MASTER THESIS

Climate Resilience and Urban Water Management: A Comparative Analysis of Cities in the Province of Overijssel, the Netherlands

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Master of Environmental and Energy Management

Specialization: Water Governance

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Master thesis

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Preface

This master thesis 'Climate Resilience and Urban Water Management: A Comparative Analysis of Cities in the Province of Overijssel, the Netherlands' is an explorative research on climate change adaptation projects in the province of Overijssel. It has been written to fulfil the graduation requirements of the Master of Environmental and Energy Management programme at the University of Twente. I have been researching and writing this thesis from April 2018 until August 2018.

I would like to thank all the interviewees who were willing to participate in and contribute to this research. I would like to thank the experts from the municipalities of Enschede, Zwolle, Hengelo, Almelo, Deventer, and Kampen, from the water authorities Vechtstromen and Drents Overijsselse Delta, and from the province of Overijssel for sharing their knowledge and perspectives with me. I would also like to thank my 1st supervisor Dr. Gül Özerol for her excellent guidance and constructive feedback, and my 2nd supervisor Dr. Kris Lulofs for his feedback as well.

Lastly, I would like to say that I hope that this research contributes to the knowledge on climate adaptation in the urban area and that it is in some way helpful for organizations that initiate, are involved with and/or manage climate adaptation projects.

Jelle Reitsma

Hardenberg, August 29th, 2018

Abstract

Climate change is one of the most challenging problems faced in urbanized areas today. Droughts and periods of heavy rainfall occur more often and cause more severe damages, which can have large negative effects on the build environment. The conventional urban water management is unsuitable to cope with the current and future challenges. One of the main reasons for this unsuitability is that the hard measures, for example increasing the capacity of the sewage system, are not sufficient to deal with the effects of climate change. To make cities resilient to the effects of climate change the urban water management should be improved. Several cities in the Netherlands and in the province of Overijssel are already doing efforts towards climate resilience through improving their urban water management systems. They have used certain approaches to develop and design these efforts. There is however no comprehensive overview of the approaches that these cities used, or have been using, to develop and design the efforts they made so far. Furthermore, there is little knowledge about the results of the application of these approaches, and about the successes and failures of these approaches. This study addresses these knowledge gaps in order to identify lessons learned on the successes and failures, which can be used by governmental organizations like municipalities, water authorities, and provinces in choosing and improving current and future climate adaptation processes and efforts.

This research focusses on six cities in Overijssel: Enschede, Zwolle, Hengelo, Almelo, Deventer, and Kampen. The research aims to create knowledge on the approaches used and their results to reach a comprehensive understanding of the efforts of six cities within Overijssel towards becoming climate resilient. It also aims to generate comparative insights for exchanging lessons learned on the successes and failures. For this purpose, data was gathered by conducting interviews with experts from governmental organizations related to the selected cities on the approaches and results of climate adaptation projects. This resulted in data on the nature of the approaches, the actual results, the assessment of the project, and lessons learned. This data, together with theory on approaches, resulted in an inductive comparison framework. This framework was used to analyse the approaches and results of 20 projects that were (being) implemented in the six cities. Based on the nature of the climate adaptation measures taken, the projects were divided into nine categories. Within these categories, the projects were compared to each other in order to identify differences and similarities between the projects and the lessons learned. Based on the lessons learned per category and the data collected through the interviews, five general lessons are identified as well. Four of these focus on the planning and design phases of projects, and one focusses on the processes at municipal level and their progress regarding climate adaptation. Another insight is the set of conditions that define a successful project regarding climate adaptation in urban areas. These conditions are as follows: 1) the collaboration between all stakeholders is excellent from the planning phase until the end of the project, 2) climate adaptation within the project is integrally linked to other projects and interests, 3) the project/measure is well integrated into the environment, and 4) the project adds value to the quality of the public space by creating water experience and water awareness.

This research makes recommendations about follow-up research, 1) To perform a similar type of research as this one for a larger area and for more cities, 2) to interview more than one person for each organization, 3) to only compare projects to each other within cities which have the same perception of successful climate adaptation projects. This research also makes recommendations to governmental organizations which initiate, are involved, and/or manage climate adaptation measures, 1) to monitor all climate adaptation measures and to perform an official evaluation for each climate adaptation project, 2) to apply the lessons learned by this research per category in case similar project as the ones in the categories will be implemented, 3) to apply the general lessons learned at each climate adaptation project and, 4) to ensure that the conditions for successful projects are fulfilled in each project.

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Chapter 1 Introduction

1.1 Background

Worldwide, the negative effects of climate change are increasing more and more over the last decennia. Climate change models of Europe predict and show already long term droughts during summers and an increase in heavy rainfall periods (Smaniotto Costa et al., 2015). Together with the growth of population, climate change is one of the most challenging problems that is and will be faced in urban areas (Wong & Brown, 2008).

Climate change can put an enormous pressure on urban water systems. On the one hand, long-term droughts mainly occur and have effects on urban areas in the southern part of Europe. On the other hand, periods of heavy rainfall mainly occur and cause flood damage to urban areas in central and northern parts of Europe (Smaniotto Costa et al., 2015). In case heavy rainfall occurs in southern Europe these can have a high potential damage, and the same situation applies regarding the damage from drought in northern Europe. Besides climate change, the growing urban population also puts a pressure on urban water systems, since urban areas are one of the main consumers as well as polluters of freshwater resources. As of 2012, 41% of the European population lives in urban areas, while this is expected to continue to increase in the future (Smaniotto Costa et al., 2015). In urban areas, droughts can cause water supply uncertainties, environmental damages, public health problems and problems regarding economic sustainability. Similarly, heavy rainfalls often cause floods, which can also cause environmental damages, public health problems and problems regarding economic sustainability (Wong & Brown, 2008).

It is acknowledged that the conventional urban water management approach is unsuitable to cope with the current and future challenges described above (Ferguson, Frantzeskaki, & Brown, 2013; Wong & Brown, 2008). One of the main reasons for this unsuitability is that the hard measures, for example increasing the capacity of the sewage system, are not sufficient to deal with the effects of climate change. A solution to this problem is to adapt urban water management towards an approach that is more sustainable and that connects technology with the environment in a way that it makes urban areas resilient to climate change (Wong & Brown, 2008). An example of an objective of adapting water management to climate change within cities can be to design a water sensitive city (Ferguson et al., 2013). Such a city is resilient towards the enormous pressures that climate change, together with urban population growth, causes. In such a city, disturbances, such as droughts and heavy rainfall, do not have dramatic consequences, such as public health problems and major floods (Wong & Brown, 2008).

In the Netherlands, adaptation to climate change through adapting water management is mostly done within urban areas, since the population density is high, the country is highly urbanized, and economic activities are intensive in these areas (Goosen et al., 2013). Several cities have already been making efforts in building resilience into their cities. For instance, Rotterdam, the second largest city in the Netherlands, is known as one of the global front-runners in preparing for climate change (Spaans & Waterhout, 2017). In the Province of Overijssel, several smaller cities are also doing efforts in adapting their water management to increase the resilience towards the impact of climate change and urban population growth to the urban water system. Examples of these cities include Zwolle, Enschede, Hengelo, Almelo, Deventer, and Kampen (Gemeente Deventer, 2016; INFRAM, Urhahn, & HydroLogic, 2015; Ministerie van Economische Zaken en Klimaat, 2016). These cities are included in this study for empirical research.

1.2 Problem Statement

In their efforts to adapting their water management to climate change, several cities in the province of Overijssel have used certain approaches to develop and design the efforts they have done so far. These approaches will probably highly differ from approaches used by for example Rotterdam because, as compared to medium- and small-size cities. Such large cities have higher capacity in terms of budget and personnel. There is however no comprehensive overview of the approaches adopted by the medium and small cities to develop and design the efforts they make. Furthermore, there is little knowledge about the results of the application of these approaches so far, and about the successes and failures of these results. This study will address these knowledge gaps as its research problem in order to identify lessons learned on the successes and failures which can be used by governmental organizations like municipalities, water authorities, and provinces in choosing and improving current and future climate adaptation processes and efforts.

1.3 Research Objective

This thesis has two research objectives. The first objective is to create knowledge on the approaches used and their results in order to reach a comprehensive understanding of the efforts of six cities within Overijssel towards becoming climate resilient. The second objective is to generate comparative insights for exchanging lessons learned on the successes and failures of the different approaches.

1.4 Research Questions

Main research question

What are the lessons learned on successes and failures of the approaches used within cities in Overijssel towards becoming climate resilient?

Sub-questions

1. Which approaches have been used or are being used by cities in Overijssel?
2. What are the results for each city, taking into account the approaches used?
3. Which criteria are needed to develop a framework for comparing the results of the different cities?
4. What are the successes and failures in terms of the results of the approaches used in each city?

Answering the four sub-questions will eventually lead to an answer to the main research question. At first, the answer to sub-questions 1 and 2 together gives the necessary input to answer sub-question 3. After that, the answers to sub-question 1 and 2, together with the answer to sub-question 3, are needed to perform the analysis to answer sub-question 4. At last, through the answer to sub-question 4 it is possible to give an answer to the main research question.

1.5 Reading Guide

After this introductory chapter, Chapter 2 reviews the relevant concepts and theory on climate adaptation in urban areas, in general and on the Dutch context in particular. Chapter 3 describes the research methodology. Chapter 4 includes the descriptions of the projects, which are examined in this research. Chapter 5 shows the results of the analysis which has been performed during this research. This will result in lessons learned on successes and failures for projects divided within specific categories. This chapter also shows general lessons learned on climate adaptation projects. Chapter 6 contains by this research identified specific conditions for successful climate adaptation projects within the specific categories and common conditions for a successful climate adaption project. At last, chapter 7 discusses and makes conclusions and recommendations.

Chapter 2 Literature Review

This chapter describes relevant literature for the research. First, section 2.1 describes climate adaptation and climate resilience in general. Section 2.2 describes different approaches of climate adaptation. Section 2.3 describes Dutch water management. Section 2.4 describes regional initiatives in Overijssel regarding climate adaptation. At last, section 2.5 describes the current situation regarding water management in the in this research included cities, followed by recent events related to water management in these cities.

2.1 Climate Adaptation in Cities

2.1.1 Climate resilience and climate adaptation

According to The World Bank Group (2011), cities can build resilience and capacity to current and future climate change impacts through informal preparations and formal planning activities. This is called adaptation, which means: reducing the vulnerability of natural and human systems to actual and expected climate change impacts through initiatives and measures. An actual resilient city is able to adapt to climate change as well as to current impacts as to future impacts. Hereby they should be able to limit the magnitude and severity of the impacts. When a severe impact occurs, such a city is able to evolve cost-effectively and equitable for all stakeholders (The World Bank Group, 2011).

In becoming a climate resilient city robust decision making of authorities is needed. Besides, the institutional and social relationships should be strong so it can provide a safety net towards vulnerable stakeholders. Before the responsible actors can start building resilience into their city they need to comprehensively understand the level of exposure and sensitivity to the impacts their city experiences or will experience in the future. When this is the case they need to develop adaptation policies and plans. The last step is to put the planned policies and plans into action by setting performance indicators and evaluating and prioritizing the adaptation actions within their city (The World Bank Group, 2011). Within Europe there are already several examples of cities of different scales which are making progress in climate change adaptation. This progress can be defined as the development of policies and strategies, and as the implementation of practical actions.

Tyler & Moench (2012) point out the need to adapt to climate change through measures as investments in infrastructure and capacity. Three elements which together can define urban resilience are identified: systems, agents, and institutions. A resilient urban system has several characteristics. It should be flexible and diverse to fulfil the essential tasks and to provide the essential needs under different conditions. It should also be redundant and modular to have spare capacity for unforeseen circumstances, and in the delivery of services, certain components should be easy to be replaced if one of them fails. At last, a resilient system should be safe failure, which means that it must be able to absorb abrupt shocks. Another crucial aspect of urban resilience is the integration of social actors. These should be responsive, resourceful, and have the capacity to learn. Responsiveness in this case means that the actors have the capacity to organize and reorganize and are able to identify problems, anticipate towards them, plan and prepare for them, and respond quickly in case this is needed. Resourceful in this case means that the actors have access to financial and other assets of themselves or others through collaboration. Capacity to learn means that the actor is able to reflect on past experiences to make sure the same failures will not happen again and they should be able to acquire new skills. At last, Tyler & Moench (2012) identified institutions as the element that is able to link systems and agents. Institutions should provide clear information on the rights and entitlements to use key resources and they should also provide access to clear information on risks and vulnerabilities. They also have to be transparent, accountable and responsive in their decision-making. At last, institutions should be a facilitator in the generation, exchange, and application of new knowledge concerning urban resilience. Based on this Tyler & Moench (2012)

state that resilience can be defined as high “where robust and flexible systems can be accessed by high-capacity agents and where that access is enabled by supportive institutions” (pp. 318, 319). The intervention towards resilience with the combination of systems, agents, and institutions makes sure that vulnerability is reduced.

