooimeijer, 2005; Boeijenga, 2011; VINEX-locaties, 2020). Acknowledging these criticisms the national government used this period to evaluate the policies. As such by the end of this period the national government became more inclusive, encouraging a collaborative working relationship with the private sector on housing and urban development (Lodder, et al., 2014). The central aim to strengthen international competitiveness persisted but the national government also spread its emphasis on improving both the urban and rural areas by raising the standard of living, mobility, and the overall environment.

Based on the VINEX experience the central government focused its attention to the connection between spatial planning and environmental policy (Galle and Modderman, 1997) and the integration of "societal changes of the service economy and empowerment of citizens into their spatial policy" (Lodder, et al., 2014: 159). From 2000 spatial planning became decentralized allowing the collaboration of various actors in finding solutions to urbanization problems. The *Nota Ruimte* (National Spatial Strategy) released in 2004 marked the beginning of a more decentralized approach to spatial planning. In this policy, most of the decision-making and design responsibilities were to be delegated to the provinces and municipalities (Lorzing, 2004; Zonneveld, 2005). A review and update of the Spatial Planning Act ensued in 2008 detailing the implementing procedures that the three levels of government would follow. In the new Spatial Planning Act all three government levels are encouraged to be proactive in development planning (Evers, 2018; Lodder, et al., 2014; Zonneveld, 2017). The purpose was to expedite and simplify planning procedures giving the provinces and municipal governments freedom in developing their structural and zoning plans (Evers, 2018; Lodder, et al., Zonneveld, 2017, van der Meer and Edelenbos, 2006). In 2012 the National Policy Strategy for Infrastructure and Planning further reinforced decentralization of spatial planning by bringing "spatial planning decision-making closer to the stakeholders (individuals and companies), delegating more to local and provincial authorities (decentralization as the first option), and focusing more on users" (Ministry of Infrastructure and the Environment, 2013: 3). At the center of the 2012 National Policy Strategy is to create a sustainable urban environment while still

tackling the national government ambition to maintain competitiveness, safety, and accessibility of the Netherlands.

5.1.1 Flood risk management in the Netherlands

Flood risk management has been in the history of the Netherlands. The entire country was built around dikes, dams, and sluices that the Dutch had maintained in the early centuries to protect them from the sea. Two floods in the nineteenth century have made an impact on the flood risk management approach of the Netherlands, the 1916 storm surge in the Zuiderzee and the 1953 Great North Sea flood. The 1916 storm surge damaged the dikes along the Zuiderzee and led to the creation of the Zuiderzee project. The Zuiderzee Act was passed in 1918 to form the legal basis of the project, work was delayed due to the First World War and construction only began in 1927 (Ley, 1961). This project closed off the Zuiderzee lagoon and shortened the coastline by 300 kilometers (Van Koningsveld, et al., 2008).

However, it was the 1953 Great North Sea flood that hit the Netherlands on the eve of 31 January until the next day 01 February that put grit on the Dutch fight against water by creating the Deltaplan. A Delta Commission a few days after the flood was formed to map out the Deltaplan so that a flood of the same magnitude will never happen again. From 1953 to 1955 the commission went through several rounds of feedback until a final comprehensive Deltaplan including a cost-benefit analysis was released on 18 October 1955 (Stichting Deltawerken online, 2004). In the Deltaplan, the Deltaworks project, a network of flood preventive infrastructures in the South of Holland was to be implemented in 25 years. The bill for the Deltaplan was passed on 16 November 1955 and was signed into law as the Delta Act on 8 May 1958. The aim was to shorten the coastline by lengthening the flood defense system.

Construction of the Deltaworks project began in 1954 starting with the Hollandsche IJssel storm surge barrier completed in 1958. A total of 13 flood defenses under the Deltaworks project were completed in 1997 composed of locks, dams, and storm surge barriers (see Figure 5.1). The Rijkswaterstaat and the water authorities maintain the Deltaworks and hundreds of kilometers of flood defenses throughout the Netherlands. The large-scale flood defenses and dikes protect large parts of the country from floods.

Ten years after the first Delta Act of 1958, the First Water Management Note was released to address issues on drainage and water supply (Water Helpdesk, 2020). In 1984, the Second Water Management Note replaced the previous note to include the growing concern on the environment and society. In 1989, the Third Water Management Note drew a long term sustainable development strategy (Van Koningsveld, et al., 2008) underscoring the need to maintain "healthy water management systems that guarantee sustainable use" (Water Helpdesk, 2020).

Figure 5.1: Delta Works project from 1954 to 1997 locations

Source: Watersnood Museum, 2018

In 1993 and 1995 there were riverine threats from the Rhine which compelled the Dutch to take further measures to reinforce and raise the level of the river dikes, improve flood warning systems and municipal contingency plans (van der Grijp, et al., 2001). Rapid reinforcements were performed in the affected embankments an intervention that was previously opposed and questioned on its sustainability (Klijn, et al. 2013). Studies found that the reclamation from the rivers Rhine and Meuse deprived both rivers a large surface area of available floodplain (Klijn, et al. 2013).

The 1993 and 1995 riverine threats became the change agents in the Dutch way of managing flood risks. In 1995, the Minister of Water Management declared that a radical shift in the approach to flood risk management after 2000 is needed by creating more space for rivers (van der Grijp and Warner, 2001). The next year, 1996, the Ministers of Water Management and Environment introduced the Room for the River policy (*Ruimte voor de Rivier*). The Room for the River aimed to restore the old floodplains by creating "room" for the river to enlarge its discharge capacity.

In 1998, a Fourth Water Management Note was released and accentuated the need to maintain a "habitable land and . . . healthy and resilient water systems" (Water Helpdesk, 2020). Van Koningsveld, et al. (2008) outlined the policies concerning coastal and flood management in their paper from 1968 to 2005. It shows the move from preventive and highly infrastructure-led management (the first Delta Act in 1958 and the 1968 Water Management Note) shifting slowly to sustainable water management strategies in combination with preservation of the environment and integration of uses and users. This supports the Room for the River policy, the plan and study for the project began in 2003 and in 2006 the plan was approved (Nikologianni, et al. 2019). In 2007, the Room for the River project began as a climate adaptation program that showcased an alternative and sustainable manner of dealing with increased rainfall and rising sea levels (Nikologianni, et al. 2019). The project introduced new ways of providing room for the river taking into consideration the variability of the rivers and their locations.

In 2005 Hurricane Katrina in New Orleans, USA had the Dutch rethink their flood management strategy. In 2007, the Dutch government formed the second Delta Committee to study the current preventive infrastructure surrounding climate change scenarios. The findings of the study are found in the report "Working together with water" published in 2008 by the Delta Committee. The aim was "to present an integrated vision for the Netherlands for centuries to come" (Deltacommissie, 2008: 7). The study found the need to cope and manage the possible situation that may arise due to the changing climatic conditions. The report included the adaptive approach to managing space for water from the coast and the riverside.

Still influenced by Hurricane Katrina and realizing the threats faced by the Netherlands due to climate change, the Netherlands saw the need to adopt a more multi-layer approach to safety and security. In 2008, the multi-layer safety (MLS) approach was introduced in the Netherlands which is a flood risk reduction method following three distinct layers: prevention (layer 1), sustainable spatial planning (layer 2), and crisis management or disaster management (layer 3). The first layer, prevention refers to preventing the river and the seawater from flooding the mainland through building, maintaining and strengthening flood preventive structures such as levees and dikes (Hoss, et al., 2011; Leskens, et al., 2013). Sustainable spatial planning also known as spatial solutions refers to spatial planning and building climate-adaptive structures to decrease losses in the event of a flood or high water levels (Hoss, et al., 2011). Lastly, crisis management or disaster management looks into the "organizational preparation for floods such as disaster plans, risk maps, early-warning systems, evacuation, temporary physical measures . . . and medical help" (Hoss, et al., 2011: 2).

In 2012, upon the recommendation of the Delta Committee, the new Delta Program was laid out and introduced into law as the Delta Act. The goal of the Delta Program is "to ensure that . . . flood risk management, freshwater supply, and spatial planning will be

climate-proof and water-resilient by 2050" (Delta Programme Commissioner, 2020). The Delta Act stipulates that the Delta Program shall be produced annually, financed under the Delta Fund. Three priorities are included under the program, the Delta Plan on Flood Risk Management, the Delta Plan on Freshwater Supply, and the Delta Plan on Spatial Adaptation (Delta Programme Commissioner, 2020). All municipalities throughout the Netherlands must anchor their own Delta Plans on the National Delta Plan.

5.1.2 Disaster risk management in the Netherlands

Disaster management in the Netherlands started in 1985 with the Disasters and Majors Accidents Act which describes disasters as a life-threatening event to a population that needs collective efforts from experts in diverse fields (Rosenthal and t'Hart, 2012). The Act describes the structure for disaster response operations, emergency management, and coordination planning. It delineated the roles of the various governmental bodies involved in emergency management across government levels. Several legislations in favor of the Disasters and Majors Accidents Act assisted the organization of crisis and emergency management in the Netherlands such as the Fire Act (1985) detailing the function of the fire department in disasters and major accidents, Medical Relief during Accidents and Disasters Act (1991) outlining medical assistance during a disaster, and the Police Act (1993) outlining the role of the police in emergency management (The Netherlands Red Cross, 2010). The fire incidents in Enschede (2000) and Volendam (2001) led the government to rethink crisis management, response, and coordination among agencies in the Netherlands. In 2004, the Quality Promotion Emergency Management Act was introduced to amend all laws related to disaster and emergency management with the primary objective of raising risk awareness of government, private, civil stakeholders, and relief workers (The Netherlands Red Cross, 2010: 15). But it was the Safety Regions Act in 2010 that put a stronghold on crisis management in the Netherlands.

The Safety Regions Act maps crisis management into the country's 25 security regions. The security regions are 'extended local governments' where each municipality within the security region has shared rules and obligations on crisis management (Ministry of Security and Justice, 2013: 13). Disaster and crisis management duties are placed on the security regions and are tightly partnered with fire departments and medical services. Rotterdam and Dordrecht are part of the security region Rotterdam-Rijnmond and Zuid-Holland-Zuid respectively. The principle behind the security regions is to create a bottom-up approach in disaster management at the level of the municipality.

There is a system of upgrading crises called the *Gecoördineerde Regionale Incidentenbestrijdings* Procedure (GRIP) or Coordinated Regional Incident Response Procedure adopted by the security regions. The GRIP outlines the extent of emergency or catastrophe in the municipality or region and has an assigned authority depending on the level of emergency.

Generally, the structure consists of a control room (*meldkamer*), a command site incident (CoPI), a regional operational team (ROT), a municipal policy team (GBT), a regional policy team (RBT). There are four levels of the GRIP and various agencies are responsible for the situation at each point. GRIP 1 refers to a localized source level crisis, where a CoPI is set up charged with resolving the source of the incident. If the source of the incident escalates to affect surrounding areas, this is elevated to GRIP 2 where a ROT is set up usually led by the fire department or the police department (The Netherlands Red Cross, 2010). GRIP 3 happens when there is a clear threat to the lives and health of a population requiring the interference of the Mayor. The GBT is formed in addition to the CoPI and the ROT (Instituut Fysieke Veiligheid, 2017; The Netherlands Red Cross, 2010). Once the crisis affects two municipalities the GRIP level escalates to 4 and entails the formation of a RBT. The RBT takes over the work of the GBT and is led by the security region. A fifth level GRIP happens if the incident includes another safety region and will entail the involvement of the national government.

5.2 DUTCH CASE BACKGROUNDS: ROTTERDAM AND DORDRECHT

The next sections provide the background of the city development of Rotterdam and Dordrecht. Table 5.1 presents a summary of the significant policies at the national level on planning and crisis management and the corresponding timeline of the policies in Rotterdam and Dordrecht. Specific policies for each of the Dutch city cases are presented in the sections.

5.2.1 Rotterdam City background

Rotterdam started as a small fishing village in the 14th century (Diem, 1967). The name Rotte came from the damming of the river Rotte to protect the then village from sea flood (Diem, 1967). The city's strategic location between the Rhine and Meuse deltas makes it an attractive port. In 1863 upgrades to the port began by digging the "Nieuwe Waterweg" which gave better and deeper access to the Port of Rotterdam by increasing the speed of the river currents, raising sediment discharge, and cleaning the river bed (Meyer, et al., 2012: 73). However, this has also increased the city's vulnerability to storm surges and the river water levels tidal difference.

The development of Rotterdam as a city revolved around its main economic function as a port. The biggest challenge of the city came during the Second World War when the Germans bombed the 'heart of Rotterdam' (Diem, 1967) or the central district. The bombing of Rotterdam on 14 May 1940 decimated 260 hectares of the city (Mccarthy, 1999), 30,000 buildings, and killed 800-900 people (Rotterdamviertdestad, 2019). However, this incident did not maim the city and by the end of December 1941 Willem

Gerrit Witteveen, who at that time was the director of the municipal development department, completed Rotterdam's reconstruction plan (Mccarthy, 1999).

Table 5.1: Policies on planning and crisis management vis-a-vis Rotterdam and Dordrecht policies, programs, strategy documents

National policies		Rotterdam planning policies	Dordrecht planning policies
Planning	**Crisis management**		
Spatial Planning Act (1965)	Disasters and Major Accidents Act (1985)	Waterplan 1 (2001)	*Room for the River (2003)
4th National Policy on Spatial Planning (1988)	Fire Act (1985)	Regional Spatial Plan for Rotterdam 2005-2020 (2005)	Stedelijk Waterplan Dordrecht 2003-2007 (2003)
Vierde Nota Ruimtelijke Ordening Extra (VINEX) (1991)	Medical Relief during Accidents and Disasters Act (1991)	Rotterdam Water City 2035, Architectural Biennale (2005)	Urban Flood Management (2005)
Nota Ruimte (National Spatial Strategy) (2004)	Police Act (1993)	Waterplan 2 (2007)	*Multi-layer safety approach (2008)
National Policy Strategy for Infrastructure Planning (2012)	Quality Promotion Emergency Management Act (2004)	Rotterdam City Vision 2030 (2007)	Waterplan Dordrecht 2009-2015 (2009)
	Safety Regions Act (2010)	Rotterdam Climate Initiative (2007)	MARE Program 2009-2012 (2009)
		Sustainability Guide for Rotterdam (2010)	*Delta Act on Flood Safety and Freshwater Supply (2012)
		Rotterdam Programme on Sustainability and Climate Change (2010)	*Delta Decisions (2014)
		Rotterdam Climate Change Adaptation Strategy (2013)	
		Rotterdam Resilience Strategy (2016)	

*These are national policies that have made a big impact in Dordrecht.

From the Second World War, the development of Rotterdam can be divided into several phases. These phases vary from different authors depending on the context of the development, for example, Stouten (2010) divided the development of the Dutch social housing policy into four important periods: pre-1940 period social housing dependent on private initiatives, 1945 to 1963 period of reconstruction, 1963 to 1973 period of economic growth, and 1973 to 1990 period of housing provision and urban renewal. On the other hand, Mccarthy (1999) divided these five phases according to the urban redevelopment planning in Rotterdam: 1940s the 'basic plan', 1950s and 1960s economic expansion, 1970s inner-city regeneration, 1980s cultural development, and 1990s the Kop van Zuid 'key project'. In this section, the five phases of Rotterdam's urban development will be reconstruction, economic growth, urban regeneration, sustainable development, and climate change adaptation. The first three were primarily taken from literature on Rotterdam's development, urban regeneration, and urban renewal (Stouten, 2010, Mccarthy, 1999). The last two were drawn from the literature reviewed on the movement of the Netherlands and Rotterdam towards a more environmental position (Government of the Netherlands, 2013; Evers, 2018; Lodder, et al., 2014).

a. Period of reconstruction: 1940s to 1960s

The reconstruction plan designed by W.G. Witteveen initially focused on the major infrastructures within the city center such as the roads, canals, bridges, commercial shops, and residential areas. Since the port is of high significance to the economy of the country, not just the city, the reconstruction of the port was also prioritized (Diem, 1967, Mccarthy, 1999). However, the reconstruction only took off after the Germans left in 1945.

In 1946, Cornelius Van Traa developed the Basic Scheme for the Reconstruction of the City of Rotterdam (Basic Plan) (Diem, 1967). Witteveen's earlier plan was to maintain the "triangular form of the inner city, without having a functional rationale" (Rooijendijk, 2005: 182) the design of which is geared towards traditional architecture (Wagenaar, 2016, Wederopbouwrotterdam, 2019, Rooijendijk, 2005). Witteveen's earlier reconstruction plan became the basis of the Basic Plan aimed to rebuild the 260 hectares of land in the city center destroyed by the bombing. However, contrary to Witteveen, Van Traa designed the city with a new vision of the city center that allowed the flexibility of the road networks and traffic. The aim was to create a dynamic business district taking into consideration vehicle and pedestrian traffic.

The Basic Plan was adopted in 1946 favoring the port area and the city center. The port as Rotterdam's main economic backbone was prioritized and in 1947 preparations for expansion culminated in the development of the Botlek harbor plan (Diem, 1967). Reconstruction of the city center was also initiated in the late 1940s to manifest Van Traa's functional rational urban design. The Hofplein transformed Witteveen's original intersection to a roundabout which eased the flow of traffic (Wederopbouwrotterdam, 2019, Rooijendijk, 2005). In October 1953 De Lijnbaan was opened to the public, this pedestrian only shopping center designed by Bakema and Van Eesteren became a hallmark of Rotterdam's modern city center (Diem, 1967, Mccarthy, 1999, Rotterdamviertdestad, 2019, Wederopbouwrotterdam, 2019). The Lijnbaan is the first pedestrian promenade in Europe (Rotterdamviertdestad, 2019), 'reminiscent of the pulsing piazzas of Italy' (Diem, 1967: 15), the design was considered an international example of a modern city.

The opening of the Lijnbaan also shows the character of the city to rise above any cataclysm noting that the country just nine months prior, 1 February 1953 to be exact, experienced the Great North Sea Flood. This flood affected the South of Holland specifically Zeeland but Rotterdam was also not spared as the water reached the city center. This period while not specific to Rotterdam gave rise to the development of the Deltaplan which is an important part of Dutch history and its relationship with water. The Deltaplan and the Deltaworks project were very significant to Rotterdam, as the Deltaworks project coincided with the port expansion in the Botlek and Europoort areas. The expansion of the port made Rotterdam the largest port in the world in the early 1960s. The Deltaworks project raised dikes, constructed storm closures in the South of Holland,

but also gave access to ships between the ports of Rotterdam and Antwerp (Watson and Finkl, 1990, Wesselink, 2007).

The expansion of the port influenced the influx of migrant workers and thus demanded housing in areas around the construction sites. From 1950 to 1965 the government invested in the construction of new housing stock extending on the fringe of the city (Stouten, 2010, Mccarthy, 1999). Various districts in the city were developed to address the housing shortage. These new residential areas were extended in Hoogvliet, Pendrecht, Lombardijen and Groot Ijsselmonde (Mccarthy, 1999).

b. Period of economic growth: 1960s to 1970s

The expansion of the port to the west side of the city led to Rotterdam's economic growth into the 1960s. The economy was good that the period 1960s to 1970s came to be known also as a period of *maakbaarheid* (feasibility) (The Netherlands Architecture Funds, 2009). Modern architecture was carried forward from the previous reconstruction period as influenced by the Modern Movement (Nieuwe Bouwen) (Mccarthy, 1999, Rotterdamviertdestad, 2019). Nientied (2018) described Rotterdam's difference from the other large cities in the country as, "[o]ther large cities in the Netherlands have a historic core, Rotterdam has a modern core" (p. 156).

In the 1960s the Euromast was completed and became the symbol of progress in Rotterdam (Wederopbouwrotterdam, 2019) with its arresting presence of 112 meters (Euromast, 2019). An additional observation tower was placed atop the 'crow's nest' of the Euromast in 1970 to increase the height making it 185 meters and the tallest building in the Netherlands (Euromast, 2019). In May 1966 the De Doelen designed by architects E.H. and H. M. Kraaijvanger and R.H. Fledderus was erected, it is the first cultural building built after the war (Rotterdamviertdestad, 2019) and an important final mark in the reconstruction of Rotterdam (Rotterdamviertdestad, 2019, Historiek, 2015).

The modernity of Rotterdam's city center was emblematic of the ideals of the government policies in that period to spread 'wealth, knowledge and power' (The Netherlands Architecture Funds, 2009). The same period also saw the completion of the port expansion to Botlek (1955-1966) and Europoort (1957-1970) (Nientied, 2018: 156) which was vital for the country to regain its economic position. This has stimulated the influx of harbor labor coming from Spain, Cabo Verde, Portugal, Morocco, and Turkey (Nientied, 2018: 160-161) and as such increased the demand for housing stock but also changed the city's demography and societal structure (Stouten, 2010).

The development pressure that came along with the city's economic expansion posed a housing shortage due to the growing labor force in the harbor (Nientied, 2018). Until the early 1960s increasing the housing stock meant greenfield residential development but

towards the late 1960s, political and social activism called for a more social approach to urban redevelopment (Stouten, 2010: 109). The city withdrew its spatial structure plan (*structuurplan*) which aimed to demolish existing residential areas and opted to maintain and improve old areas with participation from residents (Stouten, 2010).

c. Period of urban regeneration and renewal: 1970s to 1990s

In the 1970s the Maasvlakte I was completed which further extended the port farther west. There was also an expansion of the greenfield districts to move away from the city centers. However, by the mid-1970s the expansion of these growth centers created congestion problems due to the movement of people between the city center and the new growth centers (Mccarthy, 1999). As such renewal of old areas has become much more prominent in this period such as the old abandoned harbor areas. The old harbors were turned into new waterfront developments due to their proximity to the inner city (Aarts, et al., 2012; Nientied, 2018) thereby integrating the "water and city" (Nientied, 2018) which became the image of Rotterdam.

The spatial development planning approach in the period of urban regeneration and renewal highlighted mixed-use areas, that is residential, commercial, and cultural. The period also ushered in a more participatory approach to spatial development planning in Rotterdam. In 1974 an urban renewal organization was formed involving residents whose aim was to ensure affordable housing is available and to maintain a broad social mix in the city (Mccarthy, 1999). By the end of the 1980s, a total of 22 old districts and more than 25,000 homes were renovated and new houses were built financed by the government (Mccarthy, 1999). While construction and renewal were in full swing in the city there was also a dire need to diversify the economy. Work and manpower needs in the port changed from unskilled labor to highly skilled professional (Nientied, 2018, Aarts, et al., 2012). Such there was a need to attract other industries and commercial investments within the city to address employment needs.

To attract investments Rotterdam changed its strategy from expanding to greenfield areas to making the city more compact by developing mixed land-use and constructing taller buildings (Nientied, 2018). A compact city means densifying the city and attracting commercial investors by mixing office and residential space close together. Through the 1985 Inner City Plan for Rotterdam cultural and recreation facilities were built to attract people to live and work in the city (Mccarthy, 1999). Cultural developments centered around the city, the port and water, as well as the locations of these developments in old port areas targeted knowledge workers.

Aside from the Inner City Plan, the 1980s brought with it the Rotterdam Waterfront Program which sought to 'bring back the river into the heart of the city' (Aarts, et al., 2012: 13). The development of the waterfront areas brought a new charm to the city. The

Oude Haven (old port) was redeveloped to an area where the old structures such as the Witte Huis met the new modern architecture like the Kubuswoningen (cubic houses) designed by Piet Blom. High-rise residential buildings were constructed in the areas of Leuvehaven, Wijnhaven, and Zalmhaven. The Scheepvaartkwartier remained a prime residential area bolstered by the proximity of the Parkhaven. The Kop van Zuid was also redeveloped to accommodate high-rise residential and commercial spaces.

Even though the 1980s began with a slump, Rotterdam's forward-looking planners used the city's port image and location to its advantage by adopting a waterfront redevelopment program and rebranding the city. Thus, by the mid-1980s Rotterdam's period of economic recovery began and a new 2010 Port Plan to further extend the port was developed (Meyer, et al., 2012). The plan was approved in 1993 and aimed to build Maasvlakte II as an extension to Maasvlakte I. Strong opposition to this plan was raised by environmental groups who questioned the effects of these developments on the environment.

d. Period of sustainable development: 1990s to 2000s

The social activism that sparked in the late 1960s also paved the way for environmental activism in the 1970s. The increasing environmental awareness not just from civil society but also in the political arena has resulted in environmental policies. The 1988 Fourth National Policy Document on Spatial Planning called for bolstering the main ports or global gateways in the country which are The Port of Rotterdam and Amsterdam Schipol Airport. A succeeding supplement to this Fourth National Policy Document, *Vierde Nota Ruimtelijke Ordening Extra* (VINEX) released in 1991 called for the development of new residential areas called VINEX locations near town centers. This is to limit the commuting distance and protect large open green spaces from further encroachment.

The further extension of Maasvlakte II was opposed by environmental groups in the 1970s and 1980s citing further environmental impacts on marine life and biodiversity in the area. In 1991 Rotterdam released the Port Plan 2010 which highlighted Maasvlakte II as an important economic hub not just for the city but the country that would help in overturning the economy and maintaining the position of the port as the most important and busiest in Europe. In 1993 the Municipality of Rotterdam tried to raise public support on Maasvlakte II by including the creation of a 750-hectare new nature reserve (Koppenol, 2014). Still, the environmental activists and civil society created pressure on the government which prompted the delays in the construction of the port. Further review of the Maasvlakte II plan based on financial feasibility and environmental impact on nature and residential areas was raised by the Netherlands Bureau for Economic Policy Analysis (van Gent, 2014). On this basis, in 1999 the city government initiated discussions with environmental and nature preservation groups the biggest of which is the Natuurmonumenten (Koppenol, 2014). Further discussions between and among

stakeholders, city government, national government, Port Authority, non-government organizations, and civil society, ensued until a final agreement was reached in 2004.

The narrative above relating to the Maasvlakte II development underscores the rising environmental consciousness in Rotterdam in the 1990s. The river threats in 1993 and 1995 started the ball rolling in the discussion to include a softer approach to flood threats and a stronger hold on urban and rural water management. The first water management plan of Rotterdam (Water Plan 1) was developed in consultation with the waterboards in 1998 and 1999, to transfer surface water management to the waterboards and upgrade the old sewer system (de Graaf and van der Brugge, 2010). De Graaf and van der Brugge (2010) pointed out that water retention was a "low priority in Rotterdam compared to other issues such as economic development, unemployment and safety" that the waterboards leaned "towards multi-functional use of space" (p. 1284). Moreover, the 1998 pluvial flooding ushered in the thinking towards 'working with water' (climate change adaptation) rather than 'working against water' (flood preventive measures).

e. Period of climate change adaptation: 2000s and onwards

In 2000 the *Anders omgaan met water, Waterbeleid voor de 21e eeuw* (Dealing differently with water, Water policy for the 21st century) was released by the *Ministerie van Verkeer en Waterstraat* (Ministry of Infrastructure and Water Management) (Tielrooij, 2000) where it was "proposed to give water a guiding role in regional planning and urban planning" (de Graaf and van der Brugge, 2010: 1284). The report was a response and call towards change in dealing with water due to the near disasters in the 1990s (Hooimeijer, 2010).

The 1998 pluvial flooding that affected Western Holland including Rotterdam districts (de Graaf and van der Brugge, 2010, van der Brugge and de Graaf, 2010) led to an assessment of Rotterdam's water retention capacity. Assessments and projections revealed a total of 600,000 m3 in 2015 and 900,000 m3 in 2050 additional water retention capacity is needed to prevent pluvial flooding in Rotterdam (de Graaf and van der Brugge, 2010; van der Brugge and de Graaf, 2010). To meet Rotterdam's water retention needs the municipality led by the municipal departments Public Works, Urban Planning and Economic Development initiated a platform to "discuss water issues and look for synergies between urban planning, economic development and water management" (de Graaf and van der Brugge, 2010: 1284). This resulted in the Water Plan 1 (Water Plan Rotterdam 2000–2005) published in 2001 which provided a short-term plan including measures to increase the city's water retention capacity (Dunn, et al. 2017; Toorn Vrijthoff and Heurkens, 2008).

The Port of Rotterdam, still being the economic priority of the city and the country, released the Rotterdam Port Vision in 2004 which is primarily the business vision of the port of Rotterdam (Lu and Stead, 2013). The vision centered on international

competitiveness, strengthening the economic structure, and improvements in residential and living environments of the city and region (Stead and Tasan-Kok, 2013). Stead and Tasan-Kok (2013) emphasized that reference to climate change mitigation and adaptation is missing in the document, and flood protection was referred for future investigation.

In December 2005 the Regional Spatial Plan for Rotterdam (2005-2020) (*Ruimtelijk Plan Regio* Rotterdam 2020) was published covering the City of Rotterdam and affiliated municipalities. The Spatial Plan's first two main policy goals "to improve the quality of the residential environments" and "strengthen and diversify the economic structure of the city" (Stead and Tasan-Kok, 2013: 221), are similar to the thematic focus of the Port Vision. The last policy goal "to increase social cohesion" (Stead and Tasan-Kok, 2013: 221) recognizes the growing population contributing to a diverse socio-cultural background in the city and region (Rotterdam Stadsregio, 2005). More importantly, the Regional Spatial Plan acknowledges the present threat of climate change that can affect the regions' economic function.

The main turning point in Rotterdam's climate change adaptation fora is the Rotterdam Water City 2035 design study entered in the 2005 Architectural Biennial (van der Brugge and de Graaf, 2010; de Graaf and van der Brugge, 2010; Dunn, et al., 2017; Mees and Driessen, 2011; Tillie and van der Heijden, 2016). The Rotterdam Water City 2035 merged urban design and climate change adaptation strategies emphasizing the transformation of Rotterdam as an attractive city that fuses land and water. The study gained political buy-in leading to the creation of the 'Rotterdam Water Plan II: Working on water for an attractive city' (Water Plan 2) in 2006 and 2007 (Dunn, et al., 2017; Mees and Driessen, 2011; van der Brugge and de Graaf, 2010; de Graaf and van der Brugge, 2010). The Water Plan 2 was adopted in 2007 and revolves around three main themes - water safety, water storage, and water quality (City of Rotterdam, 2007). The combination of these three themes was included in the flood risk and water management and spatial development strategies of Water Plan 2.

The Water Plan 2 emphasizes the link between urban and water and the urgency to combat climate change through adaptation. The plan is aligned with the Rotterdam City Vision 2030 (*Stadsvisie* Rotterdam 2030) also released in 2007. The Rotterdam City Vision 2030 is a spatial vision for the city with the mission "Build a strong economy and an attractive place to live" (*Bouw aan een sterke economie en een aantrekkelijke woonstad*) (City of Rotterdam, 2019). The integration of the Water Plan 2 with the vision of the city gave a climate change focus in line with the city's mission. Further, the Water Plan 2 while considered a water management strategy clearly outlines the spatial planning direction of the city focusing on adaptive measures and inclusivity by collaborating with city stakeholders (de Graaf, and van der Brugge, 2010; Dunn, et al., 2017). The Water Plan 2 led to a more integrated approach to water management and spatial planning in transforming an attractive and climate-proof city.

Also in 2007, the Rotterdam Climate Initiative (RCI) was established as "a partnership between the city, companies, organizations, and residents that strives for sustainable urban development" (Spaans and Waterhout, 2017: 112). The RCI aims to reduce the CO2 emissions by 50% by 2025 compared to the 1990 levels, increase the resilience of the city to climate change, and for Rotterdam to become the leader in water innovation (Stead, 2014). In 2009, the Rotterdam Climate Proof (RCP) Programme was bourne using the Water Plan 2 as a basis. The RCP was a product of the RCI as an annual program to make Rotterdam more 'climate proof' (Stead and Tasan-Kok, 2013; Stead, 2014). The RCP prioritizes the protection of the city and port from flooding inside and outside the dike areas through incorporating "future climate developments in future spatial plans, implementation [ ] and management [of projects]" (Stead, 2014: 212). The RCP emphasizes the importance of climate resilience and sustainability in development.

In 2010 the Sustainability Guide for Rotterdam (*Rotterdam Duurzaam Wijzer*) was published for the RCI and RCP programme (Stead, 2014; Stead and Tasan-Kok, 2013). The guide provided development options for sustainable urban development at three levels – regional, urban, neighborhood, and building scales (Stead, 2014; Stead and Tasan-Kok, 2013). Climate adaptation schemes in the guide included "(i) measures [to] minimi[z]e [flooding probability]; (ii) measures [to] minimi[z]e . . . consequences of flooding; and (iii) measures [to] stimulate recovery from floods" (Stead, 2014: 23-24; Stead and Tasan-Kok, 2013: 222). Following this, the City of Rotterdam produced the Rotterdam Programme on Sustainability and Climate Change (*Programma Duurzaam*) which highlighted the City of Rotterdam's ambition to become a sustainable city while striving for a good balance between social, ecological, and economic interests. The first program which ran from 2010 to 2014 outlined the ten focus areas: "(1) lead the way in reducing CO2 emissions, (2) improve energy efficiency, (3) switch to sustainable energy and biomass as a raw material, (4) promote sustainable mobility and transport, (5) reduce noise and promote clean air, (6) make the city greener, (7) increase and promote sustainable investment sustainable products and services, (8) increase support for sustainability and embed sustainability in education and research, (9) prepare for the effects of climate change, (10) promote sustainable area development" (City of Rotterdam, 2001: 18). This ambition and focus areas were further carried out in the succeeding *Programma Duurzaam* 2015 to 2018.

In 2013 Rotterdam released its Rotterdam Climate Change Adaptation Strategy to achieve a climate-proof Rotterdam in 2025. The strategy is based on a study undertaken by Knowledge for Climate and National Delta Programmes (City of Rotterdam, 2013: 11). The strategy provides a guideline on how to reach a climate-proof Rotterdam by outlining the risks and vulnerabilities of the city to climate change and identifying strategies on how to adapt and mitigate climate change. In 2014 the City of Rotterdam formally joined the 100 Resilient Cities of The Rockefeller Foundation. In 2016, Rotterdam released its

Resilience Strategy where seven resilience goals was outlined as follows "(1) Rotterdam: a balanced society, (2) World Port City built on clean and reliable energy, (3) Rotterdam Cyber Port City, (4) Climate adaptive city to a new level, (5) infrastructure ready for the 21st century, (6) Rotterdam network - truly our city, and (7) anchoring resilience in the city" (City of Rotterdam, 2016). Each of the seven resilience goals has a corresponding 'Resilience Lab: Actions' in different parts of the city to implement the strategies. Interestingly, the Resilience Strategy boasts on not explaining what resilience is all about to the people of Rotterdam because according to the document resilience is in the DNA of the Rotterdammers (City of Rotterdam, 2016).

5.2.2 Dordrecht City background

Dordrecht was founded in the 12th century along the creek Thuredrecht[7] (Stalenberg, 2010; Bosselmann, 2018; Hinborch, 2010) where the rivers Dubbel and Merwede are located (Stalenberg, 2010; Bosselmann, 2018). Dordrecht is the oldest city in Holland[8] and used to be its capital. The location of Dordrecht which is navigable from both the north-south and east-west direction made it a successful trade city in 1250 (Stalenberg, 2010). In 1421 the Saint Elizabeth flood wiped out 17 villages (Waals, et al., 2011) in Dordrecht and greatly impacted the entire landscape of the city, separating it from Geertruidenberg.

Land was slowly reclaimed after the big flood through a compartmentalized diking system (Waals, et al., 2011). Centuries of land reclamation and diking in Dordrecht have shaped the city into what it is now, an island city that lies between the Rhine and the Meuse two large and important rivers not just in the Netherlands but entire Europe. The development of Dordrecht's harbors, Bom harbor (1540), Wolwevers harbor (1607), Lijnbaans harbor (1643), Maartensgat (1647), and Kalk harbor (1655), were significant milestones that marked the city's wealth (Stalenberg, 2010). Although, Dordrecht ceased to be a trade city these harbors called "havens" continue to serve as popular tourist attractions with their boat tours.

The City of Dordrecht like many other cities in the Netherlands are divided between the *binnen de dijk* (within the dike) and *buiten de dijk* (outside the dike). As a result of the compartmentalization, a large part of the island is *binnen de dijk*, while the historic city center, the area of the Staart, the inland seaport, and the green area near Hollands Diep and Nieuwe Merwede are *buiten de dijk*. Every two to five years Dordrecht residents most especially those living in the historic city center experience low-level flooding due to high waters coming from the river.

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[7] There are variations to the spelling some use Thuredrecht (Bosselmann, 2018), Turedri(c)ht (Stalenberg, 2010), and Thuredrith (Hinborch, 2010). The spelling Thuredrit (h) was used circa 1100.

[8] Holland refers to the Noord and Zuid Holland which are just two of the 12 provinces in the Netherlands.

The history of Dordrecht developed around the water bodies surrounding it, its function as a trading post, and the development of the harbors. While the Saint Elizabeth flood was the biggest flood that made an impact on the physical and economic landscape of Dordrecht, the 1953 Great North Sea flood made a pivotal role in constructing a long-term flood preventive measure in the entire country through technology and engineering throughout the country. The hardest hit area in the Netherlands was Zeeland where water levels reached NAP +4.55 (Rijkswaterstaat, 2019) still the water level in Dordrecht reached NAP +3.70 (Hinborch, 2011) and inundated the city specifically the historic city center. The 1993 and 1994 extreme river discharge from the Rhine-Meuse Delta have also impacted Dordrecht and led to the Room for the River project that allows vast tracks of land to be flooded in the event of a flood. In 2005 Hurricane Katrina in New Orleans, USA had the Dutch rethink their flood management strategy to adopt a more multi-layer safety approach.

These periods can be considered as the phases in Dordrecht in relation mainly to flood management. The period of reclamation after the Saint Elizabeth flood and shaping the city as an island. The following periods – period of the Deltaworks project, period of Room for the River, and period of multi-layer safety - will be elaborated in the next sections.

a. Period of the Deltaworks project

The Deltaworks project was initiated after the Great North Sea Flood in 1953. Most of the flood preventive infrastructures built under the Deltaworks project are located in the north, northwest, and southwest of Dordrecht. Still, the city benefits from these storm surge barriers as greater protection from storm surges from the river and the sea.

The primary flood defense in Dordrecht is the Voorstraat, a dike located in the historic city center. The Voorstraat is also the current shopping district of the city. A system of stop logs has been implemented in Dordrecht since 1917 where “stop logs” are placed in slots in front of the houses in the historic center. The stop log system help increase the height of Dordrechts flood defense by 0.36 m (Hinborch, 2010). Flood panels or barriers are also placed in front of door openings of houses facing the streets Voorstraat, Prinsenstraat, and Riedijk. On the other hand, large bulkheads are placed in Grote Kalkstraat, Houtsteiger and Boomstraat (Hinborch, 2010; Voorendt, 2015).

Improvements of the flood defenses in Dordrecht have mostly been on Voorstraat wherein a minimum height of 0.30 m was prescribed (Hinborch, 2010). A decision to build the flood defense in Nieuwe Waterweg was done in 1989. The 0.30 m prescribed height for Voorstraat and the commissioning of the Nieuwe Waterweg flood defense was not enough as flood defenses for Dordrecht, thus the stop log and flood barrier system are still used in the city. In 1997 the Maestlant storm surge barrier was completed to protect from storm

surges higher than 3 meters and 2.9 meters NAP near Rotterdam and Dordrecht, respectively (Rijkswaterstaat, 2020).

b. Period of adaptation: Room for the river

In 2007 the Room for the River project began in over 30 locations (Rijkswaterstaat, 2020), a large part of it is in the area of the Biesbosch which is part and parcel of the identity and ecology of Dordrecht. Redeker (2018) pointed out that while the Room for the River and dike reinforcements mitigate flood risks it has limitations in Dordrecht. These limitations pertain to the current built-up area in the city that becomes a challenge in implementing dike improvements, creating water storages, and river widening. In 2003 Dordrecht released the 2003-2007 *Stedelijk Waterplan* Dordrecht to create more space for water. It was voted as the best water plan in the Netherlands in the same year by the *Stichtung Natuur en Milieu* (Nature and Environment Foundation) and the *Provinciale Milieufederaties* (Provincial Environmental Federations) (Nierop, et al. 2003). The vision is by 2050 all main waterways surrounding Dordrecht are designed in a way that reinforces both water and spatial development.

In 2005 a joint action between the cities of London (Thames Gateway), Hamburg, and Dordrecht was formed at the 3rd International Symposium on Flood Defence in Nijmegen, The Netherlands. The three cities share similar past challenges on flood risks and urban development that a consortium was formed to have an exchange of experiences and knowledge in planning and undertaking Urban Flood Management (Kelder, 2006; Stone, et al., 2008). Urban Flood Management (UFM) in Dordrecht focused on flood risk management in Stadswerven (Kelder, 2006; Stone, et al., 2008). The Stadswerven area is faced with residual floods and unprotected by dikes but new developments have already taken place (Kelder, 2006). The three-year study (2005-2008) provided an in-depth, science-based analysis of the urban development process in the Stadswerven area. It concluded that with the different water threats faced by Dordrecht that the UFM flood data be combined with rainfall data to model pluvial or combined floods (Stone, et al., 2008). The study offered a framework for evaluating flood-proof urban designs as well as a comparison of various design concepts. (Stone, et al., 2008).

c. Period of multi-layer safety

The MLS approach introduced in 2008 calls for three layers of flood risk management, prevention, spatial planning, and crisis management. The City of Dordrecht took this MLS approach to heart from the beginning and has strengthened this through the succeeding strategies. In 2009, the 2009-2015 Waterplan Dordrecht was released which envisioned the island of Dordrecht as a climate-proof city with a safe, beautiful and healthy water system that can absorb extreme rainfall and long periods of heat and drought (Gemeente Dordrecht, 2009). The plan incorporates the *meeliftstrategie* (free-ride strategy) wherein any

new development in the city must include a water component (Gemeente Dordrecht, 2009). As a continuation of the previous Waterplan, this plan also emphasizes the important place water has in the history of Dordrecht, and thereby both water and urban plans must coincide. However, realizing the increasing impact of climate change, the 2009-2015 Waterplan takes into account not just Dordrecht's urban area but the entire island. This includes the rural areas that require equal attention on the themes of water safety, quantity, quality, and usage (Gemeente Dordrecht, 2009).

The uniqueness of Dordrecht as an important heritage and island city has made it an interesting case for many academics in the fields of science, engineering, and even public management. The UFM was one of those projects followed by the Managing Adaptive Responses to changing flood risk in the North Sea Region (MARE) program 2009-2012. The program aims to develop and demonstrate methodologies on flood risk management using a bottom-up approach (Mekel and Bastiaansse, 2013). The MARE program was successful in setting up Learning and Action Alliances (LAAs) in the four cities across the North Sea region with different flood risks. These LAAs are key and professional stakeholders in flood risk management at the local, regional, national levels, knowledge institutions, and private enterprises and are tasked to enable collaborative learning (Climate Adapt, 2016). In Dordrecht, the MARE program successfully contributed to policies on flood risk management and urban development at the local, regional and national levels (Mekel and Bastiaansse, 2013). The LAA in Dordrecht piloted a Flood Risk Management plan under the MARE program using the MLS approach which was the first pilot in the Netherlands. The pilot influenced policies on collaboration and bottom-up approaches in development and planning. Other projects in the MARE program include dike improvements at Kop van het Land and the Wielwijk Climate Proof which restructured the Wielwijk district to make it economically viable and integrated into the main redevelopment plan (Mekel and Bastiaansse, 2013).

In 2012, the Delta Act on Flood Safety and Freshwater Supply was entered into force which mandated the annual creation of a Delta Program (Deltacommissaris, 2020). The release of the Delta Program 2014 was followed by the Delta Decisions which focused on "flood risk management, freshwater supply, and a climate-proof and water-robust design of the Netherlands" (Deltacommissaris, 2020). These five delta decisions aligned with the Delta Program to provide broad support on flood safety, freshwater, spatial adaptation, Rhine-Meuse Delta, and the Ijsselmeer Region. The Rhine-Meuse Delta (Deltabeslissing Rijn-Maas Delta) agreement was necessary to address and safeguard the economic developments and increasing population in the Rijn-Maas Delta from flood risk. The delta decisions on flood safety follow the MLS approach which Dordrecht has adhered to through the various programs, projects, and studies conducted in the city on flood risk management including spatial development planning. Redeker (2018) pointed out that

flood risk in the region will be "2-5 times . . . high by 2050" and for Dordrecht this can be 100 times as high by 2100 (p. 272).

5.3 CHAPTER CONCLUSION

The goal of this chapter is to provide a perspective on disaster risk management in the Netherlands starting from the post-World War II period and the liberation from Germany. The priority right after liberation was to create human settlements and rebuild especially Rotterdam which was ravaged by the bombing. At the onset, the reconciliation of economic progress and the provision of housing services has been a criterion for the development. Top-down development was later changed to a more decentralized development with the introduction of policies such as the *Nota Ruimte* in 2004.

Flood risk management in the Netherlands leans heavily on infrastructure and is under the responsibility of the Ministry of Infrastructure and Water Management. The country's water management is profoundly rooted in the Dutch culture and life that flood risk management does not deviate from water management policies. After the experience of the Netherlands with the 1953 North Sea Flood the Deltaworks system constructed in the country marked the "never again" attitude of the Dutch. This was further reinforced with policies on flood risk management, water management and climate change.

With regard to disaster risk management, the first policy created was the Disasters and Major Accidents Act which came into effect in 1985. However, the Safety Regions Act released in 2010 was the policy that led to an organized structure on disaster risk management. The Safety Regions Act divided the country into 25 security regions responsible for the emergency and crisis management of the provinces, cities, and municipalities under their jurisdiction. A hierarchy of emergencies and protocol with specific delegated responsible unit is followed. In general, the safety region regulates the overall management of the crisis.

This chapter serves as a significant reference to the timing of events for each of the Netherlands case cities, Rotterdam and Dordrecht. In addition, the information contained in this chapter specific to the cases will be included in the subsequent empirical chapters and cross-case analysis.

CHAPTER SIX

CHAPTER SIX: PHILIPPINES COUNTRY CONTEXT AND BACKGROUND ON DISASTER RISK MANAGEMENT

6.0 INTRODUCTION

The purpose of this chapter is to provide an overview of the Philippine context for disaster risk management. This includes an overview of the policy instruments that shape each case city in terms of urban planning, disaster risk management, and resilience building. Secondary data such as policy documents, surveys, and government issuances was used to create this chapter. The chapter provides a timeline of the policies in each country to see a pattern of development and growth that can be triangulated later in the empirical chapters.

6.1 PHILIPPINE PLANNING SYSTEM

The early Philippine planning system was heavily influenced by the Americans where the cities of Manila and Baguio were part of the City Beautiful Movement of Architect Daniel Burnham in 1905. In the 1920s zoning became popular in America and the first zoning plan was issued in Manila in 1928 but was only implemented in 1940. During the Commonwealth period from 1935 to 1945 when the country transitioned to independence urban planning, economic development and housing were priority areas. Commonwealth Act 2 was issued in 1935 to create the National Economic Council (Official Gazette, 2020) tasked to formulate development plans for the new Commonwealth, in 1938, the People's Homesite Corporation was established to address urban planning and development, while Commonwealth Act 648 created the National Housing Commission specifically to address urban planning and housing targeted to economically disadvantaged individuals and families (Corpus Juris, 2020).

On 11 March 1946, Executive Order 98 was signed to create the National Urban Planning Commission (NUPC). The NUPC was assigned to prepare urban development plans and identify areas for urban development, as well as rebuild cities that have been ravaged by World War II. On 30 April 1946, the government of the United States of America issued The Philippine Rehabilitation Act of 1946 to provide compensation for war damages and allocate funding for the rehabilitation of the Philippines (Library of Congress, 2020). The National Planning Commission (NPC) was established through Executive Order 367 as the only physical planning agency of the government. It abolished the NUPC and the Capital City and Planning Commission. This streamlined the functions into one government agency.

Several laws on housing ensued in the succeeding years including the division of the country into regions to plan the regional, urban, and rural developments of the provinces. In 1959, Republic Act (RA) 2264 or the Local Autonomy Act of 1959 was enacted to

empower local government units (LGUs) to enact zoning ordinances and subdivision rules. This required towns and cities to form local planning boards to draft development plans under the guidance of the NPC. In 1965 the Institute of Planning (now University of the Philippines School of Urban and Regional Planning) was established under the national policy RA 4341. The aim was "to strengthen and assist government and local government agencies and private organizations [in finding solutions to] development problems . . . improve human settlements and their environments by the social, economic, physical and administrative considerations to produce coordinated and comprehensive development studies and plans; and to make available a pool of capable professional urban and regional planners" (RA 4341, 1965). During the 20 year regime of President Ferdinand Marcos from 1965 to 1986 numerous laws were passed to create various government agencies to expedite development. Under this regime Presidential Decree (PD) 1396 the Ministry of Human Settlements (now Housing and Land Use Regulatory Board) was created to be the governing body to guide the physical, social, economic development of the regions, provinces, towns, and cities. Section 3 of PD 1396 declared and established Metropolitan Manila as the National Capital Region of the Republic of the Philippines as a region of critical importance to the country. The Local Government Code of 1983 was also issued under the Marcos administration through *Batas Pambansa* 337 which decentralizes powers, responsibilities, and resources to local government units (LGUs). The tasks of planning the development of LGUs are under the regional, provincial, municipal, city up to the basic government unit which is the *barangay* (community level).

Under President Corazon Aquino's administration from 1986 to 1997 the 1987 Constitution of the Philippines was released which under Section 25 states that autonomy of the local government be given to them by the state. Article X of the constitution specifies the supervisory role of the President and the granting of power and resources to the local governments. With the Constitution in place, the Local Government Code was repealed to RA 7160 or Local Government Code 1991. The RA 7160 forms the general basis of the local governance system of the Philippines, it granted autonomy and at the same time granted 'more expenditure and revenue raising responsibilities' (Sicat, et al., 2019: 9) to the LGUs.

There are three tiers in the local government administrative system, (1) the provinces and highly urbanized cities, provinces are considered the largest unit consisting of municipalities and component cities while highly urbanized cities are cities with a minimum population of 200,000 inhabitants and an annual income of PhP50 million; (2) component cities and municipalities, component cities are those that have less than 200,000 population while municipalities have a population of at least 25,000 inhabitants and an income of at least PhP2.5 million; and (3) *barangays* which are the basic political unit composed of at least 2,000 inhabitants or at least 5,000 inhabitants for cities and municipalities in Metro Manila, metropolitan areas and highly urbanized cities (Republic

Act No. 7160; Morales, 2016). While the three local government tiers are decentralized and have the autonomy they still have to follow and be consistent with the national development plans.

Philippine planning is composed of a spatial plan, socio-economic development plan, and an investment program. The National Economic Development Authority is the primary agency responsible for the formulation of the national and regional plans and programs, National Framework for Physical Planning, Medium Term Philippine Development Plan, and the Medium Term Investment Program. These plans are also translated at the regional, provincial, municipal, and city levels (Table 6.1).

Table 6.1: Philippine hierarchy of plans

LEVEL	PHYSICAL PLANS	SOCIO-ECONOMIC DEVELOPMENT PLANS	INVESTMENT PROGRAMS
National	National Framework for Physical Planning (NFPP)	Medium Term Plan (MTP)	Medium Term Philippine Investment Program (MTPIP)
Regional	Regional Physical Framework Plan (RPFP)	Regional Development Plan (RDP)	Regional Development Investment Program (RDIP)
Provincial/City	Provincial Physical Framework Plan (PPFP)	Provincial Development Plan (PDP)/City Development Plan (CDP)	Provincial Development Investment Plan (PDIP)/ City Development Investment Program (CDIP)
Local/Municipal	Municipal Comprehensive Land Use Plan (MCLUP)	Municipal Development Plan (MDP)	Local Development Program (LDIP)

Source: Author interpretation

6.1.1 Flood risk management in the Philippines

The World Risk Report has consistently ranked the Philippines as one of the most vulnerable countries to disasters. In the 2019 World Risk Report the country ranked ninth most at-risk country in the world and has the highest risk in Asia (Bündnis Entwicklung Hilft and Ruhr University Bochum Institute for International Law of Peace and Armed Conflict, 2019). Being in the Pacific Ring of Fire and Pacific Typhoon Belt the country is prone to earthquakes, tsunamis, volcanic eruptions, typhoons, and tropical cyclones (Padagdag, 2018). As a tropical country, it is visited by tropical cyclones yearly especially between July and September (Gilbuena, et al., 2013). The outdated and poor drainage

system of the country has been subjected to extreme weather events for decades and because of the sewerage and drainage condition, cities are easily inundated. Improvements in the drainage systems only commenced in the early 1970s (Gilbuena, et al., n.d.; Gilbuena, et al., 2013).

The Department of Public Works and Highways (DPWH) is the government's "engineering and construction arm . . . [responsible for] the design, construction, and maintenance of national roads, bridges, flood control systems, and water-resource systems" (GovPH, 2020). Even with scientific and experiential evidence of the country's vulnerability to flooding disasters, the budget for flood control has remained low compared to roads and bridges (JICA, 2010). The National Capital Region, most commonly known as Metro Manila is the densest of the three metropolitan areas in the Philippines. It is one of the most vulnerable areas in terms of flooding due to its rapid urbanization, high population density, and cities located in low-lying areas and valleys. As such, the DPWH entered a Memorandum of Agreement with the Metropolitan Manila Development Authority (MMDA) on 09 July 2002 mandating the MMDA as the primary agency responsible for flood management in Metro Manila, while DPWH maintains a primary role for the rest of the country (World Bank, 2017a; World Bank, 2017b; AIIB, 2017; MMDA v. Concerned residents, 2008). On 28 June 2011 under MMDA Resolution No. 11-21 sole authority over flood control and management in Metro Manila was granted to the MMDA. This was granted after the 17 Mayors of the cities and a town that comprise Metro Manila reviewed and recommended the use of the calamity funds for pre-calamity and/or pre-disaster activities (MMDA Resolution No. 11-21). This included the installation of additional floodwater gauge sensors in flood-prone areas in Metro Manila to monitor the floodwater levels.

Both structural measures, through river dikes, flood gates, floodways, and pumping stations and non-structural measures, flood forecasting, and warning systems, are applied in managing floods in the country (Gilbuena, et al., 2013; GovPH, 2010). The flood and weather forecasting, monitoring, and warning systems are the responsibility of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA). The PAGASA has its roots in the Philippine Meteorological Service founded in 1865 during the Spanish regime (PAGASA, 2020). Flood events in the Philippines are caused by extreme rainfall, clogged drainage and sewerage systems, and inadequate flood control infrastructures. On top of that, esteros or drainage canals have likewise been encroached by informal settlers (Bankoff, 2003). Rapid urbanization and informal settlements that reside along the riverbanks also aggravate the flood problem, especially in Metro Manila.

There are three main flood control projects in Metro Manila, the Manggahan Floodway and Napindan Hydraulic Control Structure both located in Pasig City, and the CAMANAVA Flood Control Project located in the four low-lying cities Caloocan, Malabon, Navotas, and

Valenzuela. While the 2 flood control projects in Pasig City are fully operational composed of a total of 12 floodgates and 2 navigational lock gates, the CAMANAVA Flood Control Project has been rigged with controversy on alleged construction flaws and effectiveness in mitigating flooding (Manila Bulletin, 2012; Romero, 2013), as well as the delays that have incurred over the years (Romero, 2013). The CAMANAVA Flood Control Project was finally completed in 2012.

6.1.2 Disaster risk management in the Philippines

The first disaster risk management law in the Philippines was PD 1566, "Strengthening the Philippine Disaster Control, Capability and Establishing the National Program on Community Disaster Preparedness" issued on 11 June 1978. Presidential Decree 1566 established the National Disaster Coordinating Council (NDCC) composed of different government departments chaired by the Department of National Defense (DND). This law is characterized by a top-down and centralized function focused on emergency response.

In July 2009 Republic Act 9729 or the Climate Change Act 2009 was enacted recognizing the interconnections between climate change and disaster risks and the country's vulnerability to climate-related risks and hazards. With this understanding, the legislation demands the incorporation of disaster risk management into climate change policies and strategies and the creation of a Climate Change Commission presided over by the Philippine President. The law was approved on 23 October 2009 a month after Typhoon Ketsana (Philippine local name Ondoy) made landfall in the Philippines.

It was kismet that Typhoon Ketsana arrived in late September 2009 at the height of the Philippines' active involvement in the Intergovernmental Panel on Climate Change. The typhoon entered the Philippine area of responsibility with a maximum center wind of 105 kilometers per hour and inundated cities in Metro Manila six of which (Pasig, Quezon City, City of Manila, Caloocan, Muntinlupa, and Marikina) were the heaviest affected where flood levels reached neck to rooftop deep (NDRRMC, 2009). This experience prompted lawmakers to create a succession of climate change and disaster risk management laws to give the necessary teeth to implement disaster mitigation and preparedness measures.

On 29 May 2010 RA 10121 or the "Philippine Disaster Risk Reduction and Management Act of 2010" was ratified replacing the NDCC with the National Disaster Risk Reduction and Management Council (NDRRMC) chaired by the DND. Section 2 (e) of RA 10121 states "Develop, promote, and implement a comprehensive National Disaster Risk Reduction and Management Plan that aims to strengthen the capacity of the national government and the local government units, together with partner stakeholders, to build the disaster resilience of communities, and to institutionalize arrangements and measures for reducing disaster risks, including projected climate risks, and enhancing disaster

preparedness and response capabilities at all levels". Republic Act 10121 specified the need for the LGUs to create their local disaster risk reduction and management office. The law under Section 12 explicitly stipulated that each of these local units is responsible for setting out the direction, implementation, and coordination of their own disaster risk management programs and projects. Thus, from a top-down view on disaster risk management, it shifted to a more proactive, integrated, and participatory approach.

In the succeeding year, 2011, RA 10174 was enacted to amend RA 9729 to establish the People's Survival Fund. The aim of RA 10174 is to provide long-term financing for climate change mitigation and adaptation strategies. This law ensures that LGUs especially the most vulnerable to have the means to implement climate change related programs and projects. This includes community-based disaster risk management plans, risk assessments, disaster preparedness strategies among others.

In November 2013 Typhoon Haiyan (Philippine local name Yolanda) struck the Philippines hitting mostly Southern Luzon and the Visayas. Haiyan is considered one of the strongest tropical cyclones in history (Guardian, 2013). The NDRRMC reported a total of 16 million people were affected with over 6,300 people dead, 4.1 million displaced, and 1.1 million houses destroyed and/or damaged (NDRRMC, 2013; Esteban, 2015). These typhoon incidences cannot deny the precarious situation Filipinos live in. Lawmakers and climate experts have since rallied on more accurate, scientific-based responses and assessments on disaster risks and management.

Seeing the NDRRMC is still under the jurisdiction of the Office of Civil Defense (OCD) and the urgent need for science-based risk assessment to help in policy-making and decision-making a move to amend RA 10121 was set in motion in 2017. A proposal to create a Department of Disaster Resiliency through House bill 6075 "An act creating the Department of Disaster Resiliency and defining its powers and functions, appropriating funds therefor and for other purposes" was submitted to Congress on 27 July 2017. The bill seeks to establish an agency separate from the OCD that will manage the execution of a streamlined policy on disaster risk reduction and management nationwide. Several readings and resolutions in Congress led to the final draft submitted on 30 August 2018 for approval of the House Bill No. 8165 Department of Disaster Resilience Act. As of writing, the bill is pending final approval by Congress.

6.2 PHILIPPINE CASE BACKGROUNDS: MARIKINA AND MALABON

The next sections provide the background of the city development of Marikina and Malabon. Table 6.2 below presents a summary of the significant policies at the national level on planning and crisis management and the corresponding timeline of the policies in

Marikina and Malabon. Specific policies for each of the Philippines city cases are presented in the sections.

Table 6.2: Policies on planning and disaster management vis-a-vis Marikina and Malabon policies, programs, strategy documents

National policies		Marikina planning policies	Malabon planning policies
Planning	**Disaster risk management**		
National Urban Planning Commission Executive Order 98 (1946)	Presidential Decree 1566 (Strengthening the Philippine Disaster Control, Capability and Establishing the National Program on Community Disaster Preparedness) (1978)	Save the Marikina River Program (1992)	**CAMANAVA Flood Control Project
National Planning Commission Executive Order 367 (1946)	Republic Act 9729 or the Climate Change Act 2009 (2009)	Squatter free Marikina (1992)	Malabon Comprehensive Land Use Plan 2018 to 2027
Republic Act 2264 (Local Autonomy Act of 1959)	Republic Act 10121 (Philippine Disaster Risk Reduction and Management Act of 2010)	Rescue 161 (1992)	
Republic Act 4341 (Institute of Planning now University of the Philippines School of Urban and Regional Planning) (1965)	Republic Act 10174 (o amend RA 9729 to establish the People's Survival Fund) (2011)	*Project NOAH	
Presidential Decree 1396 (Ministry of Human Settlements now Housing and Land Use Regulatory Board)	House bill 6075 (An act creating the Department of Disaster Resiliency and defining its powers and functions, appropriating funds therefor and for other purposes) submitted to Congress on 27 July 2017 pending approval		
The Local Government Code of 1983 (Batas Pambansa 337) repealed to Republic Act 7160 (RA 7160)			
1987 Constitution of the Philippines			

*This is a national project that helps Marikina in building information base on disaster risk management.
**This is a national project under the DPWH that made an impact on Malabon

6.2.1 Marikina City background

Catholic missionaries were the first to arrive in Marikina. According to the Philippine Information Authority, the Augustinians arrived in 1500 (Guzman, 2020) and the Society of Jesus in 1630 (Guzman, 2020; City Government of Marikina, 2001). Marikina rests in a valley bounded by the Sierra Madre mountain which is the longest mountain range in the Philippines. The area was originally an agricultural town with fecund land fed by the mountains and the river. Marikina used to be one of the towns of the Province of Rizal. Perhaps as a result of its growth and prosperity as a Spanish hacienda (large plantation) (Guzman, 2020), demand for non-essential products such as clothing and footwear rose.

In 1887, the shoe industry started in Marikina (Guzman, 2020; Angeles, 2003) and was claimed to have started with Don Laureano "Kapitan Moy" Guevarra (Angeles, 2003; Scott, 2005; City Government of Marikina, 2001). The shoemaking craft in Marikina was honed in time where the production of shoes was done in clusters some of which are still in home backyards (Scott, 2005). Since the introduction of shoemaking in 1887, this

industry has slowly taken over the then agricultural town of Marikina. The introduction of shoemaking was intended to be supplementary to the other agricultural livelihood. However, during the American occupation shoemaking equipment was introduced in Marikina and the Americans placed an order for army boots (Angeles, 2003) which triggered the volume-based production of machine-made shoes. Livelihood in Marikina then shifted from agriculture to shoemaking. By the 1930s Marikina had a booming shoe industry but it was not bereft of problems such as suppliers and middlemen (Angeles, 2003). Marikina instead pushed their niche in the industry that the city's shoemakers dominated the domestic market and in 1956 declared as the "Shoe Capital of the Philippines" (City Government of Marikina, 2001; Angeles, 2003).

Marikina is traversed by the Marikina river which is an important tributary connected to the Pasig River. The Marikina river serves as a catch basin for Quezon City in Metro Manila and Tanay, Montalban, San Mateo, and Antipolo City in the Province of Rizal (Santos, et al., 2017). Marikina's shift from agriculture-based to industry-based led to a rise in population and manufacturing industries. The period between the 1930s and the 1950s saw the industrialization of Marikina providing jobs to locals and residents of neighboring towns. However, the growth of the industry and economy in the city became the reason for the gradual decline of the Marikina river where most industries dump their waste. The population of Marikina also started to increase with the immigration of people from neighboring areas who occupied vacant government land and danger areas such as the riverbanks. Informal settlements along the riverbanks grew and because of lack of sanitation facilities, the river became a dumping site for not just the informal settlers but also the industries surrounding the area (Iglesias and Yu, 2008).

As a catch basin, water from neighboring elevated cities and towns flow down to the Marikina valley but the state of the river in the 1970s and 1980s was poor that water does not flow easily to the Pasig river down to Laguna de Bay. From that time on flooding then became a customary scene during the storm season. In a study done by Monjardin et. al. (2019) on flood modeling using historical data, they found that water level and discharge volume for the Pasig-Marikina river area ranged from 14.78 meters and 507 cubic meters in 1958 to 22.16 meters and 32.11 cubic meters in 2009. The forecast based on their study shows an increasing frequency of high-level flood events due to the changes in land-use patterns and climate change.

In the 1990s Marikina was led by Mayor Bayani Fernando (known as BF) who imposed changes in the city. Solutions to the flooding problem of Marikina were sought by the simple vision to clean up the river system. This was the beginning of Marikina's transformation to one of the most well-managed cities. There are primarily two periods in Marikina's flood risk and disaster risk management, first, flood risk management and policy implementation, and second, the institutionalization of disaster risk management and preparedness.

a. Period of river rehabilitation and clearing of informal settlements

For several decades Marikina residents experienced flooding due to water overflowing from the river and poor drainage systems. In 1992, a large-scale flood happened in Marikina that inundated 27.52% of the city (Francisco, 2015) and affected 10,000 households (ADB, 2008). That same year, BF an engineer won the mayoral election who incited fundamental changes in the city. It was during the new mayor's term that strict compliance and implementation of the law and ordinances were done. Calilung (2008) mentioned that the mayor "exhibited a strong political will [to transform] Marikina from a sleepy, complacent, dormitory locality into a clean, vibrant city with disciplined residents" (p. 7). There was tough enforcement of the laws such as clearing of sidewalks from illegal vendors, enforcing standard setbacks for buildings and structures, and prohibiting the dumping of garbage outside properties and streets.

To address the flooding problems of Marikina, the city initiated the "Save the Marikina River Program" to rehabilitate the Marikina river. This was also done in conjunction with improving the drainage systems, paving of roads to reduce silt that enters the drainage systems, and clearance of obstructions which included clearing the Marikina riverbanks of informal settlers (Calilung, 2008, Iglesias and Yu, 2008). The city government also took on the responsibility of dredging the river regularly, a duty that was to be carried out under the national government (Iglesias and Yu, 2008) by the DPWH. The clearance of the Marikina riverbanks from obstruction and clean up of the river allowed the city government to transform the area into a river park. The Marikina River Park has an 11-km joggers and bike lanes, sports facilities, floating stages for performances, and open space for recreation (Iglesias and Yu, 2008; Yu and Sajor, 2008).

The informal settlers along the Marikina riverbanks needed to be relocated but were not forced out from the premises. A census of informal settlers was conducted from 1992 to 1994, not just for those who were along the riverbanks but also the other waterways, private and government properties (Iglesias and Yu, 2008). In 1994, Ordinance 10 of 1994 was issued "declaring an easement of 96 meters from either side of [the] Marikina River centerline, and authorizing the relocation of all residents found with the easement to safer ground" (Iglesias and Yu, 2008: 4). The ordinance was a combination of clearing the Marikina River from obstructions to prepare it for rehabilitation and resettlement of informal settlers. Two offices under the city government were created to implement river rehabilitation program and resettlement program, these are the Marikina River Park Authority and the Marikina Settlements Office. An area of about 106 hectares was identified within the city as resettlement areas for 22,000 families (Iglesias and Yu, 2008).

Emergency preparedness and response were also prioritized by the city by setting up 'Rescue 161' a 24-hour communication platform to receive emergency calls and dispatch emergency medical services (Iglesias and Yu, 2008; Borje, n.d.). Conceptualized in 1992,

Rescue 161 became fully operational in 1993 with the deployment of skilled and well-trained emergency responders (Borje, n.d.). In 1997, Rescue 161 introduced a 5-minute quick response time to be pursued by first responders, police, fire, and the Rescue 161 medical team. The Ordinance 264 of 1998 further strengthened the position of Rescue 161 by creating the Disaster Management Office and allocating an annual budget for its operations. Non-government organizations (NGOs), professional groups, peoples organizations, and volunteers were also accredited through the city council resolution no. 283 series of 2000 to ensure coordination and participation (Dangcalan, et al., 2019).

In 1996, the city established the Waste Management Office (WMO) to manage the city's solid waste management services and related services on sanitation (Iglesias and Yu, 2008; Fajardo, 2007). A collection system was created with the designated garbage collection schedule for residents. Residents are only allowed to leave their garbage and garbage bins outside of their residence on the day of the collection schedule. Fines are strictly imposed on violators and "would find their garbage thrown back (literally) inside their properties" (Calilung, 2008: 5). Other ordinances on waste management were also passed in the city to ensure cleanliness, Ordinance numbers 213 (1998) and 76 (1999) on anti-littering prohibit individuals from littering the streets (AEA Technology, et. al., 2003; Calilung, 2008), Ordinance No. 210 (1994) which gives the responsibility to the homeowners and/or business establishment owners to clean the sidewalk fronting their property, and Ordinance No. 57 (1999) prohibiting the burning of any waste in public spaces (AEA Technology, et al., 2003).

In 2001, BF's wife Marides C. Fernando won the mayoral race and served Marikina from 2001 to 2010. This ensured continuation of projects from the previous administration. In 2002, the users pay principle was introduced to encourage commercial establishments to reduce their waste by charging higher monthly garbage rates to commercial establishments while homeowners pay a fixed fee regardless of the amount of household waste they generate (Iglesias and Yu, 2008). Ordinance Number 046 was issued in the same year to encourage segregation of garbage at source following Republic Act 9003 or the Ecological Solid Waste Management Act of 2000 (AEA Technology, et al., 2003). To further advance solid waste management in the city and encourage the participation of all sectors, the WMO came up with the Eco-Savers Program in 2002. The program was launched in 2004 in coordination with the Department of Education (Fajardo, 2007; DELGOSEA, n.d.). The basic goals of the program were to educate households on proper waste segregation and recycling by engaging students and teachers, to minimize the cost of solid waste management, to reach a 20% waste disposal goal by recycling, and to promote environmental awareness (DELGOSEA, n.d.). Eco-savers participants, who are mainly students, are given an Eco-Savers Passbook where they log in the recyclables taken and the points gained. These points can be redeemed at the Eco-Savers Mobile Store for school supplies (Fajardo, 2007).

To further improve the city government's disaster preparedness, the city council passed Ordinance No. 54 of 2005 to authorize the use of the 20% calamity funds for disaster preparation measures (Dangcalan, et al., 2019). This was used to procure equipment and facilities and provide training for Rescue 161. This ordinance was extended to the *barangays* by the passage of Ordinance No. 073 of 2006 (Dangcalan, et al., 2019). In the same year Executive Order No. 011-16 of 2006 was issued to clarify the scope of Rescue 161's duties and responsibilities (Dangcalan, et al., 2019: 76).

Through these programs and projects, flooding in Marikina was reduced to 31% (Francisco, 2015). The success of the Marikina programs and projects has been recognized by Galing Pook Awards and the national government for innovation and excellence (Dulay, 2012; Borje, n.d.). The city was also recognized internationally as one of the "Healthiest and Most Livable Cities" in the Asia-Pacific (ADB, 2009). The concept of the Eco-Savers Program has been replicated in other cities in Cambodia, Indonesia, and Viet Nam (DELGOSEA, n.d.). Mayor Marides C. Fernando was ranked 7th in the 2008 Top Mayors of the World Award for her leadership in transforming Marikina (ADB, 2009). These accolades serve as an inspiration to the Mariqueños and succeeding leaders of the city to continue and even improve on.

b. Period of disaster risk management and preparedness (institutionalizing DRRM)

On 26 September 2009, Typhoon Ketsana hit the Philippines. An unprecedented 35 to 55 centimeters (13 to 21 inches) of rain fell in one day equivalent to a month's rainfall during a monsoon season (Environment News Service, 2009). Eighty percent (80%) of Metro Manila was inundated (Environment News Service, 2009; Nilo and Espinueva, 2011) and affected 239 *barangays* (NDRRMC, 2009) and 872,097 people affected in the metropolitan area (Sato and Nakasu, 2011). In Marikina, the flood level reached up to the second floor of houses and buildings (Sato and Nakasu, 2011). A total of 178,985 people were affected, 73 people dead and 1,083 houses destroyed (Sato and Nakasu, 2011) and an estimated economic loss of PhP2.25 billion[9] (€38.55 million[10]) (Tuaño, et. al., 2016).

Reconstruction in Marikina after Typhoon Ketsana was led by the city government with the help of the national government, financial help from international organizations, NGOs, and several volunteers from within and outside of the city. The city government of Marikina's progressive stance on city development, flood, and disaster risk management can be credited for the city's fast recovery having put in place a week after the disaster a Marikina Recovery Plan (Florano, 2014). This recovery strategy includes the short, medium, and long-term recovery plans and programs for the infrastructure, environmental,

[9] The estimated amount in Tuaño et.al. (2016) study is PhP 22.54 billion for both Marikina and Pasig cities with 90 percent of that amount representing Pasig city's loss (p. 1).

[10] Foreign exchange rate as of 22 May 2021 is at €1 = PhP58.36 https://www.likeforex.com/currency-converter/euro-eur_php-philippine-peso.htm/1

economic, social, and administrative sectors done together with the different government departments, NGOs, peoples organizations, and private sector (Florano, 2014). To help the local businesses to recover their losses, the city implemented a zero-tax policy for the shoe industry (Florano, 2014) and tax relief for local enterprises (ILO, 2010). The city government likewise opened a credit facility through the help of the national government to offer short- and long-term loans to business owners (ILO, 2010). Residents were also given a 50% discount on real property tax payments (Florano, 2014; ILO, 2010).

Having Rescue 161 in place also helped Marikina in the coordination of relief, rescue, recovery, and rehabilitation. When the national government passed RA 10121 Marikina simply adopted the law and transformed Rescue 161 to the Marikina City Disaster Risk Reduction and Management Office (MCDRRMO) (Dangcalan, et al., 2019). The law provided the necessary policy support to implement further disaster mitigation and preparedness activities for Marikina. The history of Marikina in building its MCDRRMO also made it an attractive partner and case for Project NOAH. Project NOAH incorporates science and technology for reducing and mitigating disaster risk. It uses emerging technology to improve geo-hazard and vulnerability maps (GovPH, n.d.; Department of Science and Technology, 2013).

6.2.2 Malabon City background

Malabon was originally called the town of Tambobong from the root *"tambo"* a local tree, it later became Malabon from the root *"labon"* or muddy water (Magno, 1993). The city has a rich historic and colonial past starting from the creation of Malabon as a town by the Augustinians in 1670 (Magno, 1993; City of Malabon, 2018). It was a site of many battles against Spanish colonial rule including the Philippine Revolution in 1896. It also became the 'hotbed of anti-American guerrillas' (Magno, 1993: 207) during the American occupation.

The proximity of Malabon to the river and Manila became its economic asset, as the town became a tobacco and sugar manufacturing hub under Spanish rule. Many of the local landed elites would own these sugar refineries and trading businesses. Apart from these major products and economic sources, the elites of Malabon own vast fishponds. However, during the 1970s under Martial law a privately owned fishpond in Dagat-dagatan, a district in the area of modern-day Malabon and Caloocan cities, was expropriated and turned into the Dagat-dagatan Reclamation Project. Magno (1993) calls this reclamation project a "grand failure" since the project which was intended to be the site of low-cost social housing was unfinished but succeeded to contribute further to Malabon's flooding problem (p. 210).

Malabon is located in the north of Manila City, bounded to the west by Navotas, to the north by Obando, Bulacan, to the northeast by Valenzuela, and the southeast by Caloocan

City. Three major rivers surround Malabon, Malabon-Navotas River, Tinajeros-Tullahan River and Tullahan Rivers (City of Malabon, 2018). Apart from the three main rivers, there are other waterways in the 1,571.4-hectare (15.71 sq. km.) city, such as the Batasan River, the Dampalit River, the Muzon River, the Polo River, and the Kalayaan Creek. In total there are eighteen rivers, creeks, and canals (Tyree, et al. 2013) which places Malabon in a precarious situation when it comes to floods. Furthermore, Malabon's land area is largely composed of tidal land, which means that the city is subject to tidal fluctuations during low and high tide seasons. Flooding often happens during the high tide season, heavy rainfall, and overflowing of the river, which is further exacerbated by the city's dense population and poor and outdated drainage systems.

The frequency of the floods in Malabon has gained the city the moniker "Local Venice." Residents of Metro Manila have come to recognize Malabon as a location where flooding can occur regularly just through shifting tides. To resolve this issue, the national government launched the CAMANAVA Flood Control project in 2003. This was the first period where engineering and infrastructural works were implemented to address the flood issue in the CAMANAVA area, which are the cities Caloocan, Malabon, Navotas, and Valenzuela. However, change in flood risk management on the level of Malabon alone came after in 2012 after the flood experience brought by *Habagat* (Southwest Monsoon). The succeeding section will discuss Malabon's flood risk and disaster risk management experience.

a. The CAMANAVA Flood Control Project

The CAMANAVA Flood Control Project was conceptualized in 1997, although the feasibility study was done much earlier between 1988 to 1990 (Romero, 2013; ESSC, 2013). The project aims to mitigate the amount of flooding in the northwest cities of Metro Manila (CAMANAVA) which based on experience and studies the most flood-prone (JICA, 2014; Loh and Pante, 2015; Reyes and Lu, 2016). The project consists of raising the river wall, constructing ten flood control gates, five pumping stations, polder dikes, 6.0 hectares new regulation pond, and a submersible type navigation gate, and improving the existing drainage channels (Commission on Audit, 2014; Tyree, et al., 2013; Romero, 2013).

A major part of these infrastructures is situated in Malabon along the Malabon-Tullahan River. The CAMANAVA Flood Control Project was initially planned to be finished within five years (from 1999 to 2003), but the loan agreement between the Japan Bank for International Cooperation (JBIC) and the Government of the Philippines was only signed on 7 April 2000 (Commission on Audit, 2014). The project only began in 2003 after the public tender for the contract of the project and was expected to be completed in 2007. However, by 2007 the work of the contractor, Nishimatsu Construction Company, was not even near completion and the lease has since been renewed for another year. At the time

the Nishimatsu Construction Company contract concluded the project at 88 percent completed (Romero, 2013). In order to complete the project, the DPWH awarded the continuation of the project to a local company, BMWAD Joint Venture, in 2009 to complete the work (Romero, 2013).

While the CAMANAVA Flood Control Project is indeed a priority for these highly vulnerable and flood-prone cities, reports, including the Commission on Audit's (COA) assessment of the efficacy of the project, have been less than satisfactory. According to COA (2013), the structures had not completely mitigated the floods caused by high tide and heavy rains due to structural flaws, the presence of informal settlers, and the amount of waste, such that the target of reducing the level of floods from one meter to less than 0.5 meters was not entirely achieved. In fact, the polder dike had to be increased by another meter when it was overtopped by river water during the 2012 *Habagat* (Romero, 2013). Another study found that the data used to assess the engineering specifications were inaccurate and that the contractor overlooked to incorporate the impact of climate change on precipitation and tidal fluctuations (Tyree, et al., 2013). Moreover, COA reported that there is a shortage of manpower and communication facilities to manage the flood control facilities (Commission on Audit, 2013). The CAMANAVA Flood Control Project has since concluded in 2012 but flood control projects are still ongoing with the DPWH Flood Management Master Plan for Metro Manila and Surrounding Areas.

b. Disaster risk management after Typhoon Ketsana and *Habagat*

The CAMANAVA Flood Control Project was likely the largest flood control project in Malabon. Following the completion of the project, Malabon asked the DPWH to increase the height of the polder dike, rehabilitate the Catmon creek and the river walls, and build pumping stations and floodgates (Romero, 2013). These requested infrastructures were completed in 2015 (ReliefWeb, 2015) and in 2020, 2 more pumping stations were completed to address the flood problems in *barangays* Baritan, Concepcion, Muzon, Bayan-bayanan, Dampalit, and Halong-duhat (DPWH, 2020). The experience of the Malabon residents with the CAMANAVA Flood Control Project during its implementation was less than satisfactory. A national newspaper even quoted city officials as saying that the project "fail[ed] to meet the expectations of the residents" and "did nothing as regards to the perennial flooding particularly in Malabon" (Manila Bulletin, 2012).

The sentiments expressed were understandable when in the 2009 Typhoon Ketsana over 850 families in Malabon were affected by the floods. However, it was the 2012 Habagat that had a massive impact on the city when 90 percent of the land area was flooded (Tyree, et al., 2013). It was this experience that led Malabon City to formally create a Malabon Disaster Risk Reduction and Management Office especially with the passage of RA 10121 in 2010. By 2013 several non-government organizations have also offered assistance to the

barangays in Malabon to create their *Barangay* Disaster Risk Reduction and Management units. This will be further discussed in the empirical chapter on Malabon (Chapter 9).

6.3 CHAPTER CONCLUSION

The goal of this chapter is to provide a perspective on disaster risk management in the Philippines. The chapter began with a background on urban planning and spatial growth to provide an insight into the history of its spatial development. The historical analysis started in the post-World War II period and the liberation of the the Philippines from Japan, and finally the United States of America. This part of the history saw the creation of government institutions mainly dealing with the development of human settlements and the need to repair the damages inflicted by the war. From a top-down development a more decentralized planning and development approach was introduced in 1991 with the passage of the Local Government Code of the Philippines. This gave local governments – regional, provincial, municipal – space for maneuvering the development of their localities with the national policy as a framework and direction.

In the Philippines, flood risk management is under the Department of Public Works and Highways. Water management in the country is not heavily intertwined with the development of infrastructure and flood risk management unlike the Dutch. On disaster risk management, the Philippines was more advanced in the implementation of disaster preparedness policy with PD 1566 issued in 1978. The focus of the policy was disaster control and disaster preparedness capability at national and community levels. The primary role was a top-down emergency response. However, it was the Philippine Disaster Risk Reduction and Management Act of 2010 (RA 10121) which influenced the organization of disaster risk management in the country. Republic Act 10121 mandated local governments to set up their disaster risk reduction and management office from city level to community level.

The frequent flood experience in the Philippines led to the design of preventive infrastructures, however, the slow progress on infrastructure development still place the country in danger of flooding. This chapter serves as a significant reference to the timing of events for each of the Philippine case cities, Marikina and Malabon. In addition, the information contained in this chapter specific to the cases will be included in the subsequent empirical chapters and cross-case analysis.

CHAPTER SEVEN

CHAPTER SEVEN: HOW STERKER DOOR STRIJD IS ROTTERDAM?: MINDING THE GAP TO COLLECTIVE RESILIENCE BUILDING[11][12][13]

"Rotterdam is a city that was bombed [during] the war . . . my father and his brother and their mother, the three of them the house was gone and they went to live in the West in a house without anything, they started to build a new life. And many people did in Rotterdam, and the immigrants came from everywhere and they had nothing. Now [there are] many . . . they started to work very hard in the harbor. That is resilience . . . It is really incredible how people survived the war and started with nothing."

Citizen stakeholder 4, interview date 10 January 2019

7.0 INTRODUCTION

The City of Rotterdam has always held an important role in the Netherlands. It used to be the biggest port in the world and the center of commerce and industry in the country. The economic importance of the port was, in fact, one of the reasons for its bombardment during the Second World War. Since the Rotterdam Blitz, the city has undergone reconstruction and redevelopment focusing on the city's mobility and utility. Thirteen years after while the city is going through the period of reconstruction the Great North Sea Flood inundated the South of Holland. This led to the implementation of the Deltaworks project which provided the Dutch population protection and security from flooding.

In the 1990s several riverine threats and pluvial flooding happened that prompted the City of Rotterdam to take measures on the city's water retention capacity and approach to flood risk management. Since the late 1990s and early 2000s, Rotterdam has produced climate-related plans, policies, and projects to address the city's flood threats and vulnerabilities. In 2014 Rotterdam joined the 100 Resilient Cities of the Rockefeller Foundation and in 2016 released its Resilient Strategy. This initiative is not the first to spearhead the resilience programming in the city but it is the only initiative that highlights Rotterdam as a "resilient city". In the strategy, the city flaunted that the word resilience need not be defined because it is in the DNA of the Rotterdammers. The term resilience, however, covers a variety of ideas between policymakers and technical experts alike and remains an abstract word for many stakeholders.

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[11] Initial results of the Rotterdam case was presented in the 55th ISOCARP World Planning Congress in Jakarta/Bogor, Indonesia on September 9-13, 2019. The conference paper "Mind the gap: Stakeholders perspective on resilience building in the City of Rotterdam" was selected as the track keynote for the conference.

[12] A chapter on the Rotterdam case entitled "Keeping Feet Dry: Rotterdam's Experience in Flood Risk and Resilience Building" co-authored with the dissertation supervisors was published by INTECH Open in the book Flood Impact Mitigation and Resilience Enhancement in 2020. The published chapter was the first draft of the findings and analysis for the Rotterdam case.

[13] This chapter is a result of improvements from the series of attempts in making a cohesive story on Rotterdam. It built on the conference paper and chapter until a full story using the collective engagement urban resilience framework brought it all together in a narrative.

The City of Rotterdam adopted the adage *"Sterker Door Strijd"* (stronger through struggle) after the Rotterdam Blitz, which called for the determination and solidarity of the people of Rotterdam. Through this vision, the city was able to rebuild, reconstruct, and in fact, created a modern, thriving, and vibrant city. The city is a showcase of modern architecture contributed by mostly modernist architects in Rotterdam. At present, the city also showcases climate-adaptive structures that demonstrate to the world how this modern city is facing the challenge of climate change. Still, the global threat of climate change puts the Delta city at risk of water level rise and while policymakers and technical experts understand the risk of large-scale flooding has a 1 in 10,000 years probability, the general population may interpret this differently as not happening in their lifetime.

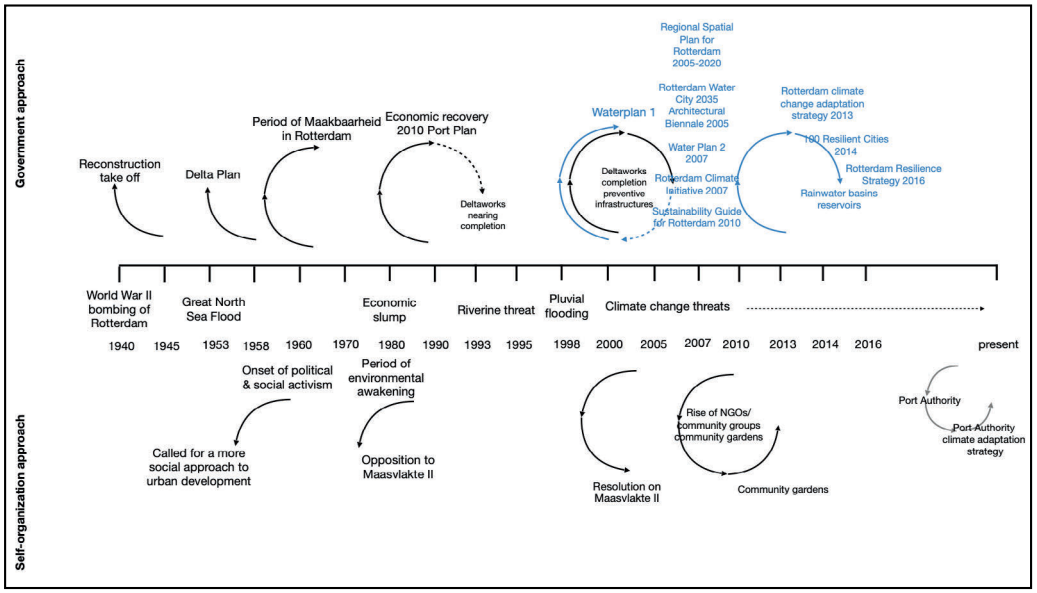
This chapter discusses the process the City of Rotterdam has gone through in building urban resilience and collective engagement. *Sterker door strijd* marks the collective struggle and rebuilding that the city has been known for. As the city progressed and modernized how does this collective "struggle" to reach a level of resilience, and in Rotterdam's case a "resilient city", resonate? Rotterdam's case highlights a long-drawn-out urban resilience process leading to security in terms of preventive infrastructure and burgeoning civil society self-organization. The case is an example of an infrastructure-secure city but struggling to close the gap between government and civil society on the topic of urban resilience.

To outline the process of urban resilience and collective engagement of Rotterdam, this chapter is divided into three sections. The first section of this chapter outlines Rotterdam's adaptive cycles centered on the significant historical disaster experiences and the policies and actions that transpired. The second section presents the collective engagement and urban resilience using the four dimensions of collective engagement. The last section brings together the conclusions highlighting the different gaps that continue in the "struggle" to build collective engagement and urban resilience.

7.1 ADAPTIVE CYCLES

The timeline shown in Figure 7.1 illustrates Rotterdam's step towards urban resilience building using the conceptual framework in Chapter 3. This reveals how the city has gone through the different aspects of collective engagement over time, and the differences and similarities between the points of time taken by the government and the self-organization approach. In the figure, the curved arrows indicate the collective engagement dimensions - concern, action, efficacy, and security - within the adaptive cycle that happened over a period of time. The figure shows that the two approaches have different starting points across the timescales but have somehow started to converge in the early 2000s when the Deltaworks was nearing its completion.

Figure 7.1: Timeline of collective engagement urban resilience of Rotterdam



The journey of Rotterdam towards urban resilience goes through mainly two adaptive cycles. The first adaptive cycle (black curved arrows) had two disturbances as triggers for the government approach, the 1940 Rotterdam Blitz and the 1953 Great North Sea Flood. The first disturbance, the bombing of Rotterdam, happened on 14 May 1940 and decimated 80% of the city's infrastructure, yet that did not dissuade the people from bouncing back from this devastation. Within four days after the Rotterdam Blitz, the Mayor of Rotterdam immediately appointed Willem Gerrit Witteveen to design the reconstruction plan of the city (Post-war reconstruction community Rotterdam, 2020) and by the end of 1941, this plan was finalized. However, it was only after the Germans departed in 1945 that the reconstruction process began, this marks the first take-off point in the collective engagement urban resilience transformation (shown in Figure 7.1 as the first curve in the government approach). Cornelius van Traa took over the reconstruction in 1946 and created the Basic Plan for Rotterdam to create a more coherent and realistic reconstruction plan. Modern architecture was encouraged during this period especially in the city center which was zoned in the plan as commercial. Modern buildings function as offices and shopping spaces, industries were located outside of the city center, and residential areas in the plan were located in the periphery of the city.

This was a long period of rebuilding, redevelopment, and growth for the city. As the city advanced in rebuilding from the 1940 bombing, the flood of 1953 added another layer to this rehabilitation work. The Great North Sea Flood of 1953, which claimed the lives of 1,835 people, became the second disturbance in the first adaptive cycle. While the damage in Rotterdam was not as serious as that in Zeeland, the flood disaster shook its economic

position. In 1958, the national government released the Deltaplan and implemented the Deltaworks project as a long-term flood preventive measure throughout the region to ensure that a flood disaster will never happen again. The Deltaplan marks the second take-off point to collective action in ensuring security to flood risk (see Figure 7.1).

The reconstruction after World War 2 continued even during the Deltaplan preparation phase and the actual building of the initial structures under the Deltaworks project. The rebuilding of Rotterdam was still very concentrated on the city center and the port area. This government-approach was essential to restore the city's economy and the overall economic position of the country's most important port. Implementation of the Deltaworks project coincided with the port expansion in the Botlek and Europoort areas which made Rotterdam the world's largest port in the early 1960s.

The self-organization approach which also has two take-off points in the adaptive cycle began much later during this first period of rebuilding. The first take-off point was ignited in the 1960s when the state-led redevelopment triggered political and social activism to advocate for a more inclusive approach to urban development. At that time, the economy of the Netherlands was beginning to grow, a period called *'Maakbaarheid'*. The economic boom also meant a rise in construction as Rotterdam continued its path to urban regeneration. The demand for unskilled labor in the country was high but the supply of unskilled laborers was low that the Netherlands government resorted to inviting 'guest workers' from other countries such as Italy, Spain, Portugal, Turkey, Greece, Morocco, Yugoslavia, and Tunisia (Zorlu and Hartog, 2001; Ersanili, 2014; Van Amersfoort and Penninx, 1994). Most of the guest workers worked in the harbor that in Rotterdam the composition of the population increased creating a tremendous demand for new housing areas. However the demand for new housing stock was not just limited in Rotterdam, it was a challenge all over the country that a variety of developments were initiated like the greenfield developments. In Rotterdam, this meant the construction of housing stock in the urban fringe away from the city center.

In the late 1960s, the strategy to construct housing in the urban fringe as greenfield developments was heavily contested by political and social activists who demanded a more social approach to urban redevelopment. The political and social activism in this period resulted in a change in the city's spatial structure plan (*structuurplan*) from the destruction of existing residential areas to the restoration and improvement of old areas with the participation of its residents. Location for new housing stock changed from greenfield areas to the renewal of brownfield areas into mixed-used areas. This marked the start of the period of urban regeneration and renewal in the 1970s and the involvement of private citizens in the development planning process.

The second take-off point for the self-organization approach was in the 1970s and 1980s when civil society and environmental organizations protested the further extension of the

Port of Rotterdam from Botlek, Europoort, Maasvlakte I to Maasvlakte II (see Figure 7.1). In the 1970s the aim for the construction of Maasvlakte II was to set up a blast furnace and, in the 1990s, to set up container terminals and the petrochemical industry (Koppenol, 2014). Resistance to the planned expansion emerged in both eras out of fear of increased air pollution due to the blast furnace (in the 1970s) and the general cargo traffic (in the 1990s) (Koppenol, 2014). To ease the public pressure and resistance towards the project and gain public support, the government included the creation of a total of 750 hectares of nature reserve to the south and north of Rotterdam (Port of Rotterdam Authority, 2007). Negotiations between the government and civil society groups went on for a decade until arriving at a resolution in 2004.

Over the same time in the 1990s, there was another catalyst for a new adaptive cycle in the government approach. In 1993 and 1995 the riverine floods from the Rhine prompted the Netherlands to take additional steps to upgrade and increase the level of river dike, strengthen flood warning measures, and local evacuation plans. The 1993 riverine flooding led to the evacuation of 8,000 people while the 1995 riverine flooding due to heavy rainfall also resulted in high discharges experienced in Lobith, Gelderland (van der Grijp and Olsthoorn, 2001). The situation in 1995 also threatened the dikes in the surrounding areas, the near-flood situation in the Rhine river led to the evacuation of 250,000 people in Nijmegen (van der Grijp and Olsthoorn, 2001). According to Institutional actor 5 (Interview date 12 December 2018), the evacuation exercise was very unusual in the Netherlands since large-scale floods have not occurred since 1953.

After the experience with the riverine flooding in 1993 and 1995, pluvial flooding in 1998, and completion of the Deltaworks project, the second adaptive cycle (blue curved arrows in Figure 7.1) for the government approach began in the late 1990s. Since 2000 more policies to address a more adaptive approach to flood risk and climate change have been created. Those policies ushered in a way to build alliances with different stakeholders to implement climate-adaptive initiatives in the cities.

Based on this synopsis of the timeline in the adaptive cycles of Rotterdam, the next sub-sections will discuss the policies and institutional context that took place during the adaptive cycles with greater emphasis on the resilience strategies in Rotterdam, and the stakeholders' interaction with the city government programs. These discussions will feed into the context of collective engagement and urban resilience in Rotterdam which will be in the next section of this chapter.

7.1.1 Policies and institutional context

The 1993 and 1995 riverine flooding and near-flood situation changed the perception in the Netherlands about high river discharges. Both incidents were catalysts to shift the water management approach in the Netherlands from preventive to more adaptive and brought forward policies from the national government such as the Flood Defence Act (1996), Room for the River (1997), and "Dealing differently with water" (2000) (Kaufmann, et al., 2016).

"I think these disasters started awareness that we couldn't continue doing what we are doing. So the National Government started thinking about how to manage the water coming from outside Holland and coming from the sea and what to do about it and that was the start of the Delta Plan and the Room for the River." (Institutional actor 1, interview date 18 December 2018)

In 1997 the last two storm surge barriers under the Deltaworks project, Maestlankering in Rotterdam and Hartelkering in Spijkenisse, were completed. This marked the completion of the first adaptive cycle from the government approach, shown in Figure 7.1 as the first full circle in the government approach transitioning (depicted as dashed lines) to the second adaptive cycle. In 1998, the pluvial flooding in the South of Holland affected districts in Rotterdam and prompted the city government to assess the city's retention capacity. The pluvial flooding ushered in the thinking towards 'working with water' (climate change adaptation) rather than 'working against water' (flood preventive measures). This concern led to the development of Water Plan 1 that highlighted the need to increase the city's water retention capacity. This was the trigger of the second adaptive cycle for the government approach.

After the Water Plan 1, flood events, dike breach threats, and the looming threat posed by the changing climate conditions have resulted in the creation of a series of policies and strategies in Rotterdam. The government approach continued towards the direction on the engineering pathway but also merged it with an adaptive pathway towards resilience. Table 7.1 shows the policies, plans, and strategies outlined in Figure 7.1.

Rotterdam's Water Plan 1 was the first effort to bring urban planning, water management, and climate change adaptation into the city's policy agenda. Following Water Plan 1, the Regional Spatial Plan for Rotterdam (2005-2020) (*Ruimtelijk Plan Regio* Rotterdam 2020) was introduced in 2005 to enhance the quality of residential environments and strengthen and diversify the economy, acknowledging the danger of climate change that could impact the economic function of the region (Stead and Tasan-Kok, 2013). In the same year, the Rotterdam Water City 2035 design study was unveiled at the 2005 Architectural Biennial. This was the primary impetus for further adaptation to climate change in urban planning in Rotterdam. The study focused on water as both the strength and the weakness of Rotterdam but factored in ways to include climate adaptation strategies to address the

city's vulnerability. The design study incorporated urban planning and climate adaptation approaches to turn Rotterdam into an attractive city that integrates urban and water. The Rotterdam Water City 2035 gained political support and contributed to the development of Water Plan 2, which further stressed the connection between urban and water, and the importance of tackling climate change via adaptation measures.

Table 7.1: Policies, plans and strategies in Rotterdam

Policy/Plan/Strategy	Year	Description
Waterplan 1	2001	Urban water strategy and short term plan which included plan to increase Rotterdam's water capacity (Dunn, et al. 2017; Toorn Vrijthoff and Heurkens, 2008)
Regional Spatial Plan for Rotterdam 2005-2020	2005	Three policy goals: "(1) to improve the quality of residential environments, (2) to strengthen and diversify the economic structure of the city, and (3) to increase social cohesion" (Stead and Tasan-Kok, 2013: 221). The strategy acknowledges the threat of climate change that can affect the regions' economic function.
Rotterdam Water City 2035 Architectural Beinnale 2005	2005	Combined urban design and climate change adaptation strategies to transform Rotterdam to an attractive city.
Waterplan 2	2007	Links urban and water highlighting the urgency to address climate change through adaptive measures. This is integrated with the Rotterdam City Vision 2030.
Rotterdam City Vision 2030	2007	A spatial vision for the city with the mission "Build a strong economy and an attractive place to live" (City of Rotterdam, 2019). The inclusion of the Water Plan 2 put a climate change focus in the vision.
Rotterdam Climate Initiative	2007	The aim is to reduce the carbon dioxide emissions by 50% by 2025 compared to the 1990 levels, increase the resilience of the city to climate change, and for Rotterdam to become the leader in water innovation (Stead, 2014).
Sustainability Guide for Rotterdam	2010	This was published for the Rotterdam Climate Initiative and Rotterdam Climate Proof programme to provide development options for sustainable development (Stead, 2014; Stead and Tasan-Kok, 2013).
Rotterdam Programme on Sustainability and Climate Change	2010	Highlighted the City of Rotterdam's ambition to become a sustainable city while striving for a good balance between social, ecological and economic interests.
Rotterdam Climate Change Adaptation Strategy	2013	Aims to achieve a climate proof Rotterdam in 2025.
Rotterdam Resilience Strategy	2016	Reflects on the past experience to establish a vision for the future across spatial scales (City of Rotterdam, 2016).

The city continued with its climate change priority which is in line with the national policies. In 2007, Rotterdam launched Water Plan 2 and in the same year, the plan was incorporated in the Rotterdam City Vision 2030 to give a climate change focus for the city. In addition, Water Plan 2 clearly defined the city's spatial planning direction, concentrating on climate-adaptive strategies and inclusiveness through cooperation with community stakeholders. It contributed to a more integrated approach to water management and spatial planning to transform Rotterdam into an attractive and climate-proof city. The year

2007 also marked the launch of the Rotterdam Climate Initiative (RCI) intending to reduce carbon dioxide emissions by 50% by 2025, increase the city's resilience to climate change, and become an international leader in water innovation and climate change adaptation. The initiative was established in partnership with the Municipality of Rotterdam, the then Port of Rotterdam Authority (now Port Authority), DCMR Milieudienst Rijnmond, and Deltalinqs. The RCI provided a venue where governments, organizations, businesses, and individuals collaborate to meet its climate goal and strengthen Rotterdam's economy.

To provide program support for RCI, the Rotterdam Climate Proof (RCP) was launched in 2009 as an annual program incorporating climate-adaptive strategies and climate-proofing projects in the city's spatial environment. Other policy and strategy documents released after the RCP are the Sustainability Guide for Rotterdam and Rotterdam Programme on Sustainability and Climate Change, the latter being a program updated to meet current goals and targets. In 2010 Rotterdam became actively involved in the National Delta Program to build strategies on spatial adaptation. The National Delta Program required cities to develop their own Delta Plan to address risks and vulnerabilities their cities face. In response, Rotterdam developed the Rotterdam Climate Change Adaptation Strategy in 2013, which laid out a framework to climate-proof Rotterdam by defining the city's climate change challenges and proposing adaptation and mitigation measures. Interviewees acknowledge that the Rotterdam Climate Change Adaptation Strategy, referred to by most as the local Delta Plan, placed more emphasis on urban resilience.

"When [the National Delta Program] started in 2010 it was really focused only on water safety, so on rivers, on the sea level, and on freshwater. That was then the focus but two years ago they thought okay but the city level, municipalities, rainfall, heat [are] also very important. So they added in fact a part to it on adaptation, on an urban level." (Institutional actor 5, interview date 12 December 2018)

In 2014 Rotterdam officially joined the 100 Resilient Cities of The Rockefeller Foundation to obtain further funding support for resilience initiatives of the city. And in 2016 Rotterdam released its Resilient Strategy widening its water and urban management strategies to include themes such as cybersecurity, social and economic issues, environment, emergency, and crisis management. The strategy acknowledges the need for an inclusive approach to building resilience. It recognizes the role of public government, non-governmental organizations, private corporations, and individuals in this vision. Although this initiative is not the first of the city's resilience initiatives, it is the only initiative that emphasizes Rotterdam as a resilient city.

7.1.2 Stakeholder interaction with city government programs

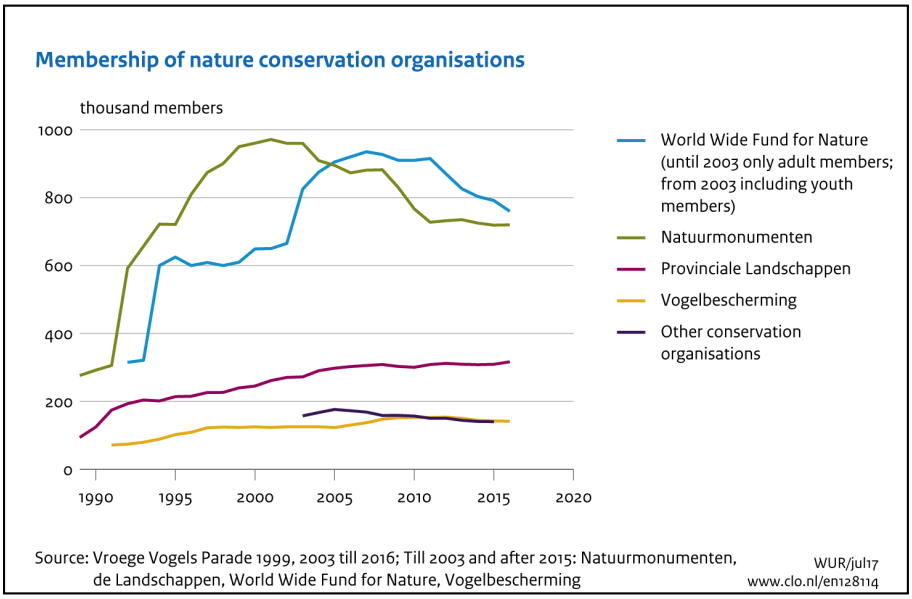
The Rotterdam Blitz and the Great North Sea flood necessitated an immediate response on the physical rebuilding of the city to restore its livability and economy. As the city gained

ground in the physical rehabilitation and development of the economy through the expansion of the port and the revitalization of the commercial areas, other issues such as the provision of housing and social services emerged. In Rotterdam, an initial *structuurplan* to develop greenfield areas and demolish old buildings was met with protests from political and social activists in the late 1960s and early 1970s (see Figure 7.1). This resulted in the government's change in strategy to refurbish old buildings and old areas with the participation of the people (Stouten, 2010).

In the 1970s and 1980s, environmental awareness was increasing in the Netherlands, membership to the largest environmental group *Natuurmonumenten* was growing (Koppenol, 2014; Rijksoverheid, 2020). This period transformed social activism, which developed in the 1960s, into environmental activism. At the time, plans were underway to expand the port to Maasvlakte II, and civil society, environmental organizations, and pressure groups protested the proposal. The expansion was first protested in the 1970s a period when there was greater interest for the environment and a lack of appreciation for the development of Maasvlakte II. The second time was in the 1990s, it was a lengthy period of negotiation before a mutually beneficial outcome was achieved between the parties that economic growth was more needed, but still considering the environmental interests and the well-being of stakeholders. The explanation for the disparity in the result was because the unemployment crisis in the 1970s was far less so than in the 1990s that the attention of civil society organizations in the former was more on 'negative externalities of economic growth' (Koppenol, 2014: 14) than on support for economic growth. Koppenol (2014) also noted that, as these organizations had more and more members, the less radical the members became, as a result, the organizations shifted their approach from activism to collaboration. Thus, although there are current nature and environmental organizations in the country, the degree of activism has declined as well as membership (see Figure 7.2).

Environmental consciousness continued in the 2000s thanks to the policies and plans of the City of Rotterdam on climate change adaptation. This has aroused community-based environmental initiatives. Policies that started in 2007 (Water Plan 2, Rotterdam City Vision 2030) also highlighted the need to collaborate with different stakeholders. The Dakpark (see Figure 7.3) is one example of multi-stakeholder collaboration involving the community, the Port Authority, the project designers, and the city government (Dakpark Rotterdam, 2020). In the late 1990s, residents of Bospolder-Tussendijken wanted to have a nice green and open space for the community. At around the same time, the Port Authority planned to build a commercial space and real estate on their property in the old railway yard in Rotterdam West (Buro Sant en Co, 2016). Since plans to renovate the area were underway, the community saw this as an opportunity to get the neighborhood park they wanted (Buro Sant en Co, 2016).

Figure 7.2: Nature organizations in the Netherlands from 1990 to 2020



Source: Government of the Netherlands, 2017

Figure 7.3: Water fountains at Dakpark

Photo by: Michelle (Job Taks)

By the late 2000s (as shown in Figure 7.1) more and more residential neighborhoods self-organized to construct community gardens including rooftop farms. These were initiated by the communities specifically to improve the green spaces in their neighborhoods. There were also some communities that initiated community gardens to provide fresh food for residents who cannot afford to buy or do not have access to fresh produce. In one neighborhood a temporary community garden was created by taking the tiles out and placing a plant into the gap. This became a signal to the city government that this can be done in various neighborhoods to increase the city's water retention capacity. The city government called this "tile out, green in" project (Planner stakeholder 02, interview date 13 December 2019; Institutional actor 1, interview date 18 December 2018).

"When we started in 2010, . . . we made that temporary community garden and from that we made . . . some front gardens. Put the bricks away and put gardens instead in it. That can also be an answer on water. In 2010 it was not a big topic in the city but now the last few years, you can see that people are becoming more and more aware of it." (Citizen stakeholder 2, interview date 21 December 2018)

Throughout the two adaptive cycles, it can be observed that stakeholders were more active on government-initiated projects during the 1960s when there was a demand for housing and inclusivity, and 1970s and 1990s opposition on Maasvlakte II. In the 2000s stakeholders were active on the need for green spaces thus the rise of community gardens throughout Rotterdam. However, the stakeholder interaction with the city government on climate change adaptation, flood risk management, and urban resilience is not prominent. These are the areas that will be discussed in the next section of this chapter.

7.2 COLLECTIVE ENGAGEMENT IN URBAN RESILIENCE

The City of Rotterdam's adaptive cycle started with an engineering resilience perspective to reconstruct from the ravages of war and secure the city from flood risk. This graduated to social and economic resilience as the city continued to forge towards building an economic powerhouse that is the Port of Rotterdam that contributes to the national economy. In this section, the dimensions of collective engagement, collective concern, collective action, collective efficacy, and collective security will be addressed with the process of collective engagement and urban resilience that Rotterdam has experienced. A summary of this discussion is shown in Table 7.2.

Table 7.2: Rotterdam City's collective engagement dimensions vis-a-vis urban resilience

	Collective engagement dimensions descriptions	Urban resilience	Present indicators
Collective concern	• Stakeholders remember the Rotterdam Blitz and 1953 Great North Sea Flood. • Residents in areas frequently flooded are more aware of local adaptation measures.	• There is a gap in understanding what a resilient city is. • Varying threats are identified not necessarily flood risk.	• Local adaptation measures • Volunteers from the Red Cross.
Collective action	• General disaster risk awareness is relatively low since there is a tendency to rely on the government.	• There is an understanding on the need for climate adaptation measures.	• Information on disaster risk management available in websites.
Collective efficacy	• Disaster preparedness plans are at the government level. • Emergency alarm systems are in place.	• Climate change adaptation plan done at the Port Authority.	• Fire drills conducted in various organizations.
Collective security	• Crisis management organized at a higher level and not with the community.	• Government role on disaster risk management.	• Coordinated disaster risk management across agencies.

Source: Author, 2020

7.2.1 Collective concern

As has been described in Section 7.1 and shown in Figure 7.1 the first adaptive cycle has two take-off points, the reconstruction period after the Rotterdam Blitz and the Deltaplan that was implemented after the Great North Sea Flood. The disturbance that has the biggest impact on Rotterdam is the bombing because 80% of the city was flattened. For this reason, the city became a sort of blank canvas for reconstruction and reinvention. At that time the concern was mainly to physically reconstruct and restore the city to bring the economy and the city back to life. The city government's swift action to create a reconstruction plan suggests that they recognized that the way to rebuild the city is to immediately restore the functioning of its most critical economic driver, the port. They also knew that this will help rebuild the lives of the people rapidly. This foresight coming from the institution was an important element in the fast recovery of Rotterdam and its people.

It was however important to note that when the Basic Plan was announced in the *Het Vrije Volk*, a daily newspaper which ran after World War II, it used the headline "Rotterdam, roll up your sleeves! A major work lies before us" (*Het Vrije Volk* as quoted in Post-war reconstruction community Rotterdam, 2020). In this period, even if the government took a command-and-control approach in the reconstruction work, the call to action from the government to work together in rebuilding the city encouraged solidarity stimulating the

social resilience among the people. The words 'roll up sleeves' because a 'major work lies before us' the Rotterdammers fostered a feeling of "togetherness". This collective disaster experience among the people of Rotterdam was the driver for the collective action to rebuild their lives and communities. Indeed, the role of the people of Rotterdam, including the migrants, was even recognized by the monarchy when Queen Wilhelmina gave the *'sterker door strijd'* motto to the city. This motto written in Rotterdam's coat of arms and the "roll up your sleeves" headline gave a feeling of solidarity which was necessary at that time to uplift the spirits of the Rotterdammers.

During the reconstruction, the city employed many local architects and engineers to design the districts and modern buildings, particularly in the city center. Slowly the commercial activity in the port was restored and new commercial areas within the city center also emerged to supplement the growing population and economy of the city. When the Great North Sea Flood happened in 1953, the Netherlands declared that such disaster should and will never happen again focusing its attention on creating the Deltaplan. Rotterdam as a city that has 13 years prior endured the bombing can be considered to have cultivated a level of resiliency among its people and institution. Rebuilding work continued in the city and even completed De Lijnbaan in October 1953, Europe's first pedestrian promenade, signifying the modernity of the city. Showing that the flood disaster just rolled off the sleeves of the Rotterdammers.

By the year 2000, all of the Deltaworks infrastructures has been completed and for decades Rotterdam, and the Netherlands, have enjoyed the security from flood risks that this infrastructure provides. When the riverine threats and floods happened in the 1990s, the national government shifted its focus on mitigation-centered approaches to flood risk management to a more adaptive approach. The policy foundations built within this period (shown in Table 7.1) set the direction of the city to address the risks linked to climate change. This shift in focus from mitigation to adaptation was the start of the second adaptive cycle (marked blue in Figure 7.1). The city government understood that these issues are important to ensure that the city remains an attractive city to invest business in. So, while the city and the national governments work closely with research institutions on climate projections and sea-level rise, the city government was also busy creating an attractive image for the investors.

Gap in understanding the city's vision

While Rotterdam was on the verge of the engineering and adaptive pathway to mitigate and adapt to flood risks, the economic pathway seeks to strengthen and position the city as a global and attractive city. In 2006 Rotterdam adopted the city brand tag 'Rotterdam World Port, World City' to emphasize the port of Rotterdam as a leading and competitive international port (Belabas and Eshuis, 2018). The slogan did not resonate very well with

the residents thinking that it was purely trying to achieve a "business-orientated" image of the city (Belabas and Eshuis, 2018: 213).

Around the same time, the city has placed emphasis on climate change adaptation innovation with the policies shown in Figure 7.1 in the timeline and listed in Table 7.1. There was an environmental sensitivity since both government actors and technocrats realize the city's susceptibility to several natural hazards. This fueled the creative juices of Rotterdam Partners, formerly Rotterdam Marketing[14], to re-brand Rotterdam and attempt to erase the detachment of the residents with the 'world port, world city' tag (Belabas and Eshuis, 2018).

In 2013, the city government together with the Port of Rotterdam Authority, Erasmus University Rotterdam, and Rotterdam Partners launched "Rotterdam, make it happen!" which plays on the creative, innovative, forward-looking, and international atmosphere of the city. With the new brand, the original call to arms after World War II "Rotterdam, roll up your sleeves! A major work lies before us" was modernized but still drives the point that the city is a "working" city and not just a "working-class city". Belabas and Eshuis (2018) expounded that the campaign places Rotterdam as "a place where people are offered opportunities to invest, grow and succeed" (p. 213). However, the question is for whom are these possibilities and opportunities.

The city has always been focused on its economic development and image as an attractive place for investment, trade, and commerce, the marketing of the city has been aggressive, and the policy documents change. Further, the terminologies being used evolve constantly from *"sustainability to cradle-to-cradle to climate adaptation, resilience, water sensitive you know there are so many terminologies"* (Capital stakeholder 1, interview date 14 January 2019). These changes in terminologies and concepts make it difficult for the community to understand if not properly communicated.

In 2014, Rotterdam's popularity as a tourism destination grew due to the physical make-up of the city (Belabas and Eshuis, 2018) and being a frontrunner in the marriage of adaptation to climate change and practical urban design. In the same year, Rotterdam joined the 100 Resilient Cities and unveiled its Resilience Strategy in 2016. However, instead of defining what resilience means in the Resilience Strategy, it boasted that resilience does not need to be defined because it is in the DNA of the Rotterdammers. The economic resilience of the city to adapt and transform or in this case re-brand is quite admirable. Yet, if indeed resilience is in the DNA then this social resilience should be glaringly prominent in the vision of the city. This is one of the gaps observed in the process of collective engagement and urban resilience.

[14] Rotterdam Marketing is a group tasked to market the city as a tourist product (Van Ulzen, 2007).

Social related threats more prominent than flooding

Rotterdam being below sea-level and a Delta City faces several flood threats - sea level rise, river rise, heavy rainfall, and groundwater level (absorption and drought) - all related to the changing climate. But these issues on flood risks and vulnerabilities are not a source of major concern among the interviewees in comparison to other threats or issues in the city. Social-related threats are seen to be a bigger threat than flooding. Unemployment, low income, low education levels in certain neighborhoods in Rotterdam affect community life and collective action.

"Here in Rotterdam it's not the physical problems of getting wet feet or things like that, it's more a lot of people. The changes of the city from the inhabitants . . . more the problems of the society and things like that which also has something to do with resilient city." (Citizen stakeholder 5, interview date 21 December 2018)

This social and economic gap among the city stakeholders is seen as a threat by the interviewees because it impedes the ability of those belonging in the lower-income from integrating into society. Integration is important in resilience-building because this makes citizens feel that they are connected to the city, that they are valued, and that they can contribute to its growth. Moreover, the social and economic gap also waylays issues on climate change and flood risks. These issues are considered as issues of those who can afford them.

"I think there is too much of a gap between people that have . . . money troubles, [do] not hav[e] the best education . . . or those kinds of problems. If you have that in your world you cannot really focus on energy transition and sustainability . . . there is too big of a gap between those people and those people who . . . are privileged." (Institutional actor 8, interview date 17 January 2019)

"If your main concern is how to make it through the month, then maybe that is actually what you are really aimed at and not so much . . . about the other stuff. Because I think also for a lot of people climate change is . . . a luxury thing, you know, I mean if you have enough money then you can afford . . . a solar panel." (Capital stakeholder 1, interview date 14 January 2019)

The ability to act on wider societal issues is evident in more affluent areas in the city. People with lower income will be more concerned about their daily living expenses than the possibility of flooding or more so climate change. Those with higher income and higher education have a wider network in the city, pay higher income tax, and may have a stronger stance on government and/or political issues that may affect them and their community.

". . . the involvement are all in neighborhoods in the north of Rotterdam. It's the richer people. The white Dutch people so to say. They have money but they also know ways on how to connect with the city

government. Then you have the south of Rotterdam where salaries are lower, people have a lot lower income. Totally other social composition of the neighborhoods, different backgrounds but the problems, the climate problems are just as high as in the north of Rotterdam but they don't come to us because they struggle to have food at the end of the month but we also want to help them." (Institutional actor 3, interview date 07 January 2019)

Some low-income residents cannot give priority to major issues such as floods and climate change. Many people, irrespective of income level, may also see it as the responsibility of the government and feel there is little urgency to climate change and disasters.

7.2.2 Collective action

Public interest in disasters and floods is almost zero since large-scale floods have not existed since 1953 and flood risk and disaster risk management has been handled by the national and regional governments. Climate change adaptation has been the priority since the late 1990s and early 2000s as such programs have been geared towards this agenda. Rotterdam has been active on climate change and works closely with the national government on the Delta Program and because of this has been at the forefront of climate change adaptation ahead of most cities in the Netherlands. Since the first Water Plan, Rotterdam led large-scale climate-adaptive projects to manage water. The city commissioned architectural and urban design firms to design multi-functional spaces that also work as climate-adaptive infrastructures. One such infrastructure is the Museumplein parking garage, the largest water reservoir in the Netherlands (see Figure 7.4). The project was initiated in 2003 and completed in 2010. The parking garage addresses both the parking and flooding problems in the city by providing parking space for 1,150 cars and a 10,000m3 water reservoir. The parking garage captures excess water during heavy rainfall and before the reservoir reaches a dangerous level a hatch beneath the reservoir releases the water (Paul de Ruiter Architects, 2020).

The Dakpark is also another project that was initiated during the early 2000s demonstrating on a grand scale a climate-proof project that has multifunctional use. It is a shopping district with the largest green roof in Europe that serves as a park, picnic area, playground, and restaurant. The Dakpark is also built on a dike and has a water reservoir underneath the green roof which adds to the water retention capacity of the city. In addition, the Dakpark was planned and developed in close partnership between residents, the Port Authority, project designers, and the City Government. The Dakpark was the first large-scale green and climate adaptive project involving the community. It was primarily driven by the residents' want and need for green space and the unutilized area owned by the Port Authority posed as an opportunity.

Figure 7.4: Museumplein parking garage

Photo by: Author (personal collection)

By the mid- to late 2000s neighborhoods started to take interest in community gardens as also encouraged in earlier climate change policies in Rotterdam (see Figure 7.1). The community gardens in the city are an example of a self-organized activity within the neighborhoods. These community gardens were initiated by neighborhoods, architects, designers, young people, and even house owner corporations where they put this garden in the middle of the compound. Most of the time housing corporations join this initiative to raise the property value of the housing units. Other community gardens were started to provide residents access to fresh produce and livelihoods. Generally, these community gardens were initiated by local groups to enhance and green their neighborhoods.

In 2010, non-government organizations (NGOs) like the Aktiegroup created a temporary community garden they called 'front gardens' by taking bricks away and putting a small garden ('tile out, green in') (Citizen stakeholder 2, interview date 21 December 2018). This idea was picked up by the city as also a means to increase retention capacity by allowing water to go directly into the earth. This 'tile out, green in' project demonstrates how self-organized initiatives can be used by the institution to involve the communities in addressing issues in the city such as increasing the water retention capacity. Another NGO active in the community gardening scene is the Rotterdam Milieucentrum which started rooftop gardening in the city center. Citizen stakeholder 2 (Interview date 21 December 2018) opines that the neighborhoods have influenced the city government rather than the

other way around. He asserted that rainwater storage and greening of the environment have been adapted five or six years ago by the neighborhoods. The NGOs demonstrated how the neighborhood can make a greener and sustainable environment which eventually became a showcase for the council. Non-government organizations like the Aktiegroup and the Rotterdam Milieucentrum have also started working on energy, solar panels, garbage collection, and environmental awareness-raising.

Despite the policies on climate adaptation, water retention and flood risk management, and the ongoing community gardening and rooftop farming activities, the interest of the neighborhoods to participate in these gardening activities was mainly aesthetic. For the community, there is no direct relationship between flood risks and green spaces. Non-government organizations like the Rotterdam Milieucentrum try to educate the neighborhoods that community gardening can help the environment but there is still some limitation.

"You cannot connect with people, yes some of them, with story about sea rise, so they see on television, they know, they know that there is a problem. But they don't know what to do. And when you say to them okay, do something in your garden, what can I do? In my garden against climate change? So you can say to them you are one garden, your neighbor is two, three, and we have a hundred gardens here, thousand gardens there, so the scale is mostly very small the campaigns. You make a big scale of lots of gardens, you make your gardens without stones." (Citizen stakeholder 4, interview date 10 January 2019)

Trying to bring together a resilient vision

In 2016 when Rotterdam released its Resilience Strategy, the city also formed the Resilience Labs to work in different parts of the city to implement the identified action plans under the strategy. This was particularly important for the residents to see practical actions on resilience that can be easily understood and felt by the neighborhoods as ways to maintain a good quality of life. According to the Resilience Strategy, there are a total of 68 initiatives and actions around the city (City of Rotterdam, 2016). The action plans are all linked to the seven resilient goals of Rotterdam[15] however, without defining resilience and a resilient city the Resilience Strategy fails to reign in a clear vision on what it means to be a 'Resilient Rotterdam'.

"I have seen the 100 Resilient City the report of the municipality . . . And we've looked through it, and we thought, yeah cool, it's complete. But it is so many things, how do you translate it, how do you communicate it, how do you involve people in it because it is so many things. I wouldn't know. I think it

[15] The seven resilient goals of Rotterdam under the Resilience Strategy are: (1) Rotterdam: A balanced society, (2) World port city built on clean and reliable energy, (3) Rotterdam Cyber Port City, (4) Climate resilient Rotterdam to the next level, (5) Infrastructure ready for the 21st century, (6) Rotterdam Networkcity - truly our city, and (7) Anchoring resilience int the city (City of Rotterdam, 2016).

is also quite a difficult task for them to be able to also bring it to a wider audience." (Capital stakeholder 1, interview date 14 January 2019)

Translation of the strategy and the concept of resilience needs to be further defined especially since the terminologies used in the plans and policies change. Moreover, catchphrases and branding included in the resilient goals such as "World port city", "Rotterdam Cyber Port City", and "Rotterdam Networkcity" do very little to bring the residents together and again highlights only the commercial and economic function of the city and detaches it from the people. If policies and concepts are not translated clearly to the stakeholders then it becomes abstract. Translation at the community level becomes problematic such that the urgency of climate change, water retention, and flood risk becomes vague.

The ambiguity of the role of the Resilient City Team led by the Chief Resilience Officer described to *"influence the workers in the municipality to have a resilient mindset"* (Institutional actor 8, interview date 17 January 2019) adds on to this vagueness. The lack of clarity in the translation of a resilient city in Rotterdam's Resilient Strategy can also be seen in the action plans which appear to be existing programs by the different departments in the city government.

"We are more working more on the abstract policy level . . . we try to influence programs and projects to work together with the citizens. Because we believe if you involve them in for example, making the city, making those houses, trying to listen to them, what are the wishes and stuff, that is very important to build resilience too. So it is not that our program does that but we influence other programs and projects to work that way, to be inclusive." (Institutional actor 8, interview date 17 January 2019)

The lack of institutional structure to integrate the Resilience Team leaves the program wanting. Huck, et al. (2021) found in their study that after Rotterdam released its Resilient Strategy cross–departmental collaboration declined due to epistemic traditions, departmental budgets, and lack of political support which left the team to link the resilience goals to the existing goals of the city's programs and focus on selected pilot and demonstrator projects. Moreover, piggy-backing on Rotterdam's existing programs such as energy transition, climate change, makes it difficult to assess whether Rotterdam's membership to the 100 Resilient City has accomplished any significant contribution to the city's 'urban resilience'. And if bringing urban resilience thinking is the main aim of the 100 Resilient City, how do you measure this? The problem lies in the ambiguity on what exactly the 100 Resilient City should accomplish. The elaborateness of the City Resilience Framework (see Chapter 2) with the four dimensions, seven qualities of a resilient system, and 52 indicators makes one think that programs and projects under the strategy are standalone. But, the 100 Resilient City only funds the establishment of a Chief Resilience Officer and the budget for programs under the team will have to be sought from the city. Further, the abrupt end of the 100 Resilient Cities in 2019 left many to speculate that the

program has become costly and is not in line with the Rockefeller Foundations aims (Bliss, 2019), or even the lack of accountability the Rockefeller Foundation has on the 100 Resilient City members and its stakeholders (Williams, 2019).

Government communication and interaction with stakeholders

The national, regional, and local governments provide information to stakeholders via text messages, websites, letters to residents in flood-prone areas but according to the interviewees, these are all passive information or information that is not retained over a long period. Institutional actor 5 (Interview date 12 December 2018) admits that there is no assurance that everybody knows about these websites and information. So even if the information is available on the website, this might not be an efficient way of sharing and disseminating information. In addition, there are some people, particularly those who belong to the lower-income group, who have little or limited access to the Internet, or even a computer.

"The communication of the local government is poor. They think that they can inspire people with the website. I know last year there was a meeting . . . there [were] only two people [from the government]. I was there and I said what did you do? And they said we put it on the website, but I said nobody in this area [looks] at your website. Do you have Facebook? Yes, we have Facebook but nobody in this area is interested in your Facebook page . . . And you have the department of sustainability somewhere there, you have so many. You have Water Sensitive Rotterdam, you have climate initiative, you have more, and every department of the city has their own sustainability officers and communication officers, it is so many. They all have their own websites, they all have their own way of doing, and they don't reach anybody, perhaps two people." (Citizen stakeholder 4, interview date 10 January 2019)

More information, discussions at the local level are needed to build awareness on flood risk, disaster risk management, and resilience building. Urban design elements can also be included to make these topics part of the overall narrative in Rotterdam. However, the interaction between the city government and the citizens is not as collaborative as what the city government wants it to be. Citizen stakeholders interviewed feel that face-to-face interaction with the government is lacking. The bigger picture on what the city wants to achieve and the role of the people in achieving this has not been brought down to the level of the community as Citizen stakeholder 3 (Interview date 21 January 2019) said *"the problems of the world are not translated into an individual problem or solution"*. Citizen stakeholder 4 (Interview date 10 January 2019) feel that *"there are no community workers, they are too short. That's the problem. The community workers need 5, 6, 7 years to develop things in the neighborhood."* Community workers can help build a good relationship with the neighborhood, which could also help bridge the gap between the city government and citizens. This face-to-face interaction with people is needed to build trust, relationships, and knowledge on resilience building.

"So what you have to do is walk into the community, walk into the neighborhood and know your way, that's the problem. [ ] There is no movement anymore, so you need movement, you need a movement in the communities to do something with resilience." (Citizen stakeholder 4, interview date 10 January 2019)

Citizen stakeholders interviewed feel that a big city like Rotterdam is not always interested in a little community. There is a feeling that the city government does not listen to the people nor do they communicate well to the residents. This disconnect between the city government and the smaller communities creates a gap that makes policy translation at the local level cumbersome. Citizen stakeholder 4 (Interview date 10 January 2019) shared that in their environmental organization they have face-to-face interactions to get their message on taking care of the environment and the need for solar panels across. A task that can also be done by the city government to bridge the gap between the government and the citizens.

"We say just go to them and give your hand, say hello, I am from the environment center, and they ask "Are you government?" "No." "Okay, are you social worker?" "No." "Okay, what are you?" "Environmental Center." "Okay, it is good. For the world, for the environment." And then they start talking, then we have a connection, we give them things also, we give them evenings with information or the information about energy savings or sometimes also about living another way. That is the way we do, it is very, you need a lot of energy, you need a lot of time and you have to be very flexible . . . Not look into your agenda, and say in 3 months, you have to be on top of it. So we [do it] like this, but the government is very poor about their policy about reaching people. So there is [no real] communication between the resilience officer, office and all these people working there." (Citizen stakeholder 4, interview date 10 January 2019)

For this reason, the vision of the city does not resonate with the community. Community participation has been limited to neighborhood projects, mostly on community gardens and greening of the environment. And this can be seen in how people perceive risks in the city where interviewees feel that social-related threats are more common than flood-related risks. Although this is partially true as the city is well protected by the Deltaworks system and the other climate adaptation infrastructure present, social and community resilience is relatively poor. Citizens have put a great deal of confidence in the infrastructure and the capacity of the government to take care of them that the extent of disaster risk awareness arising from natural hazards is low.

Perception on resilience

In the literature review chapter (Chapter 2) different conceptual definitions of resilience were presented. It shows the broad areas where "resilience" as a concept can be used which also demonstrates its deep complexity. Due to this complexity, many of the interviewees found it difficult to define resilience saying it is quite abstract. In the

interview, the various definitions shared by the interviewees can be divided into two sets - one that is more technical (T), and the other as more socially (S) oriented (see Table 7.3).

Table 7.3: Varying definitions of resilience among the four stakeholders interviewed

Summary of findings			
Institutional	**Planner**	**Capital**	**Citizen**
Resilience is the ability to overcome a certain disaster in a relatively short time. (T)	A system is resilient if it bounces back into a system that has a higher level of resilience than before. 'Transilience' a term that uses the experience to 'transition to a new resilience phase'. (T)	Resilience as the ability to adapt to the effects of climate change. (T)	The ability for a city to deal with these external shocks in a sustainable manner. (T)
Urban resilience is the ability to handle shocks and stresses in the best way. (T)	If a disaster happens you can easily recover. (S)	Resilience is preparedness in all levels to ensure that the life will continue even with the disruption. (S)	A resilient city is strong as it is complex. (S)
Resilience is not just about water related issues but the awareness on the entire environment. (S)			Resilience is an abstract word because it can be discussed in a lot of levels and themes. (S)
Resilience is the ability of the city to cope with shocks and stresses and come out of these shocks and stresses on the same level or even better level. (T)			Prefer to use the vernacular (Dutch) 'veerkracht'. (S)
Prefers to use other words such as robustness. A resilient city has a lot to do with adaptation, it is about climate change and social movements. (T)			Social resilience is more understandable. These are the social networks within the neighborhoods including organizations that work together with the people. (S)
Resilience is a mindset and a skillset. (S)			Resilience is broad and a resilient city is about the technical aspects of how city works but also about people who live there. Resilience can only be done by the people who are resilient themselves and have the capacity in terms of resources, knowledge, and awareness. (S)
Resilience can be defined in many ways such as anticipation, preparation and continuity. (T)			Resilience is knowing how to survive after a disaster. (S)

Note: (T) Technical oriented definition, (S) Social oriented definition

Since resilience is a complex subject the varied interpretations of resilience among the interviewees did not come as a surprise. Resilience and Rotterdam as a resilient city have also not been specified in the Resilience Strategy, but have been described as 'need not define resilience because it is in the DNA of Rotterdam,' leaving both concepts vague and open to interpretation. Apart from this, the "resilient city" campaign itself is not familiar to stakeholders, nor is the team completely engaged at the community level.

"I do not know if the Resilient City organization in Rotterdam is very powerful, what do you think? . . . I have to be honest I didn't know there was such an organization [before this interview]. I looked in the internet Rotterdam Resilient City and then it comes up." (Citizen stakeholder 5, interview date 21 December 2018)

"They don't really have the power to reach people, they need us for those things but we are so small to do the whole area. We only meet a few people. So this is how I think about resilience. They have some projects (in the West), but the project was started by some architects, some designers, some people from

the neighborhood, and they started to have some sort of project about resilience or energy." (Citizen stakeholder 4, interview date 10 January 2019)

Even the use of the English language makes it difficult to reach a large majority of the population. This has become a problem for stakeholders to understand the government's policies, strategies, and action plans.

"But only the word resilience it's English, Resilience Officer. People say, what is it? Many people speak English but even when you speak English you don't know what it is, never heard of it. So that is always the problem, so they have to make community campaigns . . . I haven't read it [Resilient Strategy]. No . . . I am sure most of my neighbors and in the neighborhood people don't know what the word means. No and also about water sensitive also English. Or Rotterdam Climate Initiative also English." (Citizen stakeholder 4, interview date 10 January 2019)

These anecdotes go back to the point of the previous section that there is a gap between the city government and citizens. That there is no real and direct relationship between and among the stakeholders when it comes to the concept of resilience and building a resilient city.