Wamsler (2017) states that there are three types of urban adaptation measures: hard or grey infrastructure measures (as levees), green measures (as green urban spaces), and soft measures (as encourage adaptive behaviour through incentive). Wamsler (2017) also states that urban climate adaptation requires involvement of internal and external stakeholders. There is widespread consensus that these stakeholders should become part of the change by finding innovative ways to collaborate and unite the different efforts, capacities and knowledge towards climate adaptation within cities. This is called: distributed risk governance. The main actors are defined as: the state, the market, and the civil society. These stakeholders should interact with each other in both informal and formal ways in the development and implementation of policies that can achieve sustainable development. The idea of this distributed risk governance is that by sharing the capacities and resources of all stakeholders among each other it should be possible to address and solve certain problems which are impossible to address and solve by one actor alone. Wamsler (2017) identifies six activities which are needed to develop an adaptation strategy in which the different stakeholders should be involved:

- The set-up and starting point
- The assessment of the existing knowledge an risk context
- The identification of potential adaptation options
- The selection of adaptation options
- The design of the implementation
- The design of monitoring, evaluation and learning activities

Leichenko (2011) states that resilience is becoming increasingly important in urban adaptation to climate change. Resilience can be defined as a key goal of adaptation and mitigation efforts towards climate change in cities. It is widely acknowledged that cities should become resilient in order to be prepared for a wide range of stresses and shocks caused by climate change. Besides, efforts to foster resilience should be integrated in efforts to foster urban development and sustainability. Leichenko (2011) describes three key aspects of urban climate resilience. The first aspect is that climate change is just one of many types of stresses and shocks. Climate change effects mostly occur in combination with all kind of other stresses and shocks. This means that cities should also be resilient towards these stresses and shocks. The second aspect is that key characteristics of a resilient city are: flexibility, diversity, adaptive governance, and capacity for innovation and learning. The third aspect is that efforts to foster urban resilience should be integrated with broader development plans and policies. In most cases it is easy to adapt existing plans and policies which address environmental problems (Leichenko, 2011).

2.1.2 Successful climate adaptation

According to Doria et al. (2009) a climate adaptation project is successful when “any adjustment that reduces risks associated with climate change, or vulnerability to climate change impacts, to a predetermined level, without compromising economic, social, and environmental sustainability”. It is however stated in this article that the scale on which the climate adaptation is happening has to be considered in whether this generic definition is adequate.

According to Tompkins et al. (2010) the conditions which are defined by Doria et al. (2009) are right but too simple. It is under-researched how to evaluate successful adaptation. It is also stated in this article that for example sustainability indicators and strategic environmental assessments could be

important in developing conditions for successful climate adaptation. Dupuis & Biesbroek (2013) also state that there is hardly any agreement on how to define successful climate adaptation projects.

Baker et al. (2012) defines three conditions which should lead to a successful climate adaptation project. One of these is that participatory processes are a crucial element of successful adaptation. Mainly because this will lead to higher quality plans which will more likely be implemented and maintained. The other conditions that Baker et al. (2012) identify focus on financing and governmental processes.

2.2 Approaches to Adapt Urban Water Management to Climate Change

2.2.1 Water Sensitive Cities Framework

When cities change their conventional water management, one of the options would be to strive towards designing a water sensitive city. Until now there is, according to literature, not one example in the whole world of a real water sensitive city (WSC). Brown, Keath, & Wong (2008) state that in a water sensitive city the normative values of environmental repair and protection, supply security, flood control, public health, amenity, liveability, and economic sustainability are integrated. A water sensitive city can be characterised by the following three key pillars of practice, which must be seamlessly integrated into the urban environment (Wong & Brown, 2008):

Cities as catchments: A water sensitive city has access to a diversity of water sources which provides water via a diversity of options concerning water infrastructure. There is a mixture of centralised and decentralised water supply schemes regarding harvesting, treatment, storage and delivery of water. Another important aspect is that non-potable water from different sources (such as recycled wastewater and floodwater) is used for uses such as toilet flushing, laundry, and garden watering. In an optimal situation, all aspects described above will ensure access to low cost water sources and low environmental risk/impact (Wong & Brown, 2008).

Cities providing ecosystem services: A WSC has such an urban design that it is resilient to the pressures of climate change and population growth. The urban design provides ecosystem services to protect/buffer upstream and downstream environment and habitats. Besides, the urban design also provides opportunities and technologies to face future water supply uncertainties and climatic extremes. A WSC also manages water resources in a sustainable way. Waterway health management should make sure that waterway health and water quality improves (Wong & Brown, 2008).

Cities comprising water sensitive communities: In developing a WSC and implementing different policies and concepts on the road to become a WSC the acceptance of community and broad political support is essential. The participation of communities is a fundamental requirement in defining the urban water problem and in the development of a WSC. Only with community awareness and participation a real water sensitive city can be designed and maintained (Wong & Brown, 2008).

It can be stated based on the description above that WSC creates sustainability within the urban environment by: integrated environmental protection, diversity of resource sources and technologies, and new forms of environmentally and social conscious urban design (Brown, 2012).

2.2.2 Water Wise Cities

According to the International Water Association (2016) a water wise city has four characteristics:

Regenerative water services for everyone: Public health is ensured and all current needs are ensured while at the same time the water quality and the water quantity is ensured for the future needs. This must be done by producing and using water, energy and materials in an efficient way. There are five

principles which contribute to this efficient production and usage: 1) Replenishment of water, 2) Reduction of water and energy, 3) Reuse, recover, recycle resources, 4) Systematic approach to see the different parts of the water system as a whole, and 5) Increase modularity.

Water sensitive design: In the water wise city, urban planning is integrated with the protection, conservation, and management of the total urban water cycle. In this way the urban areas will become sensitive to water. There are four principles which contribute to this sensitive design: 1) The urban design enables regenerative water services, 2) The urban design allows spaces to reduce flood risks, 3) The liveability is enhanced by visible water, 4) Urban materials are modified and adapted in such a way that their impact on water pollution is minimised.

Basin connected: In this city, water, food and energy is secured, flood risks are reduced, and activities which contribute to economic health are enhanced. This is reached by connecting to a basin. All the above is reached by complying with three principles, namely securing the water resource, protecting the water quality, preparing for extreme events.

Water-wise communities: In a water wise city, it is important to have water-wise communities to reach and maintain the above characteristics. People should behave in a water-wise way in a sense that they realise their role to make a difference. There are five actors which should behave in a water wise way, namely citizens, professionals with various expertise, transdisciplinary planning and operation teams, policy makers and leaders.

2.2.3 Cities Resilience Index

A city which complies with the Cities Resilience Index complies with four dimensions defined by ARUP & The Rockefeller Foundation (2017):

Health and well-being: This applies to everyone that is living and working in the city. If everyone meets their basic needs (under normal and crisis conditions), if diverse livelihood opportunities are supported by the city, and if health is safeguarded.

Economy and society: This applies to the organisation of the city. If law and order is enforced and if fiscal management is ensured, if the environment supports collective identity and mutual support, and if a basic level of food, water, sanitation, energy and shelter is provided.

Infrastructure and ecosystems: This one relates to place. If infrastructure and ecosystems are robust enough to protect against natural hazards, and if critical services (water supply, power, solid waste management) under shock or stress situations can guarantee continuity.

Leadership and strategy: This one is underpinned by knowledge. If a city has effective leadership and urban management, if stakeholders are empowered by giving them access to information and education, and if the city develops in an integrated way.

2.2.4 City Blueprint

The city Blueprint is a tool that helps cities to develop a path towards sustainability. Besides, it also helps in bringing the ‘ultimate blue city’ within reach. This tool can be defined as a success, since it has been used by 45 municipalities and regions within 27 different countries (Koop & van Leeuwen, 2015). The City Blueprint consists out of three frameworks (Van Leeuwen & Koop, 2016):

The Trends and Pressures Framework: The main environmental, financial, and social challenges of cities are assessed in this framework. These aspects are all aspects on which cities hardly have influence.

The City Blueprint Framework: The performance and bottlenecks of Integrated Water Resources Management are analysed in this framework. This can be done for municipalities or regions. This framework consists of indicators on basic water services, wastewater treatment, infrastructure, water quality, solid waste treatment, climate robustness and governance.

The Governance Capacity Framework: This framework focuses on five water issues which will likely increase by climate change: flood risk, urban heat islands, wastewater treatment, solid waste treatment, and water scarcity. This framework assesses the status of governance regarding these issues through three categories: 1) Knowing: Awareness, useful knowledge, and continuous learning, 2) Wanting: Stakeholder engagement, policy ambition, and agents of change, 3) Enabling: Multi-level network potential, financial viability, and implementing capacity.

2.3 Water Management in the Netherlands

2.3.1 Recent developments in Dutch water management

In recent years there has been a shift in the Netherlands regarding the focus of policy making regarding water resources, on both national and local levels (Stead, 2013). At the local level, there is a greater emphasis on climate adaptation strategies. However, the aspects that policies within municipalities focus on concerning water management varies significantly (Stead, 2013). In the last years, water has also gained increasing attention within spatial planning policies (Stead, 2013). Since spatial planning is mainly a responsibility of the municipalities, this is an important way in which urban water management can be influenced. In 2017, the Netherlands developed the Deltaplan Ruimtelijke Adaptatie (Deltaplan Spatial Adaptation). This is a national plan of municipalities, water authorities, provinces, and the state. It contains actions and goals for the responsible governmental bodies regarding spatial adaptation. It aims to speed up and frame the process of spatial adaptation (Ministerie van Infrastructuur en Milieu & Ministerie van Economische Zaken, 2017). This needs to be done following three steps: 1) Knowing: Make a clear overview of the vulnerabilities, 2) Wanting: Formulate ambitions, and 3) Working: Get to work to make the living environment climate resilient and water-robust.

In the current situation, the municipalities are responsible for rainwater and sewage water management. They are also partly responsible for river flooding. Generally, flooding is not the main reason for initiating climate adaptation measures. It is mostly seen as an additional argument to initiate measures that contribute to sustainable urban development in general. In the Netherlands, different adaptation measures for flooding are taken within cities. These measures can be divided into proactive and reactive measures. Besides, the measures can also be divided into levels on which they are taken: building, street/quarter, and city level. Within each level the measures can be divided again into categories: measures taken in order to reduce or solve the effects of downpours, river flooding, and both downpours and river floodings (Runhaar et al., 2012).

2.3.2 Urban water management in the Netherlands

In urban water management, several water types have to be taken into account which have the atmosphere or the drinking water supply as their water source (Van Der Toorn Vrijthof & Van De Ven, 2008). These include surface water, groundwater, wastewater, drinking water and rainwater. Surface water from rural areas is kept separated from surface water within the urban areas because of a difference (more stringent) in quality requirements and level fluctuation requirements within the city compared to rural areas. Within the water chain, the effluent of the wastewater treatment plants is in most cases discharged outside of the cities.

There are two types of water which put extra pressures on the urban water system: normal rains and heavy rainfall. These pressures have to be dealt with properly to prevent floods within the urban area. About 40% of rainwater within urban areas flows through groundwater to surface water within the city as well as to groundwater of surrounding areas. About 23% flows through sewers and the remaining rainwater evaporates (Van Der Toorn Vrijthof & Van De Ven, 2008). The abnormal quantities of surface water caused by heavy rainfall or snowfall is called stormwater. There are different systems to deal with stormwater. In the past, it was common to treat stormwater in wastewater treatment plants. In recent years the idea of letting stormwater flow directly into canals or groundwater is acknowledged more (Van Der Toorn Vrijthof & Van De Ven, 2008).