7.2.3 Collective efficacy

Rotterdam's image as a safe, secure, and stable city is important to maintain its economic advantage. Flood risk prevention has been established through the preventive infrastructures built under the Deltaworks project. These are the storm surge barriers in Rotterdam, the Maestlankering, and Hartelkering, which can be closed when there is a dangerous high-level tide that pushes towards the city. There is also a Sand Engine Project which extends the shoreline and strengthens the dunes between Hoek van Holland located in Rotterdam and The Hague. Another preventive measure is the heightening of the dikes along the coast and the river. When it comes to rainwater, water is pumped out through the polder system. All of these are within the jurisdiction of the national government and waterboards.

Under the authority of the city government, new construction policies for new infrastructures have been established especially in the area around Maestlankering. This is important since the Maestlankering is essential for the safety not just of the general population but particularly on the port. The Maestlankering is outside the dike, but the surrounding areas of Maestlankering are split into two areas outside and within the Maestlankering, which both have different types of threats (Institutional actor 1, interview date 18 December 2018). Outside the Maestlankering the danger is the sea level rise, while within is the river threat. The design policy states that the new infrastructure beyond the dike, but inside the Maestlankering, should be 390 mm above sea level and that the new infrastructure should be 550 mm above sea level for those beyond the dike and outside the

Maestlankering. All of these latest design policies are also integrated with national and regional government bodies.

Emergency drills and practice

The city government does not conduct a general drill or disaster risk management activities. There are fire evacuation drills conducted by organizations or building and compound management. This is done to learn about the possible escape routes but there are no flood evacuation drills in the city. In the event of a flooding disaster, Capital stakeholder 1 (Interview date 14 January 2019) opined that there is no information on how to prepare for this in the location of their workplace. Disaster risk management is not something organized at the community level because since 1953 there are no large-scale flood disasters. People prepare for every day "safety" issues such as *"safety in the streets, safety in [the] house against robbery, safe mobility"* (Citizen stakeholder 3, interview date 21 January 2019) but not for natural hazards.

There are no information campaigns on disaster management in Rotterdam. Planner stakeholder 1 (Interview date 07 December 2018) mentioned that when something happens mostly from the port like gas leaks there will be announcements on tv, radio, SMS to close the windows. This is more reactionary than preparatory like an exercise or a drill. Disaster preparedness and disaster consciousness are considered an individual responsibility, therefore it is assumed that if people are interested then it is up to them to look for this information. However, as also pointed out in the previous section, even if the information is available there is no guarantee that people will look for it.

Level of awareness

Awareness is an important precondition in collective engagement, one cannot fully participate when information is lacking and knowledge on the issues is low. Interviewees alluded that the low level of awareness of the stakeholders on flood risks and vulnerabilities in Rotterdam was because people felt safe and protected from floods. This "feeling of safety" can be attributed to the strong preventive infrastructures in the country. In addition, the level of trust placed on the government is high that the issues on flood risks and disasters seem distant and the fact that *"everything has been organized"* (Citizen stakeholder 3, interview date 21 January 2019). In the Netherlands, the term *"vezorgingsstaat"* refers to the general outlook of citizens to rely on the government to take care of them (Institutional actor 7, interview date 29 January 2019). People hold the government accountable for the taxes that they pay to "keep their feet dry".

"In the Netherlands, they trust the government. I think, in general [the government] will do everything to protect [the people]. [The people] pay taxes for that." (Citizen stakeholder 5, interview date 21 December 2018)

"I think the weird thing is that we all know it but we still trust our delay one prevention, the dikes. And I think that is a good thing because we are really amazing in building the dikes and the technological things. But I think we just don't want to scare our people to think differently. And I think you just have to tell them that the Maestlankering can fail, I mean the water can overflow, the dikes can be breached, and this can happen. So just to be informed." (Institutional actor 6, interview date 07 January 2019)

People expect the government to keep people safe and dry, to maintain the dikes and flood defenses because people pay their taxes and it is the government's job to do so. However, it is still important to educate and inform the people for them to understand the risks being faced by the city and what can be done at different levels.

Noordereiland: Flood experience leads to awareness

Communities that are more flood risk-aware are those that regularly experience flooding. In Rotterdam, interviewees agree that the residents of Noordereiland are the most aware of flood risks and are the most prepared. This small community located outside of the dike area, along the River Meuse, experiences low-level flooding every 2 to 5 years due to the storm season. Residents of Noordereiland understand that they have to prepare during the storm season and that there is a possibility that their basements will be flooded or their cars parked on the quays run the risk of being washed away. People who live in areas where the risk is high and the occurrence of a flood is frequent make people more aware.

"If there is a feeling that the chance that they might be affected is large then the inclination to respond will be larger." (Citizen stakeholder 1, interview date 19 December 2018)

The city government regularly coordinates with residents in Noordereiland during the high storm season and provides information and warnings in the form of leaflets and signages. Sandbags are also provided to the residents of the island to barricade the front doors of apartment buildings and commercial establishments. The regular occurrence of flooding and regular communication between the neighborhood and the city government increases the awareness and preparedness level of the residents in Noordereiland.

The Noordereiland neighborhood while composed of social housing, student housing, and middle-class residents have a shared experience on flood situations in the vicinity. They have quite a strong voice and can act as a pressure group and have demonstrated this when the quay was badly damaged by a vessel accident. The neighborhood group took to media to catch the attention of the broader public and the politicians to fix the damage caused. In

the end, the Port Authority, the waterboard, and the city government had the damage repaired.

". . . the city government didn't do much for quite some time so that created a bit of an outcry and increased the flood risk of course because there was sort of a dent . . . it was a difficult thing because the city government said look it's not our thing, it's the region and the region has a body called the water and flood mitigation agency . . . that is the institution that has the primary responsibility. At the same time the city cannot completely step back from this because it is in the heart of the city . . . Likewise the port authority of Rotterdam in this particular instance because it was a shipping incident also were involved and felt some sort of responsibility so the repairs if I remember correctly was eventually shouldered by the three parties not just by one but of course one was the lead on taking on the implementation of the remedial action." (Citizen stakeholder 1, interview date 19 December 2018)

Other neighborhoods in Rotterdam also have proactive citizens but mostly these are residents from better-off neighborhoods. Neighborhoods in Hillegersberg and Agniesebuurt, are more actively engaged on their neighborhood issues and take it upon themselves to solve their own environmental or infrastructural problems at the community level. These communities go directly to the city government to discuss issues on the groundwater level that affects the stability of their houses or question government projects that may affect them.

"We see some neighborhoods in Rotterdam . . . citizens from Hillegersberg its in the north, they have a lot of problems with the groundwater . . . they have these old houses which are founded on wooden poles, and when the ground water table drops those poles rot and those houses shift, they are united and they talk with us about different solutions . . . they came up with a pump that infiltrates surface water to the ground water table, raises the groundwater table so their houses are safe. Then there is also [a] citizen community in Agniesebuurt in Rotterdam North. And over there we are starting a sewerage renewal project and the citizens over there they are scared that . . . the groundwater table will rise and their houses will flood. So what you see now is that due to certain risk . . . they . . . see or . . . already have . . . they will unite [and] talk to us . . ." (Institutional actor 3, interview date 07 January 2019)

The anecdotes the interviewees shared above indicate that most of the time the community will organize themselves based on what they perceive as important in the neighborhoods. This does not necessarily mean flood disasters or climate-related threats but something the residents collectively perceive as important and urgent because it is tangible and directly affects them. This notion is no different from the Port Authority of Rotterdam who has initiated a climate change adaptation plan to safeguard their investments.

Port Authority: self-organized climate change adaptation plan

The Port Authority holds a strong role as a stakeholder in the city due to its economic contribution to the city and the Netherlands. Around 100,000 people work in the port and generate 6.2% of the Netherlands gross domestic product. In 2003 the organization of the port changed to an unlisted public limited company with two shareholders, the Municipality of Rotterdam (approximately 70%) and the Dutch government (approximately 30%) (Capital stakeholder 2, interview date 24 January 2019). This allows the Port Authority to work much more independently from the city.

Since 2016 studies on flood protection in and around the port areas have cropped up in response to the growing concern on climate change and the scenarios presented by the national government on sea-level rise. To ensure that the port remains attractive and safe for investors the Port Authority has also initiated the climate change adaptation strategy for the port. They work together with the City of Rotterdam, Ministry of Infrastructure and Water Works, water boards, safety region, and other companies in the port area. This strategy uses the scenarios developed by the national government and the city government to predict possible flooding in the port area. The strategy also covers three possible outcomes in a crisis or disaster, possible casualties, economic and environmental impacts. The Port Authority in turn provides information to the companies and coordinates with them on strategies and plans that they need to implement should there be a danger in their area.

"We are making maps with water levels depending on future scenarios for sea level rise, we are almost finished with . . . the whole port. We then . . . can explain to the companies and internally what the risks are. Another thing is that we take all the companies on board through the adaptation strategies and the workshops. And we need to inform the companies together with the municipality because actually the municipality has an official obligation to do so. So we are working on that as well. We have our website of course also, where you can read about this subject as well. Next to that we are part of the Delta Programme where we are active, through that we can also use newsletters or tell our message through the municipality of course. So there are different channels to communicate about this." (Capital stakeholder 2, interview date 24 January 2019)

Throughout Rotterdam, only the Port Authority as a "community" has a climate change adaptation plan that also includes a flood risk management plan. They have a direct link with the city government of Rotterdam, the waterboard, the safety region, and the national government. It is understandable to have this strong network among the government bodies because of the large economic contribution the port provides for the entire country and not just Rotterdam.

"Because we are such a large port and a lot of policies can influence us . . . we need to take a good look how . . . it fit[s] us and [if] we have to try to change it a little bit . . . We have somebody who is focused

on the national parliament and ministries, he can with the political parties put our issues on the table and also we have people who do the same in Europe." (Capital stakeholder 2, interview date 24 January 2019)

However, the surrounding residential areas have little involvement or information on this plan. Capital stakeholder 2 (Interview date 24 January 2019) thinks that there is *"not such a big link [between the residents and] the Port Authority"*. He assured though that all information derived from the discussions and studies within the Port Authority are relayed to the municipality who in turn do the same discussions with the residential communities.

7.2.4 Collective security

Crisis management in the Netherlands is organized at the level of the *veiligsheidsregio* (safety region) and follows the *Gecoördineerde Regionale Incidentenbestrijdings* Procedure (GRIP) as explained in Chapter 5. Rotterdam is part of the 16 cities under the care of the Veiligsheidsregio Rotterdam-Rijnmond. Each of the sixteen cities has a disaster management plan that is part of the regional disaster management plan (Citizen stakeholder 6, interview date 11 January 2019). The city disaster management plans are unique to the threats within the particular city, while the regional disaster management plan looks at the coherence of the plans between the 16 cities. This is especially important because there is a need for coordination between cities in the event of an evacuation due to large-scale disasters.

In case of a disaster, the fire brigades, the city government, the water boards, and the safety region can organize the actions and procedures to be carried out in compliance with the GRIP protocols. This means that crisis management has assigned departments depending on the level or magnitude of the crisis. It is hierarchical where the highest level GRIP 5 is taken over by the national level, GRIP 4 by the security region, GRIP 3 by the mayor of the city, GRIP 2 by the fire brigades or the police, and GRIP 1 by the command site incident. The mayor enters the scene only when there is a threat to the life and welfare of the people. There is also an agreement between the government and the Red Cross to take action in the event of a big disaster (Citizen stakeholder 6, interview date 11 January 2019; Institutional actor 7, interview date 29 January 2019). Emergency medical assistance, relief, and rescue are among the services provided by the Red Cross.

City and community level disaster risk management

There is no mandate for the creation of a disaster risk management office at the city level in the Netherlands. However, the city government of Rotterdam has a 'safety department' responsible for public safety issues and crisis management (Institutional actor 5, interview date 12 December 2018). Depending on the severity of the disaster, it is either the municipality or the safety region that handles the situation. Small-scale flooding is handled

by the city's water management department in collaboration with the police, the safety region, and the water boards (Institutional actor 5, interview date 12 December 2018).

Community-based disaster risk management or other community-based disaster risk management organization is also not present in the city. Volunteers and community associations exist, but not directly on disaster risk management and preparedness. There are support networks and WhatsApp groups in neighborhoods where people exchange news and updates on security issues such as burglary. Only the Red Cross has a network of volunteers working on crisis (Citizen stakeholder 6, interview date 11 January 2019; Planner stakeholder 02, interview date 13 December 2019) called Ready-to-Help, made up of 3,000 neighborhood volunteers. However, the city government never tapped the Red Cross to use the volunteers to carry out any awareness-raising events.

"They know it exists, they never use it. And the point is if you never use it the moment a disaster happens you don't think of it. If it is part of your regular way of working then of course you think about it. Then you can already know what you can ask from them." (Citizen stakeholder 6, interview date 11 January 2019)

Infrastructure resilient but not exactly socially resilient

Since the flood of 1953, the Netherlands fortified and raised the dike heights, constructed primary and secondary dikes, and built other preventive infrastructures like Oosterscheldekering (Eastern Scheldt Storm Surge Barrier) in Zeeland and the Maeslantkering in Rotterdam. The Deltaplan increased the level of protection in the country and has certainly influenced the way the Dutch deal with water management.

"Flood protection has been upgraded to a high level since the disaster of 1953 where 1,800 people died which was mainly [in] the southwest. [And] just affected very little [area] close to Rotterdam but actually that kind of made the country implement the Delta Plan [and] gave this part of the country, certainly a relation to the sea a very high protection level which means . . . we hardly ever, we never really actually experience any flood, at least not from the sea or from the river." (Capital stakeholder 1, interview date 14 January 2019)

Floods have remained uncommon since the development and completion of the Deltaworks system. There may be some low-level flood which according to interviewees are considered a *"nuisance"* it is *"not really a problem but you don't want it"* (Institutional actor 1, interview date 18 December 2018; Planner stakeholder 02, interview date 13 December 2019; Capital stakeholder 1, interview date 14 January 2019) but the water recede quickly. Rotterdam's additional climate-adaptive infrastructures are also an important addition to the security of the residents from flooding. Further, both the national and local governments work together with research and academic institutions to study climate

scenarios that may affect the city. This information is shared across networks and agencies to advance preparatory studies for any kind of disaster.

"They [the people] are Rotterdam. I always say we can solve everything at the technical level. We are brilliant . . . I think we have to work more with citizens because if you work with citizens they feel that they are involved. And in that way they can maintain and manage it by themselves. So you make like a closed cycle . . . with resilience you can, if you do things together, old and young can learn from each other and work with each other . . . I think we have to focus more on citizens that's why I am always outside and not in the office. It's the best." (Institutional actor 6, interview date 07 January 2019)

"But resilient city is all technical things but it also has to do with the people who live here . . . It can only be done by the people who are themselves are one, aware of it, and two, they have to have the money and the knowledge. So the city can only be flexible if people want to pay for it and people can work together. It's the only way. So it starts at the bottom with people who are willing to cooperate." (Citizen stakeholder 3, interview date 21 January 2019)

To improve outreach, communication, and involvement of citizens, resilience should be defined and translated in the Dutch language and related to what the local community perceives as important to them collectively. This ensures that people are not disenfranchised and become part of the bigger picture of the city. This brings a win-win situation for both the city government and the community especially in strengthening their capacities, awareness, and role in the city's development. Currently, there are organizations around the city that the city government can collaborate with to improve this outreach capacity and risk communication. Non-government organizations working at the neighborhood level can help stimulate discussion and participation within the communities provided the government also shows their support through their presence in dialogues and financial assistance.

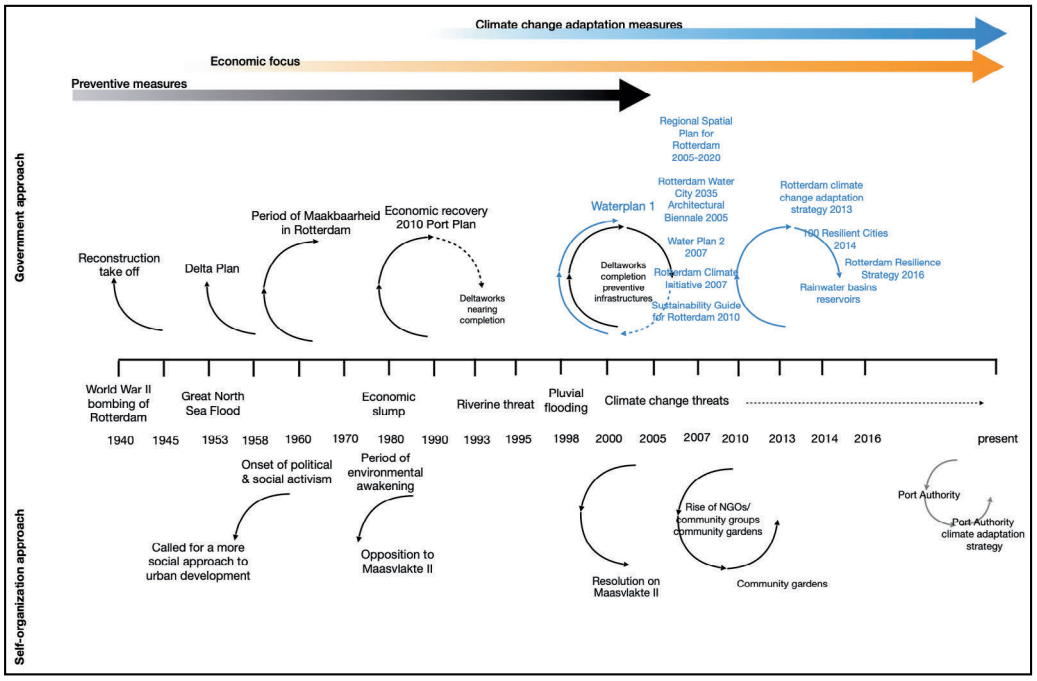
7.3 CHAPTER CONCLUSION

The call to action to "roll up your sleeves, a major work lies before us" in the first adaptive cycle evoked solidarity among the people of Rotterdam especially with the emphasis on the 'us' as part of the collective whole who will build back the city. People collectively worked together to become *"sterker"* (stronger) for the city to move forward, grow economically, and become habitable. As the city became stronger economically and physically so did the voices of the citizens. However, the growing urbanization has diversified the population and presented problems in terms of employment and social services. The gap that grew between the privileged and underprivileged lost the essence of the 'us' as 'together' in the city, instead, it cultivated an 'us' and a 'them'. This social and economic gap between residents is seen as a threat as it impedes the ability of those with lower incomes from integrating into society. People with lower incomes will be more concerned about their

daily living expenses than flood risks or climate change. While people with higher incomes and higher education have a larger network, higher income tax, and could have a stronger position on policies and/or political concerns that may impact them.

Rotterdam has always had an economic focus, primarily due to the port that even during the first cycle where preventive measures were prioritized, the design of the Deltaworks accommodated the passage of ships through Rotterdam and Antwerp. Figure 7.5 indicates that while preventive measures were taken to address flood risks, the economic emphasis on Rotterdam as a port and commercial hub did not waver but instead spread to the second adaptive cycle. Rotterdam's focus as an economic driver for the country has lost the touch to create a cohesive community. The policies that have been put in place encourage the participation of stakeholders in city and community development, but in reality, they are limited to presentations of already planned developments. Further, the rebranding of the city from 'world port city' to 'make it happen' is still devoid of participation from the residents as these brands were developed by a specialist group rather than the people themselves. While the slogan is close to 'roll up your sleeves' indicating Rotterdam's working-class background, it is unlike the 'us' call to action in the 1940s. Who then will make Rotterdam happen? This is where the current 'struggle' in Rotterdam lies.

Figure 7.5: Rotterdam's sustained economic focus



Interviewees defined resilience in two perspectives, one is more technical attributing resilience to the ability to bounce back through preventive measures. The strong continuous improvement of these preventive measures and incorporation of climate adaptive infrastructures are seen as factors in creating a resilient city. This suggests a more structural, engineering, and spatial design element. The other perspective is mainly focused on the social aspect of resilience, in particular the role of the people of Rotterdam. The interviewees see that the people and their social networks are equally important to create a resilient city. These two perspectives should not be taken as separate from each other rather as complementary and herein lies the 'we'. If the city government does not communicate and translate policies to the residents, acceptability and social cohesion which are very important in building urban resilience cannot be achieved.

The city's focus on the economy and its global image has put the people who built the city in a backseat. The government-approach in building urban resilience is robust in terms of policies, programs, and projects. The self-organization approach is also thriving in the city through community gardening and other community initiatives. Most of the communities have an idea of climate change but not necessarily flood risks and disasters. There is a struggle to close these two approaches to work together on building a resilient city because of the lack of communication from the government whether this is on flood risk and climate change or the development vision of the city. At present only the Port Authority as a community understand the flood risks and climate adaptation goals of the city that they have translated into their climate adaptation strategy but some residents are still disengaged.

CHAPTER EIGHT

CHAPTER EIGHT: LIVING WITH WATER: DORDRECHT BUILDING A ZELFREDZAAM ISLAND[16]

"There was an overflow of water . . . the city center . . . was a bit [flooded] but there were no casualties in Dordrecht . . . the dike ring opposite was severely hit and many people died there . . . that is very much in the collective memory of our country."
(Planner stakeholder 1, interview date 07 December 2018)

8.0 INTRODUCTION

The 1421 Saint Elizabeth flood has been in the Dutch narrative for centuries and in fact, has been beautifully depicted in an iconic four-panel painting aptly titled 'The Saint Elizabeth's Day Flood' (see Figure 8.1). The painting "serve as a powerful illustration of the traditional narrative describing the fight against floods that shaped the Dutch national identity" (van Asperen, 2019: 36). In Dordrecht, the Saint Elizabeth flood wiped out 17 villages and separated the city from Geertruidenberg. The series of reclamation and diking transformed the city into an island that sits between the Rhine and Meuse rivers.

Figure 8.1: The Saint Elizabeth's Day Flood 1490 by Master of the St Elizabeth Panels

Source: https://useum.org

[16] Initial results of the Dordrecht case "Living with water: How memory and experience can help build community resilience in Dordrecht" was presented in the 55th ISOCARP World Planning Congress in Jakarta/Bogor, Indonesia on September 9-13, 2019.

The city center of Dordrecht especially the main street Voorstraat is a constant reminder of this historic flood. The Voorstraat is not just a street but also a dike and the location where the *vloedschotten* (flood barrier) exercise is practiced annually. The city experiences regular occurrence of high water levels along the river in the historic city center. Regular high water levels and the *vloedschotten* exercise nourishes the collective memory and awareness of the people of Dordrecht on their vulnerability to flooding. However, as people are aware of their risk of floods, the level of concern as to whether this will happen is still very low, citing other threats as much bigger than the risk of flooding. There is also a disparity in the perception of the residents of Dordrecht as to where the unsafe areas are situated when it comes to floods. People living *binnen de dijk* (inside the dike) perceive that the areas *buiten de dijk* (outside the dike) are more dangerous.

This chapter shows that Dordrecht's collective memory on the historic flooding serves as a watermark and foundation in Dordrecht's process of urban resilience and collective engagement. The City of Dordrecht is striving to become a *zelfredzaam* (self-reliant) island and to do so, the city has embarked on studies and knowledge sharing on flood risk management in collaboration with various organizations, including partner cities. This case highlights that historical disaster memory alone cannot create a resilient city but rather a combination of factors such as creating a network, risk awareness, and policies that the residents collectively understand and familiar with. Furthermore, the case illustrates Dordrecht's approach to self-organization as an interdependent activity and actions between stakeholders that incorporates technical and mitigation approaches to urban resilience in combination with community engagement and learning. This chapter starts with Dordrecht's adaptive cycles where the disaster experience will be described including the policies created that forged the process of collective engagement and urban resilience. The second section describes the four dimensions of collective engagement followed by the last section, the conclusions.

8.1 ADAPTIVE CYCLES

Dordrecht's cycle of urban resilience and collective engagement has been running for more than 600 years. Figure 8.2 shows the timeline of the process towards urban resilience using the curved arrows in the timeline as the collective engagement dimensions - concern, action, efficacy, and security - within the adaptive cycle. It begins with the first and second adaptive cycles caused by the disturbances, the Saint Elizabeth flood of 1421 and the Great North Sea Flood of 1953, respectively, which is the period of rebuilding and reconstruction, while the third and fourth adaptive cycles started in the 2000s (coded as blue and green, respectively). The third adaptive cycle is the beginning of the climate change adaptive shift in urban design, it was also during this period where the self-organization approach and involvement of various stakeholders took place. The fourth

adaptive cycle merges this infrastructure focus and collective engagement through the multi-layer safety (MLS) approach and the learning action alliance (LAA).

Figure 8.2: Timeline of collective engagement urban resilience of Dordrecht

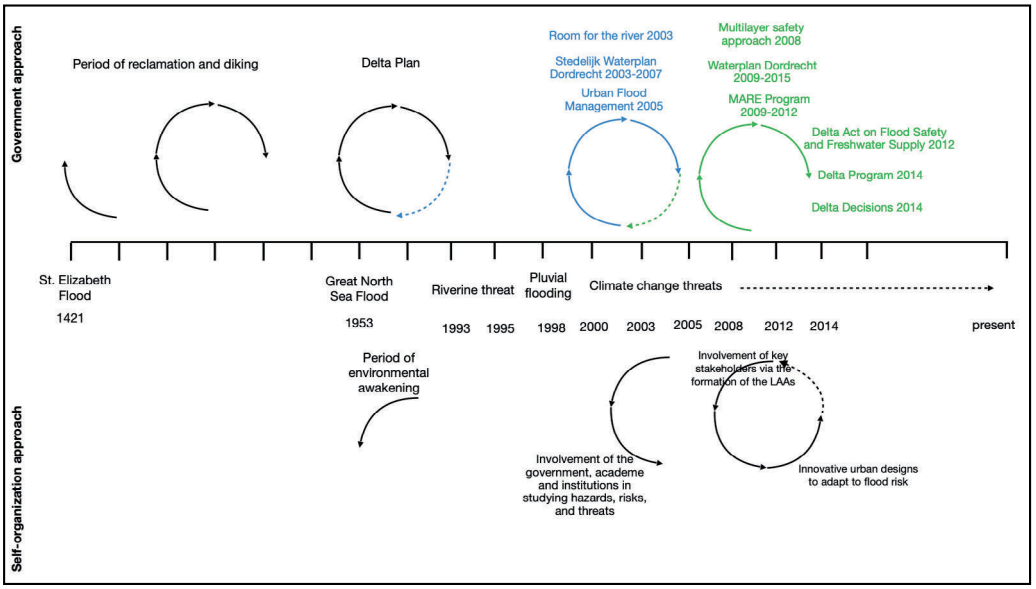


Figure 8.2 shows that the first adaptive cycle started from the Saint Elizabeth flood in 1421 where the period of reclamation and diking took centuries. This historical flooding disaster is present in the collective memory of the people for this shaped the landscape of Dordrecht. The Saint Elizabeth flood *"drowned 17 villages roughly in the hinterland"* (Institutional actor 1, interview date 30 November 2018) and separated Dordrecht from Geertruindenberg creating *"a very large inland sea"* (Planner stakeholder 1, interview date 07 December 2018). The historical flood incident affected Dordrecht's economic position that one interviewee even said, *"if that flood would not have happened Dordrecht would probably be the Amsterdam of the Netherlands"* (Planner stakeholder 2, interview date 24 January 2019). After the massive flood, the land was slowly reclaimed through compartmental diking which meant building several dike rings in the city. Centuries process of land reclamation through compartmentalized diking made *"Dordrecht an island which is still is today"* (Institutional actor 1, interview date 30 November 2018). This engineering pathway to resilience remains in Dordrecht with the continuous maintenance of the dikes.

The Great North Sea flood of 1953 is the other large-scale flood disaster that is widely recognized by the interviewees and marks the second adaptive cycle. The flood had an impact on the collective memories of the Dutch. However, interviewees noted that while

the 1953 flood was a big catastrophe, the impact on Dordrecht was not as great. The city suffered only minor flooding in Voorstraat, but no significant casualties were recorded. The dike ring opposite Dordrecht, the Hoeksche Waard, saved the island from this catastrophe.

Nevertheless, the Great North Sea flood led the Netherlands to construct the Deltaworks project. This second adaptive cycle became the height of preventive infrastructure development in the Netherlands. The beginning of the environmental awakening also took place during this period, but more on a national scale and, in particular, focused on the regeneration period, mostly in larger cities. Since strong preventive measures have been put in place, no large-scale floods have ever occurred in the Netherlands.

The third adaptive cycle (coded blue in Figure 8.2) was triggered by the 1993 and 1995 riverine threats. This led the Netherlands government to move towards a more climate-adaptive approach to flood risk management. The fourth adaptive cycle (coded green in Figure 8.2) is the introduction of the Multi-Layer Safety (MLS) approach following Hurricane Katrina in the USA. The next subsections will discuss the third and fourth adaptive cycles on the government approach and the self-organization approach further highlighting the policies and the stakeholder interaction that transpired.

8.1.1 Policies and institutional context

When the 1995 riverine threat happened over 200,000 people evacuated to the eastern part of the Netherlands as a precaution (Slomp, 2012; Vergouwe, 2016). Evacuation is uncommon in the Netherlands which prompted the national government to rethink their flood risk management strategy from highly preventive to adaptive. This was the start of a series of policies, plans, and studies on flood risk management in Dordrecht (see Table 8.1 below) which began in the third adaptive cycle and carried into the fourth adaptive cycle as shown in Figure 8.2.

Following the 1995 riverine threat, the Minister for Water Management announced the need for a structural shift in the approach to flood risk management by the year 2000 by allowing more discharge space for rivers. In 1996, the Minister for Water Resources and the Environment launched the Room for the River policy. The Room for the River was built to restore the old floodplains by constructing a “room” for the river to increase its discharge capacity and anticipate possible flooding while decreasing its impact. Figure 8.2 shows that in the third adaptive cycle (coded blue) the Room for the River was implemented in Dordrecht and followed by other policies and programs in the early to mid-2000s.

Table 8.1: Policies, plans and studies in Dordrecht

Policy/Plan/Strategy/ Study	Year	Description
Room for the river*	2003	Aimed to restore the old floodplains by creating "room" for the river to enlarge its discharge capacity.
Stedelijk Waterplan Dordrecht 2003-2007	2003	Aim to create more space for water with to have all main waterways surrounding Dordrecht by 2050 designed in a way that it reinforces both water and spatial development.
Urban Flood Management	2005	A joint action between the cities of London (Thames Gateway), Hamburg (Germany) and Dordrecht (Netherlands) share experience and knowledge on flood management.
Multi-layer safety approach*	2008	A flood risk reduction method following three distinct layers: prevention (layer 1), sustainable spatial planning (layer 2), and crisis management or disaster management (layer 3).
Waterplan Dordrecht 2009-2015	2009	Envisioned the island of Dordrecht as a climate-proof city with a safe, beautiful and healthy water system that can absorb extreme rainfall and long periods of heat and drought (Gemeente Dordrecht, 2009). It is a continuation of the previous Waterplan, emphasizing the importance of water in the history of Dordrecht and thereby both water and urban plans must coincide.
MARE Program 2009-2012	2009	The aim of the program is to develop and demonstrate methodologies on flood risk management using a bottom-up approach (Mekel and Bastiaansse, 2013).
Delta Act on Flood Safety and Freshwater Supply*	2012	The aim of the Delta Programme is "to protect the Netherlands from flooding . . . to secure sufficient supplies of freshwater [and] to make the country climate-proof." (Government of the Netherlands, 2020)
Delta Decisions*	2014	Focused on "flood risk management, fresh water supply and a climate-proof and water-robust design of the Netherlands" (Deltacommissaris, 2020).

*National policy

The impact of the Room for the River program on Dordrecht is high since a large part of the program includes the Biesbosch, which is part and parcel of Dordrecht's identity and ecology. In support of the national program, Dordrecht launched the Stedelijk Water Plan Dordrecht for the period 2003-2007 to build more water space. The strategy is to improve all major waterways in Dordrecht to enhance the city's overall water and spatial development. Both the national program, Room for the River, and the local policy, 2003-2007 Water Plan, acknowledge the value of a climate-adaptive approach to planning and flood risk management.

Recognizing that implementing climate change adaptation and flood risk management policies and programs means increasing risk and hazard studies impacting the island, the City of Dordrecht has strengthened its partnership with academic and research institutions. The City of Dordrecht extended this partnership with other cities through the Urban Flood Management (UFM) program. The UFM program partnered with the cities of London (Thames Gateway), the United Kingdom, and Hamburg, Germany, and launched the program at the Third International Symposium on Flood Defense held in May 2005 in Nijmegen, The Netherlands. The initiative aimed at sharing experience and knowledge in the planning and control of urban flooding (Kelder, 2006; Stone, et al., 2008). The three cities Dordrecht, London, and Hamburg held several workshops to exchange information on each of the cities' backgrounds, flood experiences, and current practices. This led to identifying the common issues to address in the research program namely, governance system, the role of actors, capacity building, flood risk and vulnerability assessment, floodproofing, and incorporation of UFM in spatial planning in each of the project pilot cities (Gemeente Dordrecht, 2006).

In Dordrecht, the three-year UFM study (2005-2008) provided an in-depth, science-based analysis of the urban development process in the Stadswerven, an area that is frequently flooded. Using flood simulations UFM design concepts were tested on their applicability in the Stadswerven area, interestingly these design concepts did not apply to all the areas, which shows the value of flood forecasting, flood risk assessment, and engineering design in urban planning and spatial development. The science-based analysis allows the development of alternative options or revisions if the initial design concept does not fit. The UFM project used an inter-disciplinary approach engaging experts from different fields to work together in creating a flood-proof urban design (Stone, et al., 2008). The interaction among the experts created a robust urban plan and spatial design to meet the different flood characteristics in the Stadswerven area and resulted in awareness and understanding of each of the experts' fields of specialization and improvements in communication and collaboration. Learnings from the program were carried over to the succeeding projects in Dordrecht.

The UFM study was a timely initiative along with the already strong flood preventive measures in the Netherlands especially when Hurricane Katrina struck the U.S. in August 2005. Studies and research had long supported the Dutch way of managing water, but after Hurricane Katrina, the Dutch recognized that this could happen in the Netherlands. The massive floods in New Orleans were caused by a breach of the levees and canals. This sent a clear warning to the Dutch, who relied on the same form of preventive barriers all over the country to the possibility of a breach. There was also a realization that dikes cannot be raised constantly to prevent floods. Studies on this possibility followed suit which became the trigger for the fourth adaptive cycle (see Figure 8.2 coded green). As a result, the multi-layer safety (MLS) approach was introduced in 2008.

The MLS approach is a flood risk reduction method consisting of 3 layers, layer 1 prevention, layer 2 spatial adaptation, and layer 3 critical crisis management. Layer 1 as the name suggests is the construction, operation, and maintenance of flood-preventive structures such as levees, dikes, and storm surge barriers to prevent flooding caused by sea and river water level rise and heavy rainfall. Layer 2 is sustainable spatial planning where innovative and climate-adaptive infrastructures are designed to prepare the urban environment to anticipate flooding or high water levels. In creating climate-adaptive infrastructures around the city, damage caused by flooding to important facilities is minimized. Finally, layer 3 crisis management focuses on flood preparedness including the creation of a disaster management plan and evacuation strategy.

Following the launch of the MLS approach, Dordrecht released the 2009-2015 Water Plan to make Dordrecht a climate-proof city with a particular focus on incorporating a water component into any urban development. In the same year, a project called Managing Adaptive Responses to Changing Flood Risk in the North Sea Region (MARE) was launched to demonstrate flood risk management methodologies using a bottom-up approach (Mekel and Bastiaansse, 2013). The MARE program, which ran from 2009 to 2012, was run in one city for each of the four countries, the Netherlands, the United Kingdom, Germany, and Norway. Dordrecht was the Dutch case city for the program. Similar to the aim of the UFM project, the purpose of having four cities in four different countries is to learn local adaptive flood risk measures and experiences of each city.

The MARE program created an integrated approach to address urban flood risk by establishing local Learning and Action Alliances (LAAs) in the four cities. The LAAs consisted of cities, regional bodies such as provinces, national authorities, academic institutions, and private partners (The North Sea Region Programme 2007-2013, 2009). The four cities engaged in workshops and discussions and shared their city experiences and approaches. The MARE program also produced program reports consolidating learnings derived from the four cities. An important lesson derived from the program was how the LAA impacted the governance system, policies created on climate change, and urban planning and spatial design in each of the cities. For Dordrecht, 'the project led to new design methodologies for all urban developments and a national-level discussion on norms for decision-making in investments in the dike system' (MARE, 2013: Executive Summary para 2).

In 2012, the Netherlands further strengthened its policies on climate change and flood risk management through the issuance of the Delta Act on Flood Safety and Freshwater Supply and mandated the creation of a Delta Program annually (Deltacommissaris, 2020). In 2014, the Delta Decisions was released following the Delta Program for that same year. The Delta Decisions included in its ambition, not just flood risk management and freshwater supply but also the inclusion of climate-proof and water-robust design (Deltacommissaris, 2020). This then encouraged the creation of climate-adaptive spaces,

particularly in urban areas. Planner stakeholder 1 (Interview date 07 December 2018) shared that spatial adaptation has always been neglected but this shift in thinking gave emphasis to its importance.

8.1.2 Stakeholder interaction with city government programs

From the 2000s the policies created encouraged closer collaboration between the government and the stakeholders. When the Room for the River program was introduced in Dordrecht, the proponents targeted the area of the Biesbosch which is an integral part of the city's ecological identity that getting the stakeholders to agree to this project became a huge task. The Room for the River program combines science, engineering, and climate adaptation to combat floods by simply allowing water to flood a specific area. In its approach to resilience, it is both transformative and adaptive. This transformation also takes place when *"resilience"* is *"broken"* (Planner stakeholder 1, interview date 07 December 2018) which means enabling the area to become vulnerable, in this context, flooded yet preparing the environment so that it can adapt to it.

"So what we are doing with Room for the River for example, we are giving back land to the river. So we break resilience at the low level but that makes the river system overall more resilient." (Planner stakeholder 1, interview date 07 December 2018)

However, this transformation does not only entail physical change or the construction of climate-adaptive and climate-proof infrastructures. The Room for the River program follows the concept of integrated river basin management, a comprehensive approach to water management that aligns multiple objectives across spatial and temporal dimensions (Zevenbergen, et al., 2013). The Room for the River program adopted a multi-level governance approach involving different government agencies at the national, regional, and local levels. The decision-making process was a mix of centralized and decentralized approaches whereby the national level set out the framework on water safety and spatial quality, while the plans and design are decided at the regional and local levels (Rijke, et al., 2012; Zevenbergen, et al., 2013). This means that the technical expertise is present at all levels of decision-making and includes local stakeholders in the discussion on the planning, design, and implementation of the program in their locality. Typically the local stakeholders involved are the citizen groups, farmers, environmental groups, knowledge institutions such as universities, and research organizations (Edelenbos, et al., 2017; van Herk, et al, 2015).

In Dordrecht, just like in other areas where Room for the River is implemented, dissemination of information and consultations with farmers were required to make the program acceptable, as farmers are the key stakeholders to be impacted by the initiative. Figure 8.2 indicates that the third adaptive cycle of the government approach meets the first adaptive cycle of the self-organization approach. Along with the city

government, residents who are mainly farmers, citizen groups, environmental groups, and the academe (UNESCO-IHE, Delft University of Technology) were involved in the discussion to come up with a solution that is acceptable to all. The Room for the River program merged the expertise of technical innovation with the knowledge of farmers in their decision-making and execution.

"In '96 we had a big flood from the rivers. Until then we used to [increase the height of] our dikes, on and on and on, so the dikes are getting higher and higher and the rivers were getting lower and lower. And then they thought we have to use a different strategy so we started the program, space for the river . . . just before Dordrecht there is a big area where the whole agriculture area can flood. But the farmers who are living there they don't want a flood. So we built terpen so all the houses and property were built on new higher grounds but the rest of the area can flood. So that's adaptation but it is also the knowledge on how do you do it . . . it is also technique . . . so there won't be a flooding for the other areas." (Institutional actor 6, interview date 24 January 2019)

The Room for the River program called for a more pragmatic and practical approach to climate change adaptation, requiring the participation of technical experts and the university to research this approach in detail. Although the solution is scientific and technological, the plan also included the participation of citizen groups, farmers, environmental groups, among others, who would be immensely impacted by the project. The program was just one of the many studies conducted by academic and research institutions on an integrated approach to flood risk management and urban spatial development. Other programs such as the UFM conducted in 2005 provided technical knowledge and advice on flood risk management. The study resulted in an evaluation framework for flood-proof urban designs that can be built and adapted to the city.

Forging ahead on collaboration and learning with citizen groups, environmental groups, knowledge institutions, and the private sector, Dordrecht implemented the MARE program which established a local LAA composed of key and professional stakeholders on flood risk management at local, regional, and national levels, knowledge institutions and private enterprises (Climate Adapt, 2016). The concept of the LAA came from 'learning alliance' which primarily takes into account a network where mutual learning and cross-fertilization of ideas take form. The uniqueness of the LAA in the MARE program is the inclusion of 'action' where it is seen that members of the alliance not only learn from each other but also take action (Dudley, et al., 2013). Learnings derived from the MARE program and the LAA led to policies on flood risk management and urban planning in Dordrecht. The MARE program through the LAA piloted the Flood Risk Management plan using the MLS approach. The program provided knowledge on how to strengthen policies at the regional and national levels.

The studies and programs conducted in the city of Dordrecht made the island a living laboratory especially in the implementation of the MLS approach particularly layer 2 spatial planning. Living laboratories are research environments such as cities, districts, neighborhoods, where research is conducted and applied in a real situation (Kennisportaal Klimaatadaptatie, 2021a; Veeckman and Van Der Graaf, 2015; Dorresteijn, 2019). The Ministry of Infrastructure and the Environment has supported the creation of living laboratories through the Delta Program 'Spatial Adaptation' (Kennisportaal Klimaatadaptatie, 2021a). In 2017, Dordrecht obtained a grant from the Delta Program for a Climate Adaptation Living Lab which was used to implement climate adaptive and innovative projects throughout the city. An example of a project that falls under the living laboratory umbrella is the Plan Tij a residential compound in the unembanked area built-in tidal landscape to showcase the changing tidal patterns (Kelder, 2017; Stijlgroep, 2021). Dordrecht's close collaboration with the government, academe, private sector, and residents, and the city's general openness to learning and innovation make the creation of a living laboratory feasible. The active presence of the key actors in the city (city government, *waterschap* (waterboard), and the *veiligsheidsregio* (safety region)) working as a network and in coordination build a level of social and community resilience. In the interviews two of the most significant factors found that contribute to these pathways are the climate-adaptive infrastructures and the *vloedschotten* exercise. These will be discussed in the next section on collective engagement and urban resilience.

8.2 COLLECTIVE ENGAGEMENT IN URBAN RESILIENCE

The previous section provided the timeline and process of collective engagement and urban resilience in Dordrecht. The four adaptive cycles in Figure 8.2 show the steady progress of the city towards urban resilience. The foundation, built in the first and second cycles of adaptation, was primarily the history of flood disasters the Netherlands experienced, which is in the collective, albeit historic, memory of the stakeholders (coded black in Figure 8.2). The third and fourth adaptive cycles demonstrated a shift from highly preventive measures to more adaptive flood risk management approaches (coded blue and green, respectively, in Figure 8.2).

The first main adaptive cycle of Dordrecht was the period of reclamation and diking after the 1421 Saint Elizabeth flood. The second adaptive cycle was the period of the Deltaworks after the Great North Sea Flood in 1953. The third adaptive cycle triggered by the riverine threats was the start of Dordrecht's move towards climate change adaptation and collective engagement. The third adaptive cycle in Dordrecht's collective engagement to urban resilience through the government approach is short compared to the long reclamation and reconstruction period, but it was a fast step to the fourth adaptive cycle, which is the integration of a multi-layer safety approach into Dordrecht's urban and water plans.

This section will bring together the process of collective engagement and urban resilience in Dordrecht using the dimensions of collective engagement - collective concern, collective action, collective efficacy, and collective security. Table 8.2 shows the summary of the salient points under each dimension.

Table 8.2: Dordrecht's collective engagement dimensions vis-a-vis urban resilience

	Collective engagement dimensions descriptions	Urban resilience	Present indicators
Collective concern	• Collective historical memory on the Saint Elizabeth flood of 1421 and 1953 Great North Sea Flood. • Residents in the historical city center aware of local adaptation measures because of regular flood experience.	• Collective memory on flood but high trust on government.	• Local adaptation measures • Volunteers from the Red Cross. • Presence of dike army.
Collective action	• General disaster risk awareness especially high in areas near the river such as historical city center. • Collaboration between city government, *waterschap*, veiligsheidsregio and non-government organizations on crisis management.	• There is an understanding on the need for climate adaptation measures and implementation of multi-layer safety approach in urban design.	• Information on disaster risk management available in websites. • Schools and organizations conduct awareness raising activities on water management.
Collective efficacy	• Disaster preparedness plans are at the government level and vision of *zelfredzaam* island. • Emergency alarm systems are in place.	• Stakeholders aware of spatial planning and urban design on climate change adaptation.	• Fire drills conducted in various organizations. • Regular conduct of vloedschotten exercise.
Collective security	• Crisis management organized at all levels of government. • City government ongoing initiatives to increase awareness on disaster preparation and evacuation.	• Government role on disaster risk management. • Stakeholders are aware but need to increase across all sectors.	• Coordinated disaster risk management across agencies. • City government has a 'safety team'

Source: Author, 2020

8.2.1 Collective concern

Memory-based disaster experience contributes to the knowledge and collective identity of the city to become self-reliant. Dordrecht's long history with water is evident in the collective memory of the residents as well as in the policies of the city government (as shown in Figure 8.2). The first and second adaptive cycles are the foundation of shared disaster experience and history that has fertilized the collective flood memory of the stakeholders. The same memory became the basis of the peoples' awareness of the city's long history of fighting against water by compartmentalized dikes, as well as on the general preventive strategy of the national government by developing the Deltaworks system that *"ensures the protection and security of the residents"* (Planner stakeholder 1,

interview date 07 December 2018). After the 1953 Great North Sea flood, the Netherlands, in general, has not experienced large-scale flooding that low-level floods are known to be nothing more than a 'nuisance' considering the actual flood height is just 10 to 20 centimeters. It may cause damage, but not to the point that people need to evacuate (Institutional actor 1, interview date 30 November 2018).

Awareness among the residents on the possibility of floods is still present, owing to the geographical and geological nature of Dordrecht. As an island, the area is vulnerable to water coming from the sea and the river. The City of Dordrecht is below sea level and 80% of the land area is below the Netherlands Amsterdam Pile (NAP). Just like other cities in the Netherlands, Dordrecht can be separated into two parts, *binnen de dijk* (within the dike) and *buiten de dijk* (outside the dike). When it comes to flooding, these two parts have two different challenges. *Buiten de dijk*, the danger of floods comes from river rise on one side and sea rise on the other during the high water season (Institutional actor 5, interview date 13 February 2019), while *binnen de dijk* the threat is more from heavy rainfall.

Regular flood experience an opportunity to learn

Heavy storms from the North Sea occur most of the time during the high tide season from October to April. During spring the water level usually increases (Institutional actor 2, interview date 11 February 2019) due to the melted snow from the mountains in Germany and Switzerland which flows down between Dordrecht and Gorinchem (Institutional actor 6, interview date 24 January 2019). These incidents increase the water levels of the river and the sea. If the increase in water levels happens in a combination of tidal waves, storm surge from the sea, and high water levels from the river, it will be a significant threat to the city. Higher water levels affect the old city center of Dordrecht and occur every two years but this experience gives the city government of Dordrecht an opportunity to raise awareness of flood risks.

"That is the reason why we make a big exercise every year to create that awareness for the inhabitants. And we say that it is a very good thing that there is a high water situation every two years because if it is once every thousand years people won't believe it or they will say it will not happen in my time if it is every two years they have to deal with it." (Institutional actor 5, interview date 13 February 2019)

The incidence of low-level flooding in the unembanked areas reminds residents of the city's vulnerability to environmental threats. To prepare and increase awareness of the risks of flooding, the city government, the *veiligheidsregio*, and the *waterschap* all work together to disseminate information on topics such as floods, climate change, and disasters. An annual *vloedschotten* exercise is also organized by the city government and the *waterschap* where residents place flood barriers in front of their houses. The *vloedschotten* exercise is an important participatory activity conducted in the historic

city center, alerting locals to the dangers of floods in the area and educating citizens on how to prepare.

Awareness *binnen de dijk* and *buiten de dijk*

Institutional actors and planners interviewed suggest that Dordrecht residents are more aware of their susceptibility to floods than those living in other cities in the Netherlands. They expressed, however, that while there are a general perception and knowledge of the danger of flooding in Dordrecht, there is no major concern due to strong prevention measures in the Netherlands. Comparing the inhabitants *binnen de dijk* and *buiten de dijk*, interviewees expressed that people living *buiten de dijk* are more aware of the risks of floods as they encounter flooding every two or three years. In addition to the *vloedschotten* exercise that also happens *buiten de dijk*, the residents also receive information during the storm season.

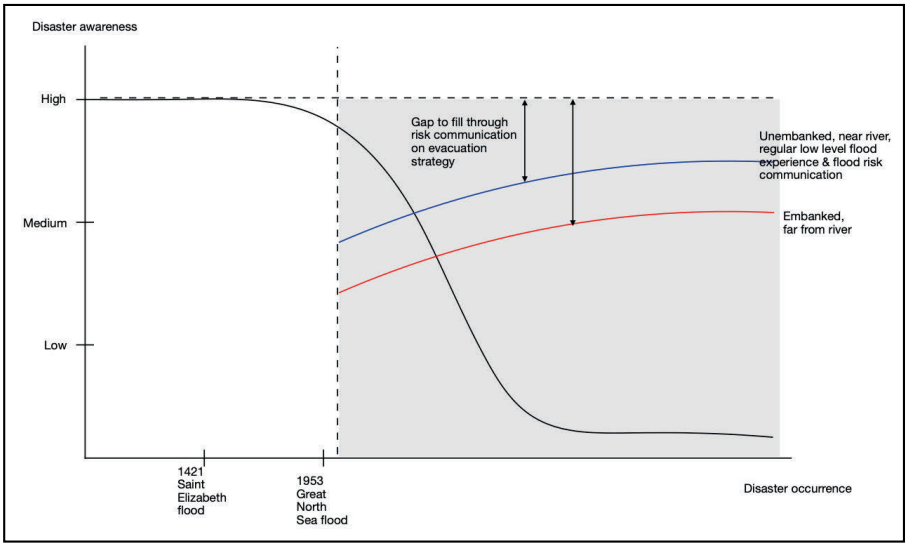
"The resilience in that location [buiten de dijk] is very high. Resilience in the rest of the town is very difficult to measure but I would say relatively low. They are also not faced with frequent threats so that does not create the urgency for them to do anything." (Institutional actor 1, interview date 30 November 2018)

The residents are generally aware of the vulnerability of the island to high water levels, however, concern and urgency to manage floods are relative. There is a correlation between the distance to the river and the frequency of flood experience of the residents to the level of awareness and concern. Residents living near the water, mostly in the unembanked areas, see the tidal rise of the rivers daily and are provided with information regularly on the high water levels that may be experienced during the storm seasons including the possibility of low-level floods. They are also warned by radio or apps to remove their cars from the quay and other precautions during that period (Institutional actor 6, interview date 24 January 2019). This does not happen in the embanked areas especially those that are farther from the river and who do not experience flooding. These types of communication contribute to the level of awareness of the people living outside the dike making them more aware of the risks. For people living inside the dike, Institutional actor 6 (Interview date 24 January 2019) admits that the city government does not have a good communication platform.

Communication and information dissemination is important in sustaining awareness and knowledge on disaster risk management and preparedness. Esteban, et. al. (2015) in their study on tsunami awareness and education indicate that awareness decays over time but can increase after disaster awareness education. This means that while memory-based disaster experience can be considered a repository of disaster knowledge and experience if these are not documented and cultivated this memory dies down. In the case of Dordrecht, the large-scale flooding that happened in 1421 and 1953 have created centuries and decade

long disaster gap (the length of time a hazard or a disaster occurred in a place) but the regular occurrence of low-level floods in the city center serves as a reminder to residents on flood risks (see Figure 8.3).

Figure 8.3: Disaster awareness gap in Dordrecht



Adapted from Esteban, et al., 2015

However, the level of awareness and preparedness is higher in the unembanked areas, indicated by the blue line in Figure 8.3, compared to the embanked areas, indicated by the red line. This is because there are an annual *vloedschotten* exercise and regular communication on flood risk in the unembanked areas compared to the embanked areas. Figure 8.3 shows that disaster risk awareness wanes overtime where the grey portion indicates the disaster gap. This disaster gap has impacted citizens' view of the floods as not such a big threat or risk to the community. In general, disaster risk awareness is fading and only reinforced by the incidence of low-level flooding, information, and flood exercises in the unembanked areas.

8.2.2 Collective action

Since the adoption of the MLS approach and the incorporation of climate-proofing and adaptation in spatial planning as stipulated in the 2009 Water Plan, Dordrecht has taken a range of steps to tackle high water levels. Priority was given to climate-proof houses and buildings in the old historic center whereby flood-proof windows were installed (see Figure 8.4), floor levels were elevated, and the backside of houses in the unembanked areas were renovated to ensure that the water does not flow inside.

Figure 8.4: Flood-proof window in Dordrecht

Source: van Son, 2018; City of Dordrecht

Other examples of climate-adaptive structures can be seen throughout Dordrecht (see Figure 8.5). Some homeowners also opted to renovate their cellars to make them floating cellar (see Figure 8.6). This allows the floodwater to enter the crevice that pushes the cellar floor and its contents upwards while keeping the contents dry. Critical infrastructures, such as power boxes, were also raised from the street level (see Figure 8.7) to ensure that it will not be damaged in case of a flood.

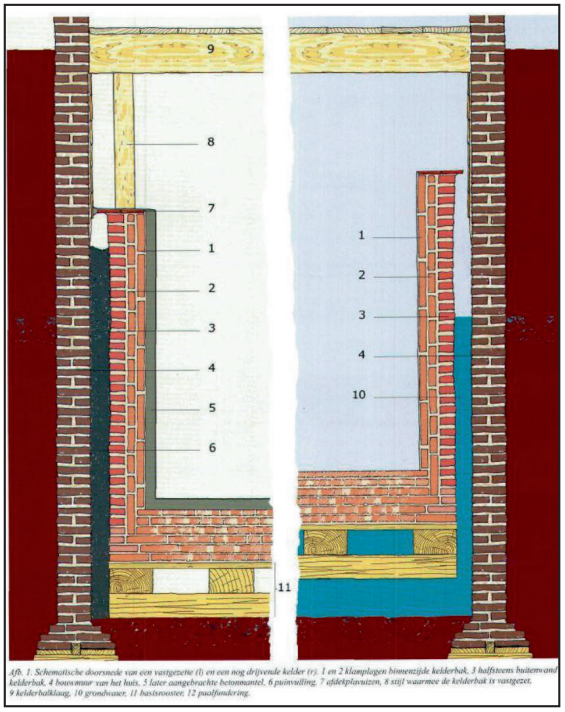
Dordrecht's vulnerability to the changing climatic conditions was dramatically felt in 2015 when a severe rainfall event (cloudburst) flooded 100 houses (Planner stakeholder 1, interview date 07 December 2018; Planner stakeholder 3, interview date 09 January 2019). There was a *"shower of 100 millimeters in 4 and a half hours"* (Planner stakeholder 3, interview date 09 January 2019) in comparison to the Netherlands average of 800 millimeters a year (Planner stakeholder 4, interview date 09 January 2019). The sewerage system does not have the capacity for a large amount of water that it flowed into the streets, basements, and houses.

". . . in Dordrecht we have 60,000 houses and we think about 100 houses where water is coming into the living room with damage. We think the damage was about 1 million euro but that damage, let's say if you are an owner of your own home then you have verzekering (insurance)." (Planner stakeholder 3, interview date 09 January 2019)

Figure 8.5: Climate-adaptive infrastructures and spatial planning examples

Source: van Son, 2018; City of Dordrecht

Figure 8.6: Floating cellar diagram



Source: van Son, 2018; City of Dordrecht

Figure 8.7: Elevated critical infrastructure

Source: van Son, 2018; City of Dordrecht

Even though the city was flooded, the residents were able to deal with the situation because most of the houses were climate-proof. The city government has also been vigilant in carrying out studies to improve the sewerage and drainage systems. Spatial planning in the city included the development of floodable *waterpleins* (water squares) which also increase the city's water retention capacity.

Communication and collaboration with stakeholders

The city government often takes the opportunity to educate stakeholders by engaging with them anytime there is a new policy or development. As shown in Figure 8.2 in the self-organization approach the involvement of government agencies, citizens, academe, non-government organizations (NGOs), among others coincided in the third adaptive cycle (coded in blue) in the government approach. Climate-proofing of residents' properties started with details coming from the city government, as well as technical and financial assistance. The floodable *waterpleins* mentioned in the previous sub-section was also a way for the city government to show stakeholders the importance of water and how it can be retained before it is released into the system.

The city government ensures that before beginning a new project, it meets with stakeholders not only to inform them of the new projects but also to engage with them. One such initiative was the floating houses that the city government, the private sector, and the residents built together. This initiative included the residents in the design,

planning, and construction of the actual floating houses. Most of the people involved were also interested in living in these houses and near the water as such were invested not just financially but more so in the consultation and decision-making. The floating house project started as an experiment that eased the pressure on the city government (Institutional actor 5, interview date 13 February 2019). It helped the project partners to try a new design and technique and see how it functions. This allowed them to make further changes if necessary. The initiative provided a forum for all actors to participate in a discussion, and if any, to merge their proposed solutions.

The tidal parks, located in an old shipyard in Stadswerven, is another innovative venture. The tidal park is adjacent to a residential neighborhood to give the residents the advantage of having open space. Floating houses and tidal parks help to visualize changing tides during the day and can be used as showpieces for the city. School children and other interested groups can visit these sites to learn more about flood risk management and the environment.

"What we also do is to create awareness . . . the floating houses are over here, this is the old shipyard it is now being transformed into a park. And what we made is a tidal park so people can see the water coming in and out everyday and when there is a high water situation the water will come at this level and the lowest the water will come over here. We made it an education park so they can see all the plants that are growing there . . . it is also making people more aware that they are living in this area." (Institutional actor 5, interview date 13 February 2019)

Innovative projects such as these have increased the city government's commitment to strengthening connectivity with different stakeholders to increase awareness (see Figure 8.2). This demonstrates the long relationship that citizens of Dordrecht have in dealing with water, as well as the willingness of the city government to collaborate with stakeholders on projects.

Information on disaster risk management

Planner stakeholders interviewed claim that Dordrecht is more focused on raising awareness of flood risk and climate change compared to other cities (Planner stakeholder 5, interview date 14 January 2019; Planner stakeholder 2, interview date 24 January 2019). The city government uses several information and communication methods including house-to-house calls, newspaper advertisements, neighborhood meetings, and presentation of plans. Although Planner stakeholder 3 (Interview date 09 January 2019) acknowledges that direct communication with citizens takes time, it is more effective and therefore more beneficial to the residents. Discussions with the community and the government lead to public debate and decision-making about the number of resources needed for prevention, public infrastructure, and crisis management. A much-needed

practice not only to educate and inform residents but also to exercise their right to citizenship.

There are also existing websites and social media where stakeholders can obtain information such as www.overtrooming.nl. However, some interviewees remain doubtful as to whether or not these platforms are accessed by the community.

"We have this national system which is called . . . NL-Alert. So I think that is good, that it is arranged on the national level and not on the municipal level. But it is going to be very important to follow up on that warning. In fact they should already be aware before they get that warning what they have to do . . . It is all on the website . . . called "Do I flood?" And you can see your own location if you will get flooded, overstroom ik. But ask all your friends did you ever look in those websites? No." (Planner stakeholder 1, interview date 07 December 2018)

"Do you really reach the people on Facebook, they 'like' you of course . . . people are not interested about what could happen." (Institutional actor 5, interview date 13 February 2019)

Risk communication remains challenging even with a general flood risk-aware population in Dordrecht. There are limitations to the resources of the city government and there is also low interest from the residents.

Perception on resilience

It is interesting to find that in the interviews there is a common understanding of what resilience is. Most of the interviewees mentioned preparation, prevention, and recovery, which are part of the disaster risk and reduction management (DRRM) cycle. But some interviewees also described it as having more alternative solutions (Institutional actor 2, interview date 11 February 2019), and absorbing flooding (Planner stakeholder 1, interview date 07 December 2018). These descriptions seem to be what can already be observed in Dordrecht and what the city government is also planning to enhance. This common understanding of resilience and relating it to DRRM is in part due to the collective memory, regular flood experience, and the awareness-raising activities present in Dordrecht.

The City of Dordrecht's manner of building urban resilience is not limited to prevention, but also to prepare for the crisis to lessen the possible damage or casualties (Institutional actor 5, interview date 13 February 2019). Resilience must be directed to alternatives and options that can enhance the city's *"ability to bounce back from a certain kind of disaster situation"* (Institutional actor 1, interview date 30 November 2018) and decrease its vulnerability over time and across scales. This means that it is not just the immediate response to the disaster but how resilience can be sustained longer by having a robust

DRRM system that provides several alternatives and solutions not just in one phase but in all phases of the DRRM cycle.

8.2.3 Collective efficacy

Interviewees attribute the higher degree of flood risk awareness of the residents of Dordrecht to the city being an island. There is a connection between people and water that is referred to as *"inside [their] DNA"* (Planner stakeholder 3, interview date 09 January 2019). Residents recognize the vulnerability of the city to many environmental challenges and the recurrence of high levels of water during the storm season reminds residents of their risk of flooding.

Although Dordrecht is still well secured, having the dike ring 22 that is made up of several dike compartments, the historic city center still experiences some high water levels every two years. The Voorstraat, located in the historic city center, is not only the main street but also the main dike of the city. It is not possible to increase the height of the dike since the street is lined with monuments and heritage buildings. To resolve this high water level situation, the *vloedschotten* exercise, which was also mentioned in the previous section, refreshes the residents' awareness of how to plan for future flooding and informs them of the risks and vulnerabilities in a city surrounded by water.

Vloedschotten exercise

The risk of a flood disaster in the Netherlands is relatively low, but if it occurs, the impact would be larger due to the number of people living in low-lying areas. However, as in the rest of the Netherlands, there are no flood drills or flood evacuation drills in Dordrecht. Institutional actors and planner stakeholders interviewed believe that it is inefficient to execute a flood evacuation exercise since it will not be cost-efficient and can also be unsafe. Furthermore, a vertical evacuation in Dordrecht is advised if a large-scale flood occurs which does not demand a large exercise.

". . . one of the first measurements on flooding . . . when it is [be]coming . . . a crisis is to get people out of Dordrecht, evacuation, or getting them on the high levels of their buildings. So if they are [going] to . . . higher levels of the buildings it is quite a simple option [with] evacuation if you want to conduct a drill [it] will be . . . a large evacuation [exercise which] will cost, and it will affect the lives of people even in an exercise people will die. So we don't try that." (Planner stakeholder 2, interview date 24 January 2019)

While there are no evacuation drills, there is an annual *vloedschotten* exercise conducted at the historic city center usually done in September before the stormy season. The *vloedschotten* exercise teaches the inhabitants to prepare and prevent the flood from entering their houses or establishments. The exercise includes the process of putting flood

barriers on the street, in front of shops, houses, and buildings, along with volunteers in the community (see Figure 8.8 and 8.9).

"Our primary dike is over here (Voorstraat) and these are all monuments so we cannot raise the dike. So all these houses over here are part of the dike so the flood barriers will be put in front of the house, and the house can be flooded but the water doesn't run over the flood barrier, so they protect the rest of the city." (Institutional actor 5, interview date 13 February 2019)

Every time a *vloedschotten* exercise is carried out, the city government makes people aware of the risks of flooding by helping them prepare for the event. Before the actual *vloedschotten* and sandbag placement drills, the city broadcasts information through newsletters or loudspeakers in the streets (Institutional actor 5, interview date 13 February 2019). The frequency of the drills depends on the high water situation, but it is done at least once a year.

Vision of a *zelfredzaam* island

Interviewees have consistently confirmed the *zelfredzaam* (self-reliant) island vision in the interview, suggesting that the vision has been widely conveyed to the various stakeholders. Institutional actor 1 (Interview date 30 November 2018) shared that for the last 10 years the city government has been working on the *zelfredzaam* vision strengthening their water safety and resilience to flooding. However, to become a *zelfredzaam* island is a bit contradictory to *'vezorgingstaat'* roughly translated by Institutional actor 3 (Interview date 29 January 2019) as *"the state delivers services to its people"* which has been deeply embedded into the Dutch culture of reliance or faith in the government.

"[O]fficially the government says if there ever is a flood, you have to rely on yourself you cannot rely on the government. You have to be self-reliant, in Dutch zelfredzaam, which is very easy to say from the national government. And which will not be the case but it is also given in such extreme situation the government will also not be able to function." (Institutional actor 1, interview date 30 November 2018)

One of the biggest challenges in Dordrecht is how to convey the message of preparation and evacuation to the public. Evacuation outside the city was identified by academics as more dangerous because there is no escape route, only two highway bridges lead out of the island. These highways are the A16 and the N3, which connect Dordrecht to Rotterdam in the north and Breda in the south. An evacuation area in the Staad, which is *buiten de dijk*, is being explored by the city government in collaboration with the academic and research institutions and the *veiligsheidsregio*. However, residents have a perception that the unembanked areas are not safe compared to the embanked areas. This perception can only be changed with stronger and more widespread risk awareness activities. This means that

Figure 8.8: Placement of flood barriers on the streets and in front of shops during the *vloedschotten* exercise

Source: City of Dordrecht

Figure 8.9: Distribution of sandbags during storm season

Source: City of Dordrecht

information such as storm and flood preparation should not be limited to only the residents in the unembanked areas which have been the practice.

Moreover, without an evacuation area at present should a disaster happen the only way to evacuate is vertical. This is because the city is densely populated and it will be difficult to evacuate the people (Institutional actor 2, interview date 11 February 2019; Planner stakeholder 2, interview date 24 January 2019). Besides, there is a need for rapid response during a disaster and there is a limited infrastructure leading out of the city. If people are not aware that a vertical evacuation (moving up the attics of individual houses) is the procedure there will be a lot of casualties. Both the vertical evacuation strategy and the Staad evacuation area are still under development, including the risk communication needed to make these strategies more acceptable.