2.4 Initiatives in Overijssel to Adapt to Climate Change

2.4.1 Twents Waternet

The Twents Waternet is a collaboration between 14 municipalities in the region of Twente and the regional water authority, waterboard Vechtstromen. This collaboration focusses on reaching a safe and climate resilient urban- and rural environment. They want to reach this by increasing the awareness among the society in Twente and the policymakers. Hereby the focus lies on four policy ambitions (Twents Waternet, 2017):

***Protection*:** A sustainable social environment should be established by incorporating extreme weather, droughts and periods if heavy rainfall, within all water issues.

***Experience*:** An attractive environment should be established by creating clean and visible water within the region. As a result, people can enjoy the water.

Awareness: To solve complex water issues the society could come as a good help. To involve society, awareness has to be created among people and organizations. These have to understand the true value of water.

Collaboration: To solve water issues, smart solutions are needed. These solutions could come from governmental organizations, education, entrepreneurs and research institutes. By collaboration between these organizations smart solutions could be established.

The main focus of the Twents Waternet is on making the sewage system and treatment of wastewater more efficient and ultimately manage it as one single system within this region. They aim to achieve a cost reduction and a better living environment in doing so. In 2009, the collaboration agreed on several agreements within the Twente Wastewater Agreement (Twents Afvalwaterakkoord (TAAK)). The goals within TAAK are: reduce costs, increase the quality of wastewater, and reduce the vulnerability of the sewage system in Twente (Dekkers & Messelaar, 2012). These goals should be reached by carefully considering sustainability and innovation on the road towards them.

2.4.2 Duurzaam Overijssel

The province of Overijssel is doing efforts towards sustainability in collaboration with relevant actors on different subjects (Provincie Overijssel, 2018). They want to realize sustainability in the province with social instruments. The province takes the role as a facilitator by bringing people and organizations together and focuses on five subjects (DuurzaamDoor, n.d.):

Climate resilience: The province wants to make urban and rural areas resilient to the future impacts of climate change. They collaborate with other provinces, municipalities, and water authorities. This is a difficult task in Overijssel since it has both a river delta and high grounds. The province wants to

come up with solutions to protect Overijssel against flooding during periods of heavy rainfall and secure the quality of the drinking water supply during periods of drought.

***Nature and biodiversity*:** The province wants to improve its nature not only within protected areas but also in urban areas and agricultural areas. Improving nature means, establishing a healthy and attractive nature for people, animals, and plants. This nature can be experienced and used, can benefit from economic developments and has a rich biodiversity. The province wants to collaborate with people, entrepreneurs, terrain managers, social organizations, water authorities, and municipalities. In improving its nature, the province focusses on a positive interaction between nature and economics.

Circular economy: The province states that climate change has created awareness regarding the use of energy, raw materials, and natural resources. These must be used more carefully and efficient. The province is assisting companies in innovating and being more sustainable. This must be done by reusing and recovering materials. The province wants to collaborate in this with entrepreneurs, people, and organizations.

***Renewable energy*: T**he province is motivating people and entrepreneurs in using and producing renewable energy. They also want to stimulate innovation in this.

***Transport*:** The province wants a better usage of transport. These have to be more sustainable. The province is stimulating the usage of electrical cars.

2.4.3 CATCH project

The CATCH project focusses on the North Sea region (European Union, n.d.). Within this project, several actors within Overijssel collaborate with actors from a couple of other European countries. Within Overijssel, the municipality of Enschede, the municipality of Zwolle, the province of Overijssel, the water authority Vechtstromen, and the University of Twente are involved (Kennisportaal Ruimtelijke Adaptatie, 2017b). The main goal of this project is to demonstrate and accelerate the redesign of urban water management of midsize cities, based on the water sensitive cities theory. The involved cities have selected different pilot areas to test climate adaptation measures to do so. The goal of this redesign is to make these cities into climate resilient cities which are liveable, sustainable, and profitable on the long term. This goal will be achieved by developing decision support tools and a roadmap by collaboration between al the involved actors. These tools will help midsize cities in developing long term climate adaptation strategies. The tools and the roadmap will be developed based on inspiration from the WSC framework (Kennisportaal Ruimtelijke Adaptatie, 2017b). The CATCH project helps in joining forces on a regional and a European level. It will also help in creating European awareness and thus is an opportunity to change behaviour. More specifically, the main project objective is divided into five sub-objectives (European Union, n.d.).

- Identify the state of the art and scope the needs of midsize cities
- Design a tool for re-designing urban water management
- Valuate decision support tools and develop and implement pilots jointly
- Build climate adaptation strategies
- Take up project innovations and dissemination

2.4.4 Klimaatactieve Stad

In a Climate Active City (Klimaatactieve Stad in Dutch), green-blue structures can be found throughout the city. These green-blue structures can have different functions, such as water storage and treatment, cooling of the city, production of biomass, production of food and recreation. In such a city, the conventional, grey structure of the wastewater chain can be a producer of energy, heat

and resources (STOWA, 2016). These functions can be combined within neighbourhoods to create synergy and thus to increase the efficiency of the city. Examples of such a synergy include:
Climate adaptation: Increase rainwater runoff by decreasing hard substrate and increasing greening/nature. This also helps in cooling the city and provides opportunities for participation of citizens.

Participation: By involving citizens in the design, construction and maintenance of 'green' areas, their awareness will be raised. This can help in decreasing the costs for construction and management. Citizens can also increase greening in their gardens and on their roofs.

Prevention of urban heat: Green areas, kitchen gardens, urban agriculture, greening in gardens, all add towards a more natural urban watersystem. As a result, the heat within the city will be reduced.

Improvement of the quality of life: More green areas and water within cities can reduce health problems. Citizens have more opportunities for recreation and relaxing, which benefits to the health of people and reduces stress levels.

A roadmap that contains all aspects which should be present in a Climate Active City is as follows:

- Local and sustainable energy production
- Local recovery and reuse of resources
- Sustainable house and garden
- Self-sufficient by urban agriculture and kitchen garden
- Green-blue veins throughout the city
- Disconnect rainwater from the sewage system

2.4.5 Living Lab Ruimtelijke Adaptatie Overijssel

Within the province of Overijssel, cities are making efforts on improving the resilience of urban areas. Zwolle, Kampen, Zwartewaterland, Enschede, Hengelo, and Almelo are working on this together within the Living Lab Ruimtelijke Adaptatie Overijssel with citizens, entrepreneurs, knowledge institutes, water authorities, the province, and the cooperation IJssel-Vechtdelta (Kennisportaal Ruimtelijke Adaptatie, 2017a). The experiences of this Living Lab help in developing climate measures in the complete region. It is mainly the case that Almelo, Hengelo, and Enschede are learning from each other's experiences and the same applies to Zwolle, Kampen, and Zwartewaterland. This is done by a continuing cycle of exploring, implementing, evaluating, learning of it, adjusting. There are three main focus points on which the activities within the Living Lab should focus (Kennisportaal Ruimtelijke Adaptatie, 2017a).

- Make connections between different policies to connect goals, knowledge, and budgets.
- Innovate spatial processes by development and stimulation.
- Stimulate participation of citizens at climate measures.

2.5 Main Events Related to Water Management in Cities in Overijssel

Zwolle

Zwolle is a real delta city, it is connected to many waterways from different directions and is situated in the delta of the rivers IJssel and Vecht (Figure 3). The IJssel, Sallandse Weteringen, and the Vecht are the main rivers that flow through the city. The amount of water which is carried by these rivers is increasing. The city centre of Zwolle is situated outside the dike. Its city canals are directly connected to the IJsselmeer (Lake IJssel). Zwolle is seen as the drain point of the region (Van Der Most, 2017). Besides the increasing amount of water which flows through the rivers and causes higher water levels, the city also has to deal with heavy rainfalls. The sewage system in Zwolle does not have the capacity to deal with this (Van Der Most, 2017).

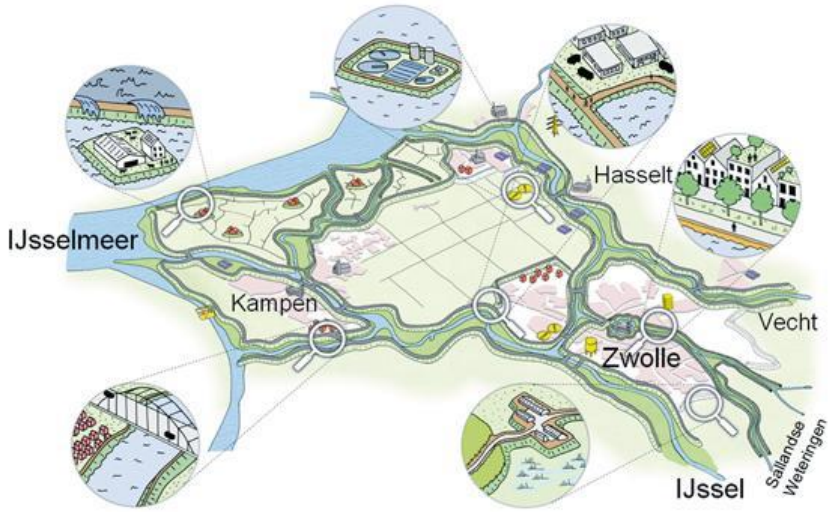

Figure 3 Geographical situation of Zwolle and Kampen (Van Der Most, 2017)

The probability of flooding of the Vecht and the IJssel is not very high, mainly because these rivers flow at the outskirts of the city and have more space, whereas the probability of flooding of the Sallandse Weteringen and the city canals are much larger (Gemeente Zwolle, 2015). Calculations show that, in the future, these waters are not capable of coping with the amount of water during peak moments. The damage these floods might cause can be enormous because the Weteringen and the city canals flow through the city itself. The financial damage can go up to a couple of hundreds of millions (Gemeente Zwolle, 2015).

In Zwolle climate change impacted the city several times in the past years. In July 2015 a rain burst resulted in precipitation of almost 30 millimetres. The fire brigade had to drain water at several locations to avoid large damages (RtvOost, 2015). In June 2017, heavy rainfalls resulted in flooding of streets, tunnels, and basements. Again, the fire brigade had to assist at several locations. At some places the amount of precipitation was almost 40 millimetres, while the amount normally lays around 70 millimetres for the whole month (Lindenburg, 2017; RTL Nieuws, 2017a). In June 2017, Zwolle also experienced the other side of the coin. A period of drought and heat resulted in the absorption of heat and a rise of temperature in the city. The temperature during these periods within the city can be about 10 degrees higher than the temperature in areas outside the city (La Faille, 2017).

Kampen

Like Zwolle, Kampen is also situated in the IJssel-Vecht delta (Figure 3). The river IJssel flows through the city and is directly connected to the IJsselmeer (Kortweg et al., 2011). In case of extremely high water levels there is the risk of flooding in Kampen (Programmadirectie Ruimte voor de Rivier, 2011). The sewage system of the city, which is mainly a mixed system, cannot drain all the water in case a period of heavy rainfall occurs. This causes flooding in streets. There are no indications that the city has problems with high groundwater levels (Gemeente Kampen, 2015). In July 2016 Kampen had to deal with heavy rainfalls as well. 30 millimetres of rain fell down within 5 minutes. Streets and basements flooded. Houses flooded as well. The fire brigade had to drain on a couple of locations (De Vries, 2016).

Enschede

The city of Enschede is situated on the edge of a push moraine (Figure 4). This is a linear ridge which is formed during an ice age by the process of an advancing glacier pushing sediment in front of it. The soil consists of clay which is badly permeable. On top, there is a thin layer of sand. Naturally, the area was covered with brooks which made sure the water was drained towards lower areas during periods of rainfall (skb, 2010). These brooks also originated from the push moraine which makes that the city of Enschede lies at the source of a water system. The city has a paved surface of 1400 hectares which is built on top of the brooks and its origins (Gemeente Enschede, 2012a). This disturbed the way the water system used to work naturally (Gemeente Enschede, 2012b). Currently the water of Enschede flows towards two rivers: De Dinkel and De Regge.

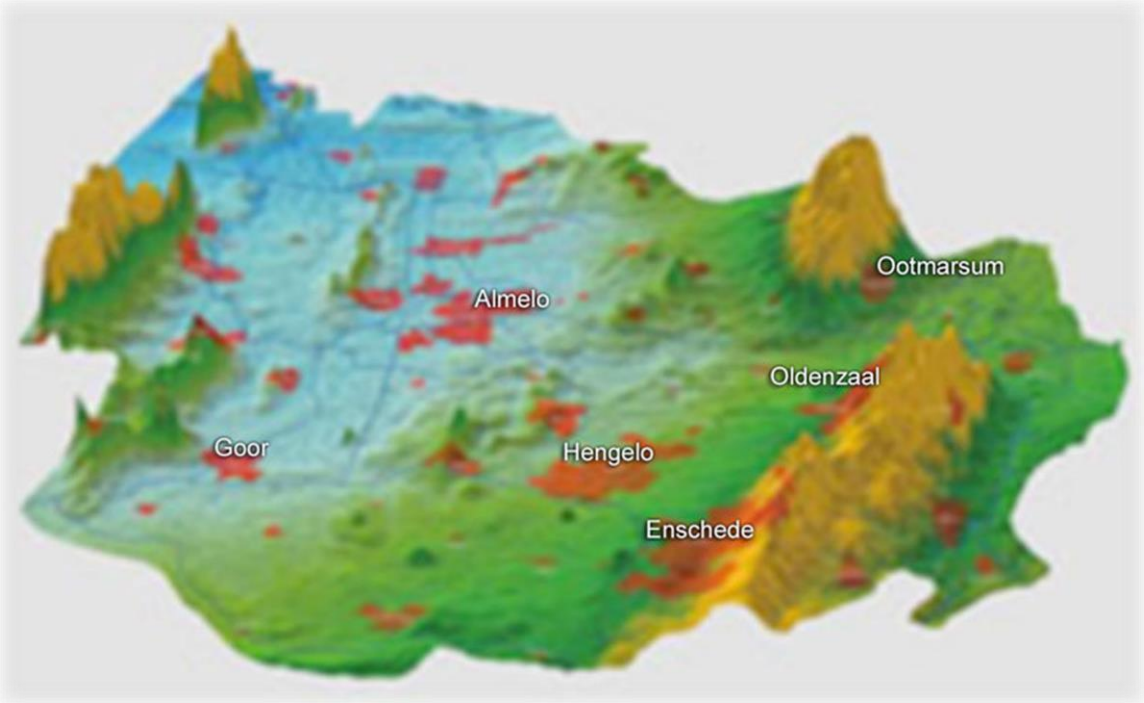

Figure 4 Geographical situation in Twente (Enschede, Hengelo, and Almelo) (Gemeente Enschede, 2012b)

Besides the disturbed water system, Enschede faces another problem caused by the disappearance of its textile industry. This industry used to extract large amounts of groundwater. Since this is not the case anymore the groundwater levels are rising (Gemeente Enschede, 2012a). This causes nuisance in lower areas. In recent years, both problems together with climate change (heavy rainfalls and longer periods without rain) resulted in floods and droughts, which caused damage in different ways (Gemeente Enschede, 2012a). The sewage system cannot handle the water anymore during periods of heavy rainfall and because Enschede has a difference in height of about 44 metres the water flows to lower areas of the city (Gemeente Enschede, 2012b). Here, these large amounts of water cause floods. In Enschede, the wastewater from households and rainwater is mixed and treated in wastewater treatment plants. During periods of heavy rainfall the wastewater treatment plants cannot handle the large amounts of wastewater. This wastewater is therefore discharged into surface water. This causes bad water quality and polluted brooks (Gemeente Enschede, 2012b).

In the city of Enschede the impacts of climate change are experienced in different ways. The temperature within the city is about 8 to 9 degrees higher than the areas outside of the city. This will continue to cause nuisance in the future (Tubantia, 2017). For example, in July 2015, the van Heek Square reached 45 degrees. At nights, the city did not really cool down and during the day people avoided going to the city centre as much as possible (Gemeente Enschede, n.d.). In June 2017,

Enschede had a period of drought as well. This resulted in a low level of groundwater, while the demand was higher than usual. The water quality and the flora and fauna in the water were under pressure. There was also threat of a prohibition of sprinkling of agricultural areas (Hart van Enschede, 2017). On the other hand, in June 2013, Enschede had heavy rainfalls. The fire brigade received more than 400 serious calls from locations in the region of Twente. Many basements and tunnels flooded. Many streets were impassable because of floods as well. The KNMI reported that Twente, in particular Enschede and Hengelo, had about 30 millimetres of rain in one day (Tubantia, 2013). In May 2016, heavy rainfalls combined with a storm caused chaos in the city centre. Shops flooded, as well as some parking garages. Again, many basements, streets and tunnels flooded; toilets overflowed and the water even entered houses and other buildings (Tubantia, 2016)

Hengelo

Hengelo lies at the bottom of the push moraine of Enschede (Figure 4). The difference in height between Enschede and Hengelo is substantial. Water flows from Enschede to Hengelo. In case of heavy rainfalls this process goes too fast (Waterschap Regge en Dinkel, 2011). Originally, three brooks flowed together through the city. As a result of industrialisation and urbanisation these brooks disappeared at many locations. This had its effects on the capacity of the city to drain its water (Waterschap Vechtstromen et al., 2015).

The city itself has two types of sewage systems. The newer neighbourhoods have separate systems for rainwater and wastewater. The older city, including the city centre, has a mixed sewage system. During periods of heavy rainfall mainly this mixed system cannot cope with the amount of water. As a result, it discharges water into brooks and lakes. This water also contains wastewater from households what causes a threat to water quality and safety (Gemeente Hengelo, 2007). Because the drainage of groundwater decreased in the last decennia, the groundwater levels of Hengelo increased. This leads to nuisance in some neighbourhoods and industrial areas. Due to its industrial past, the groundwater in Hengelo is highly polluted, mainly in the city centre.

The impacts of climate change are also visible in Hengelo. In June 2013, Hengelo, just like Enschede, had to deal with heavy rainfalls and serious floods which resulted in the flooding of many basements, tunnels, and streets (Tubantia, 2013). In August 2017, some streets and viaducts flooded completely (RTL Nieuws, 2017b). As a result, a street even prolapsed partly. Basements flooded as well. Water also entered the hospital of Hengelo (Weinreder, 2017).

Almelo

Almelo was built on a crossroad of roads and waterways (Figure 4). Water still flows to the centre of the city. This water flows via brooks from Enschede to Hengelo and from Hengelo to Almelo (Waterschap Vechtstromen, 2017). The city centre mainly has a mixed sewage system of which the capacity is in most cases sufficiently to deal with rainwater. The more recently built neighbourhoods as well as the industrial areas have a separate sewer system and a rainwater sewer. Groundwater levels are quite high at some locations and are an important point of attention for the municipality, these levels however do not cause a lot of nuisance so far (Gemeente Almelo, 2013). In August 2020, basements and tunnels flooded as a result of heavy rainfall (De Volkskrant, 2010). In July 2013, Almelo suffered of heavy rainfall in combination with strong winds. This resulted in a lot of damage caused by floods (RtvOost, 2013). Again, in May 2018, heavy rainfall caused flooding which caused a lot of damage (Tubantia, 2018).

Deventer

The city of Deventer was established on a crossroad of the river IJssel and the brook Schipbeek (Figure 5). The river IJssel flows through the city. Deventer also has canals, brooks and small lakes (Gemeente Deventer, 2013). The IJssel is connected to the Rijn which carries water from a large part

of Germany. Melting snow from the Alps cause a rise of water levels each year. This affects Deventer as well. This has negative effects to people and traffic (Gemeente Deventer, 2018).

Figure 5 Geographical situation Deventer (Rastergroep, 2018)

The sewage system in Deventer is a mixed system. Only some new neighbourhoods have a separated system (Lems & Hekman, 2007). There are locations in the city, which flood during periods of heavy rainfall because the sewage system cannot drain all the water. When this is the case, wastewater flows into surface water which affects the water quality (Gemeente Deventer, 2014).

Deventer suffered from heavy rainfalls in July 2013, and tunnels and streets flooded as a result (RtvOost, 2013). The city also suffered from severe floods caused by a period of heavy rainfall in August 2010. More than 100 millimetres of rain caused many flooded streets, tunnels and basements. This caused nuisance to traffic. The water also entered houses and school buildings and caused leaks. The ceiling of some shops in the city centre collapsed because of the water. The swimming pool had to close its doors. The local hospital also suffered from the floods. The fire brigade was not able to handle all the floods (De Stentor, 2010).

Chapter 3 Research Design

This chapter describes the methodology of this research. Section 3.1 gives a schematic overview of this research. Section 3.2 explains the key concepts included in this research. Section 3.3 describes the research strategy. Section 3.4 describes which material was needed to answer each sub-question, which data was required for this material, and how this data was collected. Section 3.5 how the collected data was analysed.

3.1 Research Framework

Step 1: Characterise briefly the objective of the research project

This thesis had two research objectives. The first objective was to create knowledge on the approaches used and their results to reach a comprehensive understanding of the efforts of six cities within Overijssel towards becoming climate resilient. The second objective was to generate comparative insights for exchanging lessons learned on the successes and failures of the different approaches.

Step 2: Determine the object(s) of the research project

The research objects in this research were the approaches used and their results within six cities in Overijssel.

Step 3: Establish the nature of the research perspective

This research was an evaluation research. Certain criteria were used to compare the results of the approaches used by six cities in the province of Overijssel. A framework for comparison has been developed during the research. Based on that the actual comparison was done. In this way, it was identified what the lessons learned are on the successes and failures.

Step 4: Determine the sources of the research perspective

To develop the framework for comparison, scientific literature, practice documents, and interviews were used to gather data about which criteria were needed to compare the results of the different approaches used within cities.

Step 5: Make a schematic presentation of the research framework

The research framework is shown in Figure 1.

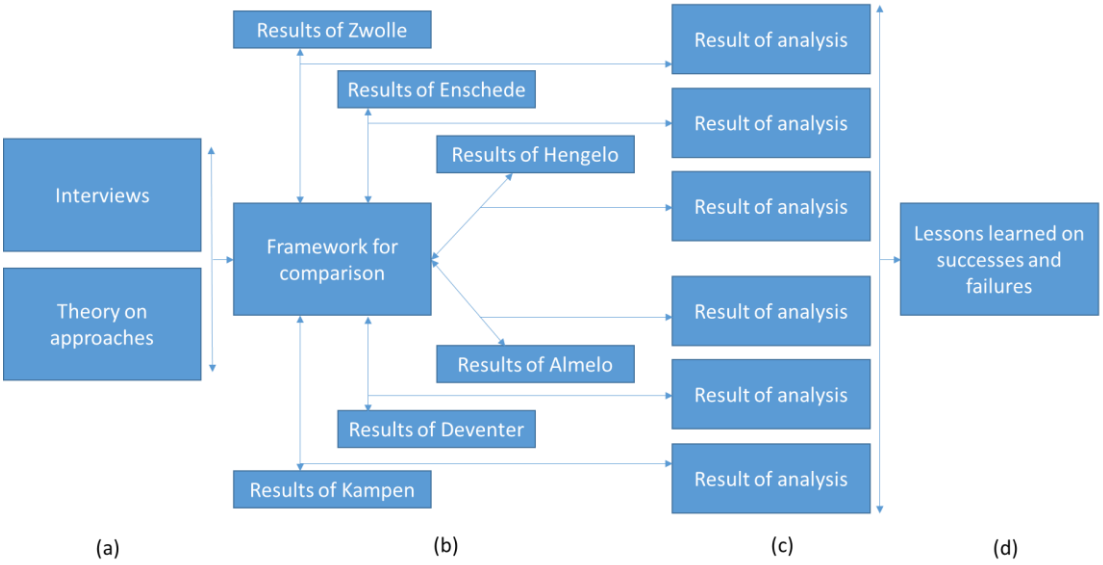

Figure 1 Research framework

Step 6: Formulate the research framework in the form of an elaborate argument

(a) An analysis was done on the results and on which approaches were used by doing interviews. And an analysis was done on the theory on approaches.
(b) This resulted in a comparison framework which was used in evaluating the results of the approaches used in the different cities.
(c) A confrontation/comparison of these evaluated results led to.
(d) Insights for exchanging lessons learned on successes and failures.

Step 7: Check whether the model developed necessitates any changes to the research objective

There was no need to change the research objective of this research.

3.2 Key Concepts

Here five key concepts which constitute an important part of the research questions are explained. In this way, these concepts are defined to make sure the reader does not have to interpret these concepts their selves or can interpret them in another way.