"It is of course good that we have the very strong dike system but we also still need to invest in creating awareness and creating resilience . . . if we get flooded, say the dikes although they are very strong they fail, we basically have no way out. It's an island, it's a very urbanized area all around us are very big cities and are also [low lying] so the traffic will immediately be blocking the road and it will be very problematic to get out so most of the people will have to stay in their own house and go to the attic, to the second floor. Whether they are prepared to do that or not is a big question. Whether they know what to do or not is also a big question. I think." (Institutional actor 1, interview date 30 November 2018)

Reliance on the government and the environmental capacity, both built and natural capitals, in Dordrecht to create a *zelfredzaam* island is just one part of the equation in building urban resilience. To balance the equation the other resilience drivers (see Chapter 3 on drivers of resilience) such as the institutional, social, human, and economic capitals should also be present. Institutional resilience is present in Dordrecht given the consistent collaboration between the city government and the *waterschap* on flood risk management. Still, to become a *zelfredzaam* island, the city government needs to put risk awareness, networking, and participation into the common consciousness of the people. Something that is much more prominent in the unembanked areas which have created a level of social resilience in this part of the city. Widening the reach of the information, education, and communication on flood risk management or in general crisis management gives people optimism and the ability to take action in the event of a disaster. So *zelfredzaam* for Dordrecht does not mean that people depend exclusively on themselves to be resilient, rather a *zelfredzaam* island means that they may depend directly on each other's network. Creating a *zelfredzaam* island includes technological preventive and mitigation approaches to urban planning and flood risk management, but it has to be balanced out with social and community resilience which can only be honed in partnership with the stakeholders.

"So I think Dordrecht now comes into a phase where it is not about knowledge but how to do it together and making people more aware of it. And that's it, the last 10 years and it was really a critical point

they did it as governmental organizations in other parts with inhabitants. So I think when you have to arrive to collective action or consciousness they really have to do it now together with the inhabitants." (Planner stakeholder 5, interview date 14 January 2019)

"It is the whole part of the experts, of the government who are thinking about it in a technological way with clever solutions of climate adaptation and lobbying for money. But don't forget [who] you are doing it for. It is for the people that live in your city. And give them some sort of role in preparation . . . Can we really use them, inform them, instruct them in a certain way that they know what to do at the moment when a disaster takes place? Then you have a resilient environment but it is very difficult to take them all or make them part of the complex situation." (Institutional actor 4, interview date 22 February 2019)

Honing this collective consciousness is vital in the ability to anticipate, adapt, and learn from the disaster experience. An awareness-raising campaign leading to the 600th anniversary of the Saint Elizabeth flood in 2021 has been organized. This includes activities on rainfall flooding and shelter, as well as programs, exhibits, and games, to help people understand the risks of floods. Educating younger people on basic information on disaster preparedness is also an important step towards ensuring the safety of the population. Such events will boost understanding and encourage people to be proactive. Awareness refers not only to people's general understanding of risk but also to how to prepare and act before, during, and after a disaster.

Partnerships with the community and other organizations

The city government understands the value of the community as such through the help of neighborhood and NGOs they try to set up neighborhood groups as support networks in times of disaster or crisis. This is not just specific to floods but any type of crisis or community issue. Institutional actor 4 (Interview date 22 February 2019), further explained that the Dutch culture is very individualistic, setting up a network and neighborhood groups to work closely with NGOs such as the Red Cross can help address immediate needs at the local level, especially during a crisis.

"We try to communicate with the citizens that when a disaster or a crisis in the neighborhood take place, we try to set up groups of people in neighborhoods to take care of each other but we have to do better with that communication because we are the government and they expect [us] to take care of them but we can't. There are too many people to take care of. A little neighborhood [can be reached] but the whole city there are too many people and we have to let the people take care of each other so Ready-to-Help is a nice example of citizen participation and we have to make that better in Holland." (Institutional actor 4, interview date 22 February 2019)

There is still a command-and-control outlook in crisis management and certainly on the evacuation strategy. The topic of evacuation *"never comes . . . from the citizens . . . it [is] mostly*

top-down" (Institutional actor 1, interview date 30 November 2018). The command-and-control strategy is considered appropriate during a crisis where there should be a clear guide about what to do and where to go. This is important to ensure orderliness during the actual response to a disaster. But there is also a need to create an environment of engagement and learning, and this is where the close relationship between the City Government of Dordrecht, the *waterschap*, the *veiligsheidsregio*, and the Red Cross comes into action.

The Ready-to-Help mentioned in the citation above was formed by the Red Cross in 2015 under the premise that an organized civilian volunteer group can act as support to the professionals and provide immediate assistance during an emergency. The Red Cross contacts the volunteers to check on their availability to assist in a crisis through email, SMS, or automated calls (Schmidt, et. al., 2018: 341). Dordrecht's close ties with the Ready-to-Help group started at the onset when the field exercise was conducted in the city on 14 March 2015. The exercise used a fictional dike breach as the source of the crisis to test the response of the Ready-to-Help volunteers. The exercise was interesting in the sense that the Red Cross was able to identify areas for improvement in the communication and deployment of the Ready-to-Help but it also encouraged residents to volunteer.

Aside from other government agencies and the Red Cross, the city's partnership with the academe and research institutions has proven to be advantageous in terms of raising awareness and identifying innovative urban design solutions to adapt to flooding. Studies on flood risk management were the result of investigations by these institutions as well as projects such as the UFM and MARE. Community capacity-building activities have also flourished from these initiatives that include information evenings or exhibits. Investing in long-term flood risk management and long-term spatial planning coupled with awareness-raising activities and risk communication builds the capacities and knowledge of the stakeholders who will benefit from these efforts.

8.2.4 Collective security

Engineering resilience refers to the fast recovery from a disturbance, recovery from the 1421 Saint Elizabeth flood took *"500 years"* (Planner stakeholder 1, interview date 07 December 2018) but the compartmentalized diking system has withstood the test of time owing to the regular maintenance and improvements. In the case of the 1953 Great North Sea Flood, the Netherlands developed the Delta Plan right after the disaster and constructed the Deltaworks system. These hard preventive infrastructures secured the city from flood disasters for decades. Policies on flood risk management and water security were created as far back as 1918 until the Delta Act and the revolving Delta Program (see Chapter 5).

Interviewees considered the Deltaworks project as the smartest thing the national government has done to ensure people's safety and security. The storm surge barriers allowed the river to be closed off from the sea if it is needed and opened to make it accessible. For Dordrecht, this meant that water levels are lowered and there is no need for the *waterschap* to raise the dikes even more (Planner stakeholder 1, interview date 07 December 2018; Institutional actor 2, interview date 11 February 2019). This is especially important for a city that is below sea level with most of the urban areas between NAP -1.0m and 0.0m (Hoss, et al., 2011).

Trust in government and preventive infrastructure

The successful prevention policy of the Netherlands has given the people a sense of security and trust in the government. Although the general public in Dordrecht is conscious of the floods, a lot of confidence has been put on the Deltaworks system. This trust in the government and confidence in the system has decreased the level of concern on possible flood incidence or flood disaster in the city.

"People know that they are living below sea level . . . They know that there are some risks but they are so convinced that we manage the risk that good that they hardly think about it." (Institutional actor 6, interview date 24 January 2019)

"[They are] aware . . . but [certainly] not that their lives are being threatened. But they know, 'I live in an area when the water is getting so high there is a possibility that we can get wet feet' but that is a thought not further. Not [like having] the consequences . . . that your house will be three months under water or under this shit with what comes with the water. We don't think about that." (Institutional actor 4, interview date 22 February 2019)

In addition, the disaster gap since the 1953 Great North Sea Flood has further reinforced this trust in the system. The timeline in Figure 8.2 shows that after the 1953 Great North Sea Flood other flood events happened, the riverine threats in 1993 and 1995, and pluvial flooding in 1998, which were not considered disastrous. People feel safe and well-protected because they have not experienced a disaster for more than 60 years. Interviewees indicated that people perceive the probability ratio of 1 in 10,000 years implies that a flood will not happen. It is problematic because even though the likelihood is low, there is still a risk that a disaster will happen, after all, there is *"no absolute safety"* (Planner stakeholder 4, interview date 09 January 2019; Institutional actor 2, interview date 11 February 2019). There are possibilities for system failure, which is the reason for the continuous operation, monitoring, maintenance, and system improvement. This ratio, however, if it is not followed by clarification, commands a feeling of absolute safety that there will never be a flood or that it will never happen in their lifetime. With the feeling of safety and security and the trust in the government and hard preventive infrastructure system, people do not see flooding as a big concern. Flooding only becomes

a concern among the people when there is news about it or there are high water levels from the river (Planner stakeholder 2, interview date 24 January 2019).

Established enabling environments for participation and learning

The national policies under the Delta Program still focus highly on preventive, engineering approaches in managing flood risk. This focus on prevention is necessary because of the geographic and geologic landscape of the Netherlands. However, having hard preventive infrastructures is not only the quality of urban resilience, an enabling environment that supports participation and learning builds resilience on the institutional and community level.

Notably, it is not only the dikes and polders that withstood the test of time but also the institutions that have been in existence for centuries. As earlier mentioned, institutional resilience in Dordrecht can be seen with the strong and longstanding presence of the *waterschap* and its partnership with the city on many of its programs such as dike management, *vloedschotten* exercises, and risk communication. The *waterschap* is the oldest government institution in the Netherlands responsible for the maintenance of dikes and dunes. In the olden times, the *waterschap* and the dike army were made up of farmers and monks who worked together to build polders, dikes, *singels*, and windmills to regulate and control water.

"In the past centuries [it was started] by the farmers, all was farmers land and it was their concern to keep their agriculture in good balance with water. Not too much water but also not few, [just] enough water for their plants. So they were concerned about [how to manage] water. All the ideas and the concern about the water management in Holland was started by the farmers and the monks from the Christian Church. They together started centuries ago . . . water management, making new polders with the dikes, making new land and with all the sloten, singels, and the gracht for managing the water, and all the windmills. And that historical development helped us with [what] it is now with our management on water." (Institutional actor 6, interview date 24 January 2019)

The *waterschap* Hollandse Delta has 700 dike armies, mainly volunteers, whose role is to inspect the dikes for damages, especially under severe weather conditions and high water levels. The dike army reports to the *waterschap* for the necessary maintenance work that needs to be done. In the past, they also perform maintenance work but now function as the *"[eyes and ears] on the dike"* (Institutional actor 1, interview date 30 November 2018). In Dordrecht, this implies not only a relationship with water but also a rich relationship between stakeholders in its annals.

In the previous section this relationship between the government, both city and regional, and the stakeholders were demonstrated when an agreement was reached between the government and the farmers on the Room for the River project. This showed that a

discussion between actors leads to an understanding of each actor's needs and wants. For the farmers, they understood that this strategy is important for the collective security of the population. On the other hand, the city government assured that the farmers residing in the area will be transferred to an elevated area (terp). It was not only farmers who had to be convinced by the city government, but also other organizations, such as the environmental organizations. Each stakeholder engaged in discussions and had to meet halfway in order to consider both its obligations and concerns. Emphasizing collective benefits or 'mutual gains' improves coordination and cooperation with stakeholders.

"You may meet half-way by making it clear to each other what their responsibilities and concerns are. What your flexibilities are, in which you cannot make a move to each other. That is very important. Before anything starts you have to be clear with each other. That is very important. So you have to look together where lays your and your partners opportunities, because then you can do something." (Institutional actor 2, interview date 11 February 2019)

In addition to a supportive and long-established enabling environment, Dordrecht created a *"safety team"* (Institutional actor 4, interview date 22 February 2019) led by the Mayor. The team composed of government staff from different departments has an assigned coordinator who works closely with the Mayor.

"My main role in Dordrecht is for crisis and disaster management. When the shit hits the fan it is my role to set up the organization from the government to take the problems away for the people and get to the normal state of the day." (Institutional actor 4, interview date 22 February 2019)

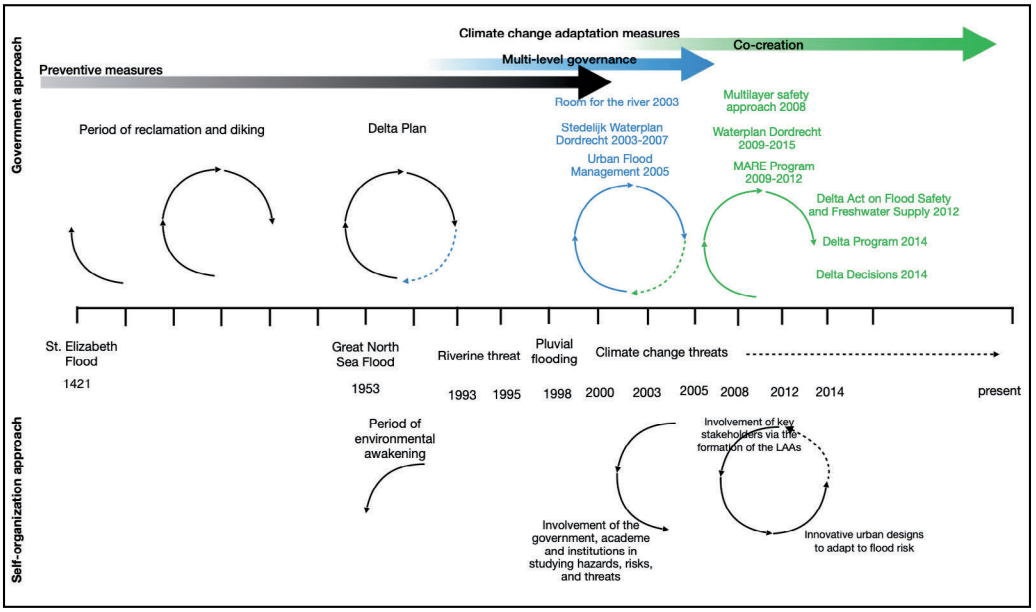
Their role is to develop strategies to address possible disasters in Dordrecht which includes delegating tasks to coordinate with other departments in and outside of the city government office. When it comes to flooding, the safety team coordinates with authorities to monitor the river and sea-level rise during the storm season. If the water rise reaches a critical level, information is blasted through the NL-Alert and the safety team coordinates with the other departments to organize the sandbags and flood barriers needed by the residents to block the water from entering their homes. The safety team is also tasked to help the city in the clean-up after a disaster if it happens.

8.3 CHAPTER CONCLUSION

Dordrecht has a long history in managing water, the first and second adaptive cycles were set off by the flood disasters Saint Elizabeth flood in 1421 and the Great North Sea flood in 1953. The flood of Saint Elizabeth remained in the historical memory of the Dutch, particularly for the inhabitants of Dordrecht, because this event formed the landscape of the region. On the other hand, the Great North Sea flood set in motion the Deltaworks project, prompted by a "never to happen again" dictum that left an indelible watermark on the Netherlands. Figure 8.10 shows that the focus on the construction and maintenance of

flood preventive infrastructures dates as far back as the 1400s. The two flood disasters in 1421 and 1953 served as cornerstones of the historic memory and flood disaster experience of the people and the city. While these flood disasters reinforced this focus on hard infrastructures, the rich history of the people working together on water-related issues, particularly in Dordrecht has been carried forward to the next adaptive cycles.

Figure 8.10: Transition of focus from hard preventive measures to climate adaptive, multi-level governance and co-creation



The third and fourth adaptive cycles show a transition from highly preventive measures to climate change adaptive flood risk management approaches. In these cycles, as shown in Figure 8.10, the approaches started from multi-level governance used in the initial studies and programs UFM and Room for the River to co-creation with the introduction of the MLS approach and innovative urban planning and spatial adaptation designs. Multi-level governance and interdisciplinary approaches used in the third adaptive cycle have made it possible for government collaboration across national, regional, and local levels, with technical experts and users, in particular the residents of Dordrecht, to carry out flood risk management studies and programs. Interaction between experts has created a robust urban plan and spatial design, resulting in awareness, understanding, and open communication between all involved stakeholders. Residents as part of water management have been institutionalized in the oldest organization in the Netherlands, the *waterschap* and the dike army, that involving them in projects such as the Room for the River has been relatively comfortable.

The spatial plans and climate adaptation urban designs adopted in Dordrecht were mainly carried out along with residents who also received guidance on the design and use of the facilities. Openness to learning and innovation and close cooperation between the government and the *waterschap*, *veiligsheidsregio*, the academe, private sector, and citizens make Dordrecht a living laboratory haven. This active network of actors also focuses on prevention and disaster preparedness programs such as the annual *vloedschotten* exercise, which provides people with knowledge as well as lessons on preparedness. However, most of these activities are done *buiten de dijk* where regular high water levels are experienced as well as regular communication on preparation is provided. While these programs increase awareness and build a level of social and community resilience particularly to residents *buiten de dijk*, a wider spread of communication and information dissemination can help bring risk awareness and preparation closer to other residents *binnen de dijk*. If this is done it can further strengthen Dordrecht's social and community resilience and ensure that the *zelfredzaam* vision is carried forward.

Historical flood disaster memory and experience can serve as a foundation for disaster knowledge, but if there is no continuity of learning and disaster awareness, memory dies down. Halbwachs (1980) stated that collective memory "is a current of continuous thought whose continuity is not at all artificial, for it retains from the past only what still lives or is capable of living in the consciousness of the groups keeping the memory alive" (page 80). The regular incidence of low-level floods in the city center reminds residents of the risks of flooding, while climate-adaptive structures built in and around the city echo what can be achieved together with the people. Using the terms of one interviewee, the regular low-level flood experienced *buiten de dijk* 'breaks resilience' or stability that helps residents in the area to 'strengthen resilience' by knowing what to do during the storm season.

Finally, for Dordrecht to become a *zelfredzaam* island maintaining this active network of actors most especially the residents, who are the users and beneficiaries who will be the most impacted by any developments, is necessary for this paves the way for opportunities to learn, recall history, and discuss what is essential in building resilience. Dordrecht continues to leverage on this co-creation with the understanding that to be a *zelfredzaam* island disaster risk awareness and collective engagement must be built into the collective consciousness of the people. This chapter shows that memory-based disaster experience can only go so far in building a collective consciousness to flood risks. Dordrecht benefits from the engineering resilience established by Deltaworks system and layers of prevention measures and the institutional resilience established through the working relationship between the city government, the *waterschap*, and the community. But the network of actors within Dordrecht builds social and community resilience that compliments the already established resilience pathways (environmental (both built (engineering) and natural) and institutional) of the city. While preventive infrastructures

ensure the safety and resilience of the city as a whole, information and training reinforce resilience at the community and social level, especially on the evacuation and preparation.

CHAPTER NINE

CHAPTER NINE: LEADERSHIP AND PARTNERSHIP: MARIKINA CITY'S RESILIENT FORMULA

"Pagka ang hari ay haling sundalo pa kayang maging magaling."
(Don't expect brilliance from your soldiers when you have a mad king.)
Citizen stakeholder 3, interview date 18 March 2019

9.0 INTRODUCTION

The City of Marikina is located in a valley flanked by the upland areas of the Province of Rizal, Quezon City, and the Sierra Madre mountain ranges. Instead of living up to the expectation of being flood-prone as a catchment area, Marikina turned itself into a highly urbanized and prosperous city. Marikina was once regarded as a laidback agricultural town until industrialization and the boom of the footwear industry started and made Marikina the "Shoe Capital of the Philippines." This was also the beginning of the city's flood problems. Heavy industries have taken root in the city and the population has also grown where some migrants have settled along the river banks. The Marikina River became a dumping ground for both industrial and domestic waste. This contributed to the silting of the river, which obstructed the flow of water from upstream and during rainfall. The inadequate drainage system has also raised the risk of floods.

In 1992, a heavy typhoon inundated 28% of Marikina's land area and in the same year, a new mayor was elected. This was the beginning of Marikina's turnaround as a city known to be frequently flooded to a model city. Grim and determined to transform Marikina into a progressive city, the new mayor, Bayani Fernando (BF as he is fondly called), laid down plans focusing first on rehabilitating the Marikina River to manage flood risk. From there the story of leadership, awareness, transformation, and partnership unfolded.

This chapter discusses the process Marikina City has gone through in building urban resilience and collective engagement. This case highlights how leadership and institution building helps in setting the foundation for urban resilience, and how collective engagement is reached through mutually adapting the stakeholders' roles in building urban resilience.

In order to outline Marikina's process of urban resilience and collective engagement, this chapter is divided into three sections. The first section of this chapter describes Marikina's adaptive processes constructed around the city's disaster experience, including the policies that have been adopted to address the disaster and the role of the different actors. The second section presents the collective engagement and urban resilience progress using the four dimensions of collective engagement as frames of discourse. The last section presents

the conclusions emphasizing leadership, partnership, and the mutual adaptation of roles as Marikina's formula for resilience building.

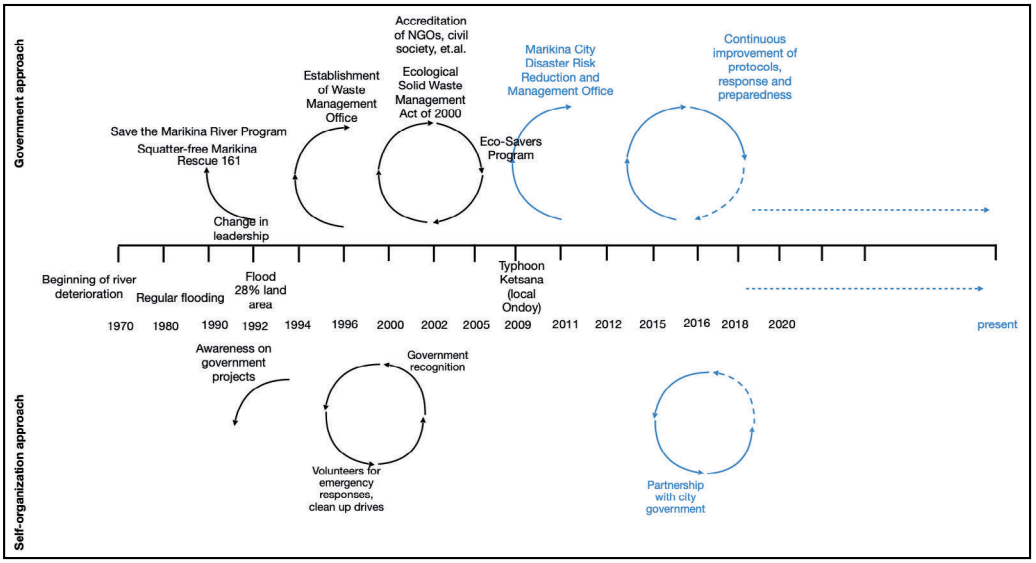
9.1 ADAPTIVE CYCLES

Marikina City's flood problem began in the 1960s when the then town started to industrialize. This period of industrialization provided opportunities to residents and attracted migrants from neighboring towns to take root in Marikina given the availability of jobs in the manufacturing industries, particularly the shoe industry. From 1960 to 1970 Marikina's population more than doubled where migrants mostly occupied vacant lots and the riverbanks (Pante, 2016; Iglesias and Yu, 2008). The Marikina River suffered as it became a cesspool of industrial and domestic waste that by the 1970s and 1980s the river water quality was so poor water cannot flow down to the Pasig River. In the 1970s, two strong typhoons Fran (Philippine local name: Meding) and Patsy (Philippine local name: Yoling) heavily inundated the Manila coastal areas and the Marikina river basin (Romero and Nakamura, 2017; Warren, 2013). In 1972, Typhoon Rita (Philippine local name: Gloring) struck Luzon and again inundated Manila (Romero and Nakamura, 2017; Warren, 2013). By that time flood has become a regular occurrence in Marikina during the typhoon season. This flood situation was further heightened by the growing population and building of subdivisions in the former agricultural floodplain of Marikina in the 1970s and 1980s.

By the 1990s residents of Marikina have become accustomed to the regular floods following heavy rains or during the typhoon season due to overflowing Marikina river, congested waterways, obstruction along river banks, and weak drainage systems. But Marikina City was able to turn itself around and became one of the more progressive cities in the Philippines. Marikina City's process towards urban resilience has mainly passed through two adaptive cycles as shown in Figure 9.1. The figure shows two approaches of the collective engagement urban resilience framework which is the government and self-organization approaches. The curved arrows indicate the four dimensions of collective engagement - concern, action, efficacy, and security - within the adaptive cycles that happened over a period of time.

Figure 9.1 shows that Marikina's first adaptive cycle (coded black) was caused by two factors, the flood in 1992, in which 28 percent of the city's land area was inundated, and the change of leadership. When Bayani Fernando (BF) took office as Mayor of Marikina in 1992, he implemented reforms in the city to address Marikina's flood problems. Mayor BF's idea was to clean up the river basin which included dredging and clearing of the riverbanks. The authoritarian leadership of BF was met with revulsion by the residents but after a couple of years, people realized the benefits of the projects that by the mid-1990s residents started to form volunteer groups to help in the river clean-up activities.

Figure 9.1: Timeline of collective engagement and urban resilience of Marikina



By the late 1990s and early 2000s, the projects and programs in Marikina were doing very well that the government approach and self-organization approach were in sync (see Figure 9.1). The government recognized the role of the residents in making the city government's projects a success. At that time Marikina was enjoying a flood-free city until Typhoon Ketsana (Philippine local name: Ondoy) happened in 2009. This triggered Marikina's second adaptive cycle (coded as blue) and led to the institutionalization of the Marikina City Disaster Risk Reduction and Management Office (MCDRRMO). The broken lines shown in the second cycle indicate the continuous improvement of the city.

To date, Marikina City has maintained its standing as one of the model cities in terms of discipline, cleanliness, and innovation (Shell Philippines, 2015; Calilung, 2008; Reysio-Cruz, 2020; Salvador, 2015; Baac and Librea, 2010). Given this synopsis of the timeline in the adaptive cycles of Marikina, the next sub-sections will discuss the policies and institutional context that took place relating this to how the city institutionalized disaster risk management and the interaction with the citizens.

9.1.1 Policies and institutional context

Policies serve as the basis for the shaping and functioning of cities. It points out the direction of the cities and the duties of the government and its agencies. The timeline (Figure 9.1) shows that Marikina implemented several projects to contribute to its transformation, such as the river rehabilitation and clearing of informal settlers (first adaptive cycle) and disaster risk management and preparedness (second adaptive cycle).

These programs were enabled by a variety of policy directives (see Appendix 8) and enforced by the different departments and agencies of government.

When BF assumed office in 1992 his vision was to "uplift Marikina from mediocrity to prosperity" (Calilung, 2008: 4) and he did this through draconian measures. The first adaptive cycle began heavily top-down with the gritty implementation of laws and city ordinances by the city government. This was especially important in implementing the priority projects "Save the Marikina River Program" and "Squatter-free Marikina" to rehabilitate the Marikina river and clear the city from informal settlements particularly those living along the riverbanks. Two offices were created by the BF administration sans the city ordinances as the implementing arm for the two programs. The Marikina River Park Authority (MRPA) for the Save the Marikina River Program and the Marikina Settlements Office (MSO) for Squatter-free Marikina. Both departments worked closely with the Engineering Department for the infrastructure and engineering support needed to execute the projects.

The plan to rehabilitate the Marikina River was reasonably simple, silt and obstructions in the waterway and riverbanks had to be removed. Dredging of riverways was needed to remove the silt and debris that have accumulated in the river for decades. The task of dredging the river falls under the responsibility of the national government through the Department of Public Works and Highways (DPWH), but the city government assumed this task to expedite the process of rehabilitating the river and maintaining the cleanliness of the river system. These actions entailed the coordination of the City Engineering Department with the DPWH on the dredging activities. But apart from the silted river system, the river banks needed to be cleared of informal settlements, a task led by the MSO.

Clearing the riverbanks of the informal settlements was a trickier process since this required identifying a relocation site for the families affected. The clearance of the riverbanks from the informal settlements was carried out systematically by first conducting a census from 1992 to 1994 to estimate the number of informal settlers not only along the riverbanks but throughout the city. The MSO conducted the census and in the same period identified private and public lands suitable for resettlement sites. The MSO, with the support of the National Government's Community Mortgage Program (CMP), contacted the owners of these lands to discuss the transfer of their assets to the local government, in exchange, the owners would receive tax incentives (Iglesias and Yu, 2008). A total area of 106 hectares spread around the city was designated as resettlement sites.

The two priority projects drew mixed reactions from the stakeholders at the onset of BF's term as City Mayor. The new mayor's authoritarian leadership style and strict enforcement of laws were a tad bit despotic. An example of this was when the city sealed the riverbanks after evacuating the informal settlers during flood events (Iglesias and Yu, 2008) citing

Ordinance 10 "Declaring an easement of 96 meters from either side of the Marikina River centerline, and authorizing the relocation of all residents found with the easement to safer ground" as the legal basis for the action. This left the informal settlers no choice but to agree to be resettled to another area. Demolition of shanties was also ordered by Mayor BF and done without prior notice. As a result, eleven cases against Mayor BF were filed by residents to the Commission on Human Rights regarding the demolition of their settlements (Baac and Librea, 2010). However, because of the ordinances that were already in place, the cases did not prosper.

The consultation process on the relocation program was far from ideal since the Mayor only presented the relocation sites and the benefits for transferring without engaging the informal settlers in a dialogue. Nevertheless, the MSO and the CMP engaged the informal settlers in discussions on the process of resettlement and the requirements for the housing loan under the CMP. Despite these indications of dissatisfaction, Baac and Librea (2010) reported that more than 30,000 families have been relocated since 2006, and beneficiaries have indirectly shown satisfaction through the number of applications to the program and personal interviews conducted. Further, the relocatees through the program and the CMP now have land tenure and located in better conditions with access to infrastructure and services. Benefits that have glossed over the harsh implementation of the program and have even earned the Squatter-free Marikina program recognition from a variety of award-giving bodies, including the Galing Pook Awards[17].

These two programs were important for the city's flood risk management focus. River pollution and clogged drainage systems have been established as one of the major causes of floods in Marikina. The Marikina River has since been regularly dredged and cleaned to remove garbage. To further sustain the clean-up and river rehabilitation efforts and maintain the cleanliness standards in Marikina City the city created the Waste Management Office (WMO) in 1996 through Ordinance No. 204. The WMO was created not just to manage solid waste but to strictly enforce waste management, on-site segregation, and anti-littering laws. A collection system that included segregation of waste and garbage collection schedules was introduced to residents. Fines are enforced on violators who do not follow the collection system and who litter the streets and the Marikina River. Aside from the fines, violators were even shamed by having their garbage thrown back into their properties if seen by inspectors illegally dumped on the street (Calilung, 2008). Waste management was an integral part of instilling discipline among the Mariqueños on the proper waste disposal.

After the administration of BF, the wife, Marides C. Fernando (MCF) won the mayoral race and took over the projects. The MCF administration continued the projects but included

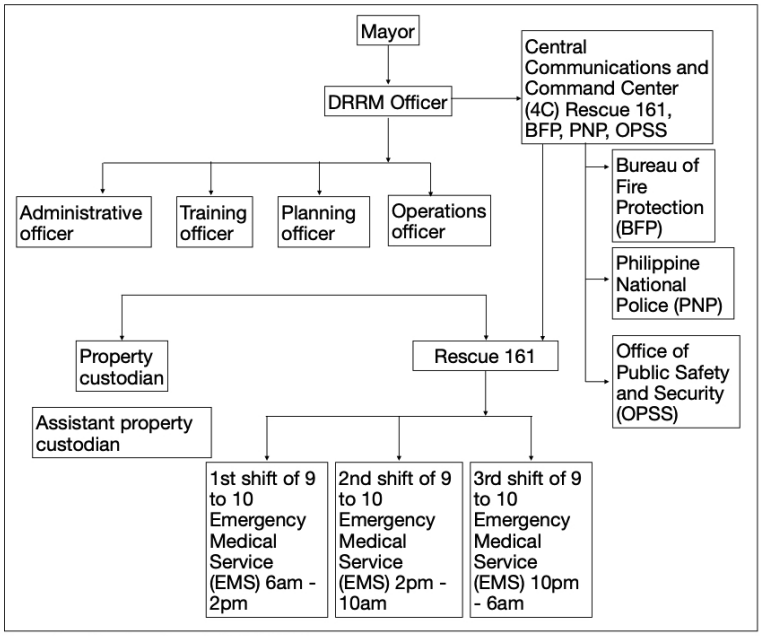
[17] The Galing Pook Award is given to local governments exemplifying innovation and excellence and local governance through their programs and projects.

an aspect of awareness-raising and education. The Eco-Savers Program conceptualized in 2002, a joint project between the WMO and the Department of Education, was one of the first programs to increase awareness on environmental issues and the relationship between pollution and flood risk. In 2004, the Eco-Savers Program was launched to encourage children and their families to recycle. The program was targeted at young students to create environmental awareness at a young age and help the residents reduce waste.

The third program that the BF administration started in the first adaptive cycle (see Figure 9.1) was Rescue 161, a 24-hour communication platform to receive emergency calls and deploy medical emergency services (Iglesias and Yu, 2008; Borje, n.d.). Launched in 1993, Marikina City was the first local government unit in the Philippines to implement such a platform. The program was more of a response to the need to have an organized emergency response system, especially during a disaster. In 1997, a response time of 5 minutes was required of Rescue 161 and its allied first responders, Philippine National Police (PNP), Bureau of Fire Protection (BFP), and medical team, to an emergency. Support was provided to Rescue 161 through Ordinance 264 series of 1998 by creating the Disaster Management Office (DMO) and allocating funds for operations and maintenance. This includes staff salaries, equipment, and training. While Rescue 161 was formalized under the city government as the DMO it still maintains "Rescue 161" as its brand.

In the second adaptive cycle (coded blue in Figure 9.1), the focus shifted to disaster risk management especially after experiencing the devastation brought by Typhoon Ketsana (Philippine local name: Ondoy) in 2009. While Rescue 161 was already in place in the previous adaptive cycle the enactment of the Philippine Disaster Risk Reduction and Management Act of 2010 (Republic Act (RA) 10121) institutionalized it and provided further resources and clarity in the allocation of funding at the local and community levels. Marikina set out to adopt the law by creating the Marikina City Disaster Risk Reduction and Management Office (MCDRRMO) under the city government. Rescue 161 remained as the emergency hotline number and brand of the office. Under Section 12 a of RA 10121, the local government units are required to set up a local disaster risk reduction and management office "responsible for setting the direction, development, implementation, and coordination of disaster risk management programs [and projects] within their territorial jurisdiction." The law further stipulates the creation of community-based disaster risk management units also responsible for their own disaster risk management programs and projects. Figure 9.2 shows the organizational chart of the MCDRRMO.

Figure 9.2: Marikina City Disaster Risk Reduction and Management Office Organizational Chart



Source: Adapted from Dangcalan, et al., 2019; MCDRRMO

9.1.2 Stakeholder interaction with city government programs

In the previous subsection, the rehabilitation of the Marikina river was presented as the focus of the local government in managing their flood risk, as such most policies were anchored on this program. Local government offices were also created to implement the programs, Save the Marikina River, Squatter-free Marikina, and Rescue 161. The local government was heavy-handed in implementing the ordinances in support of the programs. Calilung (2008) described BF's leadership style as "overbearing and unpopular" where he had the sidewalk in the public market cleared of illegal vendors and the private properties encroaching on sidewalks demolished. The latter one earned BF a lawsuit from the homeowners association of a private subdivision claiming that the subdivision is owned by a private real estate company (Albon vs. City of Marikina, 2006). However, many of the actions of the BF administration have been backed up by the ordinances and regulations that the city government only enforced. The trial court dismissed the lawsuit from the homeowners association and upheld the 'validity of Ordinance No. 59 series of 1993 which grants the City of Marikina police powers to regulate the use of sidewalks' (Albon vs. City of Marikina, 2006).

The BF administration, which lasted almost 10 years, was unyielding and sent a clear message to all that the law applied to everyone. But on the other hand, the local government started to build a cleaner, greener, and more attractive city. The clearing of the sidewalks of illegal vendors and garbage meant the installation of lamp posts, street signs, trees, and plant boxes. Bikeways and bike parking were installed making Marikina the first city to have a dedicated bike path in the Philippines. Residents did resist the harsh implementation of the law especially in the first three years of the BF administration. Citizen stakeholder 1 shared that BF once said that *"if curses can kill he would have been dead with all the people cursing him"* (Interview date 19 March 2019). However, the resplendent feedback and recognition from national and international bodies conferred on Marikina City contributed to the legitimacy of the authoritative leadership of the BF administration. The mayor's authoritarian leadership was perceived as a way to instill discipline among the Mariqueños.

"Yes, that time no one would cooperate. But starting 1995 onwards people started to follow. The people felt that what he is doing is right. Even our public market he had it fixed . . . He really fixed the entire Marikina as a city. We learned that we should not dump our garbage outside . . . so we only take out our garbage only when it is our schedule. If you take out [your garbage] when it is not yet the schedule of your community [the] City Environmental Management Office (CEMO) will give you a penalty, that's not allowed. It is also prohibited to spit in Marikina, these simple things to instill discipline are the things BF taught us." (Citizen stakeholder 5, interview date 18 March 2019)

"He also instilled discipline on the people because the number one cause of flooding is garbage . . . He created laws like anti-littering, prohibited to throw garbage on the streets, illegal vendors. And he had them policed. Because if he doesn't instill discipline he will not be able to solve the city's flooding problem." (Institutional actor 3, interview date 15 March 2019)

"But now he is reaping all the rewards because everyone saw the transformation of Marikina. We have won several times as a model city because people saw how disciplined the people are. He was the one who established this." (Citizen stakeholder 2, interview date 19 March 2019)

When the residents saw changes in the city, especially the reduction in the occurrence of flooding, they began to appreciate the work of the city government. Volunteers started to form, mostly the youth, to help in the river clean-up or during flood situations. By 2000, the city government accredited non-government organizations (NGOs), professional groups, peoples organizations, and volunteers through the city council Resolution no. 283 series of 2000 to ensure coordination and participation (Dangcalan, et al., 2019) with the city government and the MCDRRMO.

The "change in leadership" from Fernando (BF) to Fernando (MCF), guaranteed the continuity of the initiatives. Mayor MCF softened the style of governance yet still enforced discipline. The MCF administration campaigned further to empower the youth through

education and community involvement. Dangcalan, et al. (2019) asserted that this "[c]ontinuity in political leadership is a crucial element in the institutionalization of [disaster risk management] body as it ensures that the structure persists through time" (p. 73). After MCF's term, the programs were continued under Del De Guzman. It was during the term of Mayor Del that Republic Act 10121 was enacted by the national government and thus, the city had to adopt the law transforming Rescue 161 to MCDRRMO. It was during the De Guzman administration that community-based disaster risk management or *barangay* disaster risk management (BDRM) units were implemented as mandated by law.

Throughout this process, it can be observed that stakeholders' interactions with the government varied over time. Before the BF administration, people were more passive and accepting of the flooding situation that the city experiences because no reforms were imposed. This changed during the BF administration when strict enforcement of laws was done. During the imposition of changes, stakeholders became active in two points (1) in asserting their rights, resisting the changes, and opposing the government through direct lawsuits; and (2) engaging in the discussion specifically among the informal settlers during the relocation in the resettlement areas. The city government, however, upheld the laws and ordinances that the resistance from the stakeholders had fallen flat. The recognition earned by the city through these imposed changes has switched the stakeholders' negative and opposing views to more accepting and more cooperative. This realization, coupled with a flood of campaigns, information, and education, prompted the stakeholders themselves to volunteer for the city's programs and projects. The present set up particularly on disaster risk management in Marikina while it is institutionalized is led in partnership with the stakeholders. This collective engagement will be discussed in the next section of this chapter.

9.2 COLLECTIVE ENGAGEMENT IN URBAN RESILIENCE

The study defined collective engagement as a continuous collaborative process between and among multiple stakeholders. There are four dimensions of collective engagement, collective concern, collective action, collective efficacy, and collective security, in the conceptual framework of the study (see Chapter 3 for the detailed discussion). While the conceptual framework suggests that these four dimensions and adaptive cycles can go through varying timescales, these phases go through a similar sequence. The following sub-sections are classified into the four dimensions of collective engagement to demonstrate the course of the process of collective engagement and urban resilience. The description of the discussion is shown in Table 9.1.

Table 9.1: Marikina City's collective engagement dimensions vis-a-vis urban resilience

	Collective engagement dimensions descriptions	Urban resilience	Present indicators
Collective concern	• Past experiences on flooding prior to the Typhoon Ketsana experience was passive and "accepted". It was known that flooding is normal in the city being a valley and catch basin. • During Typhoon Ketsana houses were submerged up to the second floor even up to the roofs. Houses were covered with silt and mud.	• In 1992 it was the vision of the city government to address flood risk. • After Typhoon Ketsana, the city government gained traction on involving all stakeholders, it was only that this shared vision and concern came together. • Stakeholders are aware of the threats and risks.	• Volunteers at all levels
Collective action	• The Typhoon Ketsana experience led the government to become much more active in raising awareness on disaster risk management. • City government allocated budget for the DMO when RA 10121 was passed transformed DMO to MCDRRMO and BDRRM units	• Stakeholders understand and agree on the city's vision to strengthen disaster risk management after Typhoon Ketsana.	• Use of mixed face-to-face interaction, traditional media (news, leaflets), social media and websites to disseminate information. • Trainings provided at all levels and sectors of the community.
Collective efficacy	• People are more aware on what to do and where to go during a crisis. • City disaster preparedness plans and contingency plans. • Barangay disaster risk management plans.	• Inputs to disaster risk management plans sought from the community.	• Disaster risk reduction and management included in the school curriculum. • Regular conduct of trainings on disaster risk management, basic life support, first aid. Regular conduct of drills. • Early warning systems are understood by the community.
Collective security	• Instituted partnership between city government and stakeholders in disaster risk management. • Continuous improvements on city development and disaster risk management.	• High disaster risk awareness of stakeholders.	• Sustained awareness, information and education strategies. • MCDRRMO continuously improves based on experience.

Source: Author, 2020

9.2.1 Collective concern

Marikina's geographical location as a valley and a catch basin make it vulnerable to flooding. Before the changes imposed by the BF administration in 1992, people were more laid back, passive, and accepting that flooding is a regular occurrence during the typhoon seasons. The city began to experience frequent flooding when the then town started to

industrialize, the population grew and informal settlements started to form on the riverbanks.

"Marikina, as everyone knows, is a catch basin, a valley . . . a swampy . . . agricultural area . . . Flooding is common in this area since this is where the water flowing from Antipolo and San Mateo end up . . . In those days, residents were able to control the flood, as there used to be no people living near the riverbanks. That's why back then, when there's a flood in about an hour, the water subsides. The people were able to manage it well that time, but when Marikina got crowded, people settled on the riverbanks that narrowed the waterways." (Citizen stakeholder 3, interview date 18 March 2019)

The concern on the need to address flooding in the first adaptive cycle was top-down driven by the government. The authoritarian leadership employed by BF was perceived to have instilled discipline in the Mariqueños (also discussed in the previous section). This discipline was reinforced by both disincentives (strict penalties for violators) and incentives as Marikina transformed into a model city right before the eyes of the residents. Volunteers for government programs and projects, in particular the river clean-up and disaster management, began to appear in the late 1990s. This indicated a level of support for the government initiatives and in return, the city government accredited volunteer groups especially those involved in crisis management (see Table 9.2).

Table 9.2: Accredited partner organizations of the Marikina City Disaster Risk Reduction and Management Office

1) Civic Action Team (Marikina)
2) Marikina City Disaster Volunteer Group
3) Marikina Valley Medical Society
4) Philippine Contractors Association
5) Philippine Red Cross – Marikina Chapter
6) Tzu Chi Foundation

Source: Dangcalan, et al., 2019

After the rehabilitation of rivers and other infrastructure works (drainage improvements, river easements, and dikes, etc.) in the 1990s, the occurrence of floods was greatly reduced to almost none. However, in 2009 Typhoon Ketsana caught the residents unaware as floodwaters reached from waist level to up to the second floor of houses. Houses were covered with silt and mud (see Figure 9.3).

"We faced a very big problem at the time. I live in a depressed area, but I wasn't concerned at the time because we have a third and fourth floor. But still flood water reached half of our second floor. But if our house didn't have a third floor, we would have had a problem. It was so unexpected that we were all fortunate that it happened in the morning. People were caught unaware. It was so sudden that the flood

was so high in an hour. That caused phobia on a lot of people." (Citizen stakeholder 4, interview date 18 March 2019)

Figure 9.3: Aftermath of Typhoon Ketsana

Photo by: Gino Pascua

Figure 9.4: Typhoon Ketsana flood level from waist to chest deep

Photo by: Gino Pascua

Typhoon Ketsana poured 448.5 mm (17.6 inches) of rain for 12 hours in just one day (26 September 2009) (UP NOAH, 2009) and in Marikina, this meant a 19-meter rise in the water level of the Marikina River that flooded 70 to 80% of the city (see Figure 9.4) (Institutional actor 1, interview date 13 March 2019). Marikina suffered an economic loss of PhP39,639,300 (€679,162[18]) with a total of 178,985 affected population, 1,083 destroyed houses, and 73 people dead (Sato and Nakasu, 2011). This disaster experience awakened the stakeholders, government and non-government alike, to become more prepared and aware signaling Marikina's second adaptive cycle.

Interviewees claimed that the city became complacent because changes had already taken place. The city had appropriate equipment, contingency plans outlining the actions to undertake before the disaster (pre-disaster) which include early warning systems, evacuation, and post-disaster (recovery and rehabilitation) (Florano, 2014). The Flood Contingency Plan also outlines the delegated tasks for each city government department including the volunteers and non-government organizations, and private-public utility providers. However, even with a system and contingency plans in place, nothing prepared them for the severity of the flood brought by Typhoon Ketsana. Institutional actor 1 reflected that the disaster experience led to a shift in the mentality of the government workers and the people (Interview date 13 March 2019).

"We felt we were prepared for the worst . . . but when Ondoy occurred . . . the volume of rainfall was so much in a short period of time . . . the water level increased rapidly like a meter, 2 meters, 3 meters in just a matter of two hours, three hours . . . it was a realization that we can't claim we're ready, people felt it, it was a traumatic experience for all of us, because almost 80 percent of our equipment were flooded [and] almost 70 to 80 percent of Marikina was flooded. Only those areas situated in a higher elevation near the mountains were lucky enough not to suffer the flood." (Institutional actor 1, interview date 13 March 2019)

Typhoon Ketsana triggered Marikina's further improvements on disaster risk reduction and management. After the typhoon, the city government received help from all over the country from both government and non-government organizations. Volunteers from and outside the city gathered to help in the relief efforts. Cash-for-work projects were implemented to help clean up the city and help residents earn a bit of money (Florano, 2014). To help the businesses recoup their losses and ease the peoples' burden, the city government issued tax reliefs of 50% on business and land taxes for five years (Institutional actor 4, interview date 20 March 2019). This act of the city government displayed sensitivity to the needs of the people at a time of crisis. Within a week the city government drafted the Marikina Recovery Plan together with the different departments to provide post-disaster damage and needs assessment (Florano, 2014: 123). The

[18] Foreign exchange rate as of 22 May 2021 is at €1 = PhP58.36 https://www.likeforex.com/currency-converter/euro-eur_php-philippine-peso.htm/1

departments developed "short-, medium-, and long-term recovery plans and programs" in five areas: infrastructure, environment, economic, social, and administrative (Florano, 2014: 123). This expedited the recovery efforts in Marikina. Thus, the second adaptive cycle arising from this collective traumatic experience was consolidated to enhance emergency preparedness and preparation.

9.2.2 Collective action

In Figure 9.1 the first adaptive cycle in the self-organization approach started through volunteers for the city government programs on the river clean up and environment. This became the foundation of how the stakeholders worked together. But it was Marikina's disaster experience in particular Typhoon Ketsana that influenced the way people worked in the community. After Typhoon Ketsana, the city government embarked on intensifying disaster risk management awareness activities. Seminars and training were given to all stakeholders, the protocols on disaster risk reduction and management were strengthened. The MCDRRMO developed an alarm system and installed sirens in strategic areas to signal the flood levels and evacuation. Infrastructure was also improved, apart from regular dredging in the Marikina River, the river walls were reinforced and protected. Institutional actor 1 shared that after Typhoon Ketsana it was not just the city that improved but also the people's behavior (Interview date 13 March 2019).

"Before when we tell them to evacuate they will not do it, they will say, 'no we can handle this, we're used to this, we will just put our things on the second floor of our house then we are okay, we are safe.' Now they listen to us. We have not experienced high level of flooding for some time but we feel that we are ready again, what we changed is our mindset, we now always prepare [for a disaster]. We were put to a test last year [2018] when we experienced a similar Ondoy-like [typhoon] which is 20.6 [meters]. We had 20,000+ . . . evacuees in our evacuation camps. The people evacuated even [when] the water was not that high yet, it was just the first alarm and people started to evacuate." (Institutional actor 1, interview date 13 March 2019)

This change in attitude can also be attributed to the information provided to the stakeholders that happened in the second adaptive cycle. When RA 10121 was passed by the national government this gave Marikina the requisite legal mandate to institutionalize Rescue 161 into a full MCDRRMO. While Marikina has already established a disaster risk management system since 1993, the law allowed the appropriation of funds equivalent to 5% of the estimated revenue of the city to disaster risk management activities (Section 21 of RA 10121). It also contributed to the establishment of BDRM units in each of the 16 *barangays* in the city.

From the 5% budget, the MCDRRMO allocates 70% to the four disaster risk management thematic areas - prevention and mitigation, preparedness, response, recovery, and rehabilitation, while the remaining 30% can only be used once a state of calamity is

declared (Institutional actor 1, interview date 13 March 2019; Institutional actor 2, interview date 13 March 2019). Awareness campaigns, capacity building, and training fall under the disaster risk preparedness thematic area. If a state of calamity is not declared the 30% allocation remains unutilized and accumulates within the next five years, if still unutilized after five years this fund goes back to the general fund to support other social services as identified by the city council (Section 21 of RA 10121). This 70-30 budget allocation is also applied at the *barangay* level BDRM units.

Planner stakeholder 3 believes that the appropriation of funds from the revenue of the local government is a necessary precondition for local government units (LGU) to prioritize, internalize and integrate disaster risk management in development planning (Interview date 28 November 2018).

"It is just mandated but not funded. The funding will have to come from the local government. As I said the truth is the LGU will have to fund it and prioritize it [disaster], because if they don't internalize it then nothing will happen too . . . Whatever it is that needs support on big disasters or rehabilitation that has to come from the national . . . But the normal course of things will have to come from the LGU otherwise they will become dependent and will also not be integrated to their own decision making." (Planner stakeholder 3, interview date 28 November 2018)

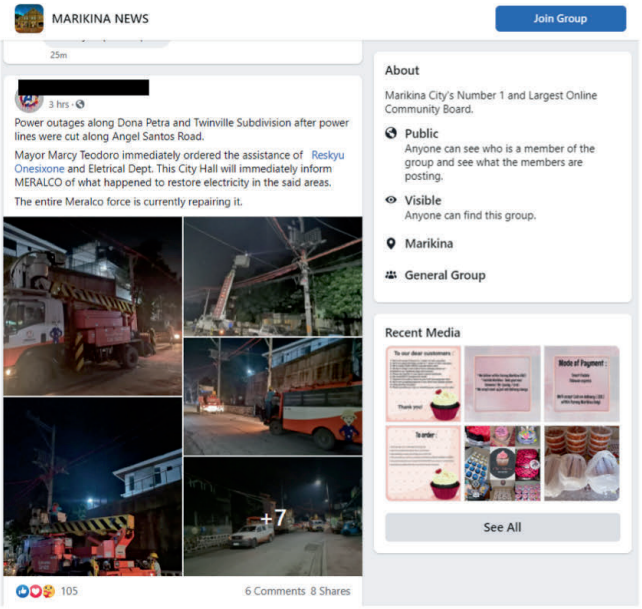
And internalization is just what Marikina has done, with information, education, and communication (IEC) campaigns taking place throughout the city. The MCDRRMO and the Public Information Office (PIO) disseminate information in order to equip people with the right knowledge to prepare for any type of emergency. The use of social media, in particular Facebook, has been an important tool for the city government to disseminate information. Most, if not all, city government departments have their own Facebook pages. The MCDRRMO live streams on Facebook their daily activities at the command center. They do this to let people know that the staff is monitoring the activities in the community and that they can contact the office anytime for any emergency.

With more than 300,000 Facebook followers[19], 75 percent of the population[20] is easily reached by the MCDRRMO. There is also a private online community board group called Marikina News with 514,700 members, where members can post anything about the community, ranging from home-based business advertisements to city issues that need attention (see Figure 9.5 as an example). The MCDRRMO monitors these social media platforms in their command center because most of the stakeholders contact them through these channels either through personal messages or by posting the incident itself on Facebook.

[19] The Marikina PIO has 337,535 followers while the MCDRRMO has 110,074 followers as of this writing 17 March 2021. (sources: https://www.facebook.com/MarikinaPIO/, https://www.facebook.com/MarikinaRescue161/)

[20] Marikina's population as of 450,741 based on the 2015 census of the Philippine Statistics Authority. (Source: Philippine Statistics Authority, 2016)

Figure 9.5: Marikina news community board



Source: Screenshot taken from Marikina news Facebook page

"We are on Facebook live 24/7. Our command center is on Facebook live. Why do we do that? We do it for people in Marikina to let them see that the operations center is working 24/7 and that they can call us anytime . . . not all LGUs embrace social media because they are afraid that it will be used against them politically. If a city official gets bashed, the elected official, their careers are over. But here in Marikina we embraced it. We used social media to our advantage and true enough it made communication with the people much easier . . . Because if you don't inform the people they will be afraid, if you inform them they will also be afraid but then they can prepare." (Institutional actor 1, interview date 13 March 2019)

The effectiveness of the use of social media platforms in disseminating information and communicating with the residents has spread to the *barangays*. Each of the 16 *barangays* in Marikina also has its own Facebook pages where they can post announcements to the residents. *Barangays* disseminate information regularly through social media, flyers, and tarpaulins posted in populated areas and critical spots in the community. Flyers that are disseminated in the community also contain contingency plans to inform the residents on what to do in case of an emergency. All of the *barangays* also have their alarm system and command post where they monitor the community.

Shared understanding on key threats

Understanding the risks and vulnerabilities of a city helps in developing effective strategies. From there, the city can pursue solutions to strengthen its capacity to handle these threats. Interviewees agree that the biggest threat in Marikina is flooding caused by heavy rainfall. Urbanization in the nearby upland areas of San Mateo, Montalban, and Antipolo, as well as the deforestation of the Sierra Madre Mountain Range and the mountains in the Rizal Province, has led to the waterlogging of soils that flow down to the Marikina River during heavy rains. This was what happened during Typhoon Ketsana, the water that flowed down from the uplands was a combination of silt and mud.

"Our river now has also changed in quality because the water that comes from the mountains contains soil particles that settle in our rivers. The problem is there are no more trees in the mountains and that causes the soil to loosen. With the soil the river has become shallow which makes the water easy to rise from the riverbanks and flood highly dense areas." (Citizen stakeholder 3, interview date 18 March 2019)

In order to estimate the amount of flood that may occur in Marikina's lowlands, the government installed five rainfall gauges in the Marikina Watershed atop the mountains. This was done together with the Project NOAH of the University of the Philippines. The rainfall gauges transmit the rainfall density data to flood sensors which then calculate the possible water level rise of the Marikina River. This information is sent to the MCDRRMO and helps them plan their course of action (Institutional actor 1, interview date 13 March 2019). However, even with the preparation, equipment, manpower, and disaster knowledge of the stakeholders, adjacent cities must do their part. As such an Alliance of Seven composed of adjacent cities, Quezon City, Pasig, Antipolo, Marikina, and the municipalities of Cainta, Rodriguez, and San Mateo was formed to share good practices on climate change and disaster risk management (Shell Philippines, 2015; Florano, 2014; Tuaño and Sescon, 2013).

A joint project of the Alliance of Seven with the Department of Environment and Natural Resources is the tree planting at the Marikina Watershed, which was enlarged from the initial 20 hectares of land to 200 hectares (Shell Philippines, 2015), to bring back the forest and safeguard the low-lying areas from natural hazards. This alliance was further expanded to a Metro Manila-Rizal LGU Network composed of member LGUs of the Alliance of Seven plus four more cities in Metro Manila, Malabon, Mandaluyong, Valenzuela, and Caloocan, and the Municipality of Taytay in the Rizal Province (Shell Philippines, 2015; Florano, 2014).

Though flooding is still a threat, stakeholders in Marikina are confident in the city's ability to handle it. In the case of flooding and fires, interviewees agree that the city is armed with manpower and facilities, but there is still some fear when it comes to earthquakes,

especially the anticipated "Big One." Even with the earthquake information, training and drills, there is still some concern from stakeholders about this specific natural hazard because it is uncommon.

"We . . . have enough equipment in case of a flood, fire, we already have a fire truck, we have volunteers in fact we have a lot of volunteers here. What we have not experienced is an earthquake. I hope the "Big One" does not happen. People are also ready because they have been trained because we are in the critical area, we are near the fault line." (Citizen stakeholder 5, interview date 18 March 2019)

The "Big One" is the term coined for the anticipated 7.2 magnitude earthquake threat located at the West Valley Fault (also known as the Marikina Valley Fault System). According to studies the West Valley Fault has a potential return period of 400 years and the last movement happened in 1658 making it ripe for activity (House Resolution No. 1988, 2018; Balgos, et al., 2014; Bidder and Maramag, 2018). The projected casualties and economic damage for a magnitude 7.2 earthquake scenario are estimated at 37,000 fatalities, 605,000 injuries, and almost 2.5 trillion Philippine pesos or €42.83[21] billion (Bautista, et al., 2014). The national government has been preparing in anticipation of this event. Local government units in Metro Manila especially critical cities like Marikina that are in the path of the fault are especially preparing the people with information materials, regular training, and drills.

Perception on resilience

Interviewees believe that the flood disaster experienced during Typhoon Ketsana significantly affected their view on disasters and resilience. There was a realization on what is still lacking in the community in terms of disaster management (Citizen stakeholder 3, interview date 18 March 2019). These were the alarm systems, rubber boats, and ambulances that have now been purchased by the *barangays* through the disaster fund. Most of the interviewees perceive resilience as the ability to bounce back from the disaster given the example from the Typhoon Ketsana disaster experience. Interviewees, however, pointed out that bouncing back from the disaster is not enough it is the ability to learn from the disaster experience that contributes to resilience. There are two words in the Filipino language that came out that the interviewees relate to resilience, *"katatagan"* (stability) and *"kaalaman"* (cognition). The word resilience has no direct translation according to the interviewees but these two words were used to describe resilience as the **strength** to rise from adversity through **awareness** and **knowledge**. This emphasizes the value of understanding the vulnerability of the city to natural hazards to be able to prepare, mitigate, adapt and survive any possible disaster.

[21] Foreign exchange rate as of 22 May 2021 is at €1 = PhP58.36 https://www.likeforex.com/currency-converter/euro-eur_php-philippine-peso.htm/1

9.2.3 Collective efficacy

In the first adaptive cycle, the city government implemented the necessary reforms through three main programs - Save the Marikina River, Squatter-free Marikina, and Rescue 161. Priority was given to the first two because BF wanted to address the flood problem of the city head-on. Towards the end of the first adaptive cycle and change in leadership from BF to MCF, there were more educational and awareness-raising activities on the river and waste management and this has carried over to the second adaptive cycle. The city government has further carried out awareness-raising programs through the MCDRRMO on disaster risk reduction and management.

In the second adaptive cycle, the focus was on disaster risk management that evacuation training, seminars on warning signs (the meaning of alarms), and monitoring of river activity were immediately provided to the stakeholders. Other training includes basic life support skills training and drills such as fire drills and earthquake drills. These training are offered year-round and are done not just on the city level but also at the community level and in different sectors.

Flood drills are no longer being carried out because, according to MCDRRMO, people have regular experience with this and are already aware of what to do and where to go. An interesting feature of the training being conducted by the MCDRRMO for the communities is its comprehensiveness and inclusivity. Section 12 c, item 4 of RA 10121, indicated that local disaster risk reduction and management offices must "organize and conduct training, orientation, and knowledge management activities on disaster risk reduction and management at the local level". The MCDRRMO interpreted this to include literally the entire community in the awareness-raising activities including all sectors in the community.

"The law says that there should be community-based programs, but the classification of the community is not defined. When I was new here they told me, 'Sir we cannot do that in the schools because it has to be community-based, they might question us,' I told them, 'What is the definition of a community, we have a school community, we have a religious community, we have different types of communities, this will not be questioned by the COA (Commission on Audit),' so it was done and we didn't face any problem." (Institutional actor 1, interview date 13 March 2019)

<u>Disaster awareness at all levels</u>

The MCDRRMO made it a point that the different sectors in the city are informed and trained on disaster risk management. Training is clustered per community and sector such as homeowners associations, schools, religious community, and the business community (Institutional actor 1, interview date 13 March 2019). Tailor-made training was created to address the needs and levels of the stakeholders. For example in schools, children are

taught natural hazards and drills like duck-cover and hold as part of their preparation for an earthquake. At the community level, other training such as first aid and basic life support are included. Some communities also request more advanced training from the MCDRRMO such as fire suppression where community DRRM volunteers are trained to handle the fire hose and nozzles.

The training received by the city government from the national government, private organizations, and academe is also transferred to the *barangays* by the MCDRRMO. In turn, the *barangays* pass on these training courses to the members of the community. Since RA 10121 has stated that each *barangay* must have a 5 percent budget allocated for disaster risk reduction and management programs, the *barangay* allocates a budget for all types of emergency training and preparation. The *barangays* implement initiatives such as competition between the various sectors or homeowners' associations to improve engagement at the community level and make the training appealing and stimulating.

"We have a training yearly. But it is not just about flooding, it is also about earthquakes, fire, all of that. Now is the fire prevention month we have a training and also a competition. The competition is on speed of the peoples response, how to handle the hose, equipments, where to get water, things like that. Even steering the boat we learned that. Every sector in the community are invited, each has a representative from the homeowners, church, TODA, senior citizens group, schools, etc. . . . only the schedule differs." (Citizen stakeholder 5, interview date 18 March 2019)

This implies that, apart from the training offered by the city to the stakeholders, each *barangay* also performs its training to make the information repetitive. It helps the stakeholders retain the lessons learned from these courses. Representatives of Marikina homeowners associations that undertake these training courses, in turn, disseminate this knowledge to their neighborhoods. This is to make sure the information goes down to the household and individual levels.

Incorporation of disaster risk management in schools

Section 14 of RA 10121 stated that disaster risk reduction education must be integrated with the school curricula and *Sangguniang Kabataan* (Youth Council), and mandatory training should be given to public sector employees. Marikina has fully integrated disaster risk reduction and management into its educational system.

"We have orientations from time to time, we have trainings, we have drills, and all these things are included in the curriculum . . . it is included in the curriculum of health and science, in biological science and natural science, earthquake drills, safety, fire drills . . . etc." (Planner stakeholder 1, interview date 20 March 2019)

All the schools, whether public or private, in Marikina, also have an organized disaster committee led by a disaster coordinator. The coordinators usually contact the MCDRRMO to help in conducting drills such as earthquake drills. At the same time, the MCDRRMO observes and evaluates the readiness of these committees during the drills.

Planner stakeholder 3 claims, however, that incorporating disaster awareness into the school curriculum prepares people, but since there is no infrastructure, that does not save the vast majority (Interview date 28 November 2018). But for a disaster-prone city with a threat on the "Big One" and have had regular experience with flooding, these exercises equip residents with resources to plan for an emergency. As part of the national risk reduction program, the local university, *Pamantasan ng Lungsod ng Marikina*, has integrated disaster risk management into its curriculum. Professors are also charged with delivering community-based training and lectures on disaster risk management as part of the National Service Training Program and part of community service.

Level of awareness

The knowledge and education provided to the stakeholders have strengthened their capacities in dealing with disasters particularly floods. The residents are familiar with the warning signals that indicate the water levels of the river. The first warning comes when the river water level reaches 15 meters, at this level residents are advised to take heed. The second warning comes when the water level reaches 16 meters and by that time residents should start to prepare for evacuation. The third warning or the final evacuation warning comes at 17 or 18.5 meters.

The protocols on disaster risk management developed and regularly updated by the MCDRRMO are also disseminated to all stakeholders. When there is a system in place and people are educated and informed clearly on what to do and where to go, they become proactively involved in the city.

"[Even] a 10 year old child . . . if he gets left behind by his parents when a flood breaks, he knows which school he needs to go to [to evacuate]. He knows the protocol. He knows how to register. His parents only need to look for him in the school where the [evacuation] camp is located." (Institutional actor 1, interview date 13 March 2019)

Because of these drills and protocols that the MCDRRMO has set up, the stakeholders are aware and prepared for emergencies. The people already know where the critical areas are and when they need to evacuate. There are even instances when people evacuate immediately even on the first warning.

9.2.4 Collective security

In the previous section, it was noted that Marikina stakeholders have a high degree of disaster risk awareness at all levels because of the amount of IEC campaigns the city government has embarked on during the second adaptive cycle. Institutional actor 1 sees that the formula to Marikina's resilience is the partnership between the city government and the community (Interview date 13 March 2019). The city government committed to maintaining a high level of disaster risk awareness among the people through a collective effort. The city involved various stakeholders and ensured cooperation within and between the different local government agencies in the area of disaster risk management and, in particular, crisis management. The MCDRRMO leads this along with the PNP, the BFP, and the Rescue 161 medical team.

During emergencies, government employees, in particular department heads, are assigned as camp managers in the evacuation camps. All government personnel is trained in crisis management, disaster risk management, and camp management. Since the identified temporary evacuation camps are mainly schools, camp managers are partnered with the schools' disaster risk management coordinators. Camp managers and the school disaster risk management coordinators manage the assigned evacuation camps while the *barangay* officials coordinate with the MCDRRMO to evacuate people from their *barangays* if necessary.

Every city government department in Marikina has an assigned responsibility for disaster management. The Parks and Development Office is assigned to monitor the Marikina River, any change in the water levels and emergency in the Marikina River and the riverbank parks are reported to the MCDRRMO for action. The PIO is responsible for sending out announcements and disseminating information in the various channels, social media, websites, television, and radio. The PNP and the BFP help in the search, rescue, and evacuation.

Protocols are provided by the MCDRRMO for various hazard types that are common in Marikina, including earthquake. There are also contingency plans for various threats in addition to the protocols. The protocols and contingency plans are periodically revised to include new experience-based learning. An example of the improvements done by the MCDRRMO is the inclusion of an animal evacuation camp after a previous evacuation experience where households brought along their pets in the evacuation camp. The animal evacuation camp was the first of its kind in the Philippines.

"Sometimes there are different scenarios on field, so when that happens we adjust just like with our experience last year. We noticed that there were a lot of animals. [They] brought their pet[s] in the evacuation camps and this endangers others so what we did was if there is a camp for people, we established another camp for animals. We put animal shelters, we immediately had shelters constructed

for the animals . . . They are also placed "room-per-room" and after the flood they also check out of their rooms like a hotel." (Institutional actor 1, interview date 13 March 2019).