Approach: The underlying reason on why the climate adaptation measure is developed and the underlying knowledge or theory which is used to develop the measure.

Climate resilient city: A city which is adapted to climate change as well as to current impacts as to future impacts. Hereby they should be able to limit the magnitude and severity of the impacts.

Results: Actual actions/measures that have been taken towards becoming climate resilient. These actions can be taken for example by increasing public awareness, changing policies, and changing the design/infrastructure of the city.

Successes: Actions/measures of which the results reached several or all of the conditions that define a **successful** project according to the specific organization which developed and/or manages the measure.

Failures: Actions/measures of which the results reached several or all of the conditions that define an **unsuccessful** project according to the specific organization which developed and/or manages the measure.

3.3 Research Strategy

The strategy that was used in this research is the comparative case study. Six interrelated cases were compared with each other. The research was carried out in two stages. In the first stage, the cases were examined as single case studies, and the results per city were identified. In the second stage, the different cases were compared based on the framework for comparison. In this comparison, similarities and differences were identified, and in this way, the lessons learned on successes and failures were identified based on the results of the approaches used within each city.

3.3.1 Research unit

The research unit was the six cities in the province of Overijssel, which are taking actions/measures to become climate resilient: Zwolle, Enschede, Hengelo, Almelo, Deventer, and Kampen. In selecting these cities it was first identified which cities within the province of Overijssel are taking measures in order to become climate resilient, a short description was made per city of events related to water management and it was also described which climate related activities are being carried out at the city level and regional level through collaboration. Next, it was identified to what extent relevant data for the research was accessible. The responsible actors for the development of the

actions/measures within the cities were also part of the research unit. In selecting these actors it was identified what the responsible persons are within 1) the province of Overijssel, 2) the relevant municipalities for the different cases and, 3) the relevant water authorities for the different cases.

3.3.2 Research boundary

For this research, specific boundaries had to be defined to make sure it could be performed within the set time span of five months. Because of this time limitation six cities within the province of Overijssel were included. Besides, for each city, at least two persons from two different organizations were interviewed. The reason for choosing persons from at least two different organizations was to make the view of a city more elaborated and prevent possible bias, which might be caused by interviewing one respondent only. The reason of choosing persons from just two organizations was because of the fact that in most cases only the municipality and the water authority had an overarching view on the cities, which was necessary for this research. The aim was to interview more persons from each organization than one. However, in some cities climate adaptation is really in the early stages, therefore it was the case that in these municipalities there were only one or two people concerned with climate adaptation. At other organizations there was no personal capacity to interview more than one person. Besides, boundaries had to be defined to make the research as reliable as possible. Therefore, only documents and scientific literature from 2007 and more recent were used. This time span of about ten years was chosen to make sure to have a wide enough range of documents and literature available and to make sure these were still relevant enough for the present situation of knowledge.

3.4 Data Collection

Data that was required to answer the research questions was collected through the examination of relevant practice documents and scientific literature, and through in-depth interviews with informants from relevant stakeholders.

3.4.1 Research material, data sources and data collection methods

The analysis of relevant practice documents and scientific literature focused on the approaches used within the cities and the results of these approaches used by each city so far. The in-depth interviews were held with informants, who did meet the criteria which are defined in 3.4. The interviews were developed in a systematic way by breaking down the research questions, and with the help of feedback from the supervisor. The interview guide in Dutch can be found in Appendix I. The responsible persons within each organization were identified and contacted at first through the contacts of the supervisor, followed by using the snowball sampling technique. The list of interviewees can be found in Appendix II. The interviews focused on the approaches used and its in-depth results for each city. This was required to make a detailed, systematic description of each approach and its results and to develop the framework for comparison. This framework was developed with additional reference from the approaches that were identified through the literature review. At last, the results (reality) per city were compared with each other in order to give insights in the lessons learned on successes and failures of the results of the approaches used by each city. Table 1 describes which material was required to answer each research question, what the source of the data was, and in which way this data was accessed.

Table 1. Research material, data sources, and data collection methods per research question

Research question	Material required to answer the question	Data sources	Data collection method
1. Which approaches have been used or are being used by	Approaches that have been used or are being used per city	Secondary data: practice documents/ scientific literature	Content analysis

cities in Overijssel?		Primary data: people, see Appendix II	Questioning: individual face-to-face in-depth interview
2. What are the results for each city, taking into account the approaches used?	In-depth results per city of the approach used	Secondary data: practice documents/ scientific literature	Content analysis
		Primary data: people, see Appendix II	Questioning: individual face-to-face in-depth interview
3. Which criteria are needed to develop a framework for comparing the results of the different cities?	Theory on what can be compared and what not	Secondary data: practice documents/ scientific literature	Content analysis
		Primary data: people, see Appendix II	Questioning: individual face-to-face in-depth interview
	Information about the nature of the measures taken within the different cities	Primary data: people, see Appendix II	Questioning: individual face-to-face in-depth interview
		Secondary data: practice documents/ scientific literature	Content analysis
4. What are the successes and failures in terms of the results of the approaches used in each city?	Conditions which define successful and unsuccessful actions/measures	Primary data: people, see Appendix II	Questioning: individual face-to-face in-depth interview
	Information on successes and failures of the results per city	Primary data: reality	Content analysis

3.4.2 Research ethics

Since there were interviews conducted during this research, ethical considerations were made. Before contacting any possible interviewee an ethics assessment form from the university was filled in. After approval of the Ethics Committee and the supervisor(s), the interviewees were contacted. In contacting possible interviewees, information about the research regarding nature, method, and purpose were provided. In case possible interviewees agreed to be interviewed they received a consent before the actual interview starts, this consent form can be found in Dutch in Appendix III. In this consent form they were able to give their preference about what information (name, function and/or company name) of them would be shown within the research report and what not. This preference could be changed at any time. Interviewees also could, at any time, terminate their participation within the research. This form was signed by both the interviewee and the researcher.

At the start of the actual interview the interviewees were asked if they agree with the fact the interview will be recorded or not. They could stop the interview at any time. During the interview or afterwards they could indicate that they want certain parts of the interview to be deleted. Personal data was stored at an external hard drive which was not moved out of the building where the research was written. Personal/identifiable data were destroyed when the research was completely finished. The interviewees were informed about the results of the research in case they wanted to. They were able to give feedback to the way the through them gathered data was used.

3.5 Data Analysis

3.5.1 Method of analysis

In this research only qualitative methods were used to analyse the gathered data. In Table 2 is described how the required material per research question was analysed.

Table 2. The methods of data analysis and research material per research question

Research question	Material required to answer the question	Methods of analysis
1. Which approaches have been used or are being used by cities in Overijssel?	Approaches that have been used or are being used per city	Analyse in detail and in a systematic way the approach that each city used
2. What are the results for each city, taking into account the approaches used?	In-depth results per city of the approach used	Analyse the results of each city in-depth and in a systematic way
3. Which criteria are needed to develop a framework for comparing the results of the different cities?	Theory on what can be compared and what not	Analyse which factors can be compared and which not based on the approaches identified in the literature review, the approached used, and the in depth results
	Information about the nature of the measures taken within the different cities	Analyse the measures taken in general in order to find out what the nature of the measure is and divide the measures into categories based on this
4. What are the successes and failures in terms of the results of the approaches used in each city?	Conditions which define successful and unsuccessful actions/measures	Analyse based on the conditions which define successful and unsuccessful and the perception of the interviewees what are successes and failures
	Information on successes and failures of the results per city	

In order to answer the main research question, the measures of the different projects within each category were compared to each other. The focus of this comparison was to identify differences and similarities in the approach and results of these measures of the different projects within the same category. Based on the differences and similarities the lessons learned on the successes and failures were identified for the projects within each category. After that, general lessons for climate adaptation projects were identified based on the lessons learned per category and the data received from the interviewees. In case two or more interviewees identified the same general lesson learned and/or two or more categories contained the same lesson learned which was not especially only relevant for that category (not only relevant for a particular scale of projects for example) then these lessons were identified as general lessons. At last, conditions for successful projects were identified based on the conditions for success and failure defined by the interviewees. At first, to identify these conditions, it was identified which conditions were present at two or more projects within each category. After that, it was identified which conditions were present at two or more categories.

These conditions taken together resulted in a set of conditions for a successful project regarding climate adaption in the urban area.

3.5.2 Validation of data analysis

To avoid own interpretations and bias of the researcher the data collected from interviews has been compared during the analysis with the data collected from practice documents and scientific literature. This was done as much as possible. However, this is mainly an exploratory research, and therefore validation might not be possible for all the collected data. Parts of the data collected from the interviews was also crosschecked with informants from other organizations, who were involved in the development of the measures.

3.5.3 Analytical framework

The analytical framework of this research is shown in Figure 2.

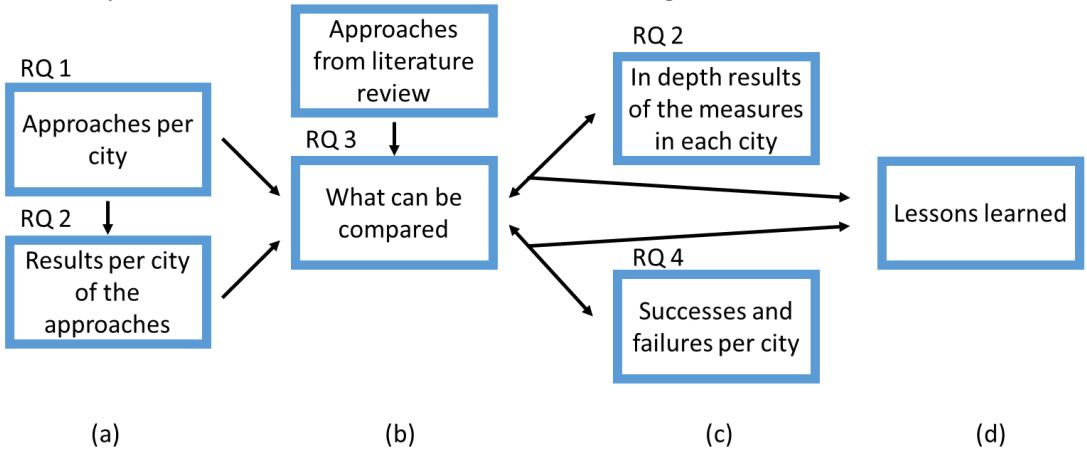

Figure 2 Analytical framework

(a) The first step of the data analysis was to analyse which approaches each city uses and what its results are.
(b) In the next step, an analysis was made to identify the aspects that can be compared. For this analysis, the approaches identified through the literature review, the approaches used and its results, and the nature of the measures were examined. The result of this analysis did constitute the framework for comparison.
(c) In this step, the in-depth results and the successes and failures of each city were assessed based on the comparison framework.
(d) In the last step, the in-depth results of the measures were analysed and compared using the comparison framework. In this way, the lessons learned on the successes and failures were identified for the results of the approaches used in each city.

The analytical framework was used during the research period as a guide for collecting material and performing the analysis. Because the above described steps were followed in the right sequence it did result in the required information to answer the main research question.

Chapter 4 Project Descriptions

This chapter describes the projects which are examined as part of this research. The data in this chapter is based on data collected through the interviewees. First, the main characteristics of each project are shown. Followed by the approach of each project, explaining why this measure is chosen and how it has been developed. At last, the results are presented per project. In chapter 5 the data presented in this chapter is used as input to compare the projects and to identify differences and similarities of comparable projects. In this chapter, an answer is given to the first and second sub-questions of this thesis:

1. Which approaches have been used or are being used by cities in Overijssel?
2. What are the results for each city, taking into account the approaches used?

4.1 Projects in Enschede

De Stadsbeek

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Watervision Enschede	*2015-2018*	*Large*

- *Description of the measure: It was decided to construct a brook as measure whereby the climate challenge of flooding caused by heavy rainfall has been addressed. The brook functions as water storage. The measure is based on the idea of the municipality. This was further developed together with the water authority and the stakeholders from the area. In choosing the measure an integral view was used: it was explored what other challenges and ambitions were in this area. In choosing to implement a brook the possibility for recreation was for example created within the city. Besides, the brook cools the city down during hot periods.*
- *Stakeholders: municipality of Enschede, waterboard Vechtstromen, citizens, companies, housing association, environmental organization (Natuur en Milieu Overijssel), project developer, tire company (Vredestein).*
- *Objectives: To prevent flooding caused by heavy rainfall and high groundwater levels. This objective has been reached.*
- *Results: A new brook was constructed right through existing urban area.*
- *Upscale or implement at different location: This project will be upscaled in phase 2 and 3 of the brook.*
- *Official evaluation: No.*
- *Self-assessment: Successful. Because the collaboration was excellent and there was an integral approach used in designing this measure.*

De Mozartlaan

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Risk driven sewer management plan	*2011-2013*	*Large*

- *Description of the measure: It was decided to lower green areas, to drain the water towards rural areas, as measure whereby the climate challenge of flooding caused by heavy rainfall has been addressed. This measure is based on internal knowledge of the municipality. This is further developed together with Witteveen & Bos. Because of restricted budget the measure had to be*

relatively cheap while having a low as possible impact to the environment. Besides, citizens preferred this solution.

- *Stakeholders: municipality of Enschede, waterboard Vechtstromen, consultancy company (Witteveen & Bos), citizens, companies, centre for medical rehabilitation (Het Roessingh).*
- *Objectives: To reduce the risks of damage and nuisance caused by flooding, to reduce flooding, and to improve the road and parking area. These objectives have been reached.*
- *Results: Green areas are lowered to drain the water towards rural area. Besides, the area has been improved: the road is renovated and a bicycle path is constructed.*
- *Upscale or implement at different location: Has been/will be implemented at different locations: Zuid Esmarkerrondweg and Goolkatenweg.*
- *Official evaluation: No.*
- *Self-assessment: Successful. Because the collaboration with stakeholders was excellent, the costs were relatively low, the measure was well integrated into the environment, work was created with work: because the area was going to be redesigned anyways it was decided to include tackling the parking problem at the same time, and the measure proved to work well.*

Drienerlo Tunnel

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Individual	*2011-2012*	*Small*

- *Description of the measure: It was decided to improve the sewage system as measure whereby the climate challenge of flooding caused by heavy rainfall has been addressed. This measure is based on internal knowledge of the municipality. This is further developed together with Witteveen & Bos. This measure is chosen based on norms/requirements for the sewage system and based on technical restrictions because the tunnel was mainly underground which means it was most easy to construct the measure underground as well.*
- *Stakeholders: municipality of Enschede, waterboard Vechtstromen, citizens, companies, consultancy company (Witteveen & Bos), public transport company (NS), train track maintenance and management company (Prorail).*
- *Objectives: To reduce flooding and to increase the quality of the area. At first flooding was not reduced, after extra changes to the sewage system this objective was reached. The second objective was reached.*
- *Results: The area around the tunnel has been redeveloped. The sewage system of the tunnel has been improved. This was not done according to the design. This resulted in the fact that flooding still occurred. After extra changes the measure works well.*
- *Upscale or implement at different location: Lessons learned are used at other locations.*
- *Official evaluation: No.*
- *Self-assessment: Unsuccessful. Because at first the measure did not work as it was supposed to do.*

4.2 Projects in Zwolle

Pannekoekendijk

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Strategy to improve the connection from the station towards the highway	*2014-2015*	*Large*

- *Description of the measure: It was decided to improve the existing flood defence as measure whereby the climate challenge water safety regarding flooding of rivers has been addressed. This measure is based on knowledge of waterboard Drents Overijsselse Delta and the municipality of Zwolle. This measure was chosen based on norms (theoretical dike profile) and the insufficient existing situation of a flood defence which was too low to secure water safety for the future.*
- *Stakeholders: municipality of Zwolle, waterboard Drents Overijsselse Delta, province of Overijssel, cable and pipe companies, cyclists' federation.*
- *Objectives: To realise a robust flood defence, a high quality public transport connection, and a beautiful and attractive looking area.*
- *Results: This regional flood defence is raised while a bus lane is built on top of it. Trees are added to the dike. A floating sidewalk is added in the water near the dike, which moves with the rising or dropping water levels.*
- *Upscale or implement at different location: No.*
- *Official evaluation: No.*
- *Self-assessment: Successful. Because the collaboration with stakeholders was excellent, water experience is created for citizens and it looks beautiful and attractive. The flood defence is also multifunctional regarding resilience, for example social resilience is increased by improving the quality of life in the area around the dike.*

Aa-landen

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Individual	*2016-2018*	*Small*

- *Description of the measure: It was decided to disconnect rainwater at private property as measure whereby the climate challenges of flooding caused by heavy rainfall, decrease of biodiversity, and droughts have been addressed. This measure is chosen out of a list of 15 ideas to learn from and earn experience in. The measure was chosen in this area because of the existing situation of a mixed sewer system. Besides, it was known that there was an active group of citizens living in this area.*
- *Stakeholders: municipality of Zwolle, waterboard Drents Overijsselse Delta, environmental organization (Natuur en Milieu Overijssel), citizens.*
- *Objectives: To gain experience on how to disconnect rainwater at private property. This objective was reached.*
- *Results: Although citizens were enthusiastic about the project, only one citizen disconnected their rainwater. At first it was expected that about 50 percent of the citizens would disconnect, the results were below the expectations.*
- *Upscale or implement at different location: No.*

- *Official evaluation: Yes. The evaluation was performed at the end of the project by the municipality of Zwolle together with the project leader from Natuur en Milieu Overijssel and citizens. It focussed on the process and the lessons learned. The results are used next time in deciding whether such a project should be started or not.*
- *Self-assessment: Unsuccessful regarding actual amount of people disconnecting (the actual objective was reached). Because there was no feeling of urgency amongst the citizens and the efficiency of effort and measure was really low.*

Stadshagen

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Strategy for safety and climate resilience in the IJssel-Vechtdelta	*2013-unknown yet*	*Large*

- *Description of the measure: It was decided to construct a sound barrier which also can potentially function as an emergency water barrier (which is an extra purpose in this) whereby the climate challenge of water safety regarding flooding of rivers has been addressed. This measure is based on the existing problematic situation. A sound barrier was going to be build, a very high potential damage in case of flooding was present, and the construction area was an open area. Therefore, it was decided to construct the sound barrier in a way in which it fits well into the environment.*
- *Stakeholders: municipality of Zwolle, waterboard Drents Overijsselse Delta, province of Overijssel, veiligheidsregio IJsselland, housing corporations, project developer, citizens.*
- *Objectives: To protect Stadshagen against flooding, and to reduce traffic noise. The first objective is not yet reached because there are openings in the sound barrier, which need to be closed. If this happens this objective is reached. The second objective has been reached.*
- *Results: A sound barrier which also can potentially function as an emergency water barrier of about 8 kilometres was built around the neighbourhood Stadshagen. It looks like a dike and therefore fits well into the environment.*
- *Upscale or implement at different location: No, because there is currently no similar situation in Overijssel regarding this scale of building houses in combination with the water safety problems/risk. In the western part of the Netherlands a similar project/measure could be implemented in the future because, there, similar situations do exist.*
- *Official evaluation: It is yet unknown if there will be an evaluation when the project is finished.*
- *Self-assessment: Successful. Because the collaboration was excellent, it fits well into the environment, a high potential damage has been reduced, the preparation phase was excellent, and it is an innovative project with excellent Public Relations (PR) which made it an example on national scale.*

Weezenlanden

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Strategy for safety and climate resilience in the IJssel-Vechtdelta and part of Deltaproof Weezenlanden	*2014-2019*	*Large*

- *Description of the measure: It was decided to construct a flood defence as measure whereby the climate challenge of water safety regarding flooding of rivers has been addressed. This measure is*

based on collaboration with stakeholders and the existing situation, which was a high potential damage in case of flooding.

- *Stakeholders: municipality of Zwolle, waterboard Drents Overijsselse Delta, province of Overijssel, veiligheidsregio IJsselland, housing corporations, project developer, citizens.*
- *Objectives: To protect Weezenlanden against flooding. It is expected that this objective will be reached when the project is finished.*
- *Results: A sheet pile wall of 170 metres in length and 6 metres high is integrated in houses and its surroundings. This flood defence is integrated in a way that it is hardly visible.*
- *Upscale or implement at different location: This project might be upscaled at the neighbourhood besides Weezenlanden.*
- *Official evaluation: Yes. This evaluation will be probably performed at the end of the project by the municipality of Zwolle together with the Province of Overijssel. The evaluation will focus on the reaching of the results with usage of the financial means. The results of the evaluation will be used, in case a comparable project will be implemented in the future.*
- *Self-assessment: Successful. Because the collaboration was excellent, it fits well into the environment, a high potential damage is reduced, the preparation phase was excellent, the combination of economics and function was excellent (because of design more construction area is available) and it is an innovative project.*

Seringenstraat

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Zwolle adaptation strategy, Program Climate active	*2017-2017*	*Small*

- *Description of the measure: It was decided to disconnect rainwater at private property as measure whereby the climate challenge of flooding caused by heavy rainfall has been addressed. Based on the idea of the municipality to do more than a soil remediation only. Citizens were willing to do so because of flooding in the past and the financial incentive of the water authority.*
- *Stakeholders: municipality of Zwolle, waterboard Drents Overijsselse Delta, housing association, project developers, citizens, companies.*
- *Objectives: To create water storage at private property, and to raise awareness within society. These objectives have been reached.*
- *Results: A soil remediation took place at private property, this made it easy to install infiltration crates into the soil. Rainwater fences were installed as well.*
- *Upscale or implement at different location: The financial incentive of the water authority has been upscaled, because they want to initiate more of these projects.*
- *Official evaluation: No.*
- *Self-assessment: Successful. Because there was an excellent collaboration, the feeling of urgency was there amongst the stakeholders, awareness is created (even on national scale), and climate adaptation is integrally linked to other projects and interests.*

4.3 Projects in Hengelo

De Veldbeek

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Municipal sewage plan	*2004-2019*	*Large*

- *Description of the measure: It was decided to construct a brook, which addressed the climate challenges of flooding caused by heavy rainfall, high groundwater levels due to long lasting rain, droughts, and heat stress. The brook functions as water storage. This measure is based on the initiative of the municipality with requirements regarding water storage and water management. This is further developed in collaboration with stakeholders within project groups. This measure is chosen because the risks were high in the area. Besides, the motivation was there to improve the quality of the public space and to create awareness.*
- *Stakeholders: municipality of Hengelo, waterboard Vechtstromen, housing association, citizens, project developers.*
- *Objectives: To realise a sustainable watersystem, in this case a brook and its connected measures, that is climate resilient and robust. This objective has been reached.*
- *Results: The brook is constructed right through existing urban area and in several parts integrated into other projects. 100 percent of the surrounding areas is disconnected regarding rainwater. Drainage water is discharged to the brook. The brook provides water storage and cools the inner city.*
- *Upscale or implement at different location: At another location in Hengelo another brook is constructed through existing urban area.*
- *Official evaluation: Yes. The evaluation will be performed at the end of the project by the municipality of Hengelo. The evaluation will focus on the process and the results of the whole project.*
- *Self-assessment: Successful. Because the collaboration was excellent, the brook adds value to the quality of the public space, an integral view has been used: all different parts of the brook had to connect to each other, in the surrounding areas 100 percent of the area is disconnected regarding rainwater, the brook functions as water storage and cools the city down, the visibility of water creates awareness amongst citizens.*

Langeler Erve

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Individual	*2005-2006*	*Small*

- *Description of the measure: It was decided to construct permeable pavement, to infiltrate water into the road and drain it towards a WADI, as measure whereby the climate challenge of flooding caused by heavy rainfall has been addressed. The measure is based on the idea of the municipality: they wanted to try something innovative. This measure is chosen based on the existing situation: area with not a lot of room for other measures.*
- *Stakeholders: municipality of Hengelo, project developer.*
- *Objectives: To realise a sustainable watersystem, in this case permeable pavement, which is climate resilient and robust. This objective was not reached.*

- *Results: The permeable pavement was constructed. However, it did not work as expected. Because of difficulties in management and maintenance, flooding occurred.*
- *Upscale or implement at different location: No.*
- *Official evaluation: Yes. This measure was evaluated by the municipality of Hengelo at the end of the project. The evaluation focussed on the process and the results.*
- *Self-assessment: Unsuccessful. Because the permeable pavement was difficult to manage and maintain and therefore did not function as it should be. This resulted in flooding.*

De Drienerbeek

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Waterplan Hengelo, Bekenplan Hengelo	*2014-2017*	*Unknown*

- *Description of the measure: It was decided to renovate a brook, to make it more suitable for water storage, as measure whereby the climate challenge of flooding caused by heavy rainfall has been addressed. This measure was initiated by the water authority (manager of the brook). The measure is further developed in collaboration with the municipality and stakeholders from the direct environment. The measure was based on the existing situation: a highly deferred maintenance situation of an existing brook. The renovation was more or less based on Climate Active City criteria.*
- *Stakeholders: municipality of Hengelo, waterboard Vechtstromen, housing association, citizens, companies.*
- *Objectives: To make maintenance situation sufficient: the brook functions well as water storage and looks beautiful and attractive. This objective has been reached.*
- *Results: The existing brook was renovated. WADI's were constructed at private ground in green areas near the brook. These areas are connected to the street for water drainage. Platforms are created in gardens that connect with the brook. These platforms function as social control for not throwing garbage in the brook.*
- *Upscale or implement at different location: Continuation through Bekenplan Hengelo.*
- *Official evaluation: No.*
- *Self-assessment: Successful. Because the collaboration was excellent, even after a situation of resistance in which citizens were not pleased with the way the governmental organizations were managing the brook which resulted in losing trust in the municipality and the water authority, integral links to other projects and interests are created, and the added value towards Climate Active City is created.*

4.4 Projects in Almelo

De Mors

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Individual	*2014-2016*	*Medium*

- *Description of the measure: It was decided to disconnect rainwater and wastewater at private property as measure whereby the climate challenge of flooding caused by heavy rainfall has been addressed. This measure is based on a collaboration between the municipality and the citizens.*

The measure is chosen because of the existing problematic situation: flooding occurred several times in the past and caused damage to the neighbourhood.