Mutual adaptation of roles

Republic Act 10121 became the policy tool that led to the creation of BDRRM units in the 16 *barangays* in Marikina. However, the effectiveness of these BDRRM units is in part due to the partnership of the government and the community and the commitment to maintain a high level of awareness and preparedness of all stakeholders. The city government consults the stakeholders in creating the city development plans and this is also carried out at the *barangay* level when the community develops its *barangay* development plans and disaster risk management plans. In the *barangay* disaster risk management plan, the community members are consulted, their suggestions are received and documented and mostly incorporated into the plans.

". . . you have there the academe, kagawads (council), barangay captains, associations, public and private associations, villages associations, from the villages, the manggagawa (workers), the public sectors, educators, teachers." (Planner stakeholder 1, interview date 20 March 2019)

"In the five years that we have our annual or disaster planning we always seek their opinion. We ask for suggestions on how we can improve in providing assistance in the barangay when there is a disaster." (Citizen stakeholder 6, interview date 18 March 2019)

"Because that is where we get ideas . . . what we can do to help them. That is also where the Barangay Captain draws ideas on budgeting in relation to their needs. What should be prioritized that everyone will benefit from if a disaster happens?" (Citizen stakeholder 2, interview date 19 March 2019)

This bottom-up approach is seen by the interviewees as a significant element in developing the city and the community's resilience. At the onset, the city government through the MCDRRMO conducted seminars in each of the *barangays* to help them properly allocate the budget from their disaster funds. The MCDRRMO made them understand that these funds are for specific needs of the *barangay* and that these funds are to be used to prepare for any natural hazard or emergency in the community as mandated by law. From these close coordination and partnership was established by the MCDRRMO and the *barangays*, the residents are made to feel that they are part of the bigger plan of the city.

At the *barangay* level, cooperation is eminent, since people know each other and the needs of the community. The *barangays* use these close social networks within the community to draw the people into the DRRM activities. Private businesses and resident volunteers are also given recognition by the *barangay* officials through ceremonies and announcements that incentivizes many of the stakeholders to volunteer and be part of the city's

development and programs. Below is an interesting transcript of the interview on this recognition.

Citizen stakeholder 4: *"They [the barangay] thanked the people for being part of the barangay's program since it is also for the sake of each resident in Malanday."* (Interview date 18 March 2019)
Interviewer: "*So they have incentives?"*
Citizen stakeholder 3: *"No they don't have incentives. They are just given recognition."* (Interview date 18 March 2019)

Most of the time residents volunteer because of their altruistic character and moral duty to help others. Maintaining a set of volunteers who will regularly help the city requires work on the part of the city government and the *barangay*. Some volunteers work for free while the more regular set of volunteers are given a base allowance to help in programs and projects in the city. Recognition through ceremonies and provision of identification cards and uniform which are usually just plain t-shirts with a printed name of the *barangay* and the word 'volunteer' gives the volunteers a sense of pride and commitment to their work. In 2019, Marikina City hired 206 long-time volunteer street sweepers as project-based employees under the CEMO (Rappler, 2019) showing the value given to the volunteers and Marikina City's commitment to the people.

With the encouragement of the city government, volunteers in Marikina remain high. The homeowners' associations in particular participate in the community-based volunteer programs of the MCDRRMO. Volunteers to this program are provided with training on first aid, basic life support, and disaster awareness. Through these efforts, the community becomes aware of their surroundings and coordinates with the MCDRRMO directly to report emergencies or any possible hazards present in the community. In turn, the MCDRRMO takes immediate action on any of these reports, ensuring the citizens that the government is working for them. This action from the MCDRRMO instills trust from the stakeholders.

The trust that the city government has earned from the stakeholders has been reciprocated by the stakeholders by being proactive. Private individuals report directly to the MCDRRMO's social media accounts on anything that is happening in the community whether this is an open manhole, garbage dumped on the streets, or vehicles that are illegally parked. The MCDRRMO relayed that these calls are quickly addressed by their office mainly to avoid accidents and/or obstructions. Disaster prevention and proactiveness have been instilled in the mindset of the stakeholders in Marikina. The academe also has a special role in modeling this mindset by advocating not just education but service for others.

"One important theory that we [practice] especially in the Pamantasan ng Lungsod ng Marikina is the social contract and social construct theory. We started telling people and everyone that the moment you

[experience] problems the immediate person who [will] help you is [someone from] your own area . . . your neighbor." (Planner stakeholder 1, interview date 20 March 2019)

The private sector, on the one hand, participates by collaborating with the *barangays* where they are based for every disaster risk reduction program. There are private companies that own fire trucks that also offer *barangay* assistance when there is a need (Citizen stakeholder 1, interview date 19 March 2019; Citizen stakeholder 2, interview date 19 March 2019). Self-organization in this regard is not due to a chaotic situation as exemplified by Partanen's (2015) "edge of chaos" behavior, but rather to the confidence that the community has so rightly given to the city government. It is also an acknowledgment that the city government and the community have certain limitations and need everyone's support.

Infrastructure support

It cannot be denied that Marikina systematically fostered and sustained disaster risk awareness that empowered the stakeholders to become proactive in disaster risk management and preparation. The city government has also been consistent in their continuous work on disaster risk management not just on awareness-raising and response but also on engineering works especially in the Marikina River. Continuous improvements on the drainage networks, slope protection of waterways, regular dredging, construction, and maintenance of road dike systems are all part of flood risk mitigation measures. However, the city government and the stakeholders also know that these efforts have limitations since the flooding that happens in Marikina is due to runoff water coming from the uplands and the bottleneck that happens in the adjacent Pasig City.

"We're done with social, I mean people are very much aware . . . but with regards to infrastructure we still lack many. Because you will not experience flooding anymore if you have good infrastructure but it is not like that . . . The flow of the water goes fast here in Marikina, when it reaches Pasig it slows down, so the problem is in Pasig . . . You can't do anything about their infrastructure because that is already in Pasig. I mean the national government should do something about it. There must be a collaboration between Marikina, Pasig and of course San Mateo because that is where the water comes from, they deforested the mountains." (Planner stakeholder 1, interview date 20 March 2019)

Collaboration with other cities and adequate infrastructure is needed for Marikina to sustain their flood risk management efforts. When the Alliance of Seven was established a year after Typhoon Ketsana, the goal was to make a band of local government units in the Marikina Watershed to exchange lessons and tools for disaster risk reduction and management practices, including the protection and restoration of the Marikina Watershed (Tuaño and Sescon, 2013). While there is a focus on disaster risk reduction and management this has been primarily on preparation, recovery and crisis management, and prevention through reforestation of the watershed and relocation of communities. The

Alliance of Seven has also approved a fund for infrastructure that they may construct within the jurisdiction of their respective local governments such as reinforcement of river walls. The involvement of the DPWH is also essential to ensure that the flood control projects are in close coordination with the members of the Alliance. However, because the Pasig-Marikina River is a transboundary river system, concerted efforts are required, within and across local government units, for river cleaning, restoration, dredging, among other activities. Marikina can regularly clean up, dredge and improve the river system within their territory, but as long as other nearby local governments do not perform their part, Marikina will bear the brunt of heavy rainfall and floods.

9.3 CHAPTER CONCLUSION

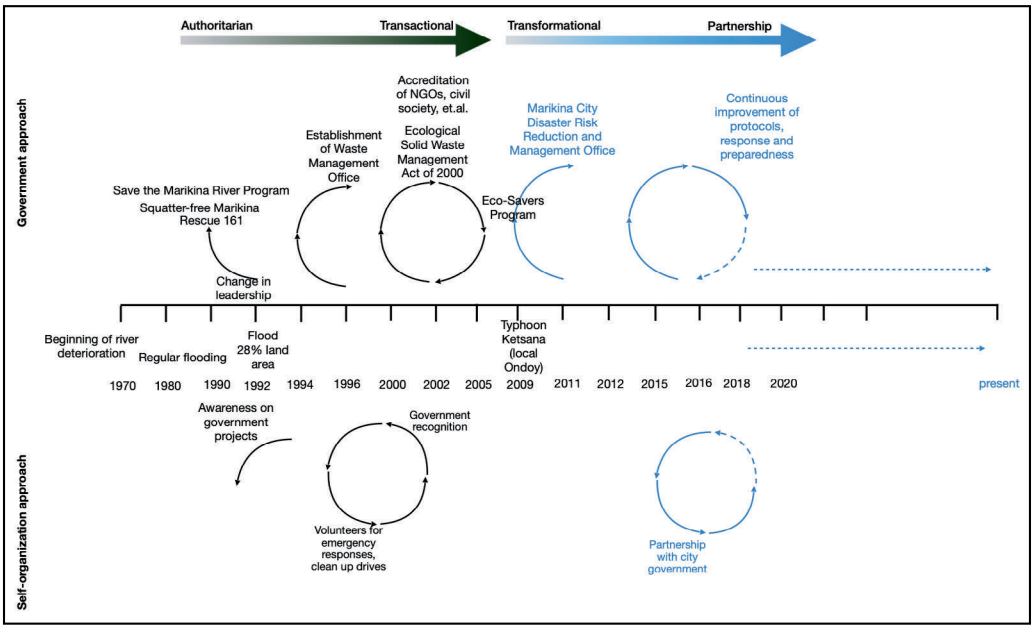
Leadership has been described as a measure of resilient cities by both the Rockefeller Foundation (100 Resilient Cities) and the OECD (see Chapter 2 for full discussion). Effective leadership and management of cities call for the involvement of all stakeholders. Marikina has experienced two main adaptive cycles based on trigger factors, floods in 1992 and change in leadership (first adaptive cycle) and Typhoon Ketsana and RA 10121 (second adaptive cycle). Within those two cycles, there were different phases of leadership styles that transitioned.

In the first adaptive cycle, BF imposed changes using an authoritarian style of leadership. At times, this authoritarian leadership style is required to expeditiously enforce necessary reforms. The then new mayor had the conviction to turn Marikina from a laid-back town to a progressive city and his "overbearing" ways was the strategy used to implement the policies and projects. This dogged determination earned BF the ire of many Mariqueños at the beginning of his term, but when these reforms contributed to improvements in the city, people gradually changed their attitude. It became what the leadership and management experts would call "transactional leadership" whereby the City Government of Marikina exerted the rule of law through the enforcement of ordinances, levied fines on violators, but also physically transformed the city into one of the cleanest in the country. This carrot and stick approach contributed to what the interviewees referred to as *"instilled discipline"* in the Mariqueños.

Figure 9.6, shows that the progression from authoritarian to transactional leadership in the first adaptive cycle has slowly earned the trust of the new administration and understanding on the projects and programs implemented that towards the middle and end of the 1990s volunteers have started to emerge. The rehabilitation of the Marikina River proved effective in reducing the occurrence of flooding and also turned the Marikina Riverbanks into a park and commercial center that benefited residents and created economic opportunities for Mariqueño shoemakers and businessmen. The recognition granted to Marikina City by national and international award-giving bodies

fostered pride in the Mariqueños contributing to the proactive engagement of stakeholders in various projects in the city as volunteers. Most of the residents who volunteered in Marikina's projects were the youth who helped in the river and street clean up. Leaders who followed after BF's administration continued the projects which shows an institutional resilience of the changes that BF catalyzed. The programs and projects were found to be both successful and beneficial to the community worthy of continuity because they developed the resilience trait *"katatagan"* (stability) of the city.

Figure 9.6: Leadership style transitions in the adaptive cycles



At the onset of the second adaptive cycle, the leadership style became more transformational (see Figure 9.6). The passage of RA 10121 in 2010 gave the requisite framework to formalize Rescue 161 as the MCDRRMO and to establish the BDRRM units. Communities were given ample capacity to meet disaster risks through the provision of a budget to implement programs and projects under the four thematic areas of disaster risk reduction and management, prevention and mitigation, preparedness, response, and recovery. While raising awareness on the environment was already in place in the first adaptive cycle through the Eco-Savers program, more vigorous IEC campaigns were employed to raise-awareness on disaster risks at all levels in the second adaptive cycle. *"Kaalaman"* (cognition) was the definitive resilience trait in the second adaptive cycle which drives the MCDRRMO to partner closely with the community, learn and improve from their disaster experiences.

Volunteer groups that started in the first adaptive cycle continued to the second adaptive cycle. The regular IEC, training, and drills done by the MCDRRMO and the BDRRM units sharpened the knowledge of all stakeholders on the disaster risk management and natural hazard protocols of the city. The interaction between the city government through the MCDRRMO and the community through the BDRRM units also helped in stimulating unity within the city. This collectiveness and mutual adaptation of roles between the city government and the communities are noticeable in the governance of the city. However, even with Marikina's successful projects and programs, daily operations, decreased flood frequency, and increased public awareness, floods will continue to happen in Marikina if neighboring cities do not contribute to the conservation of upland forests and the restoration of the Pasig-Marikina River system.

CHAPTER TEN

CHAPTER TEN: YEARS OF LIVING DANGEROUSLY: TRANSFORMING MALABON'S CULTURE OF DISASTER TO CULTURE OF RESILIENCE

"Doon kami lumaki. Wala na sa amin yun."
(We grew up like that. [Flood] is nothing to us.)
Citizen stakeholder 4, interview date 22 March 2019

10.0 INTRODUCTION

The City of Malabon is surrounded by rivers and creeks, its proximity to Manila Bay has made it an important city in history as a trade center and home to many local elites. These elites, enterprising that they are, have not only engaged in trading cash crops such as sugar but have also used the rivers to build fishponds that produce freshwater fish, clams, and oysters. A large part of Malabon's land area is tidal land and is subject to tidal fluctuations, such flooding is normal, particularly during high tides. However, the occurrence of floods has worsened over the years with growing urbanization, congestion, and outdated drainage systems.

Malabon residents have been dealing with the flood situation for years. Infrastructure projects such as diking, dredging, and pumping stations have been undertaken in the past. The CAMANAVA Flood Control Project is the largest one to date and was rigged with controversy during its execution in terms of its efficacy. In recent years, Malabon has strengthened its flood risk management and disaster risk management activities, especially following the passage of the Philippine Disaster Risk Reduction and Management Act 2010 (RA 10121).

This chapter explores Malabon City's process of developing urban resilience and collective engagement, emphasizing community resilience. It demonstrates how repeated flood experience has had a strong effect on building resilience, especially at the community level. A phenomenon Bankoff (2003) called "culture of disaster" which is described specifically in the Philippine setting as "the constant threat . . . has been integrated into the schema of daily life" (p. 4). The interest in this chapter will be how Malabon attempts to turn this "culture of disaster" into a "culture of resilience."

In order to outline Malabon's process of urban resilience and collective engagement, this chapter is divided into four sections. The first section describes Malabon's adaptive process constructed around the flood experience and the years of attempts to mitigate floods through infrastructure. The second section presents the collective engagement and urban resilience within the city using the four dimensions of collective engagement as frames of

discourse. The last section presents the conclusions emphasizing community resilience and the continued local level vigilance on flood mitigation.

10.1 ADAPTIVE CYCLES

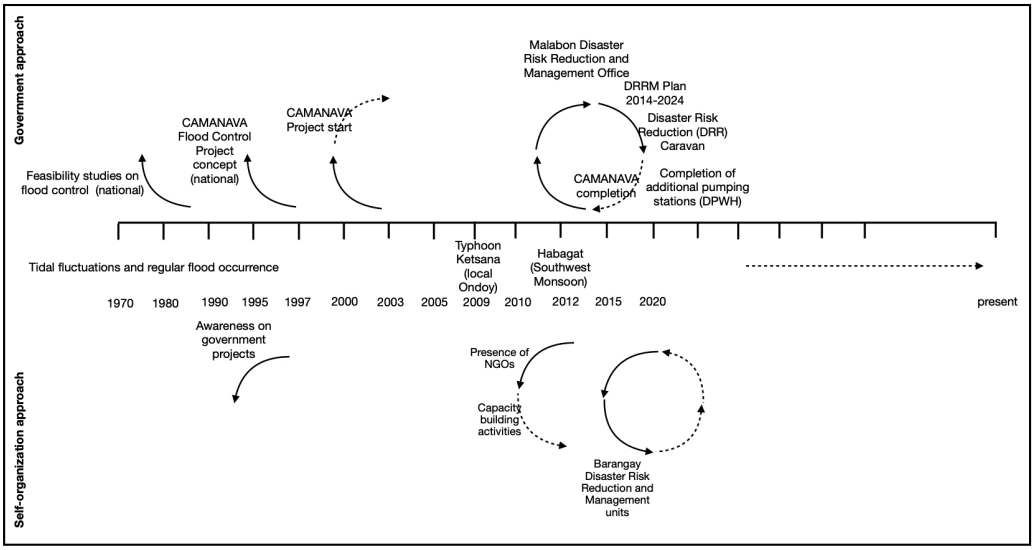
Malabon City belongs to the cluster group of cities called CAMANAVA which are Caloocan, Malabon, Navotas, and Valenzuela. The CAMANAVA is the Northern Manila District of Metro Manila situated north of the city of Manila and the Bay of Manila and surrounded by river deltas. The CAMANAVA is one of the four districts in the National Capital Region (NCR) or Metro Manila. The districts under the NCR functions as a geographical division specifically for fiscal management (Presidential decree No. 921) and statistical organization. Each local government units (LGU) under the NCR have independent administrative functions. However, national government departments such as the Department of Public Works and Highways (DPWH) have a dedicated unit for the four districts of NCR due to its geographical and population size. As such, flood mitigation projects that affect the CAMANAVA area fall under the DPWH in coordination with the Metro Manila Development Authority (MMDA) and LGUs under the district.

Much of the CAMANAVA area is flood-prone, Malabon is no exception which regularly experiences floods being mostly tidal land. Figure 10.1 shows at the adaptive cycles of collective engagement and urban resilience in Malabon. Adaptive cycles are adaptation processes that go through a complex period of disturbance, stability, and growth. Figure 10.1 illustrates Malabon's adaptive cycles in the government approach and the self-organization approach in the collective engagement urban resilience framework. The timeline shows the periods when the adaptive cycles for each approach happened. Each of the curved arrows is the collective engagement dimensions - concern, action, efficacy, and security - within the adaptive cycles. The figure shows that the two approaches have different starting points across the timescales but have somehow started to converge at some point. The dashed lines of the curved and straight arrows indicate current and/or continuous process.

This section will discuss the adaptive cycles that Malabon has gone through looking back at the regular floods experienced to the initial flood management studies in the late 1980s and projects in the late 1990s done by the national government, particularly the CAMANAVA Flood Control Project. The CAMANAVA Flood Control Project was under the jurisdiction of the DPWH funded from the loan agreement between the Government of the Philippines (GOP) and the Japan Bank for International Cooperation (JBIC). The cities of Caloocan, Malabon, and Navotas where the facilities for the CAMANAVA Flood Control Project will be located signed a memorandum of agreement (MOA) with the DPWH. The MOA set out the responsibilities of the DPWH to continuously seek solutions to mitigate

the flooding problem in the CAMANAVA and maintain and rehabilitate the flood control structures and facilities (Commission on Audit, 2014).

Figure 10.1: Timeline of collective engagement and urban resilience of Malabon



The CAMANAVA Flood Control Project was the beginning of the government approach toward flood risk management however, the disturbance that became the trigger point for an adaptive cycle is the flood experience during the 2012 *Habagat* (southwest monsoon). It was also the time when the city created the Malabon Disaster Risk Reduction and Management Office (MDRRMO) as mandated by the Philippine Disaster Risk Reduction and Management Act 2010 (RA 10121).

10.1.1 Flood incidence and interventions

Malabon's location as a tidal land surrounded by river systems and close to Manila Bay makes it vulnerable to flooding. The city's rich history as a trading town and a fishing village where numerous fishponds are located and owned by the Malabon elites make up the city's main character. In the past when the population of Malabon was relatively low and the built area was not as dense as it is now, floods come during the normal typhoon season or tidal fluctuation but easily subside. However, as the population of the city increased, demand for housing space put pressure on the carrying capacity of the drainage and water systems of Malabon. The city together with other adjacent cities Manila, Caloocan, Navotas that are along and near the port areas became hubs for manual labor attracting many people, most of whom settled in slum areas.

As there was a need for housing but a shortage of land, the option was to reclaim a private fishpond 'identified as a possible garbage dump site' (World Bank, 1985: 5) and make it a resettlement area. This reclamation project called the Dagat-dagatan Resettlement Program mainly targeted displaced slum dwellers and low-income populations from the Tondo Foreshore and Dagat-dagatan areas, and the cities of Navotas, Malabon, Caloocan, and Manila (World Bank, 1985). The vision for the resettlement program was not only to provide housing units but also employment opportunities for the resettled households (Estioko, 1977). While studies have shown that there have been marked changes in the socio-economic situation of people in the resettlement sites between 1974 and 1984 (Munarriz, 1987), the downside is that the land reclamation has further choked up the river system, exacerbating the occurrence of flooding in the already flood-prone area of Malabon.

The timeline in Figure 10.1 shows that feasibility studies on flood control facilities and infrastructure were done in the late 1980s. Plans to construct flood control and drainage have been in place since the Marcos Administration under the Medium Term Development Plan (MTDP) 1984 to 1987 targeting the Philippines major river basins and Metro Manila's drainage systems and water impounding projects (Llanto, 2002). During the Aquino Administration (1986 to 1992), reports indicate that the national government investigated the feasibility of constructing a flood control facility in the CAMANAVA area between 1988 to 1990 (Romero, 2013; ESSC, 2013). It was also during the Aquino Administration that the flood control functions and responsibilities of the DPWH in Metro Manila were turned over to the MMDA (Pante, 2016). The plans under the MTDP and previous Marcos-led infrastructure plans and projects were still being used even under the Aquino Administration (Pante, 2016). During the Ramos Administration (1992 to 1998) priority was given to sustainable development and in terms of flood control prioritized the major river basins in the country (Llanto, 2002). Within Metro Manila, the targets were building flood control facilities, flood plain management, flood forecasting, and reforestation. By the end of the Ramos Administration, a total of PhP12.2 billion (€209.02[22] million) have been spent on flood control projects (Llanto, 2002).

In 1997 the CAMANAVA Flood Control Project was conceptualized (as shown in Figure 10.1) and approval for the implementation was secured in January 1998 (Commission on Audit, 2014). Upon approval in 1998 Malabon commenced clearing the project areas from informal settlers. Detailed engineering design indicated that implementation of the project was estimated to be run for five years from 1999 to 2003 (Commission on Audit, 2014). The loan agreement between the GOP and JBIC was signed in 2000 and public bidding for the project started in August 2002 (Commission on Audit, 2014). Approval of the project until the signing of the loan agreement happened during the Estrada Administration (1998

[22] Foreign exchange rate as of 22 May 2021 is at €1 = PhP58.36 https://www.likeforex.com/currency-converter/euro-eur_php-philippine-peso.htm/1

to 2001). The three-year Estrada presidency was filled with political unrest and insurgencies and was cut short since he was impeached and eventually left the Malacañang Palace[23] on 20 January 2001 after a five-day stand-off with the opposition (ABC News, 2006; Tatler Philippines, 2020). The succeeding Arroyo Administration (2001 to 2010) was able to push the implementation of the CAMANAVA Flood Control Project in 2003 (Philstar, 2003; Commission on Audit, 2014). This delay pushed the target date of project completion and loan agreement to 2007.

During that period the CAMANAVA area was already experiencing the worst flood events, according to a study done by Rodolfo and Siringan (2006) annual floods from 1991 to 2002 have increased in height by 0.2 to one meter in CAMANAVA. This was attributed not just to sea level rise but particularly to groundwater extraction and land subsidence. The CAMANAVA Flood Control Project was deemed to be the solution to the flood situation of the residents of these cities. However, it took the project more than a decade to complete and upon completion was riddled with issues. The JICA evaluation report (2014) stated that the project delays were due to '(1) the 8-month delay on the part of the DPWH to do the pre-qualification of contractors and confirmation of the bidding criteria at the beginning of the loan period, (2) a new set of informal settlers appeared in the project area after clearance due to the delay in implementation, prompting DPWH to allocate time to decide on the resettlement and obtain budget, and (3) civil works were done only by one international contractor that had to deal with the local communities surrounding the project sites on logistics such as fishing boat traffic, relocation of electricity and water supply facilities' (p. 15). The press releases of the Philippine Senate likewise reported that while there were logistical problems on the electricity and water supply facilities and in securing road closure permits in Navotas, the DPWH also failed to provide proper supervision and monitoring of the project (Senate of the Philippines, 2007; Senate of the Philippines, 2008). By 2007, the target completion date and end of the loan agreement, the project was only at 88% completion (Commission on Audit, 2014). The agreement with the international contractor Nishimatsu Corporation Co. Ltd. was terminated in 2008 and the remaining work was taken up by a new group of local contractors until its conclusion in January 2012 (Commission on Audit, 2014; Romero, 2013).

The completion of the CAMANAVA Flood Control Project was far from solid as indicated in the broken curved lines in Figure 10.1. Following the completion of the CAMANAVA Flood Control Project, the Commission on Audit reported that the structures had not completely mitigated the flooding triggered by high tide and heavy rains due to technical shortcomings, the presence of informal settlers, and the volume of waste (Commission on Audit, 2014). Malabon officials have also taken the media to respond to the inability of the CAMANAVA Flood Control Project to control the city's flooding (Manila Bulletin, 2012). Additional infrastructure support was requested by the City of Malabon to be constructed

[23] Official residence of the Philippine President

by the DPWH. These were to increase the height of the polder dike, rehabilitate the Catmon creek and the river walls, and build additional flood gates and pumping stations (Romero, 2013). Most of these were in the area of *Barangay* Catmon and completed in 2015. Two more pumping stations were completed in 2020 to address the flood problems in 6 more low-lying *barangays* in Malabon (DPWH, 2020a).

Two flood events, Typhoon Ketsana (Philippine local name: Ondoy) and *Habagat* (southwest monsoon) 2012 affected Malabon that marked some disturbances in the adaptive cycle of the city as shown in the timeline in Figure 10.1. In 2009 Typhoon Ketsana struck affecting a total of 850 families in Malabon and the same week Typhoon Parma (Philippine local name: Pepeng) also made landfall causing more than a meter of rainfall (Tyree, et al., 2013). Typhoon Ketsana was the triggering factor for the national government to create the Philippine Disaster Risk Reduction and Management Act 2010 (RA 10121). By virtue of this law local government units, like Malabon, are required to create their local disaster risk reduction and management office and also translate this to the lowest unit which is the *barangay* level as community-based disaster risk reduction and management (CBDRM) units. In 2011 Malabon started the process of creating the MDRRMO. That same year two heavy floods happened in Malabon brought by Typhoon Nesat (Philippine local name: Pedring) and Tropical Storm Haima (Philippine local name: Egay). But it was the flood brought by the 2012 *Habagat* that "awakened" the city government to fully organize the MDRRMO.

"During the storm Habagat in 2012 . . . we were caught unaware. Although . . . we had an advisory council, we didn't have a command center. So if one design failed and you have no alternative, we were not ready. It was just us [staff] at the lobby here in the city hall. We already had to delegate tasks. We had the DRRM unit but they were just starting. There were people who would call for help but we can't do anything about it because we didn't have enough equipment. And as much as we wanted to save and make people secure in the evacuation centers we were not ready in terms of equipment." (Institutional actor 2, interview date 15 March 2019)

The floods from *Habagat* submerged 90% of Malabon (Tyree, et al., 2013) at the time when the MDRRMO had just been formed and there was a shortage of equipment and manpower (Plan International, 2020). The city was overwhelmed by the magnitude of the flood and relied on help from the national government, non-government organizations (NGOs), and the private sector. Later on, the MDRRMO developed their Disaster Risk Reduction Management (DRRM) Plan 2014 - 2024 as required by the law with the goal to "[r]educe the impact of natural disasters on vulnerable communities and maintain the safety of the population from the dangers of calamities" (Commission on Audit, 2017: 26). The plan included capacity-building and awareness-raising activities on DRRM, maintaining a database on DRRM resources including hospitals and evacuation centers, and location of critical infrastructures, early warning systems, and organization of local emergency response teams and accredited community volunteers (Commission on Audit, 2017). This DRRM

plan as suggested by the Commission on Audit (COA) in their report was to be done annually and enhanced to include performance indicators.

To help increase disaster risk awareness, the MDRRMO organized a Disaster Risk Reduction (DRR) Caravan in 2016, a concept learned from the JICA training attended by the MDRRMO staff in Japan. This DRR Caravan is held annually every March to celebrate the month of fire prevention. The caravan consists of a range of educational exercises for all levels on hazard threats and vulnerabilities and preparedness and mitigation. In the 2019 DRR Caravan, the Department of Science and Technology (DOST) together with affiliated agencies Philippine Institute of Volcanology and Seismology (PHIVOLCS) and Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) attended the event to showcase different gadgets and scale models on natural hazards (Sabile, 2019). The DOST, PHIVOLCS, and PAGASA staff were also there to facilitate discussions with the attendees. At the local government level, the MDRRMO and the Bureau of Fire Protection (BFP) were both present to provide basic life support and first aid training.

Since 2016 the MDRRMO has partnered with NGOs on various capacity-building and awareness-raising activities. The Moving Urban Poor Communities towards Resilience (MOVE UP) Project has been one of the most successful projects the MDRRMO has done in partnership with Action Against Hunger, PLAN International Philippines, CARE Nederland, and Assistance and Cooperation for Community Resilience and Development (ACCORD) (Casals, 2017). The project targeted the most vulnerable communities in Malabon with the main aim of institutionalizing urban resilience and disaster preparedness. The project piloted the Alternative Temporary Shelter (ATS) and provided sustainable livelihoods to increase the resilience of the city specifically the urban poor communities. In 2018, a large fire incident occurred in *Barangay* Catmon, which became an occasion to use the ATS as an emergency facility for the affected families. This incident highlighted the value of the training that the communities received on disaster risk management and preparedness. Seeing the value of the knowledge derived from the training and seminars, the incident also became the impetus for the stakeholders to become more proactive in the capacity building and awareness-raising activities not only under the initiative but also other activities by the MDRRMO (Plan International, 2020).

10.1.2 Stakeholder interaction with city government programs

Before the CAMANAVA Flood Control Project, the City Government of Malabon installed water pumps what locals call 'bombastic' to divert water back into the water bodies to minimize flooding (Porio, 2013: 267). The city also elevated their streets thinking that this would help reduce the flood incidence. Better off households also opted to elevate their properties particularly their first floor and parking garages. At that time people thought that these measures will solve the flood problems. When the city experienced heavy floods after

Typhoon Ketsana in 2009, the city government improved the drainage system and road networks. The city also initiated awareness-raising campaigns on disaster risk management, environment, health, and sanitation in all 21 *barangays* in Malabon.

Citizen stakeholder interviewees recalled this training fondly referring to it as something that made an impact on them. From this training, they realized that they have a role in lessening the flood incidence. Garbage adds to the problem of flooding that *barangays* now include solid waste management in their information, education, and communication (IEC) campaigns.

"We disseminate information because when we go to the community we don't just focus on disaster we also include solid waste management. Because flood starts also when there is garbage on the streets it clogs the canals, so we include that." (Citizen stakeholder 1, interview date 15 March 2019)

In 2010, the national government enacted RA 10121 which led to the creation of the MDRRMO. Figure 10.1 shows that at the self-organization approach NGOs became present in the city by 2015, this is because the MDRRMO partnered with NGOs to provide capacity-building activities at the *barangay* level. The NGOs provided a huge help in Malabon in organizing and providing training to the communities. The residents are deemed more equipped to face disasters because of the training they received. Further, all 21 *barangays* in Malabon have also organized their own CBDRM units or the *Barangay* Disaster Risk Reduction and Management (BDRRM) units by 2019. The broken lines in the adaptive cycle under the self-organization approach in Figure 10.2 indicate the process of growth of the BDRRM units and the community in Malabon.

Interviewees stated that relative to previous years, the community has become more responsive and engaged in capacity-building activities. Experience with disasters, along with preparation and knowledge, allows people to brace for disasters. Citizen stakeholder 3 (Interview date 22 March 2019) shared that when a big fire broke out in their neighborhood on New Year's Eve, the vehicles were parked on both sides in their small alleyway. The fire truck had to push its way to the burning house on the double-parked vehicles. After that, the residents learned their lesson that no one dares to double park in the area. These sorts of experiences told by the interviewees point out that people learn the hard way. That it takes a disaster for them to obey the government's laws. This is similar to the ATS introduced by NGOs and the MDRRMO, which the people began to appreciate after the Catmon fire in 2018. Interviewees expressed that the community became much more conscious, more proactive, and quicker to evacuate when there is a typhoon. According to them, there are still some people who do not evacuate quickly, fearing that once they leave their homes, they will be looted. But most of the people evacuate instantly after being warned by the *barangay*.

10.2 COLLECTIVE ENGAGEMENT IN URBAN RESILIENCE

Figure 10.1 in the previous section illustrated the adaptive cycle in collective engagement and urban resilience in the City of Malabon. In this section, the collective engagement dimensions, collective concern, collective action, collective efficacy, and collective security will be discussed with the process of collective engagement and urban resilience Malabon has gone through. A summary of this discussion is shown in Table 10.1.

Table 10.1: Malabon City's collective engagement dimensions vis-a-vis urban resilience

	Collective engagement dimensions descriptions	Urban resilience	Present indicators
Collective concern	• Regular flood experience prior to Typhoon Ketsana and *Habagat* in 2012 was a 'way of life'. • Residents have their own local adaptation measures.	• There is a common understanding and knowledge on the flood control efforts of the city and the national government. • Stakeholders area aware of the threats and risks.	• Local adaptation measures • Volunteers at all levels
Collective action	• Passage of RA 10121 led to the creation of the MDRRMO and BDRRM units. • MDRRMO partnered with NGOs to help in the capacity building activities.	• Stakeholders understand and appreciate efforts of the city in disaster risk management.	• Trainings provided at all levels and sectors of the community.
Collective efficacy	• People are more aware on what to do and where to go during a crisis. • MDRRMO created the DRRM Plan 2014-2024. • Barangay disaster risk management plans and contingency plans.	• Inputs to disaster risk management plans sought from the community.	• Regular conduct of trainings on disaster risk management, basic life support, first aid. Regular conduct of drills. • Early warning systems are understood by the community. • Facebook messenger chatgroups among BDRRM units and the MDRRMO.
Collective security	• Continuous improvements on city development and disaster risk management.	• High disaster risk awareness of stakeholders.	• Yearly DRRM Caravan • Coordination with the MDRRMO, BDRRM, and DPWH on the maintenance of flood gates and pumping stations.

Source: Author, 2020

10.2.1 Collective concern

Residents of Malabon have experienced frequent floods for years, especially during the high tide season. People have been used to this knowing that the city is surrounded by water bodies and fishponds. Citizen interviewees shared that the flood was a part of their life that, in the past, people are glad when there is a flood because the fish pens overflow that the fish goes right in their backyard. This familiarity with the flood has taught people how to brace for the high tide and typhoon season. Older generations also monitor the calendar where high tide and low tide seasons are marked so that they can prepare ahead of time.

"Well, in previous years flood was part of our life. We got used to it. Actually when there is a flood we are happy because there are so many fish, we have something to eat. The fish goes inside your house. That was our life." (Citizen stakeholder 3, interview date 22 March 2019)

Although at some point the floods bring some amusement to the people as indicated above, it is no joking matter that some urban poor communities in Malabon live in danger zones such as the riverbanks. These urban poor communities live in makeshift houses constructed from light materials that can easily be washed away once the river swells. As such, urban poor communities reinforce the posts and floors of their dwellings, and if their budget permits build a second floor. Porio (2013) described this local adaptation approach by the urban poor communities as a "water-based lifestyle" (p.265). But this "water-based lifestyle" is not just for the urban poor communities, wealthier homeowners also raise their floors and parking garages higher than the streets. Bankoff (2003) calls this "culture of disaster" which means that the constant threat of a disaster, in this case, flooding, is now rooted in their way of life. The flood is so embedded into their life that residents, whether economically better off or not, have their means to adapt to the floods such as constructing flood barriers in front of their houses, keeping boats in their houses, reinforcing their dwellings, and moving their valuables to a higher level in anticipation of floods during the high tide or typhoon season. Residents are used to the lifestyle of being surrounded by water, witnessing flooding due to tidal fluctuations and heavy rain that floods are *"wala na sa amin yun"* (nothing to us) because *"doon kami lumaki"* (that is how we grew up) (Citizen stakeholder 4, interview date 22 March 2019).

While residents are used to this lifestyle, the local government saw it as a concern, particularly in terms of the economy. Commercial businesses and industries are affected by the floods that often had to close down for several days to clear their flooded properties. It costs business owners money to suspend their operations and restore the loss. Thus, in the past, the City of Malabon used band-aid methods to pipe water back to the river system using the 'bombastic'. The CAMANAVA Flood Control Project was the long-awaited solution that the city had been looking for. Still, during the long implementation of the project as shown in the timeline in Figure 10.1 and discussed in Section 10.1.1, the city experienced floods due to some design failures and congestion caused by waste pollution.

10.2.2 Collective action

Interviewees shared that the two worst flood experiences they had were Typhoon Ketsana in 2009 and *Habagat* in 2012 (see the timeline in Figure 10.1). Eight hundred and fifty (850) families were affected by Typhoon Ketsana, while 90 percent of Malabon was submerged by *Habagat*. Both floods lasted 7 to 10 days, particularly in low-lying *barangays* and the *barangays* adjacent to the river systems. Following the 2009 flood experience, the City of Malabon started to clean up drainage and solid waste management systems. At the *barangay* level, communities started to form voluntary organizations to help in the clean-up and recovery activities. Legislation RA 10121 gave the mandate to set up the MDRRMO and BDRRM units, but it was the flood triggered by *Habagat* in 2012 that gave the requisite urgency to take DRRM much proactively rather than reactively.

The *Habagat* season can bring as much as 2,000 millimeters of rainfall (ESSC, 2013), in the 2012 *Habagat* the amount of rain was at 1,007.4 millimeters (Rappler, 2013) which significantly impacted the CAMANAVA area. Aside from the flood brought by the heavy rains, a 12.80-meter tide overtopped the structures of the CAMANAVA Flood Control facility (Commission on Audit, 2014). As a result, eighteen (18) of the 21 *barangays* in Malabon were submerged in flood (NDRRMC, 2012) with more than 4,000 families in Malabon gravely affected (NDRRMC, 2012; City of Malabon, 2012). The estimated cost of damages in Malabon was at PhP38,130,800.00 (City of Malabon, 2012) or €653,316[24], and a state of calamity was declared not just in Malabon but 40 other cities and municipalities in the Philippines (NDRRMC, 2012). While private and non-government organizations helped through donations, rescue operations, and recovery efforts, the City Government of Malabon organized relief efforts through their *barangays*. At that time the MDRRMO Command Center was not yet fully established and the BDRRM units were also not yet organized (Institutional actor 3, interview date 15 March 2019).

The *Habagat* flood experience in 2012 made the City of Malabon realize the need to strengthen its efforts in disaster risk management luckily the city was selected by the Corporate Network for Disaster Response (CNDR) an NGO as the pilot city for their Noah's Ark Project. The project aims to strengthen the local government and the community's capacity by providing training and workshops and helping develop a functional DRRM structure and flood contingency plan (City of Malabon, 2012; CNDR, 2014). The City of Malabon together with CNDR and its major sponsor Smart Communications launched the project on 16 November 2012 with a signing of a memorandum of agreement. A 3-day workshop on Mainstreaming Disaster Risk Reduction and Climate Change Adaptation (DRR-CCA) in Local Development Plans was conducted on 19-21 November 2012 attended by the MDRRMO, *barangay* officials/staff, and local government offices and agencies (City of

[24] Foreign exchange rate as of 22 May 2021 is at €1 = PhP58.36 https://www.likeforex.com/currency-converter/euro-eur_php-philippine-peso.htm/1

Malabon, 2012). This was the beginning of the process of institutionalizing disaster risk management and community resilience. The Noah's Ark Project ran activities in all 21 *barangays* in Malabon until 2013 which included workshops on CBDRM, risk assessment, contingency planning, and flood warning and evacuation, among others (City of Malabon, 2012; Smart, 2013).

Flood control and drainage improvements were done in 2012 to minimize the floods in the city. This included the construction of two additional pumping stations/floodgates and the repair of the existing pumping stations/floodgates damaged by *Habagat*. To help in the clearance of obstructions such as garbage and wastes in river systems and along the streets and canals in the city, the City Environmental and Natural Resources Office (CENRO) was created on 16 October 2012 (City of Malabon, 2012). Under the CENRO are the Waste Management Section and the Environmental Management Section which will implement the garbage and waste management system, and environmental and pollution control. These initiatives led to the City Government conducting series of capacity building and awareness-raising programs on DRRM, health, sanitation, and solid waste management in 21 *barangays*.

In addition, the MDRRMO formed collaborations with NGOs to bring these programs to fruition. This partnership with the NGO and the community has become critical in raising the level of awareness of DRRM among stakeholders. In the past, it has only been acknowledged by stakeholders that floods are part of their lives, that they only have to prepare for the worst, but training has brought a sense of responsibility to stakeholders not just in their preparation, but also in the understanding that they need to do something as part of the broader community.

Citizen interviewees recounted that there has been a lot of paperwork and planning at the *barangay* level, but for them, these efforts have had an impact on the community. Citizen stakeholder 1 (Interview date 15 March 2019) shared that after Typhoon Ketsana, several residents had formed groups of community volunteers. When there are people who need help the *barangay* can easily tap the volunteers to assist. Having experienced the hardship after the big typhoon, these volunteers want to be part of the *barangays* programs, not only for themselves but to help others. Most of the time, these volunteers help evacuate residents within their neighborhoods to evacuation centers during a crisis. They also volunteer their services at the evacuation centers if there is a need.

It could be that people who have had regular flood experiences remain unbreakable in a sense that it does not bother them as much as others who have not experienced floods. But these experiences also lead to a better understanding of how they can cope and adapt the next time it happens. This is positive when the understanding and the adaptation that can be lifted from the experience are collectively shared. Such as when people, in general, prepare for a disaster.

"Others who are not used to flood have a hard time coping. But with us it's normal, it's part of life. But now people are more aware. They prepare now, people bring their valuables to the second floor of their house as early as January. They do it to prepare instead of waiting for the heavy rains to come. Preparation became part of our culture." (Citizen stakeholder 3, interview date 22 March 2019)

The problem occurs when the stakeholders do not coordinate with the community or the city government. And it happens in the *barangay*, Citizen stakeholder 3 (Interview date 22 March 2019) recalled that one of the floodgates located in their *barangay* had been tampered with by one of the residents. The floodgates in Malabon are controlled manually, a resident perhaps hoping that they can control it to prevent the water from entering the area pounded the floodgate into the ground to the extent that it was destroyed. Citizen stakeholder 4 (Interview date 22 March 2019), on the other hand, shared that the chain hoist used to lift the flood gate was stolen in their *barangay*. These incidences add to the maintenance problem of the DPWH and MMDA who are tasked to do this. In addition, if the floodgates are left defective, the low-lying *barangays* and people residing along the river banks would face a significant risk.

The anecdotes shared by the citizen stakeholder interviewees above indicate that while there is significant awareness of the flood risk in Malabon and residents are able to prepare and anticipate flood incidences, these are mainly preparatory actions rather than preventive ones. There is a collective understanding of the need to prepare and help in crisis management and recovery efforts but the preventive measures on flood risk are still taken by some as an individual action. This can be exemplified by how individual households take it upon themselves to secure their houses, elevate their floors, construct flood barriers, and, in the anecdote above, "operate" the floodgate.

Perception on resilience

Perhaps the interpretation of the interviewees as to what resilience is can give insight into the different actions described above. Most interviewees describe resilience as the ability to recover as soon as possible from a disaster and return to normal life. For some of the interviewees, resilience has an aspect of adapting to the situation to be able to survive a disaster (Institutional actor 4, interview date 15 March 2019; Citizen stakeholder 1, interview date 15 March 2019). This hold on 'survival' seems to be the mode of thinking that fuels individual action rather than collective. But on the other hand, this also sparks ideas that can help the majority. Institutional actor 4 (Interview date 15 March 2019) shared that, in housing projects, this 'survival thinking' is meant to ensure that urban poor communities are relocated to a safer location or, if not, to build stilt houses that can adapt to floods. Another expressed that they had come up with a community savings group in their community to have the resources and the means to 'survive' after a disaster (Citizen stakeholder 1, interview date 15 March 2019).

"Resilience is for the people including the government, the community. How they can survive . . . It's about the hazard, how people can easily recover from the hazards and threats in the city. That's how I see resilience." (Institutional actor 4, interview date 15 March 2019)

"It is the preparedness and capability to recover from a disaster that you experienced . . . For people to survive we also came up with a community savings group, a livelihood that they don't have to rely on the barangay. In case of calamities they have savings that can be used for a day to seven days . . . they have to have the capacity to rise up from the disaster that they don't have to rely on others even if there are a lot of people helping. It is better to have your own savings, to have their own capacity to bounce back." (Citizen stakeholder 1, interview date 15 March 2019)

10.2.3 Collective efficacy

Figure 10.1 shows that from 2012 onwards, the MDRRMO was set up and capacity-building activities with the help of NGOs started in Malabon. From these activities, the MDRRMO was able to create the city's DRRM Plan 2014 to 2024 still highlighting capacity building and awareness-raising activities to help prepare the stakeholders from disasters and set the direction of the MDRRMO's activities. The BDRRM units also created their *barangay* DRRM plan anchored on the city's DRRM Plan. Training and drills on earthquake, flood, and fire are conducted by MDRRMO, these are often attended by community leaders and homeowners association (HOA) leaders and representatives. These community and HOA leaders and representatives in turn echo the training to their members. The training and drills are done regularly at least three times a year at the city level. At the *barangay* level, this can be done much more frequently depending on the priorities of the *barangay*. Institutional actor 3 (Interview date 15 March 2019) shared that some *barangay* captains are more active in disaster risk management while others are not.

"It really depends on the barangay captain. If the barangay captain is active . . . if that is not the priority of the barangay chairman like right now the national government prioritizes drugs, so disaster right now is behind. But they [the barangay] still focus on it because it is needed." (Institutional actor 3, interview date 15 March 2019)

To highlight DRRM, the MDRRMO conceptualizes IEC programs that can enhance engagement at the community level. The DRR Caravan is one of the activities that they developed to touch base with all levels of the community. Started in 2016, the DRR caravan showcases interactive booths and exhibits of different NGOs, local and national government agencies, civil society organizations, and other partners of the MDRRMO. The caravan is open to all stakeholders but mostly targeting students in Malabon. Games and entertainment are included to make the event more attractive and enjoyable. Institutional actor 3 (Interview date 15 March 2019) asserted that there is a need to retain and maintain this awareness and knowledge and the caravan helps in doing this.

"We need to retain it in their psyche because if it is just an ordinary drill or lecture they forget about it. But if it is something like [the caravan] even after several years when you ask them about it they know. Even if the engagement is short they retain the knowledge. They remember what they did." (Institutional actor 3, interview date 15 March 2019)

Slow but steady awareness building

It took a while for Malabon city to build a level of disaster risk awareness among the stakeholders. It was mainly through the seminars and training conducted by the city with the help of the NGOs. These days the *barangays* go around the community to provide information through leaflets, posters, face-to-face meetings. Before, the BDRRM units allocated the DRRM funds in procuring materials and equipment needed for rescue operations. Through the training given by the MDRRMO at the *barangay* level in collaboration with NGOs, the *barangays* have changed their perspective, they now allocate funds for training and seminars aside from materials and equipment.

"Now they have projects on prevention, mitigation, preparedness, they are now using it to stockpile food and medicine. Then training, they also have IEC in their plans now before we did not see that." (Institutional actor 3, interview date 15 March 2019)

Since the awareness-raising campaigns were done at the community level, people are more responsive and readily prepare and evacuate. They do not rely on the *barangays* to warn them but they remain vigilant and listen to the news so that they know what to do. Apart from community-based disaster risk reduction management training, the MDRRMO also conducts training on casualty and emergency, ICS (incident command systems), and basic life support at the *barangays* for community leaders and public safety officers.

"We conduct flood, fire, basic life support because that is important. We also teach them about solid waste because that is part of prevention and mitigation. We also conduct trainings on medical emergencies so people learn how to handle sickness." (Citizen stakeholder 1, interview date 15 March 2019)

Social media use

Coordination between the MDRRMO and the community has been easy with the use of social media in particular Facebook. Each of the 21 barangays has its own Facebook pages where they post community news including weather news and announcements on evacuation. There is also a group chat between the MDRRMO and the BDRRM units where they regularly communicate especially during crisis management. Citizen stakeholder 1 (Interview date 15 March 2019) shared that in their *barangay* aside from the chat group with the MDRRMO, they have several other chat groups such as their *purok* (neighborhood) chat

groups, youth groups, and even a ladies association chat group. This makes communication at all levels faster and easier.

"We have our own account aside from the BDRRM account where all the committees are also part of. The ladies also have their own brigade account. All the purok, the leaders in each purok have a chat group, we also have that with the emergency [group], even the youth group. We all have that so communication is easy and fast." (Citizen stakeholder 1, interview date 15 March 2019)

Funding problems at the community level

Section 21 of the Philippine Disaster Risk Reduction and Management Act of 2010 (RA 10121) stated that 5% of the estimated revenue from regular sources shall be allocated for the local disaster risk reduction and management fund. This means that cities like Malabon must set aside 5% of their annual budget for DRRM. This budget is what the MDRRMO uses for their activities which is further divided to 30% for "quick response fund . . . or stand-by fund for relief and recovery programs" (Section 21 of RA 10121) when a state of calamity is declared, and 70% for the four thematic areas of DRRM (prevention and mitigation, preparedness, response, recovery and rehabilitation). Budget allocation at the *barangay* level for DRRM funding follows the same formula, whereby 5% of the *barangay* revenue is allocated to DRRM and further divided by 70% for the DRRM thematic areas and 30% for the quick response. However, some *barangays* are highly residential and do not earn high revenues because it only relies on real property tax and not on commercial and business taxes. This poses difficulties for those *barangays* in financing DRRM activities and procuring necessary safety and rescue equipment. It is especially cumbersome for those *barangays* that are not just highly residential but also the most hazard-prone. As such, for some citizen stakeholder interviewees, this budget allocation is not enough especially when an actual crisis happens. An example of the shortfall in funding is described by the citizen stakeholders' interview transcript (Interview date 22 March 2019) below.

Citizen stakeholder 4: *"In Barangay Dampalit they used up the 70-30 fund . . . but it was still not enough."*
Citizen stakeholder 3: *"They even used the calamity fund."*
Citizen stakeholder 4: *"They [also] cashed out [from their own budget]."*
Citizen stakeholder 3: *"They even created a fund, a supplemental budget for a million, because they were greatly affected. That was not in their plan."*

The saving grace of the *barangays* is that the MDRRMO responds quickly to the community. However, collaboration with the national government, in particular, the DPWH and the MMDA, in the management of the flood control system is problematic. This specific topic will be discussed in the next section, but the extract below reveals the budgetary constraints at the *barangay* level and the appreciation of the MDRRMO.

"[For the] barangay alone the . . . funding is really not sufficient. For instance we have a total budget of PhP8.5 million so how much will be the DRRM fund? . . . So that's the only thing that we have and luckily the city responds fast but the DPWH, the national, no, they really don't." (Citizen stakeholder 3, interview date 22 March 2019)

10.2.4 Collective security

In the past, the priority of the city government was focused on hard infrastructures such as the pumping stations and floodgates surrounding the city. Upgrading of the drainage networks was also done by the city government to help ease the flow of runoff and floodwaters in the drainage and sewerage systems. Most of these initiatives were usually led by the City Engineering Department, with no formal interaction or dialogue with residents on planning and construction. The CAMANAVA Flood Control Project initiated in the 1990s (see the timeline in Figure 10.1) was also top-down led by the national government in coordination with the CAMANAVA cities. In the COA audit report (2014) shortcomings from all parties, DPWH, the international contractor, and cities, Caloocan, Malabon, and Navotas, were identified to have caused the delay in the implementation of the project. Specifically, the COA audit report (2014) mentioned that Caloocan, Malabon, and Navotas, did not deliver agreements under the MOA which were the proper implementation of the waste management system, ensuring the clearance and relocation of informal settlers in the project sites, and advocacy efforts to educate the stakeholders on the project. This indicates that the cities were only relying on the hard infrastructure without fully understanding that soft measures are necessary to make this system work. Further, in the focus group discussion conducted by COA for the audit report, participants relayed that no consultation was done at the *barangay* level concerning the project (Commission on Audit, 2014).

Another evaluation on the CAMANAVA Flood Control Project by Tyree, et. al. (2013) indicated that non-structural measures such as land use planning, urbanization pressures, and policies on informal settlers must be included in properly addressing flood risk. Institutional actor 2 (Interview date 15 March 2019) also shared that master students from Ateneo de Manila University found that apart from the climatic effects and land subsidence present in Malabon, it was also the informal settlers and waste pollution that caused flood problems. Results of these studies motivated the city government to involve the CENRO in their flood mitigation and DRRM programs.

"Our CENRO is also active. Everything is connected and coordinated. Now we also have formed our disaster management unit and we have these thematic areas [on DRRM] prevention, mitigation, response, we have given each area study and proper action. We have also established our communication protocol so we can disseminate information faster to the people." (Institutional actor 2, interview date 15 March 2019)

This means that from the 1970s until around 2015 the focus on hard infrastructures was high on the agenda until the creation of the MDRRMO. As shown in the timeline in Figure 10.1 the creation of the MDRRMO and the presence of the NGOs in Malabon stirred the direction to increase the capacities of the community to build resilience from flood risks and in crisis management. The MDRRMO collaborated with the BFP, PNP, and the City Social Welfare and Development (CSWD) to create communication and coordination guidelines detailing processes to be followed before, after, and during a disaster or emergency. The MDRRMO also has a direct emergency contact number (911) that people are familiar with which has a standard response time of five minutes. In addition to disaster risk management, the CENRO has been active in discussing with the *barangays* the importance of proper waste management and regular river and canal cleanup to reduce the occurrence of floods. Hard infrastructure is, of course, essential to prevent large-scale floods, but the participation of the community in the proper management of waste and river cleanup also contributes to safeguarding the city.

Coordination problems with national agencies

The flood control system is a vital aspect of maintaining the collective security of the people of Malabon against floods. The flood control facilities, including the large CAMANAVA Flood Control Project and the additional pumping stations installed at the request of the city government of Malabon, have provided a degree of flood protection among the stakeholders. Interviewees unanimously shared that they still experience floods, but not as much as before, the floodwaters subside much quicker now. However, the maintenance and operation of flood control facilities have been troublesome.

The dilemma that the *barangays* face is not with the local government, but with the DPWH and the MMDA. The DPWH is the primary government department responsible for the engineering and construction of infrastructure facilities such as national highways and flood control and water resources development in the Philippines (GovPH, 2020; DPWH, 2020b). On 09 July 2002, the flood control functions and responsibilities of the DPWH in Metro Manila were turned over to the MMDA (Aravilla and Sy, 2002; World Bank, 2017a; World Bank, 2017b; MMDA, 2021). The turn over was in part to fulfill the mandated function of the MMDA under Section 3 (d) of Republic Act 7924[25] which is "Flood control and sewerage management which include the formulation and implementation of policies, standards, programs and projects for an integrated flood control, drainage and sewerage system". Reverting to the CAMANAVA Flood Control Project, the MOA states that the DPWH will be responsible for the supervision of the project during construction and maintenance of the infrastructure until the facilities of the project are turned over to MMDA in 2016 (JICA, 2014; Commission on Audit, 2014). Here lies the clogged artery in

[25] Republic Act 7924 An act creating the Metropolitan Manila Development Authority, defining its powers and functions, providing funds therefor and for other purposes.

the coordination, while the flood control functions and responsibilities now fall under the MMDA, the design and construction of pumping stations and dredging of major rivers and waterways including support of drainage improvements still sit with the DPWH (World Bank, 2017a; World Bank, 2017b). Often the *barangays* will seek help directly from the DPWH because the material and equipment are with this agency but the operations and maintenance of the flood control facilities and other services as mandated by law lies with the MMDA. Whether this delineation is clear with the *barangays* was not mentioned during the interview. Moreover, this also demonstrates the lack of coordination and communication of the DPWH and MMDA with the city itself as also found in the Commission on Audit report on the CAMANAVA Flood Control Facility.

During the interview, the citizen stakeholders were asked if someone guards and operates the floodgates. The interviewees confirmed that there is a floodgate operator, however, the floodgate operator is not present 24/7 and only works when the floodgate has to be regulated. This is in contrast to the 24/7 operating service of the floodgates and pumping stations stated in the JICA and COA reports (JICA, 2014; Commission on Audit, 2014). Further, the COA audit report did find the lack of manpower to cover all the floodgates and pumping stations under the CAMANAVA Flood Control project, and no daily operational reports were found during the audit period (Commission on Audit, 2014). To be able to meet the timely operation of the floodgates and pumping stations under the national government projects, it was suggested by the *barangay* to hire someone from the community. These recommendations fell on deaf ears as revealed in the excerpt of the interview transcript (Interview date 22 March 2019) below.

Citizen stakeholder 4: *"We . . . suggested to DPWH that time we had a meeting with the engineering department to get the person from our area because they usually designate someone else. The problem is, for example there is a typhoon, the person will be coming from a place farther than the area [where the station is located]. It will take him time to get there and by the time he reaches [the floodgate] the place is already flooded."*
Citizen stakeholder 3: *"Because it is under the MMDA. The person is an MMDA operator. Even us we asked the MMDA if it is possible to get an operator from our area. They refused."*
Interviewer: *"Why?"*
Citizen stakeholder 3: *"Maybe because they already trained that person."*
Interviewer: *"Can't they train someone from your area?"*
Citizen stakeholder 3: *"I don't know why. It's so difficult."*
Citizen stakeholder 4: *"They always tell us that the person already went through the seminars and training and if we provide a person they will again train these people. We told them you can also train someone from the barangay but nothing happened."*

One can only speculate on the reason behind the refusal of the MMDA to hire a floodgate and pumping station operator from the community. The MMDA is not a government department rather it was created specifically as a special development and administrative

unit whose functions are not limited to flood control but also includes sewerage management, transport and traffic management, solid waste, and other urban-related services in Metro Manila (UNHABITAT, 2015; Republic Act No. 7924). The budget for the MMDA comes from the national government, its internal revenue allotment (IRA), contributions from the 16 cities and 1 town in Metro Manila equivalent to the 5% of their revenue of the preceding year net of IRA, and fines and fees (Manasan and Mercado, 1999: 18). The MMDA has a limited budget to meet all of its mandated functions and responsibilities for all of the 17 LGUs. For Metro Manila's Flood Control Program alone the MMDA has an allocated budget of PhP1.39 billion (€23.78 million[26]) for 2020 this includes operations and maintenance, capital outlay, and personnel services (MMDA, 2020). More than 75% of this budget allocation goes to capital outlay, 19% goes to operations and maintenance, and 4% to personnel services. Having outlined the budget there are 62 pumping stations in Metro Manila operated by MMDA, 28 of these are large pumping stations, 19 are small pumping stations, while the rest of the 15 are relief pumping stations (MMDA, 2019). In Malabon alone, MMDA maintains 18 pumping stations (City of Malabon, 2019) but there is only one large pumping station located in *Barangay* Catmon (see Figure 10.2 MMDA pumping station location map).

According to the Metro Manila Flood Management Project appraisal report by the World Bank in each of the major pumping stations, there is a qualified mechanical engineer and electrical engineer, an average of 15 staff which includes operators and utility staff (World Bank, 2017b). So even if there are several pumping stations in Malabon as shown in Figure 10.2 and outlined in Table 10.2, based on the institutional and operational structure, operators are stationed in the major pumping stations and only inspect or visit the minor pumping stations within the vicinity. Furthermore, the MMDA is tasked to operate and manage these facilities but yet still relies on the DPWH for the design, construction, and equipment. Therefore, aside from the budgetary constraints, there is this operational and institutional setup that puts the MMDA in a web of responsibilities some of which are redundant to the functions of the DPWH.

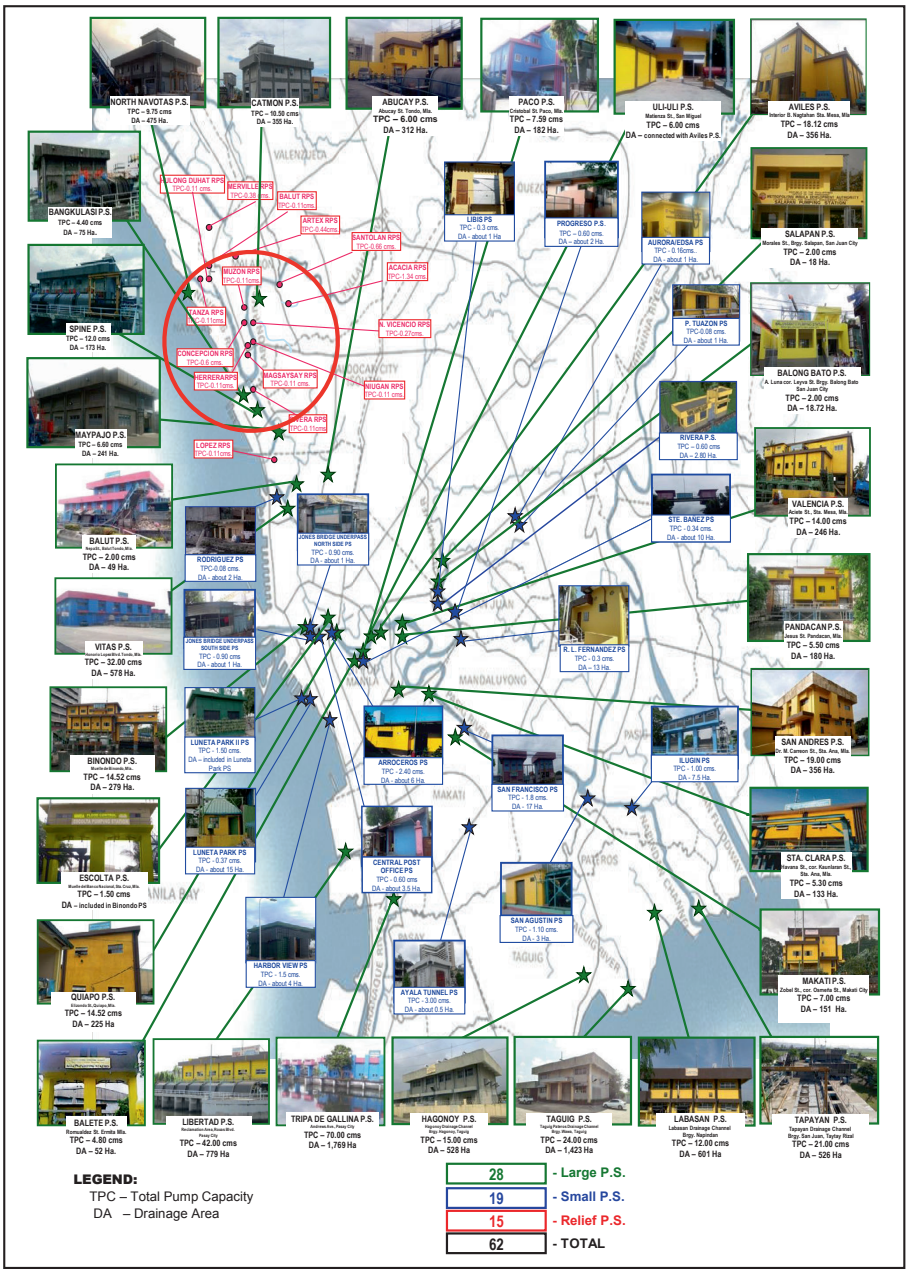
Table 10.2: Operational flood control facilities in Malabon by type and maintaining agency

Type of facility	Maintaining agency				Total
	City of Malabon	DPWH	MMDA	City and Barangay	
Pumping station	17	7	18	1	43
Flood gate	80	14	26	0	120

Source: City of Malabon, 2019

[26] Foreign exchange as of 17 March 2021 is PhP1 = €0.017.

Figure 10.2: Location map of pumping stations in Metro Manila under MMDA



Note: Encircled is the CAMANAVA area, added by the author.
Source: MMDA, 2019

Still, the insistence of the citizen stakeholders to hire a floodgate and pumping station operator from the *barangay* for the facilities under the DPWH and MMDA is valid. Having a trained operator from the community can help meet the immediate needs of the city especially during a crisis.

Self-organizing to fix infrastructure problems

Citizen stakeholders interviewed expressed that the floodgates are frequently broken. When this occurs, it becomes a problem, especially in emergency scenarios. Usually, the *barangays* take it upon themselves to find solutions to repair the floodgates. This is because, based on their experience, the DPWH and the MMDA do not respond automatically to their requests. Citizen stakeholder 3 (Interview date 22 March 2019) related their experience in their *barangay* when one of the pumping stations was damaged.

"The pumps' flooring broke during a typhoon so it was lifted from the ground, water came out from it and flooded the entire area. There was electricity but they cannot turn on the pump because it might get totally damaged. They had to use the mechanical pump. People had to place sand bags on the pumping station just to make sure it will not totally fall apart. The area was immediately flooded and even reached M. Aquino street at Baesa until N. Nicolas." (Citizen stakeholder 3, interview date 22 March 2019)

In such situations, the *barangay* normally communicates with the City Engineering Department and attempts to resolve the issue. Usually, repair requests go to the City Engineering Department, depending on which facility needs the repair the City Engineer either fixes the problem or relays the issue to the DPWH or the MMDA (see Figure 10.2 and Table 10.2 for responsible maintaining agency). Nevertheless, most of the manpower and equipment needed to repair the flood control facilities are still with the DPWH. The *barangay* has no manpower and resources to maintain the flood control facilities located in their area. That is why there are occasions where the *barangay* goes directly to the DPWH, afterward they inform the City Engineering Department that they have forwarded their request for repair of the facilities to the DPWH. However, most of the citizen stakeholders interviewed expressed that coordinating with the DPWH and the MMDA has been challenging because of the unresponsiveness or the delayed action of the agencies. As a result and due to the immediate need to fix the facility, the *barangay* advances the money for the equipment needed for the repair but the *barangay* is typically not reimbursed or takes time to be reimbursed. Citizen stakeholder 3 (Interview date 22 March 2019) recalled the difficulty that their community had to face in order to repair their pumping station.

"Even if we have flood control facilities, our mechanical pump and electrical pump, most of the time does not work. Maybe because it is always running, it breaks down and it is not that easy to get spare parts from DPWH. That's where we have difficulties because the flood control facilities are under MMDA and

DPWH. The barangay is not in the position to maintain it. If we try to shell out money from the barangay funds it is not that easy to have it reimbursed and we have experienced that, our barangay chairman shelled out PhP80,000 to PhP100,000. He was not able to have that reimbursed . . . the parts were changed but we never got anything back from DPWH. They even asked me to bring the equipment which was so heavy and I only had to take the [Metro Rail Transit System] MRT. We were not able to recover the money, there is still around PhP40,000 . . . that needs to be collected from them. That's the difficulty in dealing with the government, I mean it's good that they provide the project but the maintenance they're not that efficient." (Citizen stakeholder 3, interview date 22 March 2019)

This experience adds to the budgetary problems of the *barangay* and perhaps one of the reasons why they perceive that the budget allocation for DRRM is not sufficient. Similar to the city's DRRM budget the *barangay* allocates 5% of its annual revenue to DRRM. For *barangays* that only rely on real property tax, this amount can be quite tight especially if the *barangay* is located in a low-lying area prone to flooding. Additional maintenance costs for the flood control facilities within their *barangay* put a financial burden on them.

Social network

Self-reliance was a characteristic emulated by stakeholders during flood situations. The *barangays* have managed to establish a good set of volunteers who help evacuate people in a disaster situation. Schools and gymnasiums are typically designated evacuation areas for each *barangay*. Residents are well aware of where to go during a crisis. Some barangays do not have much space and do not have an evacuation center, in this case, the neighboring *barangay* shares their designated evacuation center. A noteworthy characteristic of Malabon is that, since the city is heavily populated and has limited evacuation areas, *barangays* have arranged what they call "adopt-a-family" evacuation. Residents whose houses have second or third floors volunteer to 'adopt' their neighbors when the city is flooded.

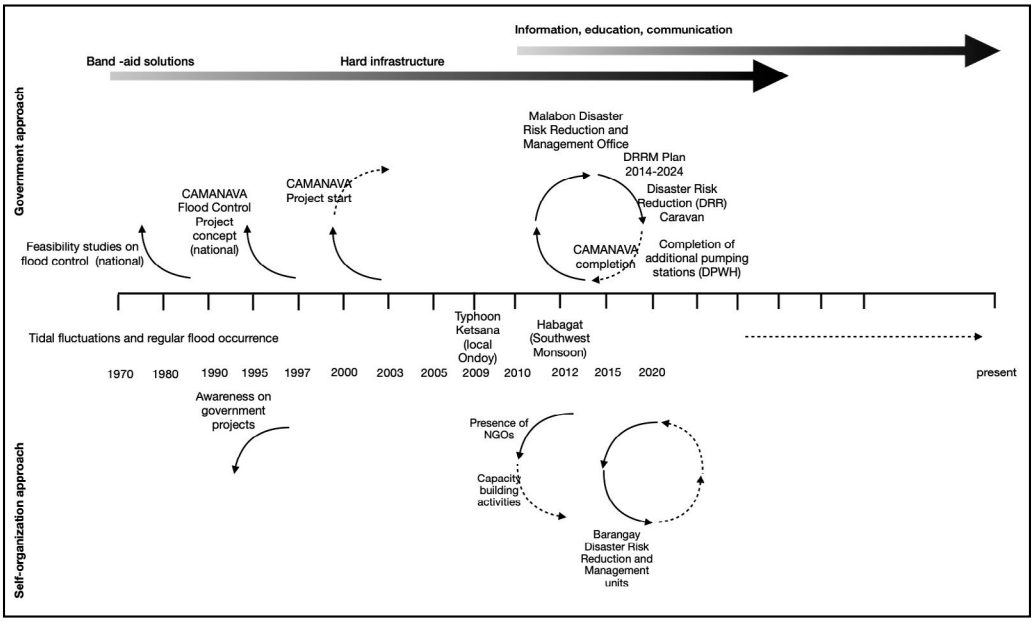
10.3 CHAPTER CONCLUSION

Community resilience has been described as the capacity of a community to bounce back and recover by using its resources (Ainuddin and Routray, 2012; Djalante and Thomalla, 2010). This terminology is often used in post-disaster recovery and disaster risk management. For a long time, Malabon residents have experienced the regular occurrence of floods not just due to tidal fluctuations but also due to typhoons and heavy rainfall. From the 1970s Malabon dealt with floods using band-aid solutions like the 'bombastic' to pump back floodwater into the river system. As shown in Figure 10.3 attempts at mitigating floods in Malabon have focused on installing flood gates and 'bombastic' until the national government initiated the large-scale CAMANAVA Flood Control project. Hard infrastructure is indeed needed in the CAMANAVA area to protect the cities from floods.

While Malabon has had a long history with floods, it was only recently that the city began focusing on its disaster risk management strategies. Institutional actors interviewed agree that their former DRRM approach is more reactive than proactive. This means they wait for the disaster to occur before they do something. The resilience of the stakeholders in Malabon centered on their vulnerability to flooding to the extent that it was part of their lives, so to speak, a 'culture of disaster.'

It took the *Habagat* flood experience of 2012 for the city to pool its resources and step up its work to develop its capacity on DRRM. The city learned lessons from the flood experiences of Typhoon Ketsana in 2009 and *Habagat* in 2012. Malabon wanted to build a proactive citizenry, armed with the knowledge required to cope with flood disasters. As such, the city developed its social networks in collaboration with NGOs to help create capacity and increase awareness. The MDRRMO also strengthened its IEC campaigns to increase disaster risk awareness and capacitate its stakeholders while the city works on the hard infrastructures (see Figure 10.3). The MDRRMO partnered with NGOs like CNDR to help conduct training and workshops on disaster risk management, community risk assessment, flood warning, and evacuation drills. The MDRRMO also regularly holds DRRM training, basic life support and first aid training, earthquake and fire drills, and early warning system IEC campaigns, including the annual DRR caravan.

Figure 10.3: Transition of focus from hard infrastructure to capacity building in the adaptive cycle



Social capital is the bond that ties citizens together (Aldrich, 2012) and plays a role in community resilience. There are two components of social capital, bonding relationships and bridging relationships (Pelling and High, 2005). Bonding relationships often coidentify within a group bound by kinships such as families, friends, and neighbors, while bridging relationships refer to social relationships of exchange (Pelling and High, 2005; Esteban, 2017). Bridging relationships are those that are outside of the groups formed under the bonding relationships. Communities with strong bonding relationships are more likely to help one another to collectively bounce back from a disturbance. Communities that have both strong bonding and bridging relationships are more likely to find longer-term solutions by proactively engaging in community activities. Both bonding and bridging relationships are present in Malabon and have become an important part of their lives that makes them resilient. The residents understand the limitations of the city in terms of providing evacuation centers that *barangays* tapped on alternative strategies. *Barangays* have a system for sharing evacuation centers with nearby *barangays* that do not have or lack evacuation centers. Other residents have drawn on their social networks by establishing an 'adopt-a-family' evacuation strategy in their *barangays*.

But as much as the stakeholders are prepared for the flooding, there are still areas that need to be strengthened in the city. Preventive infrastructures, such as flood control systems, are essential to keeping stakeholders safe from floods. Coordination with the DPWH and the MMDA to manage and run these services has been less than optimal. Due to their experience in coordinating with the DPWH and the MMDA, the *barangay* undertakes the duty of monitoring and reporting on these facilities if they are not functioning. A duty that is not, in truth, their responsibility, but since they would be adversely affected if these flood control facilities are made inoperative, they have to take that measure. This exemplifies that Malabon is trying to emerge from the 'culture of disaster' perspective to a 'culture of resilience,' but collaboration and cooperation with national agencies are required to fully achieve this.

CHAPTER ELEVEN

CHAPTER ELEVEN: EMPIRICAL CONCLUSIONS: CROSS CASE ANALYSIS OF THE FOUR CITY CASES

11.0 INTRODUCTION

The previous case chapters formed narratives on the process of collective engagement and urban resilience of the four city cases, Rotterdam, Dordrecht, Marikina, and Malabon. Collective engagement in this research is a collaborative process participated in by multiple stakeholders across sectors and networks who work on a common agenda to build urban resilience. While participation is often an initiative taken by the government to become inclusionary and self-organization is an initiative taken by civil society independent of government policies or participatory planning procedures (Boonstra and Boelens, 2011), collective engagement can either be formal or informal means of collaboration towards a common agenda and achieve mutually beneficial outcomes. It means that both state or non-state actors are aware, informed, understand, and work, mutually adapting to their roles in building urban resilience. Three levels of assessment were done for each of the four empirical case chapters: (1) understanding the city's disaster experience; (2) the government approach in addressing flood risk management including the policies which served as the backbone on how the city worked on the preventive as well as adaptive measures; and (3) the role of the stakeholders' participation, awareness and self-organization in reaching the level of collective engagement. Based on these assessments different narratives were formed for each case.

The Rotterdam case highlighted the engineering and economic resilience of the city to forge ahead on building urban resilience through strengthening the economy, implementing climate-adaptive infrastructures, and showcasing the technological know-how to plan, mitigate and adapt to possible disturbances. The Dordrecht case is an example of engineering, environmental, institutional, and social resilience highlighting that memory-based disaster experience can have a profound effect in building urban resilience if this is honed as a collective memory. The Marikina case showcases institutional, social, and community resilience as factors in building their collective engagement and urban resilience which began with a spark from a leader. Lastly, the Malabon case talks heavily about social and community resilience since the city has been left to fend for itself to experience regular flood occurrence.

This chapter attempts to put all of the learnings from the four cases into context to build abstractions from each case and create case comparisons within the same country, and across cases. The analysis will be guided by the main research question:

How does collective engagement contribute to building urban resilience in disaster-prone cities in the Netherlands and Philippines?

And sub-research questions:

1. What are the drivers of resilience and how do these drivers build urban resilience?

2. What is the role of collective engagement in the process of building urban resilience and how does the process of collective engagement unfold from the government approach and self-organization approach?

3. What role do the drivers of resilience play in collective engagement and how does it relate to the type of urban resilience experienced?

4. What are the areas of convergence and divergence in the process of collective engagement and urban resilience between the Netherlands and the Philippine cases?

The cross-case comparison of the city cases within country in this chapter will begin with adaptive cycles to draw out the differences and similarities of the city cases that will feed into the discussion on collective engagement and urban resilience. The chapter ends with the concluding summary.

11.1 THE ADAPTIVE CYCLES OF THE FOUR CASES

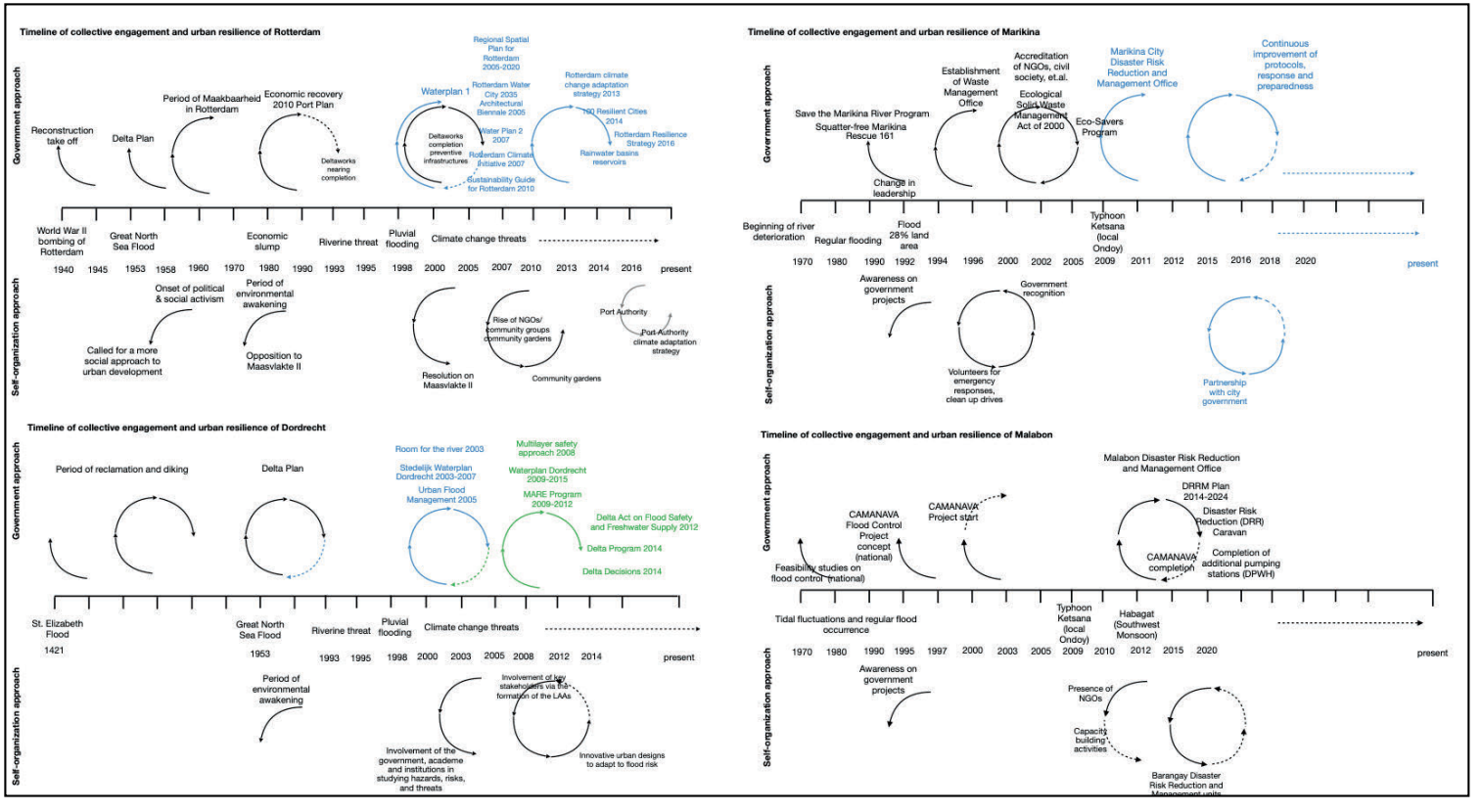
Adaptive cycles refer to the socio-ecological systems process of resilience. Gunderson and Holling (2002) used this concept in the panarchy framework specifying ecosystems as dynamic systems that go through adaptive cycles. What is remarkable in adaptive cycles is the inherent irony in describing them as a process of stability and change. Gunderson and Holling (2002) could not have described the process better than adaptive cycles "embraces the opposites of growth and stability on the one hand, change and variety on the other" (p. 47). It shows that complex systems such as cities go through multiple adaptive cycles triggered by disturbances like disasters caused by natural hazards or historical events such as political change. Similar to the four phases in disaster risk management (DRM) which comprises preparation, response, recovery, prevention/mitigation, adaptive cycles also go through four phases, exploitation, conservation, release, and reorganization. However, unlike the cyclical DRM process, adaptive cycles follow a lemniscate pattern or the infinity symbol (∞) which also symbolizes the continuous process of adaptation. In the conceptual framework of the research, collective engagement urban resilience framework (see Chapter 3), there are two approaches to urban resilience, the government approach and the self-organization approach, but both go through this adaptive cycle. In the framework, the adaptive cycle of the four case cities goes through four collective dimensions to adapt to a disturbance, concern, action, efficacy, and security, and the approaches to urban resilience may or may not be in the same timescale.

The ability of cities to reach a level of growth and stability until the next disturbance depends on their adaptive capacities. This suggests that cities, having undergone disturbances such as flood events, initially use their existing adaptive capacities, in this research the five drivers of resilience, to deal with the disturbance. This can be in the form of institutional capital (policies), human capital (memory-based disaster experience), social capital (social networks), economic capital (gross domestic product), and environmental capital (built (climate-adaptive structure or preventive infrastructures) and natural environments). But in adaptive cycles dealing with a disturbance is one thing, learning from the experience is another because learning builds on that adaptive capacity which produces a resilient urban environment. As such cities that experience a disturbance (flood disaster) may use a combination of these adaptive capacities to address the disturbance but draw on these experiential learnings to improve their adaptive capacities to respond to potential future disturbances.

Using this framework, the process of collective engagement and urban resilience in the four cases was narrated in the previous four chapters. To do this, the timeline for each of the cities was first established from the most significant flood disaster experience recalled by the interviewees. The adaptive cycles of the government approach and self-organization approach were mapped in a timeline indicating trigger points of concern (disturbance) that demonstrates that the adaptive cycles of the two approaches may or may not be in the same timescale but have an effect on the succeeding patterns of adaptation. Figure 11.1 shows that the four city case paths to urban resilience differ in the number of adaptive cycles and the years it took before arriving at the current level of collective engagement and urban resilience.

The Rotterdam case indicates two adaptive cycles, the first adaptive cycle was caused by two disruptions, the Rotterdam Blitz in 1940 and the Great North Sea flood in 1953, and the second adaptive cycle was based on the near floods in 1993 and 1995 and the floods in 1998. The first adaptive cycle concentrated on the rehabilitation and reconstruction of the city of Rotterdam, while the national government tackled the flood prevention measures and adopted the Deltaplan. The first adaptive cycle lasted 55 years, when the Deltaworks system was nearing completion, the near flood events in the 1990s contributed to the second adaptive cycle in the 2000s. In the second adaptive cycle, the City of Rotterdam recognized the need to improve the city's water retention capacity. Water retention policies were first introduced in the early 2000s which later developed into more climate-adaptation policies. Around the same time, the self-organization approach has stepped forward with the advent of NGOs, neighborhood associations, and community gardens. For Rotterdam, the main drivers of resilience were the economic, institutional, and environmental capitals, with the Port of Rotterdam as the leverage to boost the city's economy.

Figure 11.1: Adaptive cycles of the four cases - Rotterdam, Dordrecht, Marikina and Malabon



The Dordrecht case has a longer timeline (see Figure 11.1) and has four adaptive cycles beginning with the St. Elizabeth flood of 1421. The first cycle was based around the centuries-old diking and reclaiming of the land that formed the Dordrecht landscape. The second cycle began after the Great North Sea flood and the construction of the Deltaworks system. The drivers in the first and second cycles were the environmental capital and the institutional capital that contributed to the physical make-up and preventive infrastructure that protected the city. In the early 2000s, flood risk management changed from hard engineering to climate-adaptive measures. Dordrecht's third adaptive cycle was short due to the city's proactive response to policies, the national program (i.e. the Room for the River), and studies (i.e. urban flood management) that encouraged civil society participation in the self-organization approach. In the fourth adaptive cycle, Dordrecht's drivers of resilience (see Table 11.1) have created an environment of learning, innovation, and collaboration that is all-important in building resilience and establishing Dordrecht's vision of the *zelfredzaam* island.

In the case of Marikina, there were two adaptive cycles, the first cycle began in 1992 when the city experienced a large-scale flood due to severe weather, and there was a change in leadership that resulted in improvements in the city. The first adaptive cycle was driven by a deep desire for institutional, social, and environmental change in the city. The improvements brought by the new leadership motivated the people to volunteer to support the city with their projects. The second adaptive cycle preceded Typhoon Ketsana in 2009 and the passage of the Philippine Disaster Risk Reduction and Management Act 2010 (RA 10121). This contributed to the institutionalization of disaster risk management at all levels in Marikina, from the city down to the community. Marikina's key drivers of resilience are its human, social and institutional capital, making it one of the most organized and efficient cities in the Philippines when it comes to DRM (see Table 11.1).

The fourth case city, Malabon, has a longer timeline than Marikina, but currently has only one adaptive cycle. In the past, Malabon has witnessed recurrent flooding and in several instances low-level floods regularly due to high tides. The city has its local adaptation measures, but it was in the 1980s that the national government acted to resolve the flooding in the CAMANAVA district of Metro Manila. Delays in the implementation of flood control facilities also meant that flood issues have not been completely resolved. The passage of RA 10121 required the City of Malabon to set up its Malabon Disaster Risk Reduction and Management Office (MDRRMO), but it was the flood that the city witnessed in 2012 as a result of *Habagat* (southwest monsoon) that Malabon took DRRM as a priority. Malabon's high social capital remains its primary driver of resilience, a characteristic that residents have nurtured for decades.

The next sub-sections will discuss in more detail the drivers of resilience for each of the case cities within the timeline shown in their respective adaptive cycles. Since the disaster history and policies at the national level are the same for the city cases in each country, the

analysis will first compare the two cases in each of the countries to identify the variations in the translation of the national level policies and the gravity of the effects of the disaster experienced in each of the cities. The cross-comparison for all the cases will be in the next section of this chapter. The summary of each case cities drivers of resilience is shown in Table 11.1.

11.1.1 Drivers of resilience Dutch cases

The history of the Netherlands is closely related to water and water management. Both Rotterdam and Dordrecht are surrounded by multiple compartments of dikes that have been built for centuries. While the past of the Netherlands and its association with water is widely recognized by the resident population, this historical memory is even more common in Dordrecht due to the geological landscape of the island city, which has become its constant reminder. This historical memory and physical reminder in Dordrecht refreshes the memory of the residents.

Looking closely at the adaptive cycles of Rotterdam and Dordrecht from the beginning of each timeline to the riverine threats in 1993 and 1995, the focus on flood risk management is strongly preventive. But what is interesting to take note of is that in Rotterdam the two take-off points in its first adaptive cycle were motivated by first, a call to action to "roll up your sleeves, a major work lies before us", and second, the national government's mantra for a flood disaster "never to happen again" that juxtaposes memory and resilience. This historical memory as the driver of Rotterdam's resilience remains on the back burner rather than as a lived and continuous collective memory. The reason for this is throughout Rotterdam's first adaptive cycle there was a dire need to strengthen the economy focusing on the Port of Rotterdam. The city capitalized on the port to draw businesses, investments, and labor, and while the initial call to action 'roll up your sleeves' appealed and related to the residents of Rotterdam this was overtaken by the unequivocal and dogged determination to put the port back in the economic map. Flood risk and experience only happen in a small area in Rotterdam, the Noordereiland, but the rest of the population do not experience such an event. This puts the idea of flood far from the minds of the population and only considers floods as a 'nuisance'.

On the other hand, Dordrecht's historical memory of the flood disasters that transpired centuries ago is ever-present in the physical make-up of the city. Further, there is a close relationship between the City Government of Dordrecht and the Hollandsche-Delta *waterschap* built over centuries working on the maintenance of the dike system in the city. While the city benefits from the Deltaworks system it is necessary to maintain the dikes which are Dordrecht's main flood defense. The presence of the dike army is felt in Dordrecht and this has lasted throughout history.

Table 11.1: The four case cities drivers of resilience

Case	Human Capital	Social Capital	Institutional Capital	Economic Capital	Environmental Capital	Rating
Rotterdam	(high) The Great North Sea Flood is generally recognized as a historical event that led to the construction of the Deltaworks. But the general risk awareness of the people is relatively low and confined mostly in areas that are frequently flooded such as the Noordereiland. Only the Port has a crisis plan.	(medium) There are organizations at the community and city level that are engaged in city development activities. Community organizations and non-government organizations have the chance to interact in city level initiatives such as the Water Sensitive Rotterdam. However, there is a social and economic gap in the very diverse population of Rotterdam.	(high) Rotterdam's policies on flood risk management and climate change are linked with the national government policies. Translation to the community level through activities are present in terms of infrastructure but vaguely understood at the level of the community.	(high) The contribution of the Port to the Netherlands GDP is at 6.2% which is a significant amount considering the diverse industries the country has (Kuipers, et al., 2018; Port of Rotterdam, 2018). Rotterdam is considered as the economic engine of Zuid Holland. Aside from the port, the city hosts numerous, international companies, financial institutions, industries, HORECA (hotels, restaurants and catering), among others. (European Commission, 2020)	(high) The Deltaworks system have since protected the country from impending flood danger. The city is also home to smart innovative climate adaptive structures. The total built up and semi-built up area in Rotterdam is 6,335 hectares or 63.35 km2. This is 19.54% of Rotterdam's total land area of 324.16 km2. It's population density is 1,923 persons per square kilometer.*	High
Dordrecht	(high) There is a level of risk awareness among the people in Dordrecht. Preparation is more prominent in the unembanked areas.	(high) There are close links between the city of Dordrecht and the Hollandsche-Delta waterschap. The Red Cross and the veiligsheidsregio are also closely coordinated on the level of crisis management.	(high) Dordrecht's policies on flood risk management and climate change are linked with the national government policies.	(medium) Dordrecht's port is part of the Port of Rotterdam. While the Dordrecht part of the port is assumed to not be yielding the same amount of per capita income as the main port in Rotterdam it is assumed that it contributes to the Dordrecht's economy either directly or indirectly through employment.	(high) The Deltaworks system have since protected the country from impending flood danger. The city just like other cities are surrounded by dikes. Climate adaptive structures are present in the city. The total built up and semi-built up area in Dordrecht is 15.15 km2. This is 15.23% of Dordrechts's total land area of 99.47 km2. It's population density is 1,195 persons per square kilometer.*	High
Marikina	(high) The level of risk awareness and concern of the people is high. Preparation both at the community and city levels is high primarily due to the city government efforts risk awareness programs and projects.	(high) Marikina has a close tie up with the community, national government agencies and non-government organizations. the city is also in close collaboration with the Project Noah of the University of the Philippines.	(high) Marikina was the first to came up with an emergency service Rescue 161 in the Philippines. They pioneered a crisis management system before the national policy RA 10121. Led by a strongman in 1992 to fix the flood problem of the city through Marikina River rehabilitation.	(medium) Marikina is a highly urbanized city. While Marikina is considered a dormitory city there are number of industries and commercial establishments that contribute to the economy of the city.	(medium) There are no large scale flood preventive structures in Marikina rather the Marikina river has been widened and embankments strengthened. The river is also dredged regularly. The total built area in Marikina is 16.57 km2 or 77% of the city's land area. Its population density is at 20,945 inhabitants per square kilometer.**	High
Malabon	(medium) The level of risk awareness and concern of the people is high. Flood is considered as part of the culture in Malabon.	(high) Malabon works closely with the community, national government agencies particularly the Department of Public Works and Highways and Metro Manila Development Authority. There are also non-government organizations that work with the city and the community.	(high) When RA 10121 was enacted Malabon created the disaster risk reduction and management office. This was followed by the community based barangay disaster risk management units.	(medium) Malabon is a highly urbanized city. It is home to a variety of industries most prominent are the fish processing factories and plastic manufacturing.	(low) The CAMANAVA flood control system is located in the city. It has several flood pumping stations. Malabon has a land area of 15.71 square kilometers and a population of 365,525. Its population density is at 23,267 inhabitants per square kilometer. The total built area in Marikina is 13.02 km2 or 83% of the city's land area.**	Medium

Notes:

*Data taken from www.cbs.nl

**Data taken from www.psa.gov.ph

Recognizing these historical memories of disasters experienced in Rotterdam and Dordrecht is just the tip in understanding the adaptive process that transpired in the cities' developments and their drivers of resilience. National-level policies such as the Deltaplan and Delta Act on water management form the basis of strategies and policies implemented by regional and local governments in the Netherlands. Translation of these policies at the city level depends on the vulnerability of cities to floods, as well as on their experience of floods, history, and geological make-up. Water retention in Rotterdam was a priority in the 2000s due to pluvial floods that happened in 1998, while flood risk management in Dordrecht was and still is important due to the increased risk to both sea and river level rise. Still, Rotterdam and Dordrecht's drivers of resilience differ in the focus areas of each of the city's priorities.

Table 11.1 shows the salient points on the drivers of resilience for Rotterdam and Dordrecht using the scoring method discussed in Chapter 4. Rotterdam's economic capital has been the red thread that passed through its adaptive cycles and a strong driver of its resilience. The City of Rotterdam is considered as the 'economic engine' of South Holland (European Commission, 2020) and the Port of Rotterdam has consistently been in the center of this economic engine. In 1962 after the completion of the Europoort the Port of Rotterdam became the largest port in the world up until 2004 when it was overtaken by Singapore in 2005 then Shanghai in 2011 (Leach, 2011). This means that for more than 4 decades the Port of Rotterdam was the world's largest and busiest port and occupying a good number of percentage contributions to the Dutch economy. In a study commissioned by the Port Authority conducted by Erasmus University Rotterdam, the Port of Rotterdam increased its added value share of the Netherlands from 5.0% to 6.2% and contributed growth from €25.2 to €45.6 billion in the period of 2002 to 2017 (Kuipers, et al., 2018; Port of Rotterdam, 2019; Port of Rotterdam, 2018). In the same period, employment provided by the Port of Rotterdam grew from 293 to 385 thousand persons and contributed a growing share of employment to the Netherlands from 3.4% to 4.2% (Kuipers, et al., 2018; Port of Rotterdam, 2019).

On the other hand, human, social, and institutional capitals, rather than economic capital, are the strongest suits in Dordrecht. As described earlier, the geological landscape of Dordrecht reminds residents of their close history and association with water. The historic city center is home to many historical structures, and the Voorstraat, the main street in the center, also doubles as a dike. These heritage buildings, infrastructure, and landscape put a cultural reference that contextualizes the effect of the historic St. Elizabeth flood of 1421 on Dordrecht. In addition, the regular flood occurrence in the unembanked areas in particular the historic city center reinforces the flood memory and experience of the residents.

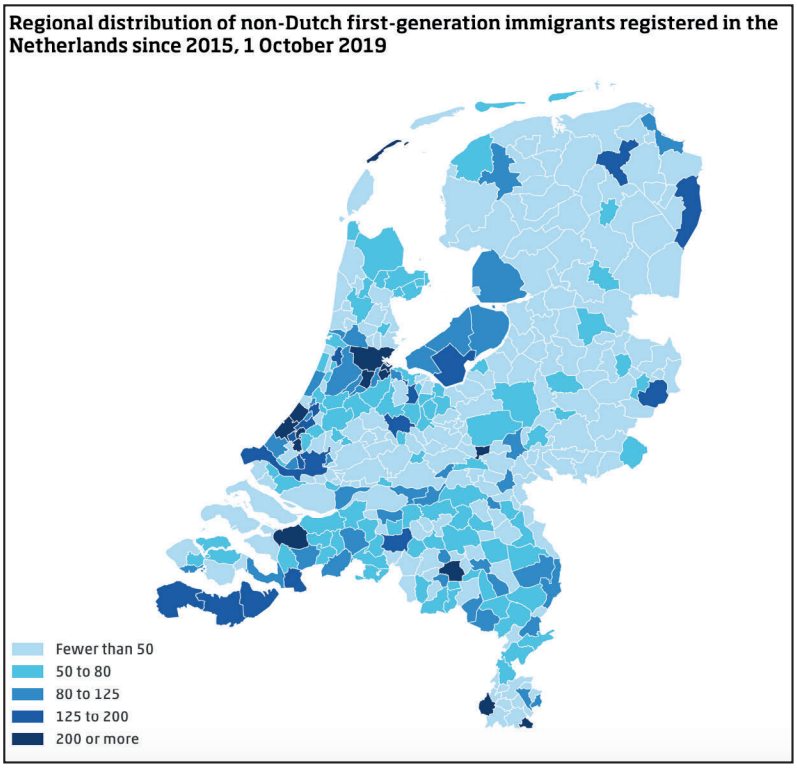
The connection that people in Dordrecht have with water can be seen in the way the stakeholders work together. There is a broad social network that goes beyond the

neighborhood associations and extends to the city government, *waterschap*, *veiligsheidsregio*, academic institutions, and non-governmental organizations. In part, this could have been influenced by the centuries-old institution, the *waterschap*, and the dike army that is much more visible in Dordrecht compared to Rotterdam. There is also a large agricultural and nature reserve area in Dordrecht managed by local farmers and residents. In history, the maintenance of the dikes fell on the shoulders of farmers, but in the 1500s agriculture became commercialized that farmers chose to maximize their income by focusing on tilling the soil rather than maintaining the dikes (Kaijser, 2002). To concentrate on agricultural activities and crop production, the farmers paid taxes to the *waterschap* to transfer this responsibility for the maintenance of the dikes. The *waterschap*, on the other hand, used taxes to hire labor that would soon be known as the dike army to work with engineers to maintain the dike (Kaijser, 2002). This kind of connection with water and nature and relationship with the community and authorities within Dordrecht has been ingrained in the culture and system. This kinship can also be observed in the activities, programs, and projects implemented in the city together with the residents.

Aside from the landscape of Dordrecht and the institutions that are present that pulls together the memories and experience on flood risks and management. The population composition of Dordrecht is not as diverse as Rotterdam. Data from the Dutch Central Bureau of Statistics (CBS) indicate that the concentration of non-Dutch immigrants in Rotterdam is twice as much as the average number in the Netherlands (see Figure 11.2). Immigration to larger cities like Rotterdam has always been the trend because of the perceived opportunities in these larger cities. Because of the seafaring and trade history in Rotterdam that persists until today, the city has been a melting pot of people coming from all over the world. In 2018, CBS reported Rotterdam to have the "largest percentage of residents with a non-Western background" at 38% in the Netherlands (Central Bureau of Statistics, 2019). Having this diversity in the population mix may affect remembering and remembrance of historical flood experiences that are not or have not been part of the previous generation's lived experience.

The diverse population of Rotterdam does not come as a surprise since in history unskilled laborers from overseas were recruited as 'guest workers' in the 1960s to work in the harbor. However, the assumption that 'guest workers' would leave the country soon after the period of their service was a little naive, which may have been the reason that it was only in the 1980s that an Ethnic Minorities Policy was introduced, followed by an Integration Policy in the 1990s. But in Rotterdam where a lot of the immigrants reside integration still comes as a challenge especially with the increasing social and economic gap. Rotterdam's concentration on strengthening its economic capital sidelined the human and social aspects of the city. For one thing, the urban gentrification process that has been going on since the 1990s, aimed at attracting the higher educated, wealthier, 'creative class' to live in the city, has led to higher rental prices forcing current low-income residents

Figure 11.2: Concentration of non-Dutch immigrants in Rotterdam and Dordrecht



Source: https://www.cbs.nl/en-gb/news/2019/44/population-growth-already-at-the-same-level-as-2018

out of the city (Stouten, 2017; Hochstenbach and Musterd, 2018; Uitermark, et al., 2007; Doucet, et al, 2011). The move to gentrify was also seen by policymakers as a way to bring the social gap closer by providing a mixed social space, however, this was not the case as people who have been displaced because of the increased rental prices may resent this, and old and new residents are also wary to jointly participate in neighborhood activities (Stouten, 2017; Uitermark, et al., 2007). The introduction of the 'creative class' and the middle class in gentrified neighborhoods, therefore, do nothing for social cohesion, since the bottomline of constructing these spaces is to maximize the wealth of the city. The dogged outlook of Rotterdam for maintaining and growing its economy can be seen in its urban fabric. The city has been rebranded many times much like a product to increase its competitiveness and attract investors. In the process of this business marketing strategy and rebranding, the essence of the people, the 'us' in the 'roll up your sleeves, a major work lies before us' was lost in Rotterdam.

Lastly, the environmental capital of both cities is rated medium (see Table 11.1). It is important to note that the basis of the rating is not exhaustive to assess the entire environmental capacity (both natural and built environments) in the cities. However, it is an indication of the city's environmental capacity to adapt to flood risk. The preventive infrastructure constructed under the Deltaworks has been a significant driver in maintaining a level of security for the entire country. Thus, even with the limited open space that can be used as an evacuation area in the event of a large-scale flood the likelihood of a disaster from happening is low because of the preventive infrastructure.

Both Dutch cases are rated high in terms of overall drivers of resilience, suggesting that both cities have high adaptive capacities. In Rotterdam, however, economic capital is a dominant driver of resilience, along with the policies and strategies implemented by the government on urban regeneration, gentrification, and marketing. Although there are policies on climate change adaptation, multi-layer safety (MLS) approach, and increasing water retention capacity, these are still within the main goal to increase Rotterdam's competitiveness to make it attractive for investors and highly educated and affluent inhabitants. Because of the emphasis on the economy, Rotterdam can be seen as economically resilient, but the human and social facets such as social cohesion, inclusiveness, and integration, which are essential factors for collective engagement and urban resilience, remain on the sidelines. Dordrecht, on the other hand, was able to close the divide between the government and the stakeholders by leveraging its institutional, human, and social capitals to the benefit of the city. The institutional and social capitals of Dordrecht have been nurtured throughout history, the existence of the dike army has been in place for centuries and is especially evident in the small island. Social and institutional networks within the city, which extend to several academic and research organizations beyond Dordrecht and also outside the Netherlands, lead to the knowledge and awareness of policies and strategic plans, which are important for building collective engagement and urban resilience. Section 11.2 provides a discussion on the collective engagement and urban resilience of the Dutch cases.

11.1.2 Drivers of resilience Philippine cases

Located in the Pacific Ring of Fire and Pacific Typhoon Belt, the Philippines is prone to earthquakes, tsunamis, volcanic eruptions, typhoons, and tropical cyclones (Padagdag, 2018). As early as 1978, the national government adopted a policy on disaster risk management, Presidential Decree 1566 (Strengthening the Philippine Disaster Control, Capability and Establishing the National Program on Community Disaster Preparedness). The policy established the National Disaster Coordinating Council and focused its functions on emergency response. However, the years and frequent occurrence of natural hazards proved that the top-down nature of disaster management was ineffective. It was because the frequent occurrence of these natural hazards demanded support at the local

level to prepare and respond to the crisis. In 2010, RA 10121 (Philippine Disaster Risk Reduction and Management Act) was enacted to grant cities the authority and support to handle their own disaster risk reduction and management operations. The enactment of RA 10121 stirred the direction of disaster risk management in the Philippines from top-down planning to bottom-up planning. The law mandated local governments to set up their DRRMOs and *barangay* disaster risk reduction management (BDRRM) units. While this law specifies the organizational structure including the budgetary requirements in running the local DRRMOs and BDRRM units, the activities, programs, and projects are city-specific. This means that the local government units are free to tailor their programs based on the priorities identified by the city and the community.

Unlike the Dutch cases where it can be seen in Figure 11.1 that climate change adaptation measures in the government approach started at the same time in the 2000s, the Philippine cases differed in the timeframe and trend of the government approach when disaster risk management was considered. This is because at the beginning of the 1990s (first adaptive cycle of Marikina) Marikina took the initiative to create their own disaster risk management system, Rescue 161, well before the 2010 mandate, making the city the first and only local government unit in the Philippines at that time to have one (Dangcalan, et al., 2019). Institutional capital, through policies and strong leadership, was the initial driver of Marikina in building the city's urban resilience. At the onset, the City Government of Marikina made their intentions to reform and transform Marikina into a progressive city known to the residents. The programs and projects, especially the 'Save the Marikina River' turned the once filthy Marikina River into a clean waterway and transformed the riverbanks into a public park. The changes that happened in the city also encouraged the residents to volunteer in the river clean-up, environmental conservation efforts, street clean up and the like. The city invested in boosting the human and social capitals of the stakeholders through training and seminars. By the second cycle, both the government approach and self-organization approach were on the same page on the urban resilience direction the city is working at. When RA 10121 took effect in 2010, Marikina only had to adopt the law to transform Rescue 161 into the Marikina City Disaster Risk Reduction and Management Office (MCDRRMO).

Taking a closer look at the adaptive cycle of Malabon as shown in Figure 11.1, since the 1970s flood mitigation measures were developed and constructed throughout the period until the completion of the CAMANAVA in 2012. This indicates that attempts have been made in trying to mitigate the flood risk in Metro Manila but it took several decades before these projects were completed. It should also be noted that from 1972 to 1981 the Philippines was under martial law. The declaration of martial law on 21 September 1972 came after Typhoon Rita (Philippine local name Gloring) which left Metro Manila and Central Luzon devastated (Pante, 2016; Warren, 2013) with over 600 dead, 370,547 homeless, and 250,000 hectares agricultural damaged (Bankoff, 2003: 74). But martial law

was not declared to address the flood emergency, it was due to the alleged mounting insurgency in the rural areas (Pante, 2016; Warren, 2013). This period in Philippine history brought the country to its knees in debt and was clouded with political unrest further aggravated by series of flood disasters. Consequently, while there were projects lined up on flood control other underlying factors such as the unstable political climate, incessant borrowing from the World Bank and other funding agencies, and delayed implementation of the flood control projects stretched the problem of flooding for decades. In Malabon, the martial law period saw the construction of the Dagat-dagatan Reclamation Project for low-cost housing, a project under another loan from the World Bank. This reclamation project was unfinished and further contributed to Malabon's flooding problem.

Although the City of Malabon created its Malabon Disaster Risk Reduction and Management Office (MDRRMO) in 2012 in response to the mandate, RA 10121, from the national government, the city leveraged on its historical flood experience which shaped the collective memory and culture in the city. Malabon residents have lived with the tidal fluctuations for centuries being a large fishing village in history. As such the regularity of flood occurrence in Malabon has been normalized for decades. The self-organization approach in Malabon became more prominent after the creation of the MDRRMO and subsequently, the BDRRM units. However, how the individual households and communities used their human and social capitals to manage the frequent flood incidences in their city prior should also be acknowledged as a driver of resilience. On the other hand, Marikina's self-organization approach started well into the mid-1990s (first adaptive cycle) when residents realized that the strongman BF has indeed made a difference in their city. As such, the City Government of Marikina struck a relationship with their stakeholders that eventually became a partnership as early as 2000 until the second adaptive cycle.

Both Marikina and Malabon have strong social capital as drivers of resilience as shown in Table 11.1. Marikina draws its social capital from the relationship established by the city government and the residents on maintaining the city's standing as one of the 'healthiest and most livable cities' in Asia-Pacific (ADB, 2009). Marikina's success in converting the city from a sleepy town to one of the most admired and well-organized has also made the city attractive to numerous private companies and academic institutions to collaborate with. The University of the Philippines partnered with Marikina on Project NOAH which is a disaster prevention and mitigation program primarily to identify natural hazards and build scenarios that are visually mapped out throughout the country (GovPH, n.d.; Department of Science and Technology, 2015). Rainfall gauges were placed in the Marikina watershed forest which would draw out data on how much rain to expect and possible flood it will bring to the valley.

Malabon's social capital, on the other hand, draws from the city's partnership with non-government organizations (NGOs) which helped the MDRRMO in their various activities.

The city government also was firm in pressing the Department of Public Works and Highways (DPWH) to construct additional flood gates and pumping stations in the city on top of the ones planned under the CAMANAVA flood control project. Moreover, the ingenuity of the residents of Malabon in dealing with floods on their own and at times directly coordinating with the DPWH, a national agency, to request help in the maintenance of the flood gates shows tenacity.

The human and social capitals in Marikina is high owing to the strong institutional capital it possessed years before the implementation RA 10121. Unlike Malabon, Marikina avoided 'normalizing' flood as a way of life and the entry of BF as a visionary leader with a strong grip on rehabilitating the river marked a turnaround in the lives of the residents. The changes implemented in the city that brought cleanliness, minimized floods, beautified the surroundings transformed the initial resistance of the residents to awareness and proactiveness. These three capitals work to Marikina's advantage in strengthening their city's urban resilience.

Economic capital for both cities is medium which means that both get by with their own funds in meeting their disaster management needs. However, the vulnerability of both cities to disaster is high, both cities have a density of over 20,000 people per square kilometer which puts the residential population in a precarious position in the event of a large-scale disaster. The predicted 7.0 magnitude earthquake called "The Big One" is a major concern in Marikina where the Marikina West Valley Fault is located. In Malabon, the threat of a tsunami is big should "The Big One" actually happen. But in terms of floods, both Philippine case cities have the capacity based on their drivers of resilience, although Marikina has a higher rating than Malabon. Marikina's drivers of resilience are rated high mainly because of their strong institutional, human, and social capitals built on the strong leadership and reforms that happened throughout the first adaptive cycle in Marikina. Knowledge, awareness, collaboration, and mutual adaptation of roles are key elements that feed into the collective engagement and urban resilience of Marikina. Malabon, on the other hand, may have the preventive infrastructure in place but still needs a stronger institutional set-up with the DPWH and the Metro Manila Development Authority (MMDA) in the maintenance and operations of the flood control facilities. Malabon's strengths lie in the residents who have proven their ability to adapt to the regular flood situation they find themselves in. The strong social capital within the community makes Malabon, community and socially resilient. The next section will discuss the collective engagement and urban resilience of the Philippines cases.

11.2 COLLECTIVE ENGAGEMENT AND URBAN RESILIENCE

In Chapter 3, collective engagement is defined as a formal or informal collaborative process involving multiple stakeholders to improve urban resilience. It is not only a one-off partnership but a long-term collaboration based on reciprocity, trust, and mutual respect between state and non-state stakeholders. In this section, the Dutch and Philippine cases will be discussed using the three main elements described in Chapter 3, strong information and education on disaster management, strong social networks that are tied to the city, and the government and stakeholders both understand and work on creating a cohesive community. These three will be used as a guide to understand how collective engagement contribute to urban resilience. The discussion will begin with the perception of risk and resilience in each of the case cities to gain insight into how vulnerability and resilience are perceived by stakeholders. How risks are perceived determines people's behavior and action. Knowing how cities view risks helps to recognize the steps they have taken in collective engagement and urban resilience. This will be followed by the influence of information and education on collective engagement, and social networks on collective engagement and urban resilience. Lastly, it will address the mutual understanding and adaptation of roles in resilience building. Table 11.2 shows the summary of the collective engagement and urban resilience for each of the case cities.

Table 11.2: The four case cities collective engagement and urban resilience

Case	Perception of risk and resilience	Influence of information and education on collective engagement and urban resilience	Influence of social networks on collective engagement and urban resilience	Mutual adaptation of roles in disaster risk management	Rating
Rotterdam	(medium) Social related threats are higher than possible flood. Varied interpretations of resilience.	(medium) Information and education on the historical flood disaster is present. Local knowledge and adaptation measures limited in areas frequently flooded such as the Noordereiland.	(medium) Social networks on DRRM is not present. There are community organizations and non-government organizations but not on DRRM.	(medium) Non-government organizations working with the community are recognized by the local government. Only the Red Cross has a set of volunteers that can be tapped during a crisis (Ready to Help).	Medium
Dordrecht	(high) Risk of floods higher in historic city center than the rest of the city. Perceive resilience according to the concept of DRRM which is prevention, preparation and recovery. Creating alternative solutions and decrease vulnerability.	(high) The LAA exists in Dordrecht where knowledge and information is shared among the stakeholders. Regular vloedschotten and sand bag exercise attended by the community. Regular information dissemination during storm season.	(high) Existence of LAA and 'safety team'. Close coordination between city government, waterschap and veiligsheidsregio on information dissemination activities.	(high) Ready to help from the Red Cross is active and well recognized. The city government has an organized 'safety team' who work closely with veiligsheidsregio, police, and fire brigades.	High
Marikina	(high) Have a shared understanding on key threats. Perceive resilience as*"katatagan"* (stability) and *"kaalaman"* (cognition) two words used to describe the strength to rise up from adversity through awareness and knowledge.	(high) Disaster risk awareness and DRRM activities are disseminated at all levels. Schools include DRRM activities and courses. Regular trainings provided.	(high) Social networks are present including non-government organizations. Academic institutions have direct engagement with the community. Use of social media is high in communicating with the city government.	(high) Barangay disaster risk management units are present and prepared. The city government works closely with the BDRRM.	High
Malabon	(medium) There is a general understanding on the risk to floods. Resilience is perceived to be anchored on 'survival thinking' or the need to survive.	(high) Disaster risk awareness and DRRM activities are disseminated at all levels. Regular trainings and drills provided.	(high) Social networks are present including non-government organizations. Adopt a barangay and adopt a family evacuation strategy. Use of social media is high in communicating with the city government.	(high) Barangay disaster risk management units are present and prepared. The city government works closely with the BDRRM.	High

11.2.1 Collective engagement and urban resilience Dutch cases

Both Dutch case cities indicate that the threats of a flood are not very high owing to the security that the general population enjoys from the Deltaworks system and the triple-redundant preventive measures in place. The long history of the construction of tough preventive infrastructures during the first adaptive cycle in Rotterdam and the first and second adaptive cycles in Dordrecht, spanning decades and centuries, has given a sense of security that the Dutch view low-level floods as a bit of 'nuisance' rather than a threat. Climate change adaptation and the creation of innovative methods to adapt to flood risks came in the second adaptive cycle in Rotterdam, and the third and fourth adaptive cycles in Dordrecht (see Figure 11.1). Even with common trends of beginning with hard infrastructure and progressing towards more climate-adaptive initiatives, as well as the policy direction of Resilient City for Rotterdam and *zelfredzaam* island for Dordrecht, there are marked variations between how each city addressed collective engagement and urban resilience.

Perception of risk and resilience

Flood risk awareness and perception are relatively low in both Dutch cases, which is not entirely surprising given the general low flood risk awareness and perception of the population (Baan and Klijn, 2004; Bosschaart, 2015; Van Doorn-Hoekveld, 2014; OECD, 2014). The disaster gap has been so long that the perception of the possibility of flooding is far from the minds of the people. Trust in the Deltaworks system plays a role in how the Dutch see flood risk which is a 1 in 10,000 years possibility, very distant from today. This judgment is valid for most people since large-scale flooding has not happened in more than 60 years. Besides this risk is something that the government will take care of because *"everything has been organized"* (Rotterdam Citizen stakeholder 3, Interview date 21 January 2019). A huge trust has been placed in the government's crisis management capacity (Kuipers and Boin, 2014) and the population has always seen this as the responsibility of the local, regional, and national governments (Terpstra and Gutteling, 2008) that reduces people's drive to prepare for or learn about flood risks. Resilience then, in this case, refers to the level of security from a disaster through the construction of infrastructure that will prevent or adapt to these disturbances.

However, in Dordrecht, there is a general understanding that flood incidence can happen because the residents see this in the historic city center. Unlike, in Rotterdam, where regular low-level flood most often only happens in the Noordereiland, which is a small community in a very large city. The rest of Rotterdam does not have a direct experience with floods. In Dordrecht, waterways and the river surround the island that people see the changing tides aside from the regular low-level flooding experienced at the historical city center. Because of the arresting presence of the water and climate-adaptive structures, as

well as the regularity of communication and drills (this will be further discussed in the next sub-section) conducted in Dordrecht, stakeholders perceive resilience as related to preparation, prevention, and recovery and the development of alternative ways to address risk.

Whereas in Rotterdam, what is seen as a bigger risk is the socioeconomic threat - low education, low incomes, and low social integration. These threats are seen to deepen the already large social and economic divide that discourages those belonging to the lower-income group from integrating into society. As a consequence, these divergences in the perception of risk in the case of Rotterdam also lead to divergences on how resilience is perceived in the city. Part of the reason for the different interpretations of resilience in Rotterdam is also due to the different visions or branding that the city went through. It was expected that with the Resilient Strategy and Rotterdam's membership in the 100 Resilient Cities the terms resilient and resilient city would have been well-defined but it was the opposite. The strategy and the membership were not exactly understood and even familiar with the stakeholders interviewed.

Influence of information and education on collective engagement and urban resilience

Information on flood risks is provided through letters in targeted areas, newspaper announcements, television, radio, and government websites in Rotterdam and Dordrecht. Letters on flood warnings and precautionary measures are provided to residents in the unembanked areas and the historic city center of Dordrecht and some unembanked areas and the Noordereiland in Rotterdam. However, given the size of Rotterdam and the relatively small target areas, this information on flood risks and preparation is not widespread. It may also be inefficient to have a widespread information campaign on disaster risk preparation. That being said, the limited risk communication in Rotterdam reduces their awareness of the risks of floods and dilutes the collective flood memory of the people. Collective flood disaster memory is almost gone in Rotterdam given the disaster gap of more than six decades and the diversity of the population who may not have been around during the Great North Sea flood. The limited reach of information and risk communication also reduces the chances of collective engagement on this subject matter as Rotterdam Citizen stakeholder 4 said, *"you cannot connect with people, yes some of them, with story about sea rise . . . they see on television . . . they know that there is a problem but they don't know what to do"* (Interview date 10 January 2019).

On the other hand, Dordrecht has been active in programs and projects in partnership with research institutions and private organizations, results of these programs are often discussed with the stakeholders. Climate adaptive infrastructures such as the elevated critical infrastructure, floating houses, and tidal parks built in Dordrecht offer learning opportunities to residents. Dordrecht also conducts regular demonstrable activities such as the *vloedschotten* and sandbag exercises which teach and reminds residents about flood risks

and preparation while also improving community interaction. This information and exercises help residents in Dordrecht retain the flood risk knowledge which is important in honing collective memory and knowledge. This contributes to the collective understanding of flood risk and resilience strategies of the city.

Influence of social networks on collective engagement and urban resilience

Housing and neighborhood associations and environmental groups in Dordrecht and Rotterdam work with the city government on programs and projects on the environment. In Rotterdam, neighborhoods are involved in the 'tile out, green in' project which transforms a portion of the pavements into pocket gardens to help increase the city's water retention capacity. There are also several community gardening projects in Rotterdam, but communities that engage in these projects do not see a clear connection between flood risks and green spaces. In comparison, there is a strong degree of community participation in Dordrecht's program and projects on flood risk and disaster management. *Vloedschotten* and sandbag exercises in Dordrecht carried out by the city government and the *waterschap* not only inform and increase the level of risk awareness among residents but also promote community spirit, particularly when residents volunteer to assist with drills.

Academic and research institutions have provided research and studies on Dordrecht and Rotterdam, which have contributed insights on flood risk management and climate change. Flood risk management studies and collaboration with these knowledge organizations are more pronounced in Dordrecht through the Urban Flood Management (UFM) and Managing Adaptive Responses to Changing Flood Risk Programs in the North Sea Region (MARE). The outcomes of the UFM and MARE programs presented Dordrecht with long-term flood risk management and spatial plans. Training and presentations on flood risk management, climate change, and spatial planning for stakeholders have also been undertaken within the context of the programs to improve their capability and knowledge on flood risk management and spatial planning. There are also a variety of studies on flood risk management and climate change adaptation in Rotterdam, ranging from governance (Mees and Driessen, 2011; Ward, et al., 2013; Dunn, et al., 2017; Tillie and van der Heijden, 2016), urban resilience (Spaans and Waterhout, 2017; Lu and Stead, 2013; Stead, and Taşan-Kok, 2013) spatial design (De Graaf and Van Der Brugge, 2010; Hooimeijer, 2010) to risk perception (de Boer, 2016). These studies add to the wealth of knowledge that aids the development of policies and strategies in Rotterdam. However, unlike in Dordrecht, where programs and studies in collaboration with knowledge organizations often include the community, there is minimal community involvement in the studies done in Rotterdam.

Mutual adaptation of roles in disaster risk management

In the Dutch cases, the Red Cross is recognized by the interviewers as the only NGO that works closely with the communities on crisis management matters. The Red Cross Ready-to-Help volunteers are present in both cities and ready to be contacted and deployed in case of crises. However, in Dordrecht, the presence of the Ready-to-Help volunteers is much more recognized owing to the field exercise conducted in the city in 2015. From then on the Red Cross has been in close contact with the City Government of Dordrecht for any crisis management exercises and training. In Rotterdam apart from the Red Cross, there are no other organizations at the community level working on disaster risk management.

The Dutch cases however show an example of a highly organized crisis management structure where a higher level agency, the *veiligsheidsregio*, commands the action in coordination with the cities, municipalities, region, and the national government, if there is a need. The organization is reliable and well-equipped, that disaster risk management work at the community level is usually not needed. It allows society to enjoy a level of security that all will be taken care of. In Dordrecht, the creation of the 'safety team' composed of city government staff who coordinate with the community, fire brigades, police, and health services allows the city to have a connection with the community. The delegated tasks allow each stakeholder an understanding of their roles in the event of a crisis. On the other hand, Rotterdam being a large city relies on the organized crisis management system that is already in place.

11.2.2 Collective engagement and urban resilience Philippine cases

Typhoons, storms, and the resulting floods are common in the Philippines, giving the population a general knowledge of flood risks and natural hazards. In Marikina and Malabon, the frequency of floods gives stakeholders this risk awareness but does not often translate immediately to policies. The pattern of adaptive cycles in Marikina (see Figure 11.1) shows that the flood experience has contributed to changes to resolve this issue through the Save the Marikina River program. Benefits in addition to the reforms introduced, such as the clean-up of the river system and park development of the river banks, and conversations with the city government and stakeholders, encouraged stakeholders, in particular young people, to volunteer on the river and street clean-up during the first adaptive cycle. Marikina was more advanced than Malabon to set up a disaster risk management office. The DRM work in Marikina began in the first adaptive cycle in the early 1990s with the establishment of Rescue 161, which was turned into the MCDRRMO in the second adaptive cycle following the passage of RA 10121. Malabon, on the other hand, has had a much more intense history with flooding as a result of the tidal fluctuations that preparing for the floods has become second nature to the people.

However, DRM work in Malabon began more than three decades after the national government put the CAMANAVA flood control project on the table (see Figure 11.1). It took RA 10121 before Malabon established its MDRRMO. The pattern in the adaptive cycles of Marikina and Malabon at the beginning is distinct from one another. For Marikina, a strong leader was required to introduce reforms, while Malabon relied heavily on the flood control infrastructure to be built by the national government. However, down the timeline for each of the city's adaptive cycles, the role of the community has shown an influence on how each city approached collective engagement and urban resilience.

Perception of risk and resilience

How the city governments of Marikina and Malabon have handled the flood situation over the years has contributed to the understanding of risk and resilience by stakeholders. Although stakeholders in both cities are aware of the flood risks and natural hazards in their cities, Marikina's view of resilience represents the successful and progressive policies of the city government on disaster risk management. Marikina addressed disaster risk management in a coordinated way, institutionalized it, and brought awareness and understanding to the communities. Marikina has a preparatory rather than a reactionary approach to risk by improving knowledge and protocols on crisis management that stakeholders see resilience as the strength to face adversity through awareness and knowledge. In Malabon, the frequency of floods has become a 'norm' that floods have become part of their culture. The band-aid measures applied to flood situations made stakeholders equate resilience to survival. For stakeholders, resilience refers to the ability to survive on their own.

Influence of information and education on collective engagement and urban resilience

Marikina's focus on river rehabilitation and overall reform of the city led to vigorous enforcement of policies on removing illegal settlers along the river banks, fines for littering and illegal garbage disposal, and other similar policies to minimize the occurrence of flooding in the city. Mayor BF's initial goal in Marikina is to instill discipline and turn Marikina into a progressive city. At the time the people could not see this vision, that in the first two years of his tenure he was harshly criticized and opposed, however, when residents experienced fewer floods, clean neighborhoods, and a riverside promenade that illegal settlers used to inhabit, the change was welcomed and supported. The city threshed out information, education, and communication campaigns throughout the city and even partnered with educational institutions to include disaster risk reduction and management courses in their curriculum. This helped the city increase risk awareness equipping residents with the knowledge on preparation and crisis management. It also helped all stakeholders to understand their role in disaster risk reduction and management and caring for the environment.

In Malabon, the information, education, and communication campaign are not as draconian as Marikina. Malabon partnered with NGOs to help in conducting disaster risk management training and seminars for the *barangays*. The city also holds an annual disaster caravan where the city partners with government agencies, academic institutions, the private sector, and NGOs to lecture and conduct activities for the residents of all ages on disaster risk management, natural hazards, basic life support, drills, and exercises. While the information dissemination approach is not as rigid it has instilled a level of awareness in the residents. The regular flood incidence due to tidal fluctuations over the years have already built flood awareness into their psyche and the additional information just reinforces this risk awareness and reminds people to prepare.

Influence of social networks on collective engagement and urban resilience

Both Marikina and Malabon have had the opportunity to work with academic and research institutions to help the city with urban planning and flood risk management. In Marikina, academic and research institutions provided DRM training in *barangays*. The *Pamantasan ng Lungsod ng* Marikina (University of Marikina) incorporated DRM into their curriculum and academic and research staff, and students, conduct free lectures on DRM, climate change, and environmental management at the *barangays* as part of their corporate social responsibility. Marikina also partnered with the University of the Philippines on Project NOAH where rain gauges were placed in the Marikina watershed from which data is transferred to the flood sensors. Data derived from the flood sensors that calculate the possible flood that the city will experience is transferred to the MCDRRMO command center who in turn issue flood warning to the population. While Malabon also has a good relationship with the academe and research institutions, this collaboration is more on the city level, such as studies on flood risk management, and urban planning. These studies are also beneficial to Malabon in developing their comprehensive land use plans, action plans, and similar policy documents.

At the community and individual levels, social networks are strong in the Philippine cases (see Table 11.2) given the fact that the country is frequently visited by typhoons and storms the ability of the people to help one another, neighbors, in particular, have been ingrained in the system. In Malabon, because of the lack of space for evacuation during flood events *barangays* organized the evacuation strategies, adopt-a-*barangay*, and adopt-a-family. Residents of *barangays* that have limited space and no identified evacuation areas can go to an affiliate *barangay* that has an evacuation area. On top of that residents in *barangays* that have no evacuation areas have an agreement within the neighborhood to open their homes to neighbors in need during a crisis. This community solidarity in times of crisis also happens in Marikina where rescue volunteers abound. In Marikina, even private enterprises that own rescue equipment like fire trucks or boats often volunteer in rescue operations during disasters.

Social media networking is high in the Philippine cases, both cities have Facebook pages where a lot of the residents engage in. Marikina and Malabon's DRRMO and BDRRM units also have their own Facebook pages. The Facebook pages are used to communicate with the residents and send out announcements. The Facebook messenger function also serves as their direct communication (group chat) with the DRRMO and BDRRM units in the cities. This makes communication faster and information among the units shared in real-time. The social media savviness in the Philippine cases does not come as a surprise since the country has been ranked as one of the highest users of social media (Sanchez, 2020; Ichimura, 2020). This may be a result of the hundreds of Filipinos scattered around the world as overseas Filipino workers whose means of communication with the family back in the home country is through social media.

Mutual adaptation of roles in disaster risk management

Both Marikina and Malabon have BDRRM units that serve as the communities lead in developing and organizing community-based disaster risk management programs and projects. The creation of a BDRRM is mandated by the law, RA 10121, but each BDRRM unit has the freedom to conduct any type and kind of program they see fit in their communities. The BDRRM units work closely with the DRRMO which oversees the entire city disaster risk management activities. Through the DRRMO and BDRRM units, stakeholders are equipped with the knowledge and information on DRRM that is especially important in emergencies. Further, the information provided by the city especially on environmental issues such as pollution and clean up of rivers allowed the stakeholders to understand that they should be part of the solution in mitigating floods by maintaining cleanliness and proper waste disposal. Information and education are important in making people self-aware.

In the Philippine cases, reliance on the government to keep the cities secure goes only as far as the city level. In Malabon where the actual flood control facility is located, it would have been expected that the national government through the DPWH will have an active role in ensuring that large floods will not happen by maintaining the infrastructure. On the contrary, Malabon's *barangay* leaders and residents take it upon themselves to have the flood gates and pumping stations located in their *barangays* fixed and maintained because it takes time for DPWH to do it for them. City governments in both cities acknowledge the role of the community in making their DRRM efforts successful. In Marikina, the city government made sure that a partnership between the city government and the community is fostered. Coordination, cooperation, and partnership are needed to face the adversities that these cities go through year after year if not month after month during the typhoon season. This mutual adaptation of their roles has had practical regular lived experiences in both cities.

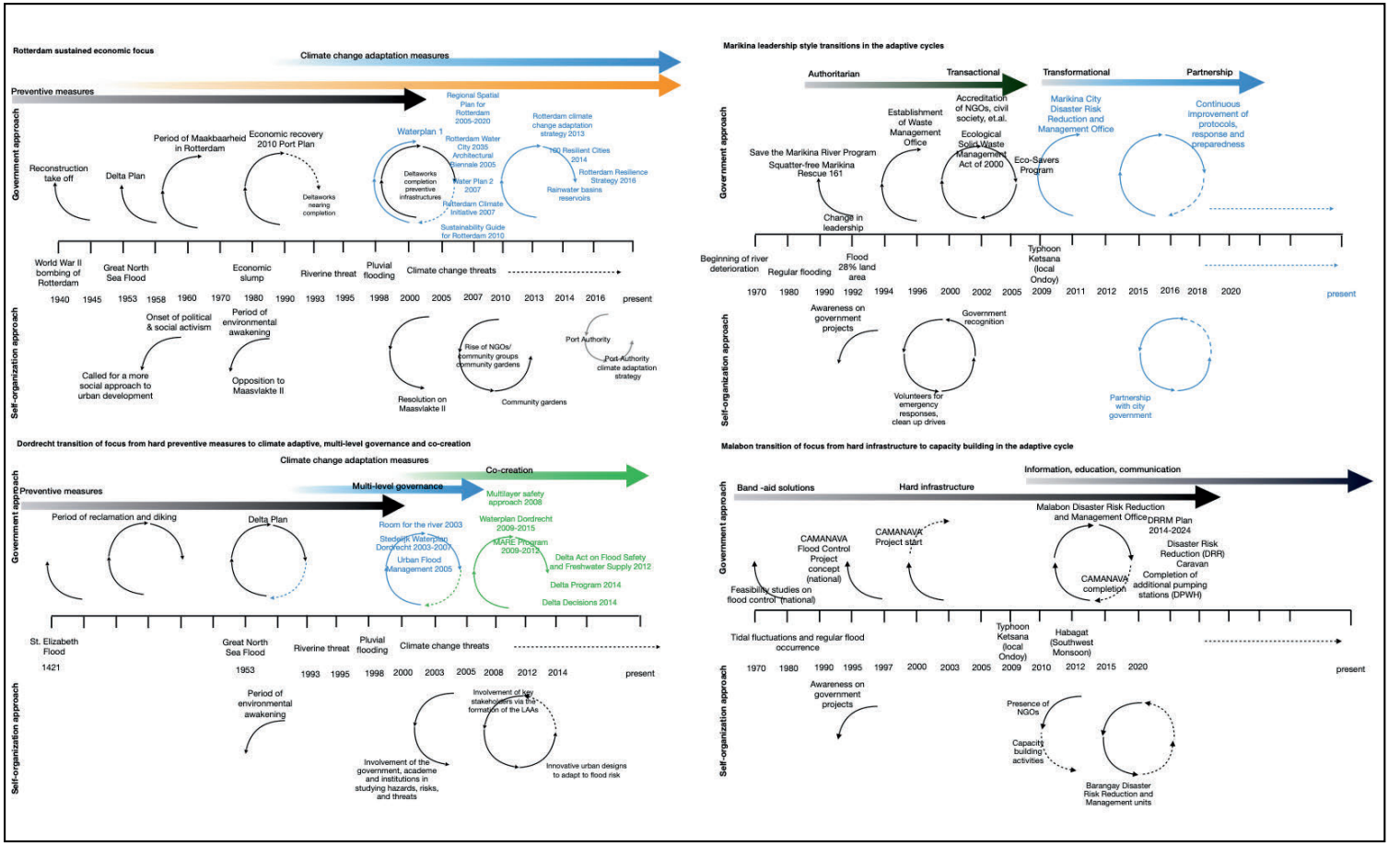
11.2.3 Section conclusion

In this section, the Dutch cases and Philippine cases demonstrate that government perception on risk or which risks are judged to be more important determines the policies they create as well as how these perceived risks are managed. Governments that prioritized flood risk management at the onset, such as Rotterdam, Dordrecht, and at some accounts Marikina, have greater success in instilling a sense of security against floods and trust in the government. Resilience perception varies for each of the city cases and most often depends also on the risk perception and the government policies and direction. The parallelism on how risk and resilience are perceived in the cases indicates that both are social constructs based on experiences. Whether risk can be controlled and manipulated to lessen the risk depends on how this risk was experienced or conveyed. Information and education on disaster risk management increase people's understanding of risk and resilience this can be done in partnership with neighborhoods, communities, academe, and private organizations. These social networks create a sense of community and help increase social and human capital. Social networks that focus on disaster risk management help stimulate risk awareness in individuals and communities, thereby increasing collective engagement and urban resilience.