- *Stakeholders: municipality of Almelo, waterboard Vechtstromen, citizens, housing association, elementary school, representatives of the neighbourhood.*
- *Objectives: To reduce nuisance in case of flooding. This objective has been reached.*
- *Results: A rainwater sewer below the road is constructed. 90 percent of the citizens disconnected their rainwater and drained it to the rainwater sewer. Green areas are increased and several other risk reduction measures are taken. These results were not as expected. It was expected that about 50 percent would disconnect their rainwater. The design also changed: more green areas were added and more risk reducing measures have been implemented.*
- *Upscale or implement at different location: During implementation, the scope of the project was extended. After the project the disconnection booklet was made based on this project. A lessons learned paper was made as well. These are used in all disconnection projects.*
- *Official evaluation: Yes. Natuur en Milieu Overijssel together with the municipality of Almelo and the citizens performed an evaluation at the end of the project. This evaluation mainly focussed on the process. The results of this evaluation will be used in future rainwater disconnection projects at private property.*
- *Self-assessment: Successful. Because the risks are reduced, 90 percent of the citizens disconnected their rainwater, and there was the feeling of urgency amongst the citizens.*

De Nieuwstraat

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Municipal sewage plan	*2016-2019*	*Large*

- *Description of the measure: The sewage system had to be replaced. It was also decided to replace hard surface by green areas to increase water infiltration and create a little water storage at the street as measures whereby the climate challenges of flooding caused by heavy rainfall and heat stress have been addressed. This measure is based on the collaboration among the municipality, citizens and entrepreneurs. The measures are chosen based on the existing situation: the sewage system had to be replaced because of age and the road is an important traffic access road of Almelo.*
- *Stakeholders: municipality of Almelo, waterboard Vechtstromen, province of Overijssel, citizens, entrepreneurs (mainly shopkeepers), emergency services, managing company of cables and pipes (Cogas), housing association.*
- *Objectives: To replace sewage system, to tackle problems regarding traffic, parking, flooding, and quality of life, and to increase citizen awareness. These objectives have so far been reached.*
- *Results: A hollow street is/will be constructed to create a little water storage in case of heavy rainfall. A few façade gardens are constructed. Green areas are/will be constructed instead of hard surface. The sewage system has been/will be replaced.*
- *Upscale or implement at different location: The project will be upscaled in the neighbourhood Nieuwstraatkwartier where the street is situated. The project will be upscaled as well in the sense that in the gardens of the street the hard substrates will be replaced by green areas. Parts of the design will be used in similar projects in the future.*
- *Official evaluation: Yes. This project has been evaluated after the design phase and will be evaluated after the end of the project by the municipality of Almelo. This evaluation after the design phase focussed on the level of satisfaction of citizens regarding the design. The focus of*

the evaluation at the end is unknown yet. The results of the evaluation will be used to make changes in case this is necessary.

- *Self-assessment: Successful. Because climate is well included in the project and an integral view is used regarding other interests and locations.*

Haven Binnenstad

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Inner city plan for Almelo	*2016-2018*	*Large*

- *Description of the measure: It was decided to construct water storage in the city as measure whereby the climate challenge of flooding caused by heavy rainfall has been addressed. This measure is based on the idea of the municipality. This is further developed in collaboration with the water authority.*
- *Stakeholders: municipality of Almelo, waterboard Vechtstromen, citizens, companies.*
- *Objectives: To increase attractiveness of the inner city. This objective has been reached.*
- *Results: A harbour in the city is constructed. This means that there is room for recreation, water experience, water awareness created, and there are possibilities created for disconnecting water. The economy of the city is stimulated as a result.*
- *Upscale or implement at different location: Continuation through inner city plan Almelo.*
- *Official evaluation: No.*
- *Self-assessment: Successful. There are lots of integral links created to other projects and interests.*

Rumerslanden

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Individual	*2013-unknown*	*Large*

- *Description of the measure: It was decided to construct WADI's, to drain water towards a brook, as measure whereby the climate challenge of flooding caused by heavy rainfall has been addressed. This measure is based on the idea of the municipality. This is further developed in collaboration with the water authority.*
- *Stakeholders: municipality of Almelo, waterboard Vechtstromen, citizens, companies, housing association.*
- *Objectives: To include Climate Active City in the rebuilding/renovation of the neighbourhood. This objective was partially reached.*
- *Results: WADI's with connection to the brook were not constructed. This was not the result as it was expected. Furthermore, half of the houses in the neighbourhood were rebuilt and half of the houses were renovated.*
- *Upscale or implement at different location: No.*
- *Official evaluation: No.*
- *Self-assessment: Unsuccessful. Because there was no added value towards Climate Active City created and there were no integral links created with the adjacent neighbourhood.*

Additional remark: The information regarding this project is unfortunately not up-to-date anymore. The current plan for this neighbourhood contains several climate adaptive measures. However, the

project is still included in this research because the information about the project and the perception on successful or not still applies to the by the interviewees known (old) situation. Still, valuable lessons learned could be identified for other governmental organizations although they do not apply to the current situation of this particular project anymore.

4.5 Projects in Kampen

Ebbingestraat

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Municipal sewage plan, inner city plan regarding disconnecting rainwater	*2016-2018*	*Large*

- *Description of the measure: It was decided to construct a pipe to disconnect and drain rainwater towards a pond, which addressed the climate challenge of flooding caused by heavy rainfall. The measure is based on the basic sewage plan. The measure is chosen based on success in the past: reality proved that disconnecting rainwater works well in Kampen.*
- *Stakeholders: municipality of Kampen, waterboard Drents Overijsselse Delta, citizens, entrepreneurs (mainly shopkeepers), emergency services, bus services, organization which employs young talents on all kind of subjects (talent region).*
- *Objectives: To disconnect rainwater, to improve roads, and to create room for cyclists. These objectives have been reached.*
- *Results: Both streets are disconnected regarding rainwater. The rainwater is drained through a constructed pipe in the parking lane to an open area were the water can be stored and infiltrate in the soil. Hard surface is reduced and more green areas are added. The construction of the pipe was different than defined in the design. The reason for this was that the original way of drainage too expensive was.*
- *Upscale or implement at different location: This project will be implemented in the same way at another location: De Noordweg.*
- *Official evaluation: Yes. The project manager will evaluate the project at the end of the project. The focus of this evaluation is on process and technical implementation.*
- *Self-assessment: Success. Because it contributes to the climate objectives.*

Prismaschoolplein

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Individual	*2017-2018*	*Small*

- *Description of the measure: It was decided to decrease hard surface and add more green areas as measures whereby the climate challenges of flooding caused by heavy rainfall and heat stress have been addressed. The measure is based on and developed during a large meeting with all disciplines within the municipality about climate adaptation.*
- *Stakeholders: municipality of Kampen, elementary school (Prismaschool), citizens, fire brigade.*
- *Objectives: To make schoolyard more climate adaptive, and to repave schoolyard. The first objective has not been reached, while the second has been reached.*

- *Results: Less happened/is going to happen regarding climate adaptation. This is caused by difficulties like rules and resistance of citizens. The schoolyard is repaved because it was subsiding.*
- *Upscale or implement at different location: The lessons learned will be used at other locations.*
- *Official evaluation: No.*
- *Self-assessment: Unsuccessful. Because there is almost no contribution to the climate goals, the planning phase went too fast which resulted in too little time to research the possibilities and to prepare properly.*

Climate workshop at the municipality

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Program Climate active	*2017-2017*	*Small*

- *Description of the measure: It was decided to create awareness as measure whereby the climate challenges of flooding caused by heavy rainfall and heat stress have been addressed. This measure is based on the idea of the water authority to raise awareness amongst the municipalities.*
- *Stakeholders: municipality of Kampen, waterboard Drents Overijsselse Delta.*
- *Objectives: To create awareness within the municipality regarding climate adaptation. This objective has been reached.*
- *Results: Awareness within the municipality is created. Climate adaptation touches several professional disciplines within the municipality, who have to work together. Even an alderman participated during the workshop, which was not expected.*
- *Upscale or implement at different location: These workshops are given at all municipalities within the management area of the water authority.*
- *Official evaluation: No.*
- *Self-assessment: Successful. Because different professional disciplines within the municipality of Kampen are now aware of the integral approach.*

4.6 Projects in Deventer

Stationsomgeving

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Individual	*2013-2018*	*Large*

- *Description of the measure: It was decided to construct a WADI and lower green areas to drain water towards open areas, improve drainage in a tunnel, and to construct a rainwater sewer as measures whereby the climate challenges of flooding caused by heavy rainfall and droughts have been addressed. This measure is based on the initiative from the municipality. With every project, they explore the opportunities regarding climate change adaptation. In this case climate adaptation is integrated into the redesign of the area around the station. The measures are further developed by a consultancy company based on the framework of the municipality.*
- *Stakeholders: municipality of Deventer, waterboard Drents Overijsselse Delta, province of Overijssel, train track maintenance and management company (Prorail), companies.*

- *Objectives: To solve flooding by improved drainage around the station. This objective has been reached so far. More monitoring needs to be done to know it certain.*
- *Results: A WADI is constructed, green areas are lowered, a rainwater sewer is constructed, more green areas are added, and the drainage in the tunnel is improved.*
- *Upscale or implement at different location: No.*
- *Official evaluation: An evaluation will probably be done at the end of the project by the municipality of Deventer. The evaluation will focus on the process and the results. The results of this evaluation will be used next time in a similar project.*
- *Self-assessment: Successful. Because water is integrated in the design, which makes the area looking beautiful and attractive.*

De Vijfhoek

Individual vs. part of a broader plan or strategy	***Year of start and end***	***Scale of project based on size, budget and/or impact***
Individual	*2013-2018*	*Large*

- *Description of the measure: It was decided to construct permeable pavement in the road and parking lane to infiltrate water and to construct infiltration facilities at private property as measures whereby the climate challenges of flooding caused by heavy rainfall and droughts have been addressed. The measures are chosen by the municipality based on cost efficiency, to improve the living environment, and to make water as visible as possible to raise awareness.*
- *Stakeholders: municipality of Deventer, citizens, project developer, elementary school.*
- *Objectives: To reduce the occurrence of flooding (It is accepted that water stays on the street maximally two times a year). This objective has been reached so far. More monitoring needs to be done to know it for certain.*
- *Results: Permeable pavement is constructed in the road and in the parking lane. Besides, infiltration facilities are constructed at private property in the newly-built neighbourhood.*
- *Upscale or implement at different location: It will not be implemented in the same way. However, a pilot project with different ways to drain water of the street and infiltrate it into the soil was started based on this project.*
- *Official evaluation: No.*
- *Self-assessment: Unsuccessful. Because the permeable pavement lost its function in the parking lane due to weeds and grass, the maintenance and management is difficult and expensive, and the infiltration facilities at private property did not work well.*

Chapter 5 Differences and Similarities and Lessons Learned

In this chapter, the projects are divided into nine categories, as summarised in Table 4 in section 5.1. In dividing the projects, the nature of the measure(s) per project was defined first. Then these were divided into nine categories, which Runhaar et al. (2012) defined out of literature. In Table 4 the categories are divided into three levels as well to avoid comparing projects with similar measures which differ highly on scale. The division on levels is also based on Runhaar et al. (2012).