11.3 CHAPTER CONCLUSION

The cases reveal that the cities adaptive cycles vary across timescales depending on the adaptive capacity (driver of resilience) that each city possesses. Figure 11.3 shows that the adaptive cycles also depend on the priority or vision of the city which may or may not be influenced top-down by the national government. In the Dutch cases, flood risk management has been prioritized for centuries that hard preventive infrastructure has always been the measure. This engineering resilience pathway is necessary to keep the Netherlands flood-free. However, the successful implementation of the Deltaworks system has affected the flood risk perception of the general population, who most consider 'flood' a 'nuisance' and see no flood threat in the country. Since flood has been well-managed by the government with little effort from the community, reliance on the government has been sustained over the years that trying to instill safety as an individual responsibility in the people is still a challenge. For Rotterdam, the economic focus strengthened the city's economy, built its image as a world-class modern and climate-adaptive city lost its connection with the residents and the community (see Figure 11.3). On the other hand, Dordrecht may not have the edge on the economy, but there is a balance on the five drivers of resilience that still maintains this connection between the government and the residents. The efforts the city government and the *waterschap* makes in conducting demonstrable activities such as the *vloedschotten* and sandbag exercises still remind people of their collective responsibilities in addressing flood risks.

Figure 11.3: Transition of focus from hard infrastructure to capacity building in the adaptive cycle



In the Philippine cases, despite the threat of floods in history little efforts have been done at the national level to construct flood preventive infrastructures. The political instability resulted in delays in the implementation of flood control projects as well as the direction which left cities to do things on their own using band-aid measures or full reform. Marikina took the latter route in the early 1990s, the reform started with a strong focus on institutions, policies, and laws (see Figure 11.3). The physical changes in the city especially the river rehabilitation earned Marikina recognition which in turn became the pride of the residents. Partnerships with the local university and schools and the community have been one of Marikina's priorities in making sure that the disaster risk management procedures are understood by all sectors. These partnerships and commitment to learning improve the awareness of DRM and strengthens the adaptive capacities of Marikina as well as the level of its collective engagement and urban resilience. For Malabon, the route to urban resilience started at the heart of the city, the community. Residents have had to endure the years of flood risk experienced in the city that even with the flood control facilities in place, the community still wants to make sure that it is functioning properly. The human and social capitals of the residents are high that strengthens Malabon's collective engagement and contributes to the city's resilience.

Finally, there are five points learned from the cases:

1. Flood experience can build knowledge but frequent flood experience can also normalize flood risk. Experiential learning is most often retained longer this helps residents build knowledge and experience to address future risks. However, years of frequent flood experience may desensitize residents and consider these events as part of daily living or culture.

2. Partnership and mutual adaptation of roles build collective engagement and adaptive capacity. Cities where city governments and stakeholders acknowledge their roles in building urban resilience show higher capacities and engagement. This includes engagement through information dissemination, training, and education that equally builds social and human capital.

3. Responsibility and accountability. Reliance on the government to take care of the population requires an organized structure on disaster risk management. Consistent exemplary performance that secures the residents builds this trust in the government and system. In contrast, the non-performance of the government to ensure the security of the residents destroys this trust and leads the community to fend for themselves.

4. Frequent flood experience builds community. Extending help to neighbors especially during a crisis is a normal human reaction but having the frequent flood experience creates this bond of shared flood experience among residents.

5. Perception of risk and resilience is socially constructed. The different perspectives of risks and resilience derived from the interview indicate how risk can be socially constructed based on experience and culture. Studies on the perspective of risks have been done in the field of psychology (Slovic, 1987; McDaniels, et al., 1997; Slovic, 1997) and framing of the risk to the general public is equally important in the cognition of the existence of flood risk. Similarly, resilience can also be socially constructed in parallel to the perceived risk.

In the final chapter, the conclusions of the study will be discussed and the areas for further research.

CHAPTER TWELVE

CHAPTER TWELVE: ENDINGS AND BEGINNINGS

12.0 INTRODUCTION

This final chapter sheds light on the research aim to assess whether disaster experience leads to collective engagement between stakeholders in building urban resilience. The aim was to explore the drivers of resilience that impacts the process of collective engagement and pattern of urban resilience. This led to the separate unpacking of urban resilience and collective engagement in Chapters 2 and 3, and subsequently to the creation of the collective engagement urban resilience framework used in this research as a tool to shed light on the relationship between the drivers of resilience, collective engagement and urban resilience. In the previous empirical conclusions chapter, an attempt on the process and pattern was done for each case cities to understand the impacts of the drivers of resilience on the relationship between collective engagement and urban resilience.

Based on the analytical insights outlined in Chapter 11, this chapter highlights the key contributions of the research on the topics of collective engagement and urban resilience. The analysis, and more precisely the collective engagement urban resilience framework developed under this research, contribute significantly to both practical and academic discourse on urban resilience. First, recognizing the process of urban resilience and collective engagement as a synthesis of two approaches, government-approach and self-organization. This allows professional practitioners and decision-makers to develop better policies that support the cross-fertilization of learning from both approaches. At the same time, it adds to knowledge on governance thematic areas of collaboration, engagement, and self-organization. Second, the research indicates that both approaches lead to the cross-fertilization of learning that contributes to the mutual adaptation of goals and mutual benefits between stakeholders. Third, the research shows that perception of risk and resilience is socially constructed based on disaster experiences. Finally, the research offers insight into the role of government accountability and social resilience in building a resilient city.

This chapter begins with reflections on the empirical chapters including the empirical conclusions guided by the main question and sub-questions of the research. This will be followed by the theoretical contributions building on the framework used in the research. The last section presents the areas for future research.

12.1 REFLECTIONS ON THE EMPIRICAL CHAPTERS AND CONCLUSIONS

This research began with the main research question: *How does collective engagement contribute to building urban resilience in disaster-prone cities in the Netherlands and Philippines?* To

unpack this main question the following four sub-questions were formulated: (1) What are the drivers of resilience and how do these drivers build urban resilience? (2) What is the role of collective engagement in the process of building urban resilience and how does the process of collective engagement unfold from the government approach and self-organization approach? (3) What role do the drivers of resilience play in collective engagement and how does it relate to the type of urban resilience experienced? and (4) What are the areas of convergence and divergence in the process of collective engagement and urban resilience between the Netherlands and the Philippine cases? Responses to these sub-questions help distill and explain conditions, process of collective engagement and patterns of urban resilience. This section will first discuss the answers to the sub-questions before proceeding to the discussion in response to the main question.

12.1.1 Fitting the puzzles: Reflections on the sub-questions

What are the drivers of resilience and how do these drivers build urban resilience?

The first sub-question was mainly discussed in chapters 2 and 3. In Chapter 2 the five drivers of resilience, human, social, economic, institutional, and environmental capitals, were observed in the policy frameworks studied and the systematic literature review. The criteria of resilient urban systems were also derived from the systematic literature namely, (1) adaptive capacity and resilience to manage, adjust, learn and cope with different changes; (2) disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; (3) established enabling or supporting environments in creating a resilient city; (4) maintaining city resilience through diversity; (5) memory-based disaster experience; and (6) social, physical and economic drivers that contribute to household, community, and city resilience, which infer that the presence of these qualities in an urban system facilitates resilience building. In a series of cross-referencing of the relationships of variables and indicators from the policy frameworks and systematic literature review, the research showed relationships between the drivers of resilience and the criteria of resilient urban systems. This further resulted in the merging of the drivers of resilience and criteria of resilient urban systems by using the criteria as variables and indicators of the drivers of resilience.

Having established the drivers of resilience and its corresponding variables and indicators for the research, in Chapter 3 these drivers of resilience were used and explicitly called 'capitals' to frame the drivers as resources which is a necessary input to the output, urban resilience. It was also necessary to frame it as such to build in the idea that the drivers of resilience form the adaptive capacity to be utilized in the process of collective engagement and building urban resilience.

The research revealed that the drivers of resilience have a direct influence on how cities build urban resilience. The reason for this is that the drivers serve as not only a resource

but also as the priority area for the city's development. The research shows that as a resource the drivers of resilience in combination influence the adaptive capacity of the case cities, such that a weaker driver does not equate to the city having a weak adaptive capacity overall because other drivers can supplement the other. This is shown in the results of the case studies (see Table 11.1 in the previous chapter) where all of the case cities do not have a perfect rating for each of the drivers of resilience. However, each of the drivers combined increases the city's adaptive capacity which is needed in building and maintaining urban resilience.

Moreover, the result of the case cities reveals that the drivers of resilience for each case vary in dominancy. This means that there are drivers (capitals) that have a more dominant presence in the case city than others. For example, in the case of Rotterdam, the more dominant driver in the city is its economic capital. The city has leveraged the presence of the port as its main economic resource and has built a city that centers on trade and commerce. The city also capitalized on having the economic resources to build infrastructures that will not only help the city address its climate change challenges, both flood and water retention, but also make it physically attractive as a modern and climate-adaptive city.

In another case, Marikina, a strong driver in the city is its institutional capital. This became the city's gavel that hammered the idea of reform and progress in the city and its citizens. The strength of the city's institutional capital was its ability to put teeth in its laws especially during the first few years of Bayani Fernando's administration as mayor. The city was able to implement programs and projects that truly benefited the citizens such as the Marikina River rehabilitation, relocation of the informal settlers from the danger zones along the river to a safer district, and Rescue 161. The last one, Rescue 161, was even further strengthened and institutionalized in the city as a department even before the issuance of the Philippine Disaster Risk Reduction and Management Act (RA 10121) in 2010. These two examples indicate that the case cities utilize the adaptive capacity (driver of resilience as a resource) that are available at the time, as in the case of Marikina, and the priority focus in city development, as in the case of Rotterdam.

What is the role of collective engagement in the process of building urban resilience and how does the process of collective engagement unfold from the government approach and self-organization approach?

The theoretical part of this second sub-question was answered in Chapter 3 where the conceptual framework was formulated. From the criteria of a resilient urban system derived from the systematic literature review, the common thread found were participation, knowledge, information, learning, and awareness. These qualities were used in developing the concept of collective engagement and the three theoretical expectations. The three theoretical expectations: (1) strong information and education on disaster

management provided and accessible to all stakeholders, (2) strong social networks of stakeholders that are collectively involved and tied to the city and its vision to become resilient, and (3) the government and the stakeholders must understand the need to have a cohesive community in order to address disasters, presumes that having these three points in place facilitate collective engagement. However, it was observed in this research that the role of collective engagement is not as simple as laying out these theoretical expectations, there are different stakeholders involved in the process of collective engagement in building urban resilience. These stakeholders may also have different insights and experiences that may or may not have been heard by other stakeholder groups.

The research findings revealed that at the onset of a disaster a command and control strategy was adopted by all the case cities. As part of the government approach, this top-down strategy was seen as necessary at the onset of the disaster the cities experienced. Studies have also found that a top-down strategy during a chaotic period such as a crisis is necessary to maintain a level of order (Jahangiri, et al., 2011; Romero-Lankao and Gnatz, 2013; McSweeney and Coomes, 2011). In the Dutch cases, the flood disaster in 1953 immediately led the government approach to construct flood preventive infrastructures to ensure that the disaster will never happen again. In the Philippine cases, flood preventive infrastructures specifically for the Malabon case, the CAMANAVA flood control facility was also constructed.

The results of the case analysis show that the government approach specifically the adoption of the national level policies impacted the case cities but the manner of implementation of these policies at the city level is tailored by the city's adaptive capacity. In Rotterdam, the national government is in close collaboration because of the significance of the Port of Rotterdam to the entire country's economy. The city adopted the Deltaplan and policies on climate change adaptation in a creative and marketable manner that made the city attractive and modern. This was exemplified by the Rotterdam Water City 2035, Architectural Biennale (2005), and the city's membership in the 100 Resilient Cities. On the other hand, this close contact with the national government was not as fervent in Dordrecht. Still, Dordrecht followed the policies on the Deltaplan, climate change, Room for the River among others, but implemented these policies and projects by involving their networks, specifically their residents and more particularly the farmers.

In the Philippine cases, the release of RA 10121 led to the setting up of the Marikina City Disaster Risk Reduction and Management Office (MCDRRMO) and Malabon Disaster Risk Reduction and Management Office (MDRRMO). These offices are tasked to manage emergency and disaster situations at the city level and create community-based disaster risk management units, the *barangay* disaster risk management (BDRM) units. Here, the uniqueness of the Marikina case needs to be pointed out since the city created a disaster risk management office even before the national government mandated its creation. This is a significant finding that gives an example of how a city with strong institutional capital,

leadership, and foresight can enact change. This is also supported by studies showing that in some instances change happens when initiated by a top-down approach (Romero-Lankao and Gnatz, 2013; McSweeney and Coomes, 2011). Yet, caution should be taken in this statement since in the Marikina case the authoritarian approach at the beginning of the reforms was also met with criticism and lawsuits against the mayor. Support was only given by the residents after witnessing and experiencing the benefits of the reforms. Thus, it shows that an authoritarian approach to change may work if the actual benefit from these reforms is experienced by the residents.

It is observed in the case cities that collective engagement unfolded with the recognition of the government on the role of the non-government stakeholders in urban resilience building. This observation is relevant in all four cases albeit with variations. In Rotterdam, while the self-organization approach is limited to the community garden initiatives of the residents, results from the interviews indicate that the city government stakeholders are aware of the relevant role that citizens have in urban development. This is shown in the city governments' attempt to involve the non-government stakeholders in dialogues, workshops, and seminars organized around the city (i.e. Water Sensitive Rotterdam). In Dordrecht, the involvement of non-government stakeholders, planners, academe, and civil society, has been present in the projects implemented following the multi-layer safety (MLS) approach around the city including the yearly *vloedschotten* and sandbag exercises. The involvement of residents in Marikina began with volunteers in the river clean up and the government initiated project 'Eco-savers program'. Residents in Marikina participate in regular disaster risk management training and awareness-raising activities. In Malabon, an interesting facet is a mutual recognition by the city government and the community of the city's limited resources specifically in providing an evacuation area in some communities. This led communities to share an evacuation center or neighbors to open their homes to those who need to evacuate during an emergency. While this may not be ideal especially in maintaining order, Malabon's main driver of resilience is their social and human capital which the city government and its stakeholders recognize.

What role do the drivers of resilience play in collective engagement and how does it relate to the type of urban resilience experienced?

In Table 11.1 in the previous chapter, it was shown that all of the case cities have exhibited strength in their institutional capital. The findings in the empirical chapters also reveal that the policies released in each of the case cities encourage the participation of stakeholders in urban planning and development which is an important facet of collective engagement. However, the implementation of these policies in the case cities varied implying the influence of the other drivers of resilience in the process of collective engagement. This means that even if there is a policy that mandates the participation of stakeholders in city development it still depends on how the city government interprets these policies which in some cases can only be through the presentation of plans to

stakeholders rather than creating a joint discussion and decision making. Still the role of institutional capital is strong as it sets the policy environment where stakeholder participation is recognized and encouraged.

With the institutional capital setting the mandate, other drivers of resilience come into play to facilitate collective engagement towards building urban resilience, specifically, social capital and human capital. These three capitals, institutional, social and human, combined and with equal or at least almost equal condition in the urban system help build collective engagement among stakeholders. The results of the Dordrecht and Marikina cases both showed that the two case cities have strong institutional, social, and human capitals and that these three capitals were honed throughout the timeline (see Figure 11.3), facilitating a supportive atmosphere where stakeholders are involved and voices are heard.

In Dordrecht, the city government engaged various stakeholders in planning and decision-making, the academe, civil society, and the community, including the dike army, in addition to implementing policies on climate change adaptation and flood risk management that led to the construction of climate adaptive infrastructures. Projects in Dordrecht, such as Urban Flood Management (UFM) and Managing Adaptive Responses to Changing Flood Risk Programs in the North Sea Region (MARE), were carried out in collaboration with the city, academe, community, and even external networks, which strengthened stakeholders' social and human capitals while also providing additional technical knowledge on managing flood risks in the city. The annual *vloedschotten* and sandbag exercises also offered regular training and information for stakeholders, increasing their awareness of hazards and preparation, as well as collaboration with the community.

In Marikina's case, engagement of the citizens with government initiatives started when the reforms under Bayani Fernando's administration took shape. Private citizens began to volunteer and offer their services to the city government to help in the river, canals, and street clean-up. The City Government of Marikina demonstrated that leadership and political will can enact changes and turn a sleepy town into a progressive city. Marikina used this institutional capital and the growing interest of the community in the government initiatives to strengthen the residents' social capital. The city was the first to develop a disaster risk management system, Rescue 161, and recognized the need of community volunteers in risk management. The city moved from an authoritarian leadership to transactional leadership and eventually a partnership with the community through regular involvement of stakeholders in training at all levels and sectors of society (see Figure 11.3 in the previous sections). With the transition of the leadership style and the benefits reaped by the stakeholders from the reforms, the city was able to forged trust and partnerships with the community and bond with the stakeholders.

The drivers of resilience, institutional, social and human capitals, present in Dordrecht and Marikina strengthened collective engagement in the case cities. These three drivers also influenced the kind of urban resilience that the case cities experience. Dordrecht and Marikina both show a strong institutional and social resiliency by demonstrating the ability to adopt policies based on the cities' changing circumstances, experiential learnings, and knowledge derived from partnerships with stakeholders and across their networks within and outside the city. Institutional resilience refers to the ability to "maintain[ ] its effectiveness over time despite changing external conditions" (Steinberg, 2009: 65). This is what the dike army and Rescue 161 have done for Dordrecht and Marikina, respectively. These resilient institutions have a felt presence in the cities throughout the years and have adapted to the changing urban environment, and political and social landscape of the cities. Moreover, the social networks and partnerships that are present in the city have imparted knowledge and information in the stakeholders that contribute to social resilience in the case cities.

The results from the two case cities, Dordrecht and Marikina are examples of how a policy-enabling environment that encourages stakeholder participation with non-government stakeholders, academe, planners, private sector, and civil society, positively influence collective engagement. The case cities took advantage of the existing social networks within the city and built on programs to further enhance the city's social and human capitals. This has created an urban environment where co-creation and partnerships between and among stakeholders thrived. This has also fostered learning and awareness among stakeholders on disaster risk, preparation, and prevention.

On the other hand, if there is one driver of resilience that is more emphasized and prioritized in terms of setting the direction of the city, other drivers of resilience are set back. An example of this is Rotterdam where the dominant driver of resilience is its economic capital which also plays a central role in the direction of the city. The city strengthened its global commercial position as a port and as a competitive city open to investors. The climate adaptive infrastructures while helping the city cope with flood risks has a commercial appeal to further showcase the attractiveness of the city and position itself as a city in the forefront of climate adaptation. However this economic focus in Rotterdam especially its branding allowed the city to become more like a commodity or a product to be marketed to increase its economic attractiveness which has downplayed the role of its residents. This has harmed residents' connections with the city, with results from the Rotterdam case indicating a lack of residents' awareness of flood risks and resilience, which is exacerbated by the existing social and economic divide between residents and limited integration of those living in lower social status. Rotterdam's use of economic resources and outlook on the economy has sustained over time as seen in Figure 11.3 in the previous chapter. The economic focus of Rotterdam also nurtures this engineering resilience perspective which is to quickly bounce back from a disturbance as

quickly as possible to return to its normal state. This is in contrast to social and ecological resilience where adaptation and learning is honed to be able to transform to a better state. As such, the city has lost touch with the stakeholders because of the lack of meaningful engagement between the city government and the community.

In contrast, the relatively strong social capital in Malabon honed over the years of flood experience has created a 'culture of resilience' that when the city government introduced the disaster risk management systems and procedures it was initially not followed because the people felt they already have their own system. Understanding the difficulty in instilling change at the community level and the resource limitation of the city, the city government partnered with non-government organizations who can help provide training at the community level. The city leveraged the existing social capital and elevated it to collectively engage and reach a level of urban resilience. In Malabon, social and community resilience is well demonstrated by how the community uses their social networks in adapting to their flood situation.

This research finding deduce that the drivers of resilience provide an enabling environment for collective engagement to thrive and build urban resilience. This means that these drivers of resilience act as enablers of the city to attain its vision, whether this vision is to strengthen social cohesion, build urban resilience, or attract investments. This result lends credence to the notion that adaptive capacity and an enabling environment promote collective action and foster and create resilience (Wolfram, 2016; Chelleri, et al., 2015; Djalante and Thomalla, 2010; Seeliger and Turok, 2013; Schwarz et al., 2011). The drivers of resilience provide the 'capital' that cities can use in developing the city into what it desires to be. However, the strength or weakness of the drivers of resilience in creating an enabling environment for collective engagement and urban resilience are found to be determined by the combination of these drivers. This will be discussed as part of the findings under the next sub-question.

What are the areas of convergence and divergence in the process of collective engagement and urban resilience between the Netherlands and the Philippine cases?

The research results show that while the combination of the drivers of resilience impacts the level of adaptive capacity of the case cities, the drivers institutional, social and human capitals have a significant positive impact on the case cities' collective engagement and urban resilience. This is because the three theoretical expectations in this research, strong information and education on disaster management, strong social networks that are tied to the city, and the government and stakeholders both understand and work on creating a cohesive community, are rooted in the ideas surrounding collective engagement, participation, social networks, and public management (see Chapter 3 for the full discussion). From the previous sub-section, the institutional capital lays down the policy that guides the process of collective engagement and building urban resilience, but the

social and human capitals are the drivers that bind the concept of collectiveness. These drivers aid in controlling the chaos that might occur during a flood disaster.

As shown in Figure 11.3 the transition from hard infrastructure to climate-adaptive strategies specifically the increased participation of stakeholders indicates a meeting of the adaptive cycle of the government approach and the self-organization approach. When the policy environment encourages co-creation and partnership and the cities follow through with activities in support of this, as in the case of Dordrecht and Marikina, this increases knowledge and acceptability of changes implemented by the city government and provides an opportunity for learning exchange between the stakeholders. Schwarz, et al. (2011) concluded along with the same premise that good governance "components are necessary to create (or support) the enabling environment to build resilience and facilitate adaptation to external drivers" (p. 1138).

On the other hand, the research finds that in instances where a city focuses predominantly on a top-down management approach, genuine interaction with stakeholders is lost. A level of urban resilience may be achieved by concentrating on other resilience drivers such as economic capital and environmental capital, resulting in a city that is equipped and secure physically and economically but may be vulnerable in other areas such as social cohesion and integration. An example of this is Rotterdam's focus on the economy and limited participation in city development with the community. Another example was at the onset of Marikina's reforms where no real consultation was done with the stakeholders. Such that the more distant the government appears to the stakeholders the harder it is to develop collective engagement. This distance can be because of the control and reliance given to the government, such as the hierarchical flood and crisis management employed in the Netherlands, or the opposite of this, unreliability, in the case of Malabon where the community has a relationship with the city government but a flawed one with the national government line agencies. This finding indicates that a more holistic and inclusive approach to decision-making, planning, and development facilitate collective engagement and urban resilience.

12.1.2 Addressing the main question: How does collective engagement contribute to building urban resilience in disaster-prone cities in the Netherlands and Philippines?

The findings underscored in the last sub-question posed an important jump-off point to address the main question. Figure 11.3 shows that each of the case cities went through adaptive cycles in specific periods after a disturbance. The empirical findings show that flood disasters whether big or small scale trigger the process of collective engagement (adaptive cycle) at the onset of the event. This collective engagement varies across time and scale and is shaped by governance mechanisms (policies and structure), trust, and

leadership. Policies in each period of the case cities showed the transition from preventive infrastructures or an engineering focus to climate change adaptation and participation. This transition was quite prominent in the Dutch cases when the national government first implemented the Delta Plan in the 1950s to construct the Deltaworks system. In the late 1990s, the Dutch government introduced a climate-adaptive approach to flood risk management with the introduction of the Room for the River and the Fourth Water Management Note. Other ensuing policies such as the "Working together with water", multi-layer safety (MLS) approach, and the Delta Program became the urban and spatial planning guideline of the case cities.

In Figure 11.3, it can be observed that the Dutch cases show similarities in the pattern of collective engagement and urban resilience. This is also because of the organized structure not just of the flood risk management in the country but also the crisis management following a hierarchical protocol. Still, the adoption of these policies at the local level is tailored according to how the city envisions its development. Figure 12.1 shows Rotterdam and Dordrecht's summarized process of collective engagement and urban resilience that was taken from the empirical findings in Chapters 7 and 8. In this figure, the upper half of the vertical lemniscate pattern is the government approach, and the lower the self-organization approach, and the four curved arrows depict the collective dimensions as has been described in Chapter 3. Descriptions that fall within the cycle indicate that this process is contained and influences the collective engagement in the city. Figure 12.1 shows that the focus on the economy in Rotterdam created a more management style of governance that affected the process of collective engagement in the city. Interactions between the institutional actors and planners, and institutional actors and capital stakeholders are regular and two-way (as indicated by the two-headed arrow broken lines). Interactions between institutional actors and citizens are not regular (as indicated by a single head arrow). Compared to Dordrecht where the process shows a robust and inclusive approach to achieve the city's vision of a *zelfredzaam* island.

In the Philippine cases, the transition from an engineering approach to an adaptive approach is not as clear as the Dutch cases. For one, the construction of preventive infrastructures did not take off as smoothly as in the Netherlands. The Philippines went through the martial law period from 1972 to 1981 which was a tumultuous time in Philippine history. The political unrest and amount of debt incurred from loans taken from multilateral donor organizations sunk the economy and delayed the construction of flood control projects. This has led to a decentralized flood risk management approach, often band-aid measures, in cities that are frequently flooded. In Figure 12.2 Marikina and Malabon's process of collective engagement and urban resilience has been summarized from the empirical findings in Chapters 9 and 10. The figure shows that the partnership focus of Marikina enabled the creation of direct partnerships between and among

Figure 12.1: Summary of Rotterdam and Dordrecht's process of collective engagement and urban resilience

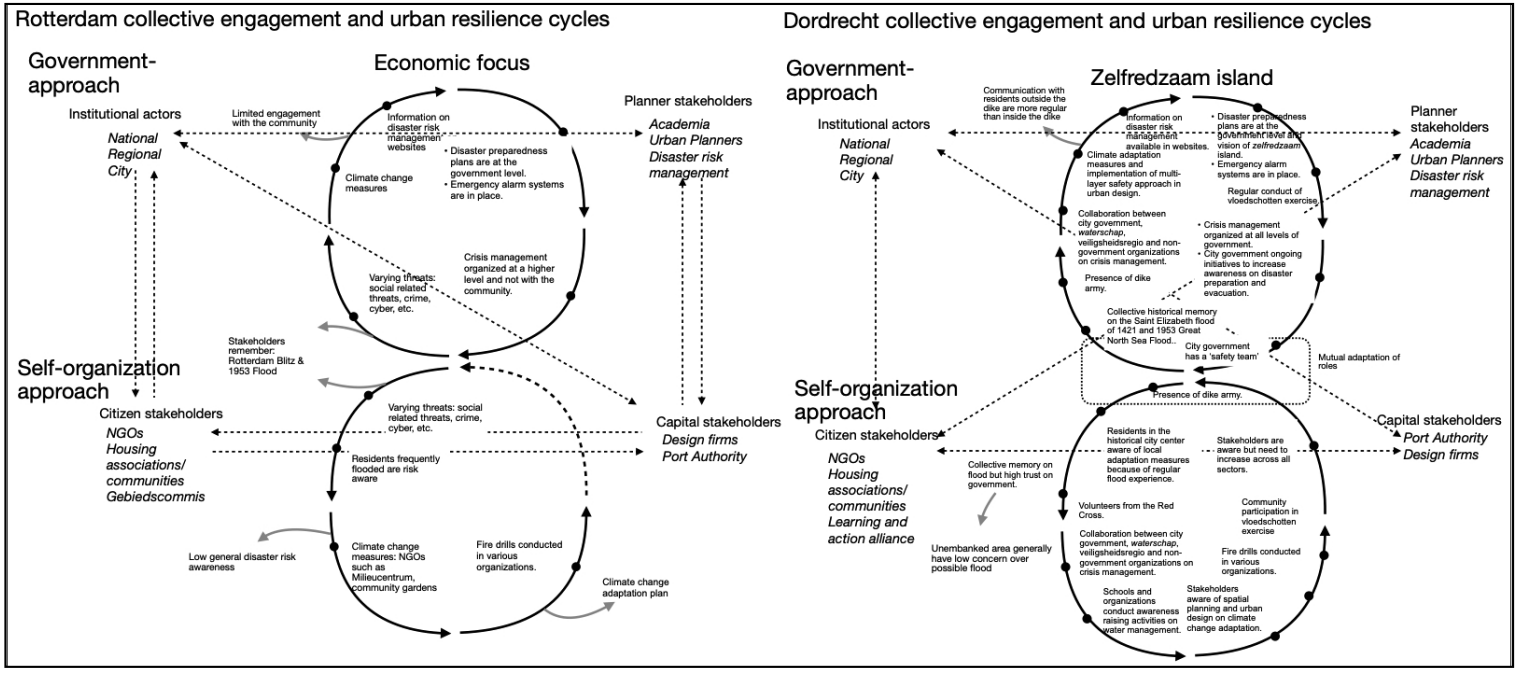
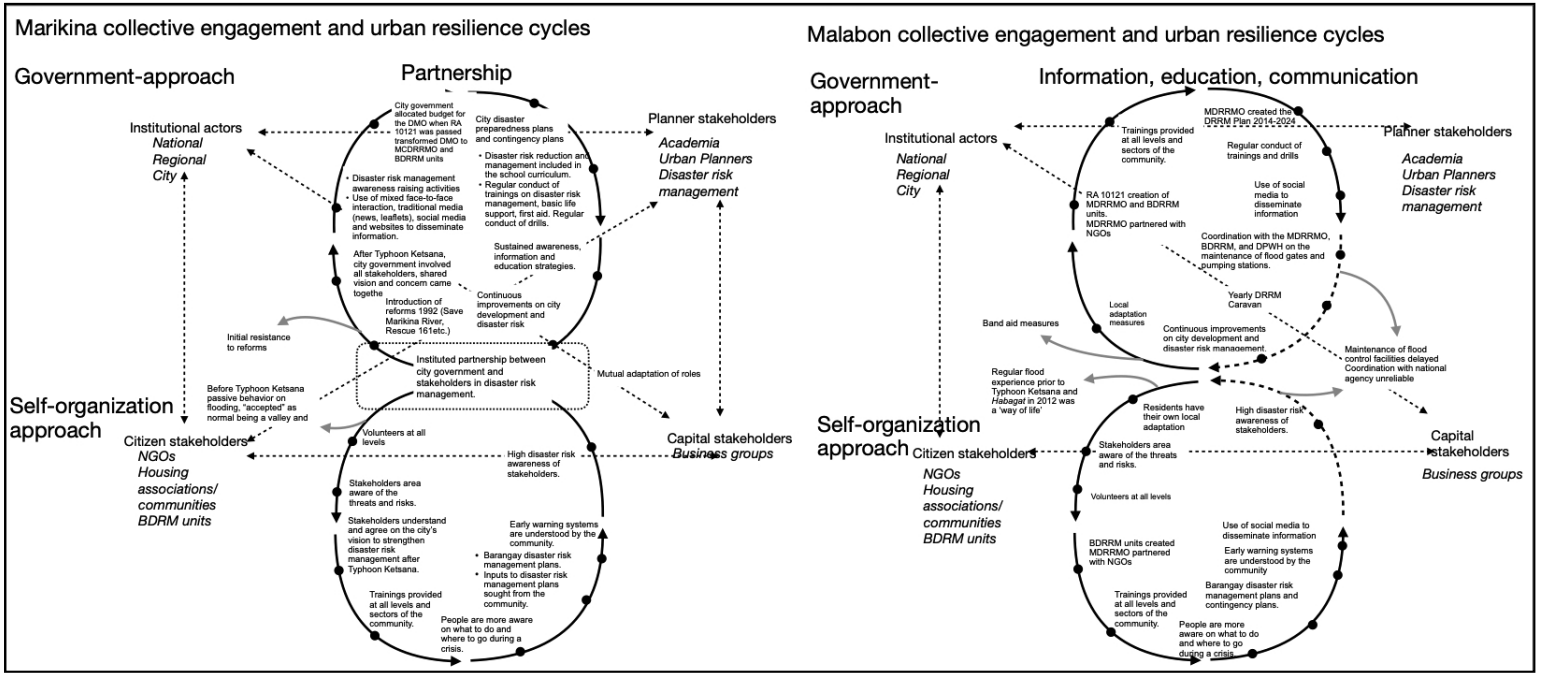


Figure 12.2: Summary of Marikina and Malabon's process of collective engagement and urban resilience



stakeholders at all levels. Activities that fall within the adaptive cycles were guided by policies that prioritized participation and education. On the other hand, Malabon's experience and familiarity with floods have instilled a "culture of disaster" that has normalized these incidents to the point where when the MDRRMO was established, residents were still practicing their own individual techniques in handling the floods. This later changed when the city partnered with non-government organizations to conduct information, education, and communication campaigns in the 21 *barangays*. The only problem that stymies the process of collective engagement and urban resilience in Malabon is the maintenance of the flood control facilities that are in the jurisdiction of the national and regional government agencies (Department of Public Works and Highways and the Metro Manila Development Authority).

The findings of the research demonstrate that a coordinated and reliable government system on flood and disaster risk management that has shown remarkable success in flood prevention and planning stimulates trust and demonstrates accountability. On the other hand, unreliability promotes self-organization among the stakeholders to take matters into their own hands (Malabon case).

Collective engagement concerning the disaster experience has been found in the research to decline over time due to the disaster gap and low-risk awareness and communication. The disaster gap refers to the long period that a place has not experienced any kind of disaster that the previous experiential knowledge has diminished. Cities with a long disaster gap and low-risk communication, such as Rotterdam and Dordrecht, further widen the gap on risk awareness and management among the stakeholders. This makes it difficult to engage the stakeholders in discussions on disaster risk management. In contrast, the findings demonstrate that frequent or regular flood experiences increase collective engagement by drawing on experiential learning.

The research indicates that there is a higher degree of collective engagement on disaster risk management amongst cities that engage directly with stakeholders in a discussion, a program, or a drill. Empirical evidence shows that consistent direct engagement between state and non-state stakeholders leads to enhanced collective engagement on issues such as flood and disaster risk management. This was shown in the findings in the case cities, Dordrecht and Marikina, where the city government facilitated interactions and collaborations with different stakeholders and involved the community in decision-making, planning and implementing projects in the city. Through this direct engagement non-state stakeholders, especially those at the community level, have a better understanding of the risks and vulnerabilities in their cities and are more receptive to collaborating with the city's initiatives. This results in a better appreciation of the city's development vision among all stakeholders and the role that each of them would play in achieving this vision. Whereas the top-down management vision, as in the Rotterdam case and at the beginning

of the first adaptive cycle of the Marikina case, and the lack of direct and real engagement with the community lowers cohesiveness.

These findings also highlight that the city's institutional capital lays out the foundation for the direction of collective engagement and urban resilience. The drivers of resilience, economic and environmental capitals, provide resources and capacity to physically handle flood risks which influence urban resilience in the financial and physical aspects. However, these drivers can be considered passive in terms of influence in the process of collective engagement. While the drivers of resilience, social and human capitals have a more direct link with collective engagement and urban resilience as it binds social networks, improves awareness through information and education, and leads to collective action. As mentioned in the previous section the drivers of resilience create an enabling environment for both collective engagement and urban resilience.

From the previous chapter, Table 11.1 shows that the level of adaptive capacities of each of the case cities depends on each of the drivers of resilience level of capital (capacity). This adaptive capacity is the resource that the city can use. On the other hand, in Table 11.2 the research shows how collective engagement builds urban resilience by underscoring that perception of risk and resilience determines behavior and action, the influence of information, social networks, and mutual adaptation of the stakeholders' roles in the process of collective engagement and urban resilience. Elements that are present in the three drivers of resilience, institutional, social, and human capitals. As such, the research argues that a lower degree of adaptive capacity (Malabon) but a high degree of collective engagement increases urban resilience. The reason for this is that collective engagement compensates for what is lacking in terms of resources that make a city resilient, such as physical or economic capitals. An example is Malabon, the social and institutional capitals of the city are high while the rest are rated medium and low (see Table 11.1) but because of the engagement of the stakeholders in disaster risk management activities and the ability of the stakeholders to use their social networks (see Table 11.2) their collective engagement augments what is lacking that the city maintains a level of resilience even with the frequent flood that they experience.

The analysis of the cases demonstrate that collective engagement contributes to urban resilience depending on the type, amount, frequency, and reach of the information and education on disaster risk management, strength of the social networks, and the mutual understanding and adaptation of roles of both the state and non-state stakeholders in resilience building (as shown in Figures 12.1 and 12.2). The availability and accessibility of information and education on disaster risk management for all stakeholders is important in building a knowledgeable and risk-aware population. The continuous and consistent communication and engagement between the government and the stakeholders, especially the community, helps in creating a cohesive and integrated atmosphere in the city which is necessary for collective engagement and building urban resilience. Social networks are

important in urban resilience at all stages of disaster risk management, especially in the preparatory, response, and recovery stages. While at the mitigation stage, networks are needed to provide technical expertise and know-how on disaster risk mitigation but also to share this information with the wider public. The analysis of the cases also shows that stakeholders have a consistent perception of resilience with cities that have a clear vision and direction on urban resilience (Dordrecht and Marikina). The research also discovered that the stakeholders' perception of risk and resilience are socially constructed so that institutional actors must frame and communicate these two concepts explicitly and consistently. This brings consistency and clarity on the two concepts and shared awareness and mutual adaptation of roles and responsibilities between stakeholders.

In comparison, in the Rotterdam case, the lack of communication and involvement in disaster risk management, the disaster gap experienced, and the trust in the government decreased collective engagement and urban resilience. This does not mean that the drivers of Rotterdam's resilience are weak, evidence in the case analysis indicates that Rotterdam has a high degree of adaptive capacity. What this shows is that the adaptive capacity, which is the availability of resources, helps create urban resilience so if it is not used together with the stakeholders then urban resilience declines. The findings illustrate that in cases with opposite outcomes on the adaptive capacity and collective engagement, urban resilience tips to only one form of resilience such as engineering resilience (Rotterdam) and community resilience (Malabon) but not generally a deep socio-ecologically resilient urban environment. It also implies that the drivers of resilience contribute to a degree of urban resilience to compensate for capacities that may be weaker than the other, such that the stronger resilience driver becomes the focal point of the city's urban resilience.

Finally, the cases demonstrate that collective engagement and urban resilience is a continuous, complex, and dynamic process. The patterns over time in the cases show that actions taken vary in strategies and periods. It indicates that learnings extracted from past experiences whether effective or ineffective are adjusted to suit the present circumstances demonstrating the capacity of the cities to adapt, learn and transform which is the nature of urban resilience.

12.2 THEORETICAL CONTRIBUTIONS OF THE FRAMEWORK

The research focused on how collective engagement helps to create urban resilience in flood-prone cities in the Netherlands and the Philippines, this entailed an examination of how different stakeholders in each of the case cities proceeded to take purposive actions beginning at the onset of the disaster experience until reaching a level of security and what propelled these initiatives. The research looked at how each case city used the drivers of resilience during each period of its disaster experience to create urban resilience by way of collective engagement. In the attempt to understand this interaction between the drivers of

resilience, disaster experience, and collective engagement, the research unpacked elements that shape the urban resilience of each of the case cities.

Instead of just looking into the structural aspects in addressing disasters and urban resilience the research moved beyond this analysis by analyzing the actors involved in urban planning and disaster risk management and the enabling factors that facilitate these initiatives. In this manner, the research contributed to the discussion on cross-sector collaboration between stakeholders that is found to be a means to solve wicked problems and achieve common goals (Bryson et al., 2006; Ansell and Gash, 2008; Simo and Bies, 2007). Through analyzing each of the case cities adaptive cycles, how it was triggered by a disturbance (flood disaster, ravages of war, reforms), what policies were developed, how cities adopted these policies, and why (and why not) stakeholders collectively engage, the research found not just the networking and collaborative aspect but also how institutional systems are anchored on discursive systems, and how risk and resilience are found to be social constructs.

12.2.1 Framing urban as a socio-ecological system

At the beginning of this research, the term socio-ecological system was introduced as a concept that brings together the social system (human, social, institutional, economics) and ecological system (built and natural environments). The introduction (Chapter 1) noted that the socio-ecological system was not as prominently used in urban planning as it was in ecological studies, citing the historical emergence of urban planning as a spatial design-oriented field. However, urban planning theories such as the Growth Pole theory, Central Place theory, and Concentric Zone theory (Chicago model) tried to link geography, economics, and human settlements with land use and spatial patterns, which shows how early theories on urban planning stirred towards a social science direction. The concentric zone theory for one, while having earned numerous criticisms (Vashisth, 2008; Grove and Burch, 1997; Alihan, 1938; Hollingshead, 1947; Schwab, 1992) gave birth to the concept of human ecology.

The socio-ecological systems framework was used in this research to examine the diverse and dynamic interactions between the city's physical, social, institutional, economic, and natural components. It contributes to the discussion on how a variety of disciplines better explain city planning and urban resilience. While urban planning has its origins in architecture, spatial design, and geography, it has evolved to become an interdisciplinary field (Chen, et al., 2020; Pinson, 2004; Abd Elrahman and Asaad, 2021) so much so that understanding the urban ecosystem within the realm of socio-ecological systems gives it more depth than seeing urban as just a physical built system.

The systematic literature review in Chapter 2 is an important part of this research as it draws attention to the limited studies conducted on the relationship between urban

planning, socio-ecological systems, disaster, and resilience. Results of the review showed that studies that include these topics were mostly on natural hazards and climate-related disasters (Gunderson, 2010; Ainuddin and Routray, 2012; Gotham and Campanella, 2011; McSweeney and Coomes, 2011; Hooli, 2016; Wagner, et al., 2014), governance systems (Wilkinson, 2012; Bahadur and Tanner, 2013; Baud and Hordijk, 2009), community and social capital (Ainuddin and Routray, 2012; McSweeney and Coomes, 2011), climate change adaptation (Chelleri, et al. 2015; Schwarz, et al., 2011), urban development (Baud and Hordijk, 2009; Picket, et al., 2013; Seeliger and Turok, 2013; Romero-Lankao and Gnatz, 2013; Takeuchi et al., 2014; Wolfram, 2015), environmental capital (Steiner, 2014; Djalante and Thomalla, 2011; Mehmood, 2015; Sharifi and Yamagata, 2016), and disaster experience and memory (Bhattacharya-Mis and Lamond, 2014). In each of these studies, only one or two factors contributing to urban resilience were discussed but an important outcome in the entire systematic review was the development of the criteria for assessing a resilient urban system. This outcome together with the variables and indicators drawn from both the systematic literature review and the policy review contributes to the discussion that the study on urban development and planning, and resilience, cannot be separated between the structural and non-structural, hard and soft measures, and social and ecological.

As a result of the systematic literature review, the research led to the strengthening of the relationship between the social and ecological system in the urban environment. Framing cities as a socio-ecological system not only acknowledges the different sectoral components of the city but also its complexity as a multidimensional system. Drawing on the socio-ecological system as a starting point of this research is also important in bringing in the resilience discussion which is equally complex and multidimensional.

12.2.2 Defining collective engagement and urban resilience

The definition of collective engagement in the context of urban development is few and far between and is often associated with stakeholder engagement and citizen participation. Ilan and Kantini (2013) offered an insight on the concept of collective engagement in development that underscored the different development levels working on harmonized efforts towards sustainable development. However, how these efforts are organized nor who is involved are not identified. Having described participation and engagement in Chapter 3 helped in building up elements that can be factored in defining collective engagement. This research provided a working definition of collective engagement that factors in who is to be engaged in urban resilience, how long this engagement lasts, and what kind of engagement. Collective engagement on urban resilience is characterized as a collective process between multiple stakeholders that uses both formal and informal methods to reach a solution or decision to create urban resilience. By providing a definition this research has contributed to the collective engagement, collaboration, co-

production, and collaborative governance discourse where participation and engagement are found to have an active deliberative role in enacting change (Fung and Wright, 2001; Cernea, 1993; Chambers, 2003; Gundersen, 1995; Collier, et al., 2013; Delli-Carpini, et al., 2004).

On the other hand, the concept of urban resilience is based on a socio-ecological resilience perspective that emphasizes cities as dynamic socio-ecological systems with the adaptive capacity to absorb disturbances, reorganize, learn and transform. Defining collective engagement and urban resilience as processes emphasizes the dynamism and evolution that takes place in cities over time, based on experience and learning. While this research did not define urban resilience empirical findings demonstrated that urban resilience in the four cases is correlated to a sense of being of the stakeholders. This feeling or sense comes from the learned experiences (or lack thereof) and is also related to the policies that the cities carried out. These policies coming from the national government trickling down to the local governments created an atmosphere among the stakeholders and became the basis for which stakeholders identify themselves as part (or not) of the city. This identification with the city and its policies determines how stakeholders engage which contributes to their experiences and defines their perspective on urban resilience. This finding in the research is reminiscent of Lynch (1984) and Appleyard and Jacobs (1982) publications that linked urban design principles with identity. Place identity is important for citizens for this not only gives a sense of place and ownership but also affinity, pride, and control which are characteristics that fuel their resolve to participate. As a consequence of this finding, the research had added to the existing body of knowledge on place identity and policies, especially studies on how policies contribute to the enhancement or deterioration of place identity (Barata-Salgueiro and Guimarães, 2020; Nagaynay and Lee, 2020; Adobati and Garda, 2020).

12.2.3 Two approaches of collective engagement and urban resilience

The conceptual framework built in this research, the collective engagement urban resilience framework, illustrates a transformative way of approaching disaster risk management and urban resilience research by emphasizing two procedural approaches (government and self-organization approach) in building urban resilience. Most studies on resilience emphasize vertical and horizontal linkages establishing feedback mechanisms in decision-making across stakeholders that contribute to efficient governance systems and resilience building (Baud and Hordijk, 2009; Sharifi and Yamagata, 2016; Gotham and Campanella, 2011). In this research, the two approaches not only show the vertical and horizontal linkages but that creating urban resilience demands a networked management approach because of the complexity of the urban environment. Network management stems from governance networks which are "more or less stable patterns of social relations between mutually dependent actors" (Klijn and Koppenjan, 2015: 11) that seek to address

policy issues through a series of interactions. Equally important to factor in these interactions are the results of the interaction and the evolving or perhaps growing array of involved actors.

The complex pattern of interactions within the urban environment is what network management tries to address which is to "facilitat[e] and guid[e] the interactions and/or chang[e] the features of the network with the intent to further the collaboration within the network process" (Klijn and Koppenjan, 2015: 11). Huck, et al. (2021) pointed out that several scholars have intensified debates on urban resilience specifying that with the complexity of urban threats and interconnectedness with different sectors of the urban environment, policies must be designed by actors collaboratively across sectors and boundaries. This is because of the different amount and types of threats that are present in the urban environment. In addition, disaster risk management calls for collaboration among sectors and across levels of government and society at all phases - pre-disaster, during, and post-disaster - to ensure security and safety. However, it should be pointed out that the scale of the networks or number of stakeholders involved in the collaborative process does not equate to its legitimacy or deliberative participation rather it is the quality of the collaborative process (Mosley and Wong, 2021; Huck, et al., 2021; Van Meerkerk and Edelenbos, 2014; Ysa, et al., 2014; Sotarauta, 2001). This 'quality' is founded on the ability to draw in inclusiveness (Romero-Lankao and Gnatz, 2013; Vale, 2014; Merrifield, 2002; Gaventa and Barrett, 2012; UNDP, 2016), voice opinions and be heard (Merrifield, 2002; Delli Carpini, et al., 2004; Gaventa and Barrett, 2012; Mosley and Wong, 2021), and hone trust (Takeuchi, et al., 2014; Gotham and Campanella, 2011; Mosley and Wong, 2021; van Meerkerk and Edelenbos, 2014; Ysa, et al., 2014; Sotarauta, 2001; Patterson, 2017). It is also worth mentioning that the two approaches in the collective engagement urban resilience framework do not only draw on the top-down or bottom-up approaches commonly considered in disaster risk management, governance, and public policy research. As evidenced in the cases, the governance and self-organization approaches in building urban resilience through collective engagement are best achieved parallel to each other. This does not necessarily mean though that these two approaches are working together on one particular project or program although they can be (i.e. co-production in Dordrecht in developing the floating houses and working together on the Room for the River) but rather these two approaches are aligned towards the same vision (i.e. partnership in Marikina where schools whether public or private independently have incorporated disaster risk management in their curriculum). Huck, et al. (2021) extended this by concluding that local activities should be aligned with the regional and national levels of government and roles and responsibilities of cross-sectors and cross-departments must be clarified. As such, in attempting to institutionalize urban resilience, the mutual adaptation of roles among stakeholders is important in the process of collective engagement and in enhancing the adaptive capacities of those stakeholders and sectors involved in the urban environment.

In order for this to work, Van Meerkerk and Edelenbos (2014) stressed the importance of connective capabilities of those involved in the governance network and the existence of connective agents to facilitate connective activities. The research used what it calls the drivers of resilience which are the adaptive capacities of the city specifically, human, social, institutional, economic, and environmental (both built and natural) capitals. Using the capitals as the drivers allow manipulation of the possible indicators to be used in attempting to measure urban resilience or resilience in general. The research offers insight into the use of capital to directly connect to adaptive capacities as resources that can be utilized. This is particularly important in disaster risk management research where the terms vulnerability and capacity have often been cited. The extensive study done by Wamsler (2007) points out that lack of capacity of households, communities, or institutions can either be the lack of capacity to respond to and recover from disasters. This research supports Wamsler's idea and advocates that vulnerability is not limited to the human capacity to respond to disaster because doing so tethers the entire meaning of risk to only human vulnerability and human capacity. Whereas widening the definition of vulnerability to include social, institutional, economic, and environmental aspects, broadens the definition of capacity to the holistic capacity of the city to respond to disaster risk. Studies on vulnerability and resilience have equally called for the expansion of its analysis to include individual and collective processes (Schwarz, et al., 2011), sectoral drivers (in this research drivers of resilience) (Ainuddin and Routray, 2012; Gotham and Campanella, 2011; Schwarz, et al., 2011; Wagner, et al., 2014; Baud and Hordijk, 2009) to holistically understand the relationship between vulnerability and resilience. Moreover, it follows the logic that resilience is the capacity of the system to withstand shocks, reorganize, evolve, adapt and retain the same function and structure whereas vulnerability is not, substantiating that vulnerability is the antithesis of resilience. It is understood that "urban resilience is far from being merely the flipside of vulnerability" (Chelleri, et al. , 2015: 182) however, it cannot be ignored that resilience and vulnerability is linked and can be better understood together to gain better insights and identify areas for development and change (Seeliger and Turok, 2013) and improve adaptive processes and cross-scale interaction (Bhattacharya Mis and Lamond, 2014; McSweeney and Coomes, 2011; Gotham and Campanella, 2011; Schwarz, et al., 2011). In this aspect, this research contributes to the debate on the link between resilience and vulnerability and the importance of cross-scale interaction of sectoral components of the city in urban resilience.

12.2.4 Perception of risk and resilience as social constructs

One significant finding in this research is the perception of risks and resilience by the stakeholders. The research sought the perception of stakeholders on what resilience is and in the process was also able to uncover and relate this to how the stakeholders perceive risk. The research found that the perceptions of risk and resilience are socially constructed and allied on both the institutional and social systems of the cities. Marcus and Colding

(2011) have underscored this as the hierarchy of embeddings where institutional systems are embedded in discursive systems. That the policies cities implement is anchored on what is deemed valuable and dismiss what is deemed unimportant.

The cases offer two interesting perspectives on flood risks one that is seen as just a 'nuisance' because it does not happen and if it does it is shallow and nothing to worry about (Rotterdam and Dordrecht) and 'used to it' that even if it happens it is fine it can be managed (Malabon). As such these perceptions on risk appear to be what is 'normally' experienced that stakeholders distantiate themselves from what is 'not normally' experienced. From the former perspective, this is close to the 'levee effect' where the successful flood prevention measures that created a long disaster gap enabled people to place their trust in the government and the infrastructure (Baan and Klijn, 2004). The high level of trust in the government to protect the citizens (Kuipers and Boin, 2014; van Heel and van den Born, 2020) and the flood protection infrastructure reduces flood risk perception and lessens the feeling of dread on the possibility of flood risk (Terpstra, 2011; Slovic, 1987). This false sense of security ('levee effect') (Baan and Klijn, 2004; Hutton, et al., 2019; Collenteur, et al., 2015) is further reinforced by a long disaster gap and recognition and reliance on the government's responsibility to take care of them.

On the other hand, the 'used to it' perspective takes on what Bankoff (2003) calls 'culture of disaster' that is the disaster experience has been ingrained into the daily life of the people that it has become a normal occurrence thus part of the culture. Terpstra (2011) highlighted in the study on flood preparedness behavior in the Netherlands that preparatory behavior has a causal relation with how risks are perceived and understood (cognition or cognitive) and how risks are felt (affective). In both perceptions flood risk can be managed, in the Dutch cases by the government and in the Philippine cases by the community (more prominently with the Malabon case). This feeling of manageability is linked to the flood experience (or lack of), whether positive or negative, (van Heel and van den Born, 2020; Baan and Klijn, 2004; Terpstra, 2011) which determines behavior towards flood risk or flood preparation.

In the same vein, resilience is a social construct shaped by governments through policies and society through experience. The cases (Rotterdam, Dordrecht, and Marikina) showed that the interpretation of resilience is directly due to the government policies, such that the clarity of the urban resilience direction coming from the city government produce the same clear understanding of resilience from the stakeholders, and the opposite, the vagueness result to the same ambiguity in understanding resilience. In the case of Malabon, societal experience on flood risks, the frequency, regularity, and severity, have led to equate resilience to survival. Resilience, more specifically urban resilience, cannot just be constrained to one definition because there are different perspectives and approaches (see Chapter 2 on the different resilience perspectives). Defining urban resilience is as complex and varied as the concept of resilience. Meerow, et al. (2015) reviewed 25

definitions of urban resilience and found ambiguity as well as inconsistencies in the usage and definition of urban resilience. As such, they culled out six conceptual tensions in the definitions and provided their position for each to define urban resilience as,

> *"Urban resilience refers to the ability of an urban system-and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales-to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity."* (Meerow, et al., 2015: 45)

This definition recognizes the complexity of an urban system with varying subsystems and networks – governance, material and energy flows, urban infrastructure and form, and socioeconomic dynamics (Meerow, et al., 2015). In each of the subsystems and networks are a diverse set of stakeholders with varying stakes in the city as well as beliefs, values, perceptions, and biases. As such the question 'resilience for whom, what, when, where and why' (Meerow, et al., 2015: 46) is particularly valid in trying to understand urban resilience. These are areas worth exploring in urban resilience research to give an understanding of how discursive systems influence institutional systems and how institutional systems influence social systems.

12.3 PRACTICAL CONTRIBUTIONS AND RECOMMENDATIONS

An important practical contribution of this research is the recognition that urban resilience takes on different perspectives and the only way to hone in on a more general understanding of urban resilience is by creating a dialogue between and among stakeholders. While a general concept that includes attributes and criteria of urban resilience is found in this research, policymakers must be able to integrate these concepts into the social and cultural setting of the city. The sense of place and sense of being of stakeholders in a city must be included in urban development and resilience-building because this connection with the stakeholders and the city can help in the process of collective engagement. Collective engagement does not mean that stakeholders band together for one specific program of the city working together in unison. On the contrary, stakeholders can work on different sectors in the city as long as this is towards the same agenda or vision of building urban resilience. And in order to this, institutional actors must take the lead by creating an enabling environment that encourages participation and engagement. Where a common vision and definition of urban resilience can be drawn from the stakeholders. In this way, resilience can be fully understood by the stakeholders and in so doing can better participate and deliberate.

The conceptual framework developed in this research demonstrated a way to understand the process of collective engagement and building urban resilience can be led by both the government and the self-organization approaches and shows the interdependency and interconnectedness of the different networks in the city. The findings demonstrate that

leadership, trust and transparency facilitate partnership, co-production, and co-creation, however, not everyone can wait for a leader like what Marikina had at the start of their reforms. The research showed that policies just like the Philippine Disaster Risk Reduction and Management Act and Safety Regions Act help in delegating responsibilities and tasks to specific groups and organizations to deal with crises and emergencies. Both countries devolved the responsibility for disaster risk management to the local level, but the distinction is that in the Netherlands the safety region regulates the overall management and, based on the hierarchy of emergencies, there is a delegated responsible unit, while in the Philippines the task is assigned to local governments. In this aspect, it is proposed that to institutionalize urban resilience it should be facilitated with guiding frameworks to clarify the "roles and responsibilities for cross-territorial risk management, cross-sectoral and cross-departmental budgeting of resilience measures, and a better alignment of local activities with activities at regional and national levels of government" (Huck, et al., 2020: 19). In this way, the cities can organize not just their networks within the city but also the network of cities especially those adjacent to them, and have transboundary issues such as a shared water body (i.e. deltas, rivers) or affected by run-off water from higher areas.

In the research the drivers of resilience were used in conjunction with collective engagement to determine the level of collective engagement and urban resilience in the case cities. This can be used by cities all over the world to reflect on their respective cities' adaptive capacities in order to determine which drivers dominate and which fall short. By doing so, cities in both the Global North and the Global South can assess which drivers to strengthen and which to leverage. This is especially important in rapidly urbanizing cities in the Asia-Pacific region, where natural disasters are common (see Table 1.1 in the introductory chapter). Cities in these vulnerable regions can identify which areas of urban development and disaster risk management need to be prioritized by understanding both disaster vulnerabilities and available resources (drivers of resilience). As well as what institutional mechanisms should be developed in order to create a conducive enabling environment for collective engagement to thrive.

Lastly, the perception of risk and resilience is one of the more interesting findings in this research as it deals with both cognitive and affective aspects of behavior (individual and communal). The research found that the lack of risk communication but high trust in the government and infrastructure have fostered feelings of complacency and reliance which have a direct relation to the low perception of flood risk. This finding is particularly important in the Dutch cases as it relates to how they can develop risk communication. This finding showed that the information and education on risk and resilience should appeal to both cognitive and affective senses in such a way that the feeling of dread or helplessness is cast away to improve the participation of stakeholders in risk management and resilience-building activities (Terpstra, 2011; van Heel and van den Born, 2020; Slovic, 1987).

12.4 LIMITATION OF THE RESEARCH

While the research uncovered valuable findings and research contributions it is not without limitations. First, the comparisons between the case cities were made including planning policies on participation, disaster risk management, and urban planning but did not look into the political situations of each city and country in detail. The city cases Rotterdam, Marikina, and Malabon provided some insights on the political environment in given periods that affected the process of collective engagement and urban resilience of the cities but the discussion was not as hearty to generalize associations between the political environment and urban resilience. This may be an interesting topic for future research, focusing on the political environment and its effect on urban resilience.

Second, while a good amount of data and representation of key informants were included as research participants, there were not a lot of representatives from the capital stakeholders (business groups). Findings in the research indicate that the stakeholders acknowledge the presence and support of business groups in providing aid and assistance during a crisis. These claims were confirmed and consistent coming from different stakeholder groups (institutional actors, citizens, and planner stakeholders) interviewed. However, it will be curious to know in future research a good representation of the capital stakeholders and their role and involvement in building urban resilience.

Third, researching four case cities on a complex subject such as urban resilience on a limited time and budget is a feat. While the research was able to obtain useful insights and robust and unique narratives for each of the case cities, it was not able to fully identify and describe the connective agents that provide the internal and external links within the network (Van Meerkerk and Edelenbos, 2014). The research was limited to the boundary-spanning activities, as described in Chapter 3, as the link between people, ideas, and resources. An exploration of domains of change which includes not just the boundary spanning activities but specific connective agents within the collective engagement urban resilience framework and in each dimension would have been useful given a longer time frame and a generous amount of resources.

12.5 AREAS FOR FUTURE RESEARCH

The complexity of cities means some layers interlace with one another that may not be as obvious at one glance. The research contributed to the development of empirical evidence on the iterative process of urban resilience and collective engagement. It also demonstrated the complexities in studying urban resilience as it deals with the intersecting vertical and horizontal linkages across time and boundaries. There are several potential areas for further exploration taken from this research, three of which are presented as follows.

First, the perception of risk and resilience as social constructs was mentioned in the previous sections. Environmental psychology studies have already included risk perception in the analysis of flood risk management (Baan and Klijn, 2004), environmental policies and programs (Slovic, 1987; McDaniels, et al., 1997), environmental attitudes and biases (Böhm and Tanner, 2013; Xie, et al. 2019; Macias, 2016; Terpstra, 2011; van Heel and van den Born, 2020). On the other hand, there has been limited to no research done on the perception of resilience as social constructs and its marked parallelism with the perception of risks. This research offers a step forward in highlighting the parallelism of perception of risks and resilience, where areas of inquiry can include the different perceptions of risks and resilience in cities in the Global North and Global South. This direction of the research can provide valuable insights in policy development on urban resilience and disaster risk management especially in the areas of risk communication, collaborative planning, and integration.

Second, the research provided the processes of urban resilience and collective engagement in the four cases which highlighted the adaptive capacities of the cities and how these were utilized in the adaptive cycles. The disaster history including the history of urban planning, disaster, and flood risk management of the cities was crucial in piecing together the process. While the cases were able to highlight the history and policies that accompany the process of urban resilience, it was uncovered in the research the importance of understanding the political environment for each period of the adaptive cycle to provide an exhaustive appreciation of each period in each case. In this light, follow-up on-the-ground research for each case individually would be ideal. An initial step towards this direction has been done for the Rotterdam and Malabon cases, where the research touched on the idea that collective engagement may have been hampered by policies on integration of the *allochtoon* (immigrant) in Rotterdam, and the political instability in the Philippines rigged with corruption and insurgency have delayed the development and construction of flood preventive infrastructures in Malabon.

Finally, this research offered a conceptual framework on collective engagement and urban resilience that can be tested on any kind of disturbance that affects society and the urban environment. It will be interesting, since at the time of concluding this dissertation the world is in a pandemic, to investigate whether collective engagement can be a success factor for cities in addressing the pandemic and maintain its level of urban resilience? If fragmented crisis management approaches is a result of a lack of adaptive capacities? The framework can be used to assess the drivers of resilience that cities possessed and the government approach and self-organization approach employed. In this instance, the QCA method which is a research methodology that analyzes multiple cases to identify and explain the occurrence of a phenomenon can be used as a possible research methodology because it can assess complex cases and narrow down the conditions of occurrence of a given phenomenon (Berg-Schlosser, et al., 2009). This method was used by Edelenbos, et.

al. (2020) in the study of community-based initiatives (CBI) where they found different causality for the high performance of CBIs not necessarily influenced by government support. This research can be further expanded using context variables (Edelenbos, et al., 2020) such as sectors (i.e. drivers of resilience), not included in the CBI study, and political climate which was also not fully explored in this research. It can contribute further to studies on crisis governance approaches that can lead to better governance networks, systems and policies.

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APPENDICES

APPENDICES

APPENDIX 1 CRITERIA, VARIABLES AND INDICATORS

Appendix 1: Criteria, variables and indicators for assessing a resilient city

Criteria for assessing a resilient city	Variables	Indicators	Key sources
Adaptive capacity and resilience to manage, adjust, learn and cope with different changes	Develop alternative scenarios	Shared vision among stakeholders that reflect social needs and the existing diversity of values Stakeholders are motivated to contribute to achieve the vision Wide range of urban strategies, programs and projects Flexible range of urban strategies, programs and projects Urban development scenarios mutually shaped by social, ecological, economic and technological dimensions Stakeholders choose alternative scenario and understand uncertainties Scenarios and options for action including preconditions and implications for relevant stakeholders	Wolfram, M. (2015)
	Different types of knowledge for learning on adapting to changes and uncertainty	Technological knowledge Experiential knowledge Social learning Use of local and community-based knowledge Transformational knowledge Systematic management of practical knowledge to implement sustainable development projects and programs Collaborative learning	Wilkinson, C. (2011); Gotham and Campanella (2011); Steiner F. (2014); Wolfram, M. (2015)
	Capacity of the community to cope with past and future threats	The community coped with the disaster event at the time The community has learnt from past disaster experiences and can now cope better in the future Reduced threats from disasters through individual and collective action Improved livelihoods through individual and collective action Identification of issues related to natural resources management and sustainable livelihood and industries. Application of what was learned from the disaster in future planning and design Capacity to avoid, reduce, minimize impacts of disaster Ability to learn to mitigate future disasters Understanding and awareness of the uncertainty of risk plays an important role in building up of adaptive capacity within the system Appropriate capacity to understand status-quo, and identify patterns, potential threats, and contingencies	Schwarz et al. (2011); Steiner F. (2014); Djalante and Thomalla (2010); Bhattacharya-Mis and Lamond (2014); Sharifi and Yamagata (2016)
	Adaptive co-management and cross-scale interactions	Multi-level collaboration: between stakeholders and government; between stakeholders and private institutions and organizations; between stakeholders, the private institutions and organizations, and the government Stakeholders provide feedback on government services Knowledge sharing and integration Trust building Government and stakeholders monitor and adapt co-managed projects and programs Presence of leaders and agents for change Linked social, technical and institutional networks	Wilkinson, C. (2011); Gotham and Campanella (2011); Wagner et al. (2014); Sharifi and Yamagata (2016); Mehmood, A. (2015)

Appendix 1: Criteria, variables and indicators for assessing a resilient city (continuation)

Criteria for assessing a resilient city	Variables	Indicators	Key sources
		Functional relationships between systems and networks (receive support, provide inputs and feedbacks)	
		The managerial capacity to effectively coordinate preparatory and recovery actions between various sectors and organizations at different scales.	
		Physical relationships between systems and networks	
		Flexible systems able to respond to disturbances and changes	
		Focus on localization of social and economic processes and activities	
		Encourage multi-stakeholder participation and engagement in disaster risk reduction activities	
	Integrated and strong governance structure	Multi-level capacity development: public, private, civil society sectors at the individual, household, organizational levels	Djalante and Thomalla (2010); Picket, et al. (2013); Romero-Lankao and Gnatz (2013); Wolfram, M (2015); Sharifi and Yamagata (2016)
		Interactions between political-administrative levels and between geographical scales	
		Ensure all stakeholders have access to resources and services	
	Capacity to adapt to external changes	Ability to survive and cope with disaster with minimum impact and damage	Chelleri, et al. (2015); Djalante and Thomalla (2010); Bhattacharya-Mis and Lamond (2014); McSweeney and Coomes (2011); Wolfram, M. (2015); Hooli, L.J. (2015); Mehmood, A. (2015); Takeuchi et al. (2014)
		Complementary functions between geographically proximate places	
		Understand that cities are complex systems that change is a long term social and political condition and process following a disturbance	
		Ability to conduct rebuilding work	
		Ability to recover quickly and effectively	
		Renewal, innovation, recombination, self-organization and novelty following stress conditions	
		Adaptation to external changes while balancing ecosystem, economic and cultural functions	
		Ability to adjust to actual or expected changes and consequences	
	Self-organization	Multi-scale networks and connectivity	Wilkinson, C. (2011); Hooli, L.J. (2015); Sharifi and Yamagata (2016)
		Interplay between diversity and disturbance	
		Community-based management	
		Strong local communities capable of independently responding to disasters.	
		Stakeholders involved in cross-scale partnerships	
		Strong horizontal and vertical institutional connections that provide direct feedback to the system and enable better informed decision-making	
		Presence of strong leadership that facilitates the ability to set goals and visions, and initiate actions.	
		Stakeholders from all sectors of society have a strong sense of social and environmental citizenship	
		Stakeholders support locally driven initiatives	
	Transformability and innovation	Spatial heterogeneity	Seeliger and Turok (2013); Steiner F. (2014); Mehmood, A. (2015); Takeuchi et al. (2014); Sharifi and Yamagata (2016); Wolfram, M. (2015)
		Continuous and stable adaptation through rising productivity and innovation over time.	
		Improved social relations between stakeholders, public and private institutions	
		Empowering the people in terms of socio-political decision-making and satisfying basic human needs	
		Enable high level of innovations in both technical, structural adaptation measures and social, economic, non-structural measures	
		Utilizing innovations in management, planning, and designing the urban system	
		Ability of the urban system to adjust to external and internal change through self-organizing and collective learning	
		Ability to adjust, adapt and progress to a new regime	
		Access to creativity and innovation occurring in other cities and nations	
		Ability to adapt and cope with constant change	
		Contribute to building alliances and networks to produce projects of wider societal benefits	

Appendix 1: Criteria, variables and indicators for assessing a resilient city (continuation)

Criteria for assessing a resilient city	Variables	Indicators	Key sources
Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales	Recognition of risks and hazards, and their potential impacts at different scale levels	Recognize and develop local risk profiles Develop knowledge on hazards and risks Capacity of institutional networks to deal with potential and existing risks Know and allocate or access funding flows for dealing with risks Proactive identification of risks and hazards Flexibility and adaptability in both physical as well as social network systems Use of knowledge and information Experience in working together with different actors Political leadership Awareness and understanding of disasters and how to cope with it Awareness and understanding of preventive mechanisms	Baud and Hordijk (2009); Ainuddin and Routray (2012); Mehmood, A. (2015)
	Ability to cope with risks and hazards	Available funding from local government, public, and/ or private organizations Strength of social capital in civil society organizations (learning, self-organizing capacity) Linkages to all levels of the government National government provides organized support for local governments National networks of civil society organizations Links with international disaster relief organizations	Baud and Hordijk (2009)
	Long-term planning	Local capacity in disaster planning Disaster prevention planning are in place Adaptation planning are in place Support programmes for rebuilding and adaptation Financial support for rebuilding	Baud and Hordijk (2009)
Established enabling or supporting environments in creating a resilient city	Bridging connections to create opportunities of learning and cooperations	Social networks and links (number of social networks and links) Sharing of information, knowledge, and resources (types of information sharing and knowledge disseminated; types of resources available; increase disaster awareness and protection through social learning and connections) Mobilization of neighborhood coalitions (number and type of neighborhood coalitions) Nonprofit organizations and cultural associations (number and type of nonprofit organizations and associations) Trust and cooperation Awareness building Public education and outreach Consensus building (understanding actor networks and their influence on discourse) Convening diverse urban actors to lead shared learning Work together with local community networks Provision of space for ideas and participation of different actors and stakeholders Flexible patterns of planning and management Emphasis on the strength of horizontal and vertical networks Community empowerment and autonomy Rapid mobilization of resources for a timely recovery upon a disturbance Participation in community level programs to increase collaboration capacities with communities and strengthen social capital and adaptive capacity Powerful institutional mechanisms	Gotham and Campanella (2011); Sharifi and Yamagata (2016); Wolfram, M. (2015); Bahadur and Tanner (2013)
	Built- and natural- capital	Abundant resources Intact natural resources structure Natural resources sourced sustainably Improved physical accessibility Promote affordable and sustainable economic options that build on an social capital and ecological capital Physical order of urban area	Picket, et al. (2013); Mehmood, A. (2015); Sharifi and Yamagata (2016); Djalante and Thomalla (2010); Romero-Lankao and Gnatz (2013)

Appendix 1: Criteria, variables and indicators for assessing a resilient city (continuation)

Criteria for assessing a resilient city	Variables	Indicators	Key sources
		Available climate and disaster proof infrastructures	
		Development of physical structures or engineering techniques to reduce or avoid disaster impacts	
		Resources and supporting processes must be supplied by ecosystems beyond any formal urban borders	
		Includes both built and designed elements and natural features	
		Expand the limits and reduce the threats posed by nature	
		Land use, urban geometry and morphology	
	Engineering/technical solutions	Long-term structural transformation (transitions)	Bahadur and Tanner (2013); Chelleri, et al. (2015); Steiner F. (2014); Sharifi and Yamagata (2016)
		Support for the use of green infrastructure (environmental conditions; social relations; economic incentives and constraints; political and regulatory systems)	
	Interdisciplinary approach to address planning challenges	Inclusive and multidisciplinary notion of progressive dimension with a strong social dimension especially focusing on the disadvantaged and vulnerable groups and communities in a city.	Picket, et al. (2013); Mehmood, A. (2015); Sharifi and Yamagata (2016); Wolfram, M. (2015)
		Improved social, economic and environmental well-being	
		Development of innovative technologies	
		Develop knowledge and information based on culture, organized structures, and practical application of adaptive measures	
		Analysis of conflicts between governance structures, institutions and stakeholders	
		Stakeholders recognize different degrees of changes (e.g. concerning institutions, regulations, infrastructures, built environs, routines, values)	
		Both technical and non-technical stakeholders are involved in knowledge production	
		Stakeholder organizations support transformative actions	
		Stakeholders provide critical assessments of adaptive actions	
		Stakeholders (citizens, civil society organizations, public and private sector) participate directly in the deliberation of actions with the government	
		Government recognize the role of stakeholders and help build social capital	
		Build institutional capital through mobilization and support	
		Government recognize the importance of multi-level and cross scale interactions	
		Number of ties between stakeholders involved with common interest and balance socio-ecological perspectives	
		Key individuals leading knowledge and information exchange between sectors and levels	
		Established communities of practice to help articulate societal needs	
		Gaps in social services and resources are identified	
	Institutional and governance conditions	Adapt institutional, legal and policy change to include adaptive capacity to build resilient cities	Gotham and Campanella (2011); Sharifi and Yamagata (2016); Bahadur and Tanner (2013); Steiner F. (2014); Djalante and Thomalla (2010); Picket, et al. (2013); McSweeney and Coomes (2011); Schwarz et al. (2011); Ainuddin and Routray (2012); Wolfram, M. (2015); Chelleri, et al. (2015); Takeuchi et al. (2014); Wagner et al. (2014); Sharifi and Yamagata (2016)
		Opportunities for leadership	
		Developing human skills within community	
		Disaster risk reduction integrated in government investments and priorities	
		Employ more bottom-up management and decision-making	
		Develop more holistic approaches to top-down decision-making	
		Favor solutions that rely on decentralized infrastructures	
		Generate incentives in building resilient cities and infrastructures	
		Connections or association of city functions with peoples shared values and desires	
		Enact new, locally meaningful post-disaster order	
		Designated leaders within a decision making hierarchy	
		Organizational and institutional capacities	
		Governance performance and rights	
		Access to markets and financial services	
		Strong leadership by local customary authority	

Appendix 1: Criteria, variables and indicators for assessing a resilient city (continuation)

Criteria for assessing a resilient city	Variables	Indicators	Key sources
		Transparent and participatory governance would also facilitate learning from past events and "learning by doing" that are essential for boosting the adaptive capacity of the system.	
		Implementation of building codes	
		Regulations are aligned with the vision and adjusted to remove innovation barriers and support transformative actions	
		Regulations leave room for alternative solutions and context-specific interpretation and implementation.	
		Regulations enable to use wider resource streams for transformative action (financial, human, technical, organizational)	
		Spatial stretching of policy decisions	
		Social capital	
		Long-term cultural commitment	
		Build overlap in governance	
		Creating opportunity for self-organization	
		Broad community involvement, trust and motivation	
		Involvement of many stakeholders (from local municipalities, the private sector, non-profit and non-governmental organizations)	
		Influence of institutions in shaping adaptive capacity of society	
		Local patterns of reciprocity and exchange	
		Capability of sensing threats	
		Ability to detect disturbances and be able to make prompt changes and adjustments	
	Social development (social resilience)	Emergency management	Djalante and Thomalla (2010); Picket, et al. (2013); Sharifi and Yamagata (2016)
		Social and administrative services	
		Social-economic and political linkages	
		Integration of development efforts across sectors such as government, economic, social and the built environment	
		Increase local/community capacities (institutions and mechanisms)	
		Build trust, values, partnerships, networks and capacity	
		Involvement of community in the design and implementation of activities	
		Application of knowledge, practice, and agreement to reduce risks and their translation into laws, codes and policies	
		Civic dialogues and suggesting processes of change toward that goal	
		Promotion of social equity	
		Includes the interaction of human decisions and ecological processes	
		Behavioural change to transition to becoming resilient communities and eventually cities	
	Economic development	Community self-reliance	Djalante and Thomalla (2010); Sharifi and Yamagata (2016)
		Diversity of livelihoods sources	
		Economic strength	
		Provision of capitals that influence peoples livelihoods	
		System ′s capacity to mobilize the resources necessary for recovery and return to normal functioning within an acceptable time frame	
	Nurture conditions for recovery and renewal after disturbance	Social capital	Wilkinson, C. (2011); Romero-Lankao and Gnatz (2013)
		Network of actors	
		Cities form a continuum with nature through interactions between societal and ecological processes.	
		Introduced innovative responses to their own particular set of pressures, constraints and opportunities	
		Broader and more stable level made of economic developments, political coalitions, environmental problems (e.g. climate change)	
		Stable social, ecological, technological development trajectories	
		Physical, human, cultural and material hybrids embedded in the social construction and transformation of ecosystems′ structure, function and services	

Appendix 1: Criteria, variables and indicators for assessing a resilient city (continuation)

Criteria for assessing a resilient city	Variables	Indicators	Key sources
Maintaining city resilience through diversity	Economic activities	Number and type of economic activities Number of employed residents by industry type Socio-economic diversity Income/economic related Diversified sources of income	Gunderson L. (2010), L.; Wilkinson, C. (2011); Ainuddin and Routray (2012); Takeuchi et al. (2014)
	Natural capital	Number and types natural resources Regulatory feedbacks on populations Regulated natural resources Increase biodiversity Ecological diversity Diverse in terms of land use patterns, infrastructure, supply providers, knowledge economy, and demographic structure.	Gunderson L. (2010), L.; Picket, et al. (2013); Takeuchi et al. (2014); Schwarz et al. (2011); Wilkinson, C. (2011); Chelleri, et al. (2015); Romero-Lankao and Gnatz (2013); Sharifi and Yamagata (2016)
	Social capital	Formal and informal social networks Number and type of social networks present Number and type of formal social networks Number and type of informal social networks Percentage of population part of formal networks Location of formal networks vis-a-vis percent of population part of formal networks Type of community activities Number of community activities Trust and communication Flow of resources and ideas that facilitate connections among people Facilitate socio-economic diversity General demographic characteristics of households Number of households Number of population Number of ethnic group, age, etc. Diverse stakeholders from across sectors and levels are involved in the co-production of knowledge on urban development	Gunderson L. (2010) L. (2010), L.; Wilkinson, C. (2011); Takeuchi et al. (2014); Schwarz et al. (2011); Wolfram, M. (2015)
	Social resilience	Socio-ecological diversity Sparking human ingenuity, technology and collective determination to intervene and avert looming disaster Available resources Locational choice Strengthened regional and community resilience Strengthening local traditions Providing opportunities for all ages to participate in the creation of strategies Engaging communities in restoration activities and through environmental education and education for sustainable development implementers of plans for the park in collaboration with sustainability scientists have the opportunity to develop a model for restoration of social ecological systems Strength of the system to withstand short-term (sudden), acute internal and external shocks without suffering from major degradation of the main functions	Seeliger and Turok (2013); Picket, et al. (2013); Takeuchi et al. (2014); Sharifi and Yamagata (2016)
Memory based disaster experience	Memory pathways	Memories passed on through individuals within the family over generations People with long term residency in a disaster affected area often refer to their childhood memories and try to relate them with changing attitude towards living with risk Community interactions Information of physical locations previously flooded can be gained from lay knowledge of flooded individuals Resistance or resilience measures adopted by flood affected populations Readiness to discuss the experience Building memory from the past and using previous experiences in the coping process to face anticipatory disturbances in the future	Bhattacharya-Mis and Lamond (2014); Wilkinson, C. (2011)

Appendix 1: Criteria, variables and indicators for assessing a resilient city (continuation)

Criteria for assessing a resilient city	Variables	Indicators	Key sources
	Memories of social and external support	Positive memories on social support during stressful time Reduce pressure level and stabilize the post disaster situation especially for the well-being of more vulnerable section of the population Local institutions as support system for the community Ability and capacity of community or individual to respond or recover from the disaster rather than depend on external assistance or aid Governance and institutions Institutional with mandates and knowledge to implement climate adaptation	Bhattacharya-Mis and Lamond (2014); Hooli, L.J. (2015); Wagner et al. (2014)
	Human and social capitals	Age Life stage Prior health (physical and mental) Social demographics Living condition and setting Income	Bhattacharya-Mis and Lamond (2014)
	Predictive capacity	Past experience or history of natural disasters Capacity to foresee impacts of natural disasters Anticipating impact of disasters Human capacity for foresight and intentionality Ability to foresee and strategize actions	Gunderson L. (2010); Wilkinson, C. (2011)
	Learning from disaster experience	Creation of new policies or approaches to solve problems that were revealed by an ecological event Stakeholders collectively participate and take action to become resilient Ability to solve a problem or reach another regime Assume change and uncertainty Development of informal, creative, and sustainable solutions to infrastructure provision	Gunderson L. (2010); Wilkinson, C. (2011); Steiner F. (2014)
Social, physical and economic drivers that contribute to household, community, and city resilience	Economic capital	Economic condition and financial capacity High economic growth Diversified income Insurance Coordination, cooperation with other sectors Stable macroeconomic setting Stakeholders are provided access to resources (human, knowledge, financial, technical, etc.) for capacity development Slow social, economic, and political transformation towards sustainability	Ainuddin and Routray (2012); Schwarz et al. (2011); Wolfram, M. (2015); Chelleri, et al. (2015); Romero-Lankao and Gnatz (2013); Takeuchi et al. (2014); Sharifi and Yamagata (2016)
	Social and human capitals	Demographics Build social capital to address equity Ability to foresee and plan for uncertainty and nonlinearity of the impacts and behaviors upon a disturbance Self-reliance that gives the ability to maintain a minimum acceptable level of functioning (without external support) when influenced by disturbance. Increasing social and ecological diversity Ability to deal with information Information networks that work Ability to cope with contingencies Level of social cohesion and governance Human capability Assets and income poverty Age Education Capacity to diversify income Increasing connectedness Increased learning capacity of communities through knowledge exchange and sharing mutual experiences Using locally available social, human, cultural and environmental resources Expansion of networks and strengthening the sense of community through building social, cultural and human capitals Institutional capacity, social and political makeup	Picket, et al. (2013); Schwarz et al. (2011); Mehmood, A. (2015); Ainuddin and Routray (2012); Gotham and Campanella (2011); Wolfram, M. (2015); Sharifi and Yamagata (2016); Bahadur and Tanner (2013); Hooli, L.J. (2015); Djalante and Thomalla (2010); Chelleri, et al. (2015); Romero-Lankao and Gnatz (2013); Takeuchi et al. (2014)

Appendix 1: Criteria, variables and indicators for assessing a resilient city (continuation)

Criteria for assessing a resilient city	Variables	Indicators	Key sources
		Education	
		Population growth	
		Community competency	
		Household characteristics	
		Socially vulnerable groups	
		Humans as agents of change acting within social-ecological systems	
		Culture	
		Personal behavior	
		Social organization	
		Economic status	
		Self-organization	
		Social characteristics	
		Living conditions	
		Assets and livelihood strategies	
		Practical approaches for coalition building and decision-making	
		Citizens agree to participate and change their behavior	
		Understanding that behaviour change takes time and depends on the strength of social capital	
		Community mobilization, participation, and awareness	
		Community knowledge	
		Community dialogue and meetings	
		Shared vision and collective decision on future pathways	
		Formation of cohesive relationships and identity	
		Community partnerships and participation	
		Adaptive capacity and resilience to manage, adjust, learn and cope with different changes	
	Natural and physical capital	Capability to draw up internal resources and competencies to management demands, challenges, and changes encountered in the course of a disaster	Ainuddin and Routray (2012); Schwarz et al. (2011); Chelleri, et al. (2015); Romero-Lankao and Gnatz (2013); Takeuchi et al. (2014); Sharifi and Yamagata (2016)
		Social construction and transformation of physical and climatic conditions (the environment)	
		Adopts diverse mechanisms to live and learn from the change and shocks	
		Present natural hazards and adaptation or mitigation measures	
		In-stock natural resources	
		Physical environment	
		Distance to evacuation site	
		Location	
		Open spaces	
		House type with construction materials used	
		Climate change and environmental uncertainty	
		Meeting land use changes and population pressure	
		Infrastructure development	
		Biodiversity	
		Nurturing biological and cultural diversity	

Appendix 2: Variables and indicators from the Systematic Review for the five drivers of resilience vis-a-vis criteria for selecting indicators

Drivers	Variables from Systematic Review	Indicators	Sub-indicators	Criteria for selecting the indicators for each of the drivers					
				Level of assessment				Disaster type: Flooding	Includes element of criteria for assessing resilient city (indicate which)
				Community	City	National	Regional		
Human capital	Memory pathways	Memories passed on through individuals within the family over generations	% current population (by generation) know about previous disaster events	✓	✓			✓	Memory based disaster experience
		People with long term residency in a disaster affected area often refer to their childhood memories and try to relate them with changing attitude towards living with risk	% residents living in the area for 10,15, 20, 25, 30 years can identify changing attitudes of residents	✓	✓			✓	Memory based disaster experience
		Information of physical locations previously flooded can be gained from lay knowledge of flooded individuals	% residents living in the area for 10,15, 20, 25, 30 years can identify flooded areas and affected households	✓	✓			✓	Memory based disaster experience
		Resistance or resilience measures adopted by flood affected populations	# of disaster risk management initiatives adopted by the affected population	✓	✓	✓	✓	✓	Memory based disaster experience
		Readiness to discuss the experience	% population ready and able to discuss flood experience after the disaster	✓	✓			✓	Memory based disaster experience
		Building memory from the past and using previous experiences in the coping process to face anticipatory disturbances in the future	# of community initiatives on disaster risk management based on previous disaster experience	✓	✓	✓		✓	Memory based disaster experience
	People (demographics)	Age	% population between above 15 and below 65	✓	✓	✓	✓	✓	Memory based disaster experience; Social, physical and economic drivers that contribute to household, community, and city resilience
		Life stage	% of population classified according to age ranges - youth, working, senior	✓	✓	✓	✓	✓	Memory based disaster experience; Social, physical and economic drivers that contribute to household, community, and city resilience
		Assets and income	economic classification of households	✓	✓			✓	Memory based disaster experience; Social, physical and economic drivers that contribute to household, community, and city resilience
		Education	literacy rate	✓	✓	✓	✓	✓	Memory based disaster experience; Social, physical and economic drivers that contribute to household, community, and city resilience
		Capacity to diversify income	# of households with varied sources of income (more than 1 income source)	✓	✓			✓	Memory based disaster experience; Social, physical and economic drivers that contribute to household, community, and city resilience
		Population growth	growth rate	✓	✓	✓	✓	✓	Memory based disaster experience; Social, physical and economic drivers that contribute to household, community, and city resilience
		Household characteristics	by age, income, 1 or 2 income earners, size	✓	✓	✓		✓	Memory based disaster experience; Social, physical and economic drivers that contribute to household, community, and city resilience
Social capital	Capacity of the stakeholders to cope with past and future threats	The stakeholders coped with the disaster event at the time	% household population evacuated; % recovered	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		The stakeholders has learnt from past disaster experiences and can now cope better in the future	% households rebuilt; % households trained to build back better; % households aware of disaster risk management	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Reduced threats from disasters through individual and collective action	% households rebuilt; % communities/ villages within the city rebuilt	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Improved livelihoods through individual and collective action	% households received livelihood assistance from networks (NGOs, donors, agencies, government)	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Application of what was learned from the disaster in future planning and design	% households trained to build back better; % households aware of disaster risk management	✓	✓			✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
	Capacity to adapt to external changes	Ability to conduct rebuilding work	% of households provided assistance to rebuild; % of households that were able to rebuild; type and source of assistance	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Ability to recover quickly and effectively	% of households that were able to rebuild houses and go back to economic activities	✓	✓			✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes

Appendix 2: Variables and indicators from the Systematic Review for the five drivers of resilience vis-a-vis criteria for selecting indicators (continuation)

Drivers	Variables from Systematic Review	Indicators	Sub-indicators	Criteria for selecting the indicators for each of the drivers					
				Level of assessment				Disaster type: Flooding	Includes element of criteria for assessing resilient city (indicate which)
				Community	City	National	Regional		
	Self-organization	Multi-scale networks and connectivity	# of organizations with complementary functions on disaster recovery, rebuilding, management, and urban planning	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Community-based management	# and type of community-based disaster management and resilience building activities conducted; # of attendance to these activities	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Strong local communities capable of independently responding to disasters.	# community coalitions or organizations dealing with disasters; # of community formed; types of organizations; services provided	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Strong horizontal and vertical institutional connections that provide direct feedback to the system and enable better informed decision-making	# of organizations with direct partnership with communities, city government, private entities, public entities, academe	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Stakeholders from all sectors of society have a strong sense of social and environmental citizenship	# stakeholders aware of disaster management and activities; urban planning; building resiliency	✓	✓			✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
	Bridging connections to create opportunities of learning and cooperations	Social networks and links (number of social networks and links)	# of networks within the community; % population as members of networks; classification per socio-economic status as members of networks	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
		Sharing of information, knowledge, and resources (types of information sharing and knowledge disseminated; types of resources available; increase disaster awareness and protection through social learning and connections)	Types of information sharing and knowledge disseminated; types of resources available; increase disaster awareness and protection through social learning and connections	✓	✓			✓	Established enabling or supporting environments in creating a resilient city
		Mobilization of neighborhood coalitions (number and type of neighborhood coalitions)	Number and type of neighborhood coalitions	✓	✓			✓	Established enabling or supporting environments in creating a resilient city
		Nonprofit organizations and cultural associations (number and type of nonprofit organizations and associations)	Number and type of nonprofit organizations and associations	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
		Awareness building	# of public education and outreach initiatives on disaster risk management; % reached	✓	✓			✓	Established enabling or supporting environments in creating a resilient city
		Rapid mobilization of resources for a timely recovery upon a disturbance	# of disaster assistance mobilized by type within 3 days; 1 week; 1 month	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
		Participation in community level programs to increase collaboration capacities with communities and strengthen social capital and adaptive capacity	Type of community activities; Number of community activities; community mobilizations	✓				✓	Established enabling or supporting environments in creating a resilient city
		Consensus building (understanding actor networks and their influence on discourse)	# of disaster risk management forums and discussions; organizations; institutions working with government and private entity on disaster issues	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
	Social capital (networks)	Socio-ecological diversity	Number and type of social networks present; Number and type of formal social networks; Number and type of informal social networks; Percentage of population part of formal networks; Location of formal networks vis-a-vis percent of population part of formal networks; Number of households; Number of population; Number of ethnic group, age, etc.; Providing opportunities for all ages to participate in the creation of strategies	✓	✓	✓		✓	Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	Predictive capacity	Past experience or history of natural disasters	Percent of population experienced disasters and can recall experience	✓	✓			✓	Memory based disaster experience
		Capacity to foresee impacts of natural disasters	Percent of population knowledgeable on disaster risk management	✓	✓			✓	Memory based disaster experience
		Ability to foresee and strategize actions	Percent of population knowledgeable on disaster risk management	✓	✓			✓	Memory based disaster experience
Institutional capital	Develop alternative scenarios	Shared vision among stakeholders that reflect social needs and the existing diversity of values	% Stakeholders within the city adhere to the city vision and goals	✓	✓			✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Stakeholders are motivated to contribute to achieve the vision	% of population aware of city vision and goal	✓	✓			✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes

Appendix 2: Variables and indicators from the Systematic Review for the five drivers of resilience vis-a-vis criteria for selecting indicators (continuation)

Drivers	Variables from Systematic Review	Indicators	Sub-Indicators	Criteria for selecting the indicators for each of the drivers					
				Level of assessment				Disaster type: Flooding	Includes element of criteria for assessing resilient city (indicate which)
				Community	City	National	Regional		
		Flexible range of urban strategies, programs and projects	# of urban strategies, programs and projects are both structural and non-structural disaster risk management efforts; comparison between both structural and non-structural measures	✓	✓	✓		✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Stakeholders choose alternative scenario and understand uncertainties	% population aware and take part of the consultation planning activities; % of recommendations from stakeholders present in the city development plans and projects	✓	✓			✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
	Different types of knowledge for learning on adapting to changes and uncertainty	Technological knowledge	% policies based on technical knowledge on disaster risk management and reduction; % policies with technical basis implemented	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Experiential knowledge	% policies based on previous disaster experiences	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Collaborative learning	% policies on enhancing community learning and social learning on disaster risk management, urban planning, and resilient city planning; % policies that include use of local and community-based knowledge	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
	Adaptive co-management and cross-scale interactions	Multi-level collaboration: between stakeholders and government; between stakeholders and private institutions and organizations; between stakeholders, the private institutions and organizations, and the government	% feedback received by government services from stakeholders; % government satisfaction rating; # of collaborative activities and initiatives between stakeholders and government; between stakeholders and private institutions and organizations; between stakeholders, the private institutions and organizations, and the government	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Functional relationships between systems and networks (receive support, provide inputs and feedbacks)	# of linked social, technical and institutional networks with the government on disaster risk management	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
	Integrated and strong governance structure	Encourage multi-stakeholder participation and engagement in disaster risk reduction activities	# of multi-level capacity development: public, private, civil society sectors at the individual, household, organizational levels provided by the government; % participation of stakeholders in these activities	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
	Recognition of risks and hazards, and their potential impacts at different scale levels	Recognize and develop local risk profiles	City risk, hazard and vulnerability maps and reports regularly updated	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales
		Know and allocate or access funding flows for dealing with risks	Allocated budget for disaster risk management, including reconstruction and rebuilding (disaster risk insurance) at the community, city, and national levels	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales
	Long-term planning	Local capacity in disaster planning	Existence of national, community disaster risk management office; Existence of city, community disaster risk management office; Use of knowledge and information; Disaster prevention planning are in place	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales
		National government provides organized support for local governments	% of local funds for disaster management acquired from national budget; linkage between national and local government on disaster risk management	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales
		National networks of civil society organizations	# of CSOs involved in the local government disaster management activities	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales
		Links with international disaster relief organizations	# of international disaster relief organizations involved in the local government disaster management activities	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales
	Interdisciplinary approach to address planning challenges	Government recognize the role of stakeholders and help build social capital	% stakeholders by categories (residents, civil society organizations, public and private sector, NGOs) participate in city wide consultations; % stakeholders support transformative actions; Stakeholders provide critical assessments of adaptive actions	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city

Appendix 2: Variables and indicators from the Systematic Review for the five drivers of resilience vis-a-vis criteria for selecting indicators (continuation)

Drivers	Variables from Systematic Review	Indicators	Sub-indicators	Criteria for selecting the indicators for each of the drivers					
				Level of assessment				Disaster type: Flooding	Includes element of criteria for assessing resilient city (indicate which)
				Community	City	National	Regional		
		Government recognize the importance of multi-level and cross scale interactions	Number of ties between stakeholders involved with common interest and balance socio-ecological perspectives; Key individuals leading knowledge and information exchange between sectors and levels; Established communities of practice to help articulate societal needs	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
	Learning from disaster experience	Adapt institutional, legal and policy change to include adaptive capacity to build resilient cities	# of informal, creative, and sustainable solutions developed to address disaster risk (flooding)	✓	✓	✓	✓	✓	Memory based disaster experience
		Disaster risk reduction integrated in government investments and priorities	# of new policies or approaches to solve problems created after a disaster event	✓	✓	✓	✓	✓	Memory based disaster experience
Economic capital	Transformability and innovation	Spatial heterogeneity	Land use and zoning appropriate based on hazard and vulnerability map, and land use guidelines	✓	✓			✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
	Ability to cope with risks and hazards	Available funding from local and national government, public, and/or private organizations	% allocated budget for disaster risk management in comparison to national budget; % of funding allocated to disaster risk management at different levels	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales
	Economic capital	Economic strength	GDP, GNP	✓	✓	✓	✓	✓	Established enabling or supporting
		Diversity of livelihoods sources	types and contribution of each livelihood to employment and productivity; Provision of capitals that influence peoples livelihoods	✓	✓			✓	Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Number and type of economic activities	Number and type of economic activities	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Number of employed residents by industry type	Number of employed residents by industry type	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
Environmental capital	Built- and natural- capital	Natural resources sourced sustainably	% of natural resources available compared to 10 years, 15 years, 20 years ago; Type of natural resources available by %; Number and types natural resources;	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Physical order of urban area	Community access to social services; Land use, urban geometry and morphology	✓	✓			✓	Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Development of physical structures or engineering techniques to reduce or avoid disaster impacts	Available climate and disaster proof infrastructures; Includes both built and designed elements and natural features;	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Capability to draw up internal resources and competencies to management demands, challenges, and changes encountered in the course of a disaster	Distance to evacuation site	✓				✓	Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	Engineering/technical solutions	Long-term structural transformation (transitions)	Number of pipelined structural/engineering solutions; Number of actual structural/ engineering solutions built	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
		Support for the use of green infrastructure (environmental conditions; social relations; economic incentives and constraints; political and regulatory systems)	Percent and types of green infrastructures in the city	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city

APPENDIX 3 VARIABLES AND INDICATORS FROM THE OECD FRAMEWORK VIS-A-VIS CRITERIA FOR SELECTING INDICATORS

Appendix 3: Variables and indicators from the OECD Framework for Resilient Cities for the five drivers of resilience vis-a-vis criteria for selecting indicators

Drivers	Sub-drivers	Potential parameters	Possible indicators (examples)	Criteria for selecting the indicators for each of the drivers					
				Level of assessment					Includes element of criteria for assessing resilient city (indicate which)
				Community	City	National	Regional	Disaster type: Flooding	
Economy	Industries are diverse	Diversity of economic structure	GDP by industry	☐	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Employment by industry	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Links to value chain	Contribution of GDP in national value	☐	☐	✓	☐	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Contribution of employment in national value	☐	☐	✓	☐	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	Innovation takes place	Entrepreneurialism	Business demography (the number of start-up companies, cessation and current companies)	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Research and development (R&D)	Patent applications	☐	☐	✓	☐	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			R&D expenditure	☐	☐	✓	☐	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	Workforce has diverse skills	Access to education	Employment by education	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	Infrastructure supports economic activities	Fulfils expected purpose	Back-up plans	☐	✓	✓	☐	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Long-term maintenance plans	☐	✓	✓	☐	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Anti-disaster structure	☐	✓	✓	☐	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
Society	Society is inclusive and cohesive	Demographic change	Population (inflow/ outflow)	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Immigrants	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Income	Household income	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Poverty level	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			GINI coefficient	☐	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Safety	Perceived safety	✓	✓	☐	☐	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Crime rate	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	Citizens' networks in communities are active	Citizens' network	Number of community associations	✓	✓	☐	☐	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	People have access to services	Access to services	Accessibility to public services (hospitals)	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Accessibility to public transport	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience

Appendix 3: Variables and indicators from the OECD Framework for Resilient Cities for the five drivers of resilience vis-a-vis criteria for selecting indicators (continuation)

Drivers	Sub-drivers	Potential parameters	Possible indicators (examples)	Criteria for selecting the indicators for each of the drivers					
				Level of assessment				Disaster type: Flooding	Includes element of criteria for assessing resilient city (indicate which)
				Community	City	National	Regional		
Environment	Urban development is sustainable	Aligns with long-term urban development strategy	Long-term strategies (i.e. compact city policies, etc.)	☑	☑	☑	☑	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Risk-based land-use strategy	☑	☑	☑	☐	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	Adequate and reliable infrastructure is available	Performs the expected function	Back-up plans	☐	☑	☑	☐	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Long-term maintenance plans	☐	☑	☑	☐	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Anti-disaster structure	☐	☑	☑	☐	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	Adequate natural resources are available	Pollution/emissions	Air, water and green space quality	☐	☑	☑	☑	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Air, water and green space quantity	☑	☑	☑	☑	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Energy	Energy consumption and production, smart energy management	☑	☑	☑	☑	☐	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
Institutions	Leadership and long-term vision are clear	Long-term vision and leadership	Long-term vision of the city	☑	☑	☑	☐	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Social, physical and economic drivers that contribute to household, community, and city resilience
	The public sector has proper resources	Financial resources	City's revenue by sources	☐	☑	☐	☐	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Social, physical and economic drivers that contribute to household, community, and city resilience
			Capability to increase revenue	☑	☑	☑	☑	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Social, physical and economic drivers that contribute to household, community, and city resilience
		Human resources	Number of public officials	☑	☑	☑	☐	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Social, physical and economic drivers that contribute to household, community, and city resilience
			Expenditure on training	☑	☑	☐	☐	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Social, physical and economic drivers that contribute to household, community, and city resilience
	Collaboration with other levels of government takes place	Collaboration with the national government	Coordinated planning with the national government	☐	☑	☑	☐	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Social, physical and economic drivers that contribute to household, community, and city resilience
		Collaboration with the neighboring cities	Coordination mechanisms with neighboring cities	☑	☑	☑	☐	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Social, physical and economic drivers that contribute to household, community, and city resilience
	Government is open and citizen's participation takes place	Open government and open data policies	Open government data	☑	☑	☑	☑	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Social, physical and economic drivers that contribute to household, community, and city resilience
		Active citizen engagement	Number of citizens engaged in participatory programs	☑	☑	☑	☐	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Social, physical and economic drivers that contribute to household, community, and city resilience
			Voting rate	☑	☑	☑	☑	☑	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Social, physical and economic drivers that contribute to household, community, and city resilience

Appendix 4: Variables and indicators from the Systematic Review and OECD for the five drivers of resilience vis-a-vis criteria for selecting indicators

Drivers	Variables from Systematic Review and OECD	Indicators	Sub-indicators	Criteria for selecting the indicators for each of the drivers					
				Level of assessment				Disaster type: Flooding	Includes element of criteria for assessing resilient city (indicate which)
				Community	City	National	Regional		
Human capital	Memory pathways	Resistance or resilience measures adopted by flood affected populations	# of disaster risk management initiatives adopted by the affected population	✓	✓	✓	✓	✓	Memory based disaster experience
	People (demographics)	Age	% population between above 15 and below 65	✓	✓	✓	✓	✓	Memory based disaster experience; Social, physical and economic drivers that contribute to household, community, and city resilience
		Life stage	% of population classified according to age ranges - youth, working, senior	✓	✓	✓	✓	✓	Memory based disaster experience; Social, physical and economic drivers that contribute to household, community, and city resilience
		Education	literacy rate	✓	✓	✓	✓	✓	Memory based disaster experience; Social, physical and economic drivers that contribute to household, community, and city resilience
		Population growth	growth rate	✓	✓	✓	✓	✓	Memory based disaster experience; Social, physical and economic drivers that contribute to household, community, and city resilience
Social capital	Capacity of the stakeholders to cope with past and future threats	The stakeholders coped with the disaster event at the time	% household population evacuated; % recovered	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		The stakeholders has learnt from past disaster experiences and can now cope better in the future	% households rebuilt; % households trained to build back better; % households aware of disaster risk management	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Reduced threats from disasters through individual and collective action	% households rebuilt; % communities/villages within the city rebuilt	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Improved livelihoods through individual and collective action	% households received livelihood assistance from networks (NGOs, donors, agencies, government)	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
	Capacity to adapt to external changes	Ability to conduct rebuilding work	% of households provided assistance to rebuild; % of households that were able to rebuild; type and source of assistance	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
	Self-organization	Multi-scale networks and connectivity	# of organizations with complementary functions on disaster recovery, rebuilding, management, and urban planning	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Community-based management	# and type of community-based disaster management and resilience building activities conducted; # of attendance to these activities	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Strong local communities capable of independently responding to disasters.	# community coalitions or organizations dealing with disasters; # of community formed; types of organizations; services provided	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Strong horizontal and vertical institutional connections that provide direct feedback to the system and enable better informed decision-making	# of organizations with direct partnership with communities, city government, private entities, public entities, academe	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
	Bridging connections to create opportunities of learning and cooperations	Social networks and links (number of social networks and links)	# of networks within the community; % population as members of networks; classification per socio-economic status as members of networks	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
		Nonprofit organizations and cultural associations (number and type of nonprofit organizations and associations)	Number and type of nonprofit organizations and associations	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
		Rapid mobilization of resources for a timely recovery upon a disturbance	# of disaster assistance mobilized by type within 3 days; 1 week; 1 month	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
		Consensus building (understanding actor networks and their influence on discourse)	# of disaster risk management forums and discussions; organizations; institutions working with government and private entity on disaster issues	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
	Society is inclusive and cohesive	Demographic change	Population (inflow/outflow)	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Immigrants	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience

Appendix 4: Variables and indicators from the Systematic Review and OECD for the five drivers of resilience vis-a-vis criteria for selecting indicators (continuation)

Drivers	Variables from Systematic Review and OECD	Indicators	Sub-indicators	Criteria for selecting the indicators for each of the drivers					
				Level of assessment				Disaster type: Flooding	Includes element of criteria for assessing resilient city (indicate which)
				Community	City	National	Regional		
		Income	Household income	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Poverty level	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Safety	Crime rate	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	People have access to services	Access to services	Accessibility to public services (hospitals)	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Accessibility to public transport	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
Institutional capital	Different types of knowledge for learning on adapting to changes and uncertainty	Technological knowledge	% policies based on technical knowledge on disaster risk management and reduction; % policies with technical basis implemented	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Experiential knowledge	% policies based on previous disaster experiences	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Collaborative learning	% policies on enhancing community learning and social learning on disaster risk management, urban planning, and resilient city planning; % policies that include use of local and community-based knowledge	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
	Adaptive co-management and cross-scale interactions	Multi-level collaboration: between stakeholders and government; between stakeholders and private institutions and organizations; between stakeholders, the private institutions and organizations, and the government	% feedback received by government services from stakeholders; % government satisfaction rating; # of collaborative activities and initiatives between stakeholders and government; between stakeholders and private institutions and organizations; between stakeholders, the private institutions and organizations, and the government	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
		Functional relationships between systems and networks (receive support, provide inputs and feedbacks)	# of linked social, technical and institutional networks with the government on disaster risk management	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
	Integrated and strong governance structure	Encourage multi-stakeholder participation and engagement in disaster risk reduction activities	# of multi-level capacity development: public, private, civil society sectors at the individual, household, organizational levels provided by the government; % participation of stakeholders in these activities	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes
	Recognition of risks and hazards, and their potential impacts at different scale levels	Recognize and develop local risk profiles	City risk, hazard and vulnerability maps and reports regularly updated	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales
		Know and allocate or access funding flows for dealing with risks	Allocated budget for disaster risk management, including reconstruction and rebuilding (disaster risk insurance) at the community, city, and national levels	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales

Appendix 4: Variables and indicators from the Systematic Review and OECD for the five drivers of resilience vis-a-vis criteria for selecting indicators (continuation)

Drivers	Variables from Systematic Review and OECD	Indicators	Sub-indicators	Criteria for selecting the indicators for each of the drivers					
				Level of assessment				Disaster type: Flooding	Includes element of criteria for assessing resilient city (indicate which)
				Community	City	National	Regional		
	Long-term planning	Local capacity in disaster planning	Existence of national, community disaster risk management office; Existence of city, community disaster risk management office; Use of knowledge and information; Disaster prevention planning are in place	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales
		National government provides organized support for local governments	% of local funds for disaster management acquired from national budget; linkage between national and local government on disaster risk management	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales
		National networks of civil society organizations	# of CSOs involved in the local government disaster management activities	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales
		Links with international disaster relief organizations	# of international disaster relief organizations involved in the local government disaster management activities	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales
	Interdisciplinary approach to address planning challenges	Government recognize the role of stakeholders and help build social capital	% stakeholders by categories (residents, civil society organizations, public and private sector, NGOs) participate in city wide consultations; % stakeholders support transformative actions; Stakeholders provide critical assessments of adaptive actions	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
		Government recognize the importance of multi-level and cross scale interactions	Number of ties between stakeholders involved with common interest and balance socio-ecological perspectives; Key individuals leading knowledge and information exchange between sectors and levels; Established communities of practice to help articulate societal needs	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
	Learning from disaster experience	Adapt institutional, legal and policy change to include adaptive capacity to build resilient cities	# of informal, creative, and sustainable solutions developed to address disaster risk (flooding)	✓	✓	✓	✓	✓	Memory based disaster experience
		Disaster risk reduction integrated in government investments and priorities	# of new policies or approaches to solve problems created after a disaster event	✓	✓	✓	✓	✓	Memory based disaster experience
	The public sector has proper resources	Financial resources	Capability to increase revenue	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Social, physical and economic drivers that contribute to household, community, and city resilience
	Government is open and citizen's participation takes place	Active citizen engagement	Voting rate	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Social, physical and economic drivers that contribute to household, community, and city resilience
Economic capital	Ability to cope with risks and hazards	Available funding from local and national government, public, and/or private organizations	% allocated budget for disaster risk management in comparison to national budget; % of funding allocated to disaster risk management at different levels	✓	✓	✓	✓	✓	Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales
	Economic capital	Economic strength	GDP, GNP	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Number and type of economic activities	Number and type of economic activities	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Number of employed residents by industry type	Number of employed residents by industry type	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience

Appendix 4: Variables and indicators from the Systematic Review and OECD for the five drivers of resilience vis-a-vis criteria for selecting indicators (continuation)

Drivers	Variables from Systematic Review and OECD	Indicators	Sub-indicators	Criteria for selecting the indicators for each of the drivers					
				Level of assessment				Disaster type: Flooding	Includes element of criteria for assessing resilient city (indicate which)
				Community	City	National	Regional		
	Industries are diverse	Diversity of economic structure	Employment by industry	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	Innovation takes place	Entrepreneuralism	Business demography (the number of start-up companies, initiation and closure of companies	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	Workforce has diverse skills	Access to education	Employment by education	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
Environmental capital	Built- and natural- capital	Natural resources sourced sustainably	% of natural resources available compared to 10 years, 15 years, 20 years ago; Type of natural resources available by %; Number and types natural resources;	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
		Development of physical structures or engineering techniques to reduce or avoid disaster impacts	Available climate and disaster proof infrastructures; Includes both built and designed elements and natural features;	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	Engineering/technical solutions	Long-term structural transformation (transitions)	Number of pipelined structural/ engineering solutions; Number of actual structural/engineering solutions built	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
		Support for the use of green infrastructure (environmental conditions; social relations; economic incentives and constraints; political and regulatory systems)	Percent and types of green infrastructures in the city	✓	✓	✓	✓	✓	Established enabling or supporting environments in creating a resilient city
	Urban development is sustainable	Aligns with long-term urban development strategy	Long-term strategies (i.e. compact city policies, etc.)	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
	Adequate natural resources are available	Pollution/emissions	Air, water and green space quality	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience
			Air, water and green space quantity	✓	✓	✓	✓	✓	Adaptive capacity and resilience to manage, adjust, learn and cope with different changes; Disaster preparedness, risk perception and awareness and recognition of disaster impacts at different levels and scales; Established enabling or supporting environments in creating a resilient city; Maintaining city resilience through diversity; Social, physical and economic drivers that contribute to household, community, and city resilience

APPENDIX 5 SAMPLE INTRODUCTION LETTER

27 November 2017

Hon. Marcelino Teodoro
Mayor
Marikina City

cc: Mr. TOMAS C. AGUILAR, JR.
City Planning Officer

Dear Mayor Teodoro,

I am a Ph.D. candidate from the Erasmus University Rotterdam Graduate School of Social Science and the Humanities in The Netherlands. My dissertation is on **Collective Engagement: from disaster-prone city to disaster-resilient city**. This dissertation project aims to develop a theory on resilient city through distilling critical conditions and patterns of resilience vis-a-vis the city's collective engagement. It aims to explain the correlation between resilient city and collective engagement. The end goal of the study is to contribute to strengthening the planning theory in developing a resilient city.

At present, I am finalizing the indicators for my dissertation project which I plan to test in three cities in Metro Manila - Quezon City, Marikina, and Malabon. I would like to seek your permission to conduct interviews with your staff from the City Planning Department, City Disaster Risk Management Offices, barangay officials, and conduct a survey with stakeholders. All of this will only be used to test my indicators and develop an academic paper.

I will fly to Manila on December 10 and will stay until the end of February. I hope you can accommodate my request.

Looking forward to meeting you and your staff.

Kind regards,

[redacted]

Theresa Audrey O. Esteban
Ph.D. Urban Management and Development
Graduate School of Social Science and the Humanities
Erasmus University Rotterdam

APPENDIX 6 STAKEHOLDERS AND THEIR ROLES IN THE FOUR CASE CITIES

Table 1: Stakeholders and their roles in Rotterdam

Stakeholders	Department/ Organization	Role in urban development and resilience
Government approach		
Institutional actors		
City government	Engineering	The engineering department is responsible for the maintenance of drainage and sewerage systems in the city. They design and construct water retention facilities among other engineering responsibilities for the city.
	Urban design/ landscape	Works closely with the engineering department for climate adaptive infrastructure especially structures that are in relation to water retention and flood management.
	Climate adaptation and flood management	Oversees climate adaptation planning in the city of Rotterdam. Works with a team on flood projections. Helps in setting the direction of the city towards climate adaptation and works closely with the academe.
	Strategy	Provides policy advise to the city.
	Resilient City	Under the funding of the 100 Resilient Cities, created the Rotterdam Resilient Strategy which provides the action plans in creating a resilient Rotterdam.
Waterboard	Rotterdam-Rijnmond Hollandse-Delta	The waterboards are responsible for water management. They ensure the cities' safety by the regular maintenance of the dikes and polders and sufficient supply of water.
Planners		
Academe	TU Delft Rotterdam University of Applied Science	The academe contributes to academic research on climate change, urban design, urban planning, climate adaptation, and urban resilience. They are important partners of the city especially in providing technical and scientific knowledge, and contributing innovative solutions.
Self-organization approach		
Citizens		
Resident	Head building association Gebiedscommissie Private resident	The residents are important stakeholders since they are the direct users and beneficiaries of the development or non-development of the city. They are responsible to make sure that services are provided to the citizens and inefficiencies are addressed therefore they are responsible to take part in the city's development. At the community level residents are responsible to be vigilant and to improve the community environment.
Non-government organization	Red Cross Environmental NGOs Water Sensitive	Non-government organizations are responsible for various advocacies and issues. In Rotterdam a number of NGOs work on environmental issues starting with community gardening within different neighborhoods. The Red Cross is also active in Rotterdam and is present to support crisis management.

Stakeholders	Department/ Organization	Role in urban development and resilience
Capital		
Business sector	Port Authority Architectural and urban design firm	Aside from generating jobs and industry to support the economic growth of cities, the business sector's role in urban development and resilience building is to comply with the policies on urban development and building resilience. They can contribute to the building urban resilience by supporting climate adaptive solutions for their own businesses, infrastructure, developments and by preparing and educating their networks.

Table 2: Stakeholders and their roles in Dordrecht

Stakeholders	Department/ Organization	Role in urban development and resilience
Government approach		
Institutional Actors		
City government	Climate adaptation	Oversees climate adaptation planning in the city. Works with a team on flood projections. Helps in setting the direction of the city towards climate adaptation and works closely with the academe.
	Crisis coordination	While not exactly a department, the crisis coordination or safety team is a group of city government employees tasked to coordinate when a crisis happens.
	Urban planning/design	The group is responsible for implementing the multi-layer safety approach spatial planning and design component in Dordrecht.
	Water and adaptation strategies	Works in coordination with the climate adaptation and urban planning on flood risks.
Waterschap (Waterboard)	Hollandse-Delta	The waterboards are responsible for water management. They ensure the cities' safety by the regular maintenance of the dikes and polders and sufficient supply of water.
Planners		
Academe	UNESCO-IHE Erasmus University Rotterdam	The academe contributes to academic research on climate change, urban design, urban planning, climate adaptation, urban resilience, flood risk management, and the multi-layer safety approach. They are important partners of the city especially in providing technical and scientific knowledge and contributing to innovative solutions. The academe is also an important partner and member of the learning action alliance in Dordrecht.
Veiligheidsregio	South Holland South	The Veiligheidsregio Zuid-Holland Zuid (VRZHZ) is one of the 25 security regions in the Netherlands. It is responsible for crisis management, disaster relief, fire brigade care and medical assistance. (Veiligheidsregiozhz, 2020)
Drechsteden	Dordrecht	The drechsteden is a group of seven municipalities that work together to address the water challenges of the city. They provide technical support apart from contributing to policies that can be adapted regionally to improve the state of the cities in the area.
Self-organization approach		

Stakeholders	Department/ Organization	Role in urban development and resilience
Citizens		
Non-government organization	Red Cross	Non-government organizations are responsible for various advocacies and issues. The Red Cross has an active role in Dordrecht. They are involved in the crisis management planning and coordination in the city.
Capital		
Business sector	Port Authority	Aside from generating jobs and industry to support the economy, the port authority contributes to building urban resilience by supporting climate adaptive solutions for their own businesses, infrastructure and by preparing and educating their networks. The Port Authority is currently working on the main port of Rotterdam where they are developing a climate adaptation strategy and crisis management plan. This same process will be done in Dordrecht.

Table 3: Stakeholders and their roles in Marikina

Stakeholders	Department/ Organization	Role in urban development and resilience
Government approach		
Institutional Actors		
City government	MCDRRMO	Set the direction of the city's disaster risk reduction and management programs and projects in coordination with the various city government departments. Coordinates with the National Disaster Risk Reduction and Management Council (NDRRMC) and translates national policies at the city level.
	Planning office	Leads the development of the city development plans, master development plans and land use plans in coordination with the city government departments and key stakeholders.
Planners		
Academe	*Pamantasan ng Lungsod ng Marikina* Manila Observatory University of the Philippines School of Urban and Regional Planning University of the Philippines Resilience Institute	The academe contributes to academic research. They provide guidance on urban planning, disaster risk management and urban resilience. The PLM is instrumental in helping the city create the citizen charter. The PLM included disaster risk management in their curriculum.
Self-organization approach		
Citizens		

Stakeholders	Department/ Organization	Role in urban development and resilience
Resident	Barangay officials	The residents are important stakeholders since they are the direct users and beneficiaries of the development or non-development of the city. They are responsible to make sure that services are provided to the citizens and inefficiencies are addressed therefore they are responsible to take part in the city's development. At the community level residents are responsible to be vigilant and to improve the community environment. A *barangay* is the smallest local government unit in the Philippines.

Table 4: Stakeholders and their roles in Malabon

Stakeholders	Department/ Organization	Role in urban development and resilience
Government approach		
Institutional Actors		
City government	MDRRMO	Set the direction of the city's disaster risk reduction and management programs and projects in coordination with the various city government departments. Coordinates with the National Disaster Risk Reduction and Management Council (NDRRMC) and translates national policies at the city level.
	Planning Office	Leads the development of the city development plans, master development plans and land use plans in coordination with the city government departments and key stakeholders.
	Housing and Resettlement Office	Leads the identification of resettlement sites for informal settlers in the city. Coordinates with the other city government departments concerned in the relocation of informal settlers or upgrading of resettlement sites.
	Bureau of Fire Protection (BFP)	The BFP is the first responder for fire emergencies and evacuation. They also assist the MDRRMO in conducting drills and trainings in the city.
Planners		
Academe	Manila Observatory University of the Philippines School of Urban and Regional Planning University of the Philippines Resilience Institute	The academe contributes to academic research. They provide guidance on urban planning, disaster risk management and urban resilience.
Self-organization approach		
Citizens		
Resident	*Barangay* officials and representatives Homeowners association	The residents are important stakeholders since they are the direct users and beneficiaries of the development or non-development of the city. They are responsible to make sure that services are provided to the citizens and inefficiencies are addressed therefore they are responsible to take part in the city's development. At the community level residents are responsible to be vigilant and to improve the community environment. A barangay is the smallest local government unit in the Philippines.

APPENDIX 7 SAMPLE INTERVIEW GUIDE FOR INSTITUTIONAL ACTORS

Disaster experience, knowledge and awareness

Memory-based disaster experience

Q1.1 What types of flooding disasters do you remember that hit the city? When did this happen?

Q1.2 How did the disasters affect the city that time? What did the government do that time?

Urban resilience vision

Q1.3 What are the key drivers of change and threats to your city?

Experiential knowledge

Q1.4 What are the local adaptation measures (local knowledge in managing floods) of the community?

Q1.5 Based on experience from past disasters, please give an example(s) of how the city now prepare for and/or respond.

Awareness building

Q1.6 What are your disaster risk management activities?

Q1.7 What kind of trainings on disaster risk management do you do? When do you do these trainings?

Q1.8 How do you equip the people with the knowledge and build their resiliency? And inform them on the causes of flooding and disasters?

Q1.9 What are your ICT campaigns? Who are your targets? What kinds of campaigns do you have? How is it disseminated?

Q1.10 Aside from trainings in the communities/villages, what else are your information and communication strategies?

Q1.11 Are the people now more aware on why there is flooding and their contribution to it? What are your campaigns on that?

Disaster knowledge

Q1.12 Aside from flooding what other disasters or dangers do you see in your city? What makes your city vulnerable to hazards?

Q1.13 Are people concerned with these disasters? Why do you say that? (as follow up)

Q1.14 Is disaster management and training included in the school curriculum? Is it supported by law? What laws support this? How does the city government ensure that this is followed by the schools?

Self-organization and social networks

Self-organization

Q1.15 Is there an organized group within the local community that work on disaster preparedness/response and management? Are these local community organized groups recognized by the city government?

Q1.16 What are the locally initiated disaster preparedness/response and management activities of these organized groups?

Q1.17 Who within the city/communities are more involved in these activities?

Volunteering

Q1.18 Are there volunteer groups on disaster preparedness and response in your city?

Q1.19 Why do you think these volunteer groups emerged? How did they emerge?

Q1.20 What kind of activities (programs and projects) in the city do the volunteers participate in?

Organizations dealing with disaster risk management

Q1.21 Are there civil society and non-government organizations dealing with city development, community development and disaster risk management issues? What are these civil society and non-government organizations?

Q1.22 Do these civil society and non-government organizations conduct trainings and workshops on disaster risk management? What kind of trainings and workshops are these?

Q1.23 Who attends in the disaster risk management workshops/trainings? Are there representatives of the stakeholders like the homeowners associations, rescue volunteers, cooperatives, livelihood associations, etc.? How many times in a year do they conduct trainings?

Q1.24 How involved are the city stakeholders, communities in disaster risk management activities? What do they contribute?

Local disaster risk management units

Q1.25 Are there community based disaster risk management units in your city?

Q1.26 Are the community based disaster risk management offices composition the same as the main DRRM office? Is there a guideline in the composition of committees and technical working group?

Q1.27 What are the requirements for the community based disaster risk management for each community/ village?

Q1.28 Does each community based disaster risk management unit have a plan that they update annually? How is it linked to the city plan?

Q1.29 What infrastructure measures have your city undertaken to help prevent, mitigate or adapt to disasters?

Q1.30 Is your city equipped with manpower, equipment and facilities to meet flooding disasters?

Policies and mandates

Policies and mandates

Q1.31 Do you think disaster (risks, hazards) and vulnerability influence government policies? How does it influence government policies? How do you think are policies on disaster management, urban planning and resilience influenced by economic investment and politics?

Q1.32 Is there a national policy placing more emphasis on urban resilience or resilient city, if so, why? Has your city adopted this in your city development plans? How? Which documents?

Q1.33 Is there a law from the national government mandating the creation of a disaster risk reduction management office for each city? Do you think that even without this law, your city will create a disaster risk reduction management office?

Q1.34 What are the fundamental policy instruments on disaster risk management and planning in your city?

Q1.35 Does the city have a disaster risk reduction management office? What is it's composition? How was it formed?

Q1.36 How much support does the city government give to the disaster risk management office and the community counterparts? What kind of support is provided to them?

Q1.37 How much is the budget allocated by the city government on the disaster risk management office and its programs and projects? Is this enough for the city/community?

Q1.38 Who are in charge and involved in disaster risk management planning and urban planning in your city? Who has the highest authority to manage the city development plan and disaster risk management plan?

Collaboration and communication

Collaborative actions

Q1.39 Are the stakeholders involved in the decision-making process in the development of these plans? How are they involved?

Q1.40 How deep is their involvement in the decision-making process and in the implementation of the plans and activities?

Q1.41 How do stakeholders coordinate with each other in the decision-making process of the plans?

Q1.42 What do you see are the challenges and barriers in coordinating and communicating between government, NGOs, other stakeholders and the community? What do you think can the your city do to improve coordination and communication with your organization/institution?

Collaboration and communication with stakeholders

Q1.43 What strategies does the city government use to maintain communication with the stakeholders? Are there any technologies, tools, social media used to support the communication between the city government and stakeholders?

Q1.44 Do people respond to disasters depending on the magnitude of the disaster? Is their response also different based on where people live and what resources are available to them? For instance, are populations living at the edge of urban environmental boundaries (coast, rivers, cliffs, mountain slopes, forests, industrial areas) more or less resilient to shocks and surprise than those living near the urban core? Why and why not?

Urban resilience

Q1.45 How do you define resilience? What makes a city resilient? Do you think it is necessary for a city to build resilience? Why and why not? And in what way can a city build resilience?

Q1.46 Which factors are important to develop urban resilience?

Q1.47 What do you think can urban resilience add to your city? How does it relate to urban planning and disaster risk management?

Q1.48 What are the challenges in incorporating resilience thinking in urban development and planning? How do you think can this be overcome? Do you think that resilience thinking should even be incorporated in urban development and planning?

Q1.49 Is building resiliency an important element in your plan right now as a city? How do you see the city achieve this?

Q1.50 How can we ensure that other stakeholders become partners in making the city resilient? What support can be given to them?

Q1.51 What approach will be most effective to strengthen local capacity for disaster preparedness in your city?

Q1.52 What role does leadership, trust, social capital, and natural and built capital play in urban resilience?

Q1.53 How does the extension of the urban landscape (those that comprise one or more core business districts and nearby interdependent towns) influence urban resilience?

Q1.54 Can you recommend other people from (1) institutional actor; (2) citizen; (3) planners; and (4) capital to interview on the topic of the research?

APPENDIX 8 POLICIES, PLANS AND STUDIES IN MARIKINA

Policy/Plan/Strategy/ Study	Year	Description
Ordinance No. 32	1990	Outlines the proper garbage disposal within the city and the waste management system
Save the Marikina River Program	1992[1 2]	The goal is to restore the Marikina River, preserve the natural contours of the river and boost its esthetic beauty and make it a place of leisure for residents.
Squatter-free Marikina	1992[1 3]	Relocate informal settlers to resettlement sites within Marikina. Provide social housing and tenure.
Rescue 161	1993[1 4]	Communication platform for emergency response.
Ordinance No. 59	1993	Holding public spaces open to optimize the free flow of vehicular and human traffic (essential in emergency situations). (Iglesias and Yu, 2008: 4)
Ordinance No. 10	1994	“Declaring an easement of 96 meters from either side of the Marikina River centerline, and authorizing the relocation of all residents found with the easement to safer ground.” (Iglesias and Yu, 2008: 4)
Ordinance No. 210	1994	Mandating homeowners and business owners to clean the sidewalks fronting their properties.
Ordinance No. 204	1996	Ordinance to create the Waste Management Office (WMO) and define its functions
Ordinance No. 281	1998	Mandate to create positions under the WMO and appropriation of funds for operations
Ordinance No. 213	1998	Anti-littering code of Marikina
Ordinance No. 264	1998	“Creating a Disaster Management Office also known as Rescue 161, to be responsible for emergency preparedness, coordinating response, for first response skills training, and monitoring during emergencies.” The city government shall provide an annual budget for the management and operation of the office. (Iglesias and Yu, 2008: 4)
Ordinance No. 171	1999	“Declaring two titled lots found by the river as a danger zone and non-buildable area, revoking unused building permits for the area, and prohibiting any new construction.” (Iglesias and Yu, 2008: 4)
Ordinance No. 76	1999	Amendment of Ordinance No. 213 series of 1998 Anti-littering code to increase the fines charged against violators.
Ordinance No. 57	1999	Prohibits publicly burning garbage in public areas and spaces which includes streets and sidewalks.
Ordinance No. 73	2002	Amendment of Anti-littering code Ordinance No. 76 series of 1999 to increase penalties and fines against violators and deputizing Sanitation Officers for each barangays to implement the law.
Eco-savers program	2002	A recycling scheme to encourage young people to take responsibility on recycling solid waste through a point-system that they can exchange for school materials.
Ordinance No. 46	2002	Requiring the segregation of household, institutional, industrial and commercial wastes to wet or biodegradable and dry or non-biodegradable.
Ordinance No. 109	2005	“Creating the Comprehensive Earthquake Reduction program and action plan, and identifying the roles of 20 offices/agencies of the local authority.” (Iglesias and Yu, 2008: 4)

Policy/Plan/Strategy/ Study	Year	Description
Ordinance No. 54	2005	“Authorizing the use of 20% of the Calamity Fund for Disaster Preparedness, specifically for disaster-related tools, gadgets and equipments to be used during emergencies.” (Iglesias and Yu, 2008: 4)
Marikina Recovery Plan	2009	Post-disaster damage and needs assessment after Ondoy. Includes short-, medium, and long-term recovery plans and programs for infrastructure, environment, economic, social and administrative sectors. (Florano, 2014)
Flood Contingency Plan	2009[5]	Includes the delegation of tasks for the local government offices. The plan itself is divided into pre-disaster, evacuation proper, and post-disaster. (Florano, 2014)
Marikina City Disaster Risk Reduction and Management Office	2012	Institutionalized Rescue 161 per Republic Act 10121

Note: [1] Year launched.
[2] The city regularly monitors the river with the Engineering Department, MRPA, and the DPWH.
[3] The city has since transformed the MSO into a department to continue the services for the urban poor.
[4] Transformed as the MCDRRMO but kept the Rescue 161 as a brand and hotline number.
[5] Contingency plans evolve after every experience with disasters.

ABOUT THE AUTHOR

Theresa Audrey O. Esteban is an urban planner and international development worker. She has managed urban planning, environmental, disaster risk management, water and sanitation, and social development projects in the Asia-Pacific region including several comprehensive land use plans, investment programs, protected area management plans, and UNDP, Asian Development Bank, and World Bank funded projects. Ms. Esteban was the co-author of a chapter for the ADB publication Green Cities entitled *A Water Secure Future*. She was the Team Leader for the Contribution to Change Philippines Appeal Project and the main author of the final report *Philippine Typhoon Appeal: Contribution to Change*. She is the author of the book chapter *Collective engagement: picking up after the storm*, in the book Urban Governance in the realm of complexity, which discusses participation, community, and disaster recovery, and co-authored the *Metro Manila* chapter in the Asia-Pacific Economic Cooperation publication Partnership for the Sustainable Development of Cities in the APEC Region. Her co-authored publication *Bouncing back together: Mapping the story of post-Haiyan rebuilding in a coastal community* looks at the rapid recovery of disaster affected communities through mapping out their different capacities. Her publication *Building resilience through collective engagement* outlines the collective engagement urban resilience framework which she has been developing since 2013 while at the ADB. With her technical background she has developed programs and projects including international seminars, trainings and workshops on various development issues. She has done technical programs and projects in varying capacities in the Philippines, Viet Nam, Singapore, People's Republic of China, Malaysia, The Netherlands, and Sweden. Ms. Esteban holds a masters degree in Urban Management and Development with a specialization in Urban Governance at the Erasmus University Rotterdam, The Netherlands, and masters degree in Urban and Regional Planning at the University of the Philippines. She has given public lectures on urban planning, disaster management, social development, climate change and water security before professional and academic audiences. Ms. Esteban's dissertation case on Rotterdam has been used as the basis of the COVID-19 Policy Briefs for Rotterdam.

List of publications and conference papers in relation to this dissertation:

- Lead author of the book chapter. *Keeping Feet Dry: Rotterdam's Experience in Flood Risk and Resilience Building*. Co-authors Prof. dr. Jurian Edelenbos and Dr. Naomi van Stapele. In the book Flood Impact Mitigation and Resilience Enhancement. Available: https://

www.intechopen.com/online-first/keeping-feet-dry-rotterdam-s-experience-in-flood-risk-and-resilience-building

- Author. *Mind the gap: Stakeholders perspective on resilience building in the City of Rotterdam* (track keynote) presented at the 55th ISOCARP World Planning Congress "Beyond the Metropolis". Available: https://isocarp2019.isocarp.org/paper-platform/abstract/public/50/mind-the-gap-stakeholders-perspective-on-resilience-building-in-the-city-of-rotterdam

- Author. *Living with water: How memory and experience can help build community resilience in Dordrecht* presented at the 55th ISOCARP World Planning Congress "Beyond the Metropolis". Available: https://isocarp2019.isocarp.org/paper-platform/abstract/public/51/living-with-water-how-memory-and-experience-help-build-community-resilience-in-dordrecht

- Author. *Building resilience through collective engagement*. Constructing an urban future: The sustainability and resilience of cities. Link: https://www.scienceopen.com/hosted-document?doi=10.14324/111.444.amps.2020v17i1.001

- Lead author. *Bouncing back together: Mapping the story of post-Haiyan rebuilding in a coastal community*. Constructing an urban future: The sustainability and resilience of cities. Co-author Janeen Kim Cayetano. Abu Dhabi University, United Arab Emirates. Link: https://www.researchgate.net/publication/330713714_Bouncing_back_together_Mapping_the_story_of_post-Haiyan_rebuilding_in_a_coastal_community

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