The projects within the categories which contain two or more projects are compared to each other within a comparison matrix. In this matrix, the projects within each category are compared to each other based on the aspects on approaches and results which are presented in chapter 4. The result of this comparison are differences and similarities of the projects within each category, which are shown in section 5.2. These differences and similarities will lead to lessons learned on the successes and failures of the projects within each category.

Based on the differences and similarities of the projects within each category as described in section 5.2 and the data received from the interviewees, the lessons learned on successes and failures are identified per category in section 5.3. Identifying the lessons learned on the successes and failures was done as follows:

- An example on differences: Project 1 was defined as a failure because of the absence of a certain aspect, e.g. aspect X, and project 2 was defined as a success and here this aspect was included. Lesson learned: Aspect X is important to include to make the project a success.
- An example on similarities: Project 1 and project 2 were both defined as a failure because aspect X was not included. Lesson learned: Do include aspect X to make this type of project a success.

These examples are of course quite basic. Nevertheless, they demonstrate in essence how the lessons learned are derived from the differences and similarities of the project within each category.

Section 5.4 identifies general lessons which are learned from the climate adaptation projects included in this research. These general lessons were identified based on the data collected through the interviewees and the identified lessons learned per category in section 5.3. In case two or more interviewees identified the same general lesson learned and/or two or more categories contained the same lesson learned which was not especially only relevant for that category (not only relevant for a particular scale of projects for example) then these lessons were identified as general lessons. These general lessons were divided among three general principles which were identified based on section 2.2. Here, four approaches to adapt urban water management to climate change are described 1) Water Sensitive Cities Framework, 2) Water Wise Cities, 3) Cities Resilience Index and, 4) City Blueprint. The principles of these approaches were quite similar. Therefore, three general principles could be identified 1) *Urban planning in a way that it reduces risks and its effects, and increases liveability,* 2) *Ensure current and future needs regarding water supply and storage by preparing for extreme events,* 3) *Effective leadership and urban management by government and participation and awareness of communities.*

This chapter gives an answer to the third and fourth sub-questions of this research:

3. Which criteria are needed to develop a framework for comparing the results of the different cities?
4. What are the successes and failures in terms of the results of the approaches used in each city?

This chapter also partially answers the main research question:

'What are the lessons learned on successes and failures of the approaches used within cities in Overijssel towards becoming climate resilient?'

For each category, the differences and similarities and the lessons learned are based on data collected through interviewees. Therefore, it was decided to not include the references to each interview in the text to make the presentation of results simpler and the reading of the text easier. Instead it was decided to show the references to the interviews per category in Table 3.

Table 3. References to interviews per category

Categories	References to interviews
Water drainage (Building level)	Policy advisor sewerage and water & Project manager, personal communication, July 9, 2018
	Advisor urban water management, personal communication, June 15, 2018
	Program secretary IJssel-Vechtdelta & Communication advisor IJssel-Vechtdelta, personal communication, June 14, 2018
	Policy advisor spatial planning and climate adaptation, personal communication, June 28, 2018
Additional flood defences or reinforcing existing ones (Street/quarter level)	Advisor urban water management, personal communication, June 15, 2018
	Program secretary IJssel-Vechtdelta & Communication advisor IJssel-Vechtdelta, personal communication, June 14, 2018
Drainage system (Street/quarter level)	Anonymous & Designer water1, personal communication, May 28, 2018
	Designer water2, personal communication, June 1, 2018
	Advisor water and sewerage1 & Advisor water and sewerage2, personal communication, June 22, 2018
	Senior advisor sewerage and water, personal communication, July 13, 2018
	Strategic advisor & Senior policy advisor water chain, personal communication, June 13, 2018
Measures for better water infiltration and water outlet (Street/quarter level)	Policy officer water management and sewerage, personal communication, July 11, 2018
	Senior advisor sewerage and water, personal communication, July 13, 2018
Water storage facility (Street/quarter level)	Strategic advisor & Senior policy advisor water chain, personal communication, June 13, 2018
	Anonymous & Designer water1, personal communication, May 28, 2018
	Policy officer water management and sewerage, personal communication, July 11, 2018

In section 5.4 the data collected through the different interviewees mentioned above in the references was used to directly (data out of interview) or indirectly (data from lessons learned per category) identify the general lessons learned. Therefore, all the references mentioned above were used in section 5.4 as well.

5.1 Categories Comparison Matrix

Table 4. Division of projects into categories within different levels

Levels	Categories	Projects
Building	Unpaved garden	• Prismaschoolplein
	Water drainage	• Aa-landen • Seringenstraat • De Mors
Street/quarter	Additional flood defences or reinforcing existing ones	• Pannekoekendijk • Stadshagen • Weezenlanden
	Drainage system	• De Mozartlaan • Rumerslanden • Ebbingestraat • Stationsomgeving
	Increase sewer capacity or enhanced maintenance	• Drienerlo Tunnel
	Measures for better water infiltration and water outlet	• Langeler Erve • De Vijfhoek
	Water storage facility	• De Stadsbeek • De Veldbeek • De Drienerbeek • Haven Binnenstad
	Extra green space and increased sewer capacity or enhanced maintenance	• De Nieuwstraat
City	Information campaign	• Climate workshop at the municipality • Provada

5.2 Differences and Similarities per Category

5.2.1. Building Level - Water drainage projects

Differences

De Mors and the Seringenstraat are both seen as a success because the results did meet expectations, and were therefore upscaled in a way, while Aa-landen is not seen as a success because the results did not meet expectations, and was therefore not upscaled. The main reasons for this level of success are that the feeling of urgency was there at de Mors and the Seringenstraat because of flooding in the past, while this feeling of urgency was absent at Aa-landen. Besides, the efficiency of effort and measure was high at de Mors and the Seringenstraat and low at Aa-landen. Another reason is that at de Mors and at the Seringenstraat the municipality was putting a lot of effort into the project themselves while at Aa-landen this was not the case. At de Mors, the municipality constructed a rainwater sewer, while at the Seringenstraat the municipality initiated a soil remediation. Both projects linked the disconnection of rainwater to the other efforts of the municipality.

All projects reached their objectives, these were however different. At de Mors, the nuisance level during and after heavy rainfall was reduced; at the Seringenstraat water storage was created at private property and awareness was raised, and at Aa-landen they earned experience on how to realise disconnection of rainwater at private property.

Similarities
In all three projects, a financial incentive was used to stimulate citizens to disconnect rainwater at private property.

5.2.2. Street/quarter Level - Additional flood defences or reinforcing existing ones

Differences
At Weezenlanden the building of a flood defence/water barrier was the only purpose, at Stadshagen (sound barrier as main purpose) and the Pannekoekendijk (improvement of area and connection from the station to the high way) the project had other purposes as well. The objectives were also to construct the other purposes, while at Weezenlanden the only objective was to protect the neighbourhood against flooding. At the Pannekoekendijk and Stadshagen green areas were added to the measure, while at Weezenlanden the flood defence is a hard structure only. This is mainly because at Weezenlanden the flood defence is integrated into the buildings while at Pannekoekendijk and Stadshagen the measure is a structure in an open area.

Pannekoekendijk is seen as a success because it is multifunctional regarding resilience, while Stadshagen and Weezenlanden were seen as a success because they were both innovative and therefore an example on national scale.

Similarities
All three measures were implemented because the existing situation was insufficient to protect the area behind it which all have a high potential damage. The measure was constructed in a way that it fits into the environment, the results were the same as expected. The projects belong to a larger strategy and are large-scale projects. Therefore, the province was involved to help funding the project.

The three projects were seen as a success mainly because the collaboration within the project was excellent, the measure fits well into the environment and they reduce a high potential damage.

5.2.3. Street/quarter Level – Drainage system

Differences
At the Mozartlaan, Rumerslanden, and Stationsomgeving the water is drained via mainly green measures like WADI's and lowering of green areas, while at the Ebbingestraat a hard structure was used to drain the water (pipe). At Rumerslanden, and Stationsomgeving the measures were integrated into a project regarding the redesign/renovation of the area while at Mozartlaan and Ebbingestraat the measure was the project itself.

The Mozartlaan, Ebbingestraat, and Stationsomgeving are seen as a success and the objectives were reached while Rumerslanden is unsuccessful and the objective was not reached. At Mozartlaan and Stationsomgeving the objective was to reduce flooding in the area, while at Rumerslanden the objective was to create the added value towards Climate Active City within the project, and at Ebbingestraat the objective was to disconnect rainwater in the street. Both Mozartlaan and Stationsomgeving were seen as a success because the measures were well integrated into the environment. Mozartlaan also was successful because the measure works well, the collaboration was excellent, the costs were relatively low, and work was created with work: because the area was going to be redesigned anyways it was decided to include tackling the parking problem at the same time. Ebbingestraat was successful because it added to the climate goals. Rumerslanden was unsuccessful because there was no added value realised towards Climate Active City and there were no integral links with adjacent neighbourhoods. Mozartlaan and Ebbingestraat were upscaled and/or implemented at another location, while this is not the case for Rumerslanden and Stationsomgeving.

Similarities
All four projects were initiated by the municipality and all relevant stakeholders (from the area) were involved.

5.2.4. Street/quarter Level – Measures for better water infiltration and water outlet

Differences
At Langeler Erve the only infiltration measure was permeable pavement, while at De Vijfhoek infiltration facilities at all private properties were constructed as well (in a newly constructed neighbourhood, therefore no stakeholders from the area were involved as well).

At Langeler Erve the permeable pavement turned out to be difficult to maintain and manage, and therefore lost its function. At De Vijfhoek, the same problem occurred, however this only applies to the permeable pavement in the parking lane, the permeable pavement in the road seems to work well so far. Therefore, it was also the case that at Langeler Erve the objective of realising a sustainable watersystem, which is climate resilient and robust was not reached, while at De Vijfhoek the objective to reduce the occurrence of flooding was reached so far.

Similarities
The Langeler Erve and De Vijfhoek are individual projects initiated by the municipality and will not be implemented at another location in the same way. However, a pilot project with different ways to drain water of the street and infiltrate it into the soil was started based on De Vijfhoek.

Both projects are seen as a failure because maintenance and management is difficult and expensive which resulted in the permeable pavement losing its function. For De Vijfhoek this applies to the parking lane, the street needs to be monitored first.

5.2.5. Street/quarter Level – Water storage facility

Differences
De Stadsbeek, De Veldbeek, and the Haven Binnenstad are newly constructed measures into existing area, while De Drienerbeek is an existing water storage facility which is made more suitable for water storage.

Although all projects reached their objectives, the objectives were very different. The objective of De Stadsbeek was to prevent flooding caused by heavy rainfall and high groundwater levels, the objective of De Veldbeek was to realise a sustainable watersystem which is climate robust, the objective of De Drienerbeek was to make the maintenance situation sufficient again, and the objective of the Haven Binnenstad was to increase the attractiveness of the inner city.

Similarities
All four projects were developed by the municipality and the water authority in collaboration with citizens and other stakeholders from the area, are part of a bigger plan or strategy, take several years and require a large budget.

All projects are seen as a success and the results were the same as defined during the planning phase mainly because the collaboration between all stakeholders went really well, they added value to the quality of the public space, and the measure was integrally linked to other projects and interests. De Veldbeek was also successful because it had to be realised through several subprojects because of its size and because of the existing urban area, and in the end all subprojects link to each other into one brook. All projects will be upscaled or implemented at another location.

Finally, through all four projects, water experience and water awareness is created in the city, also the possibility to drain rainwater to the water storage facility is there.

5.3 Lessons Learned per Category

The lessons learned per category presented in this section are relevant for municipalities and other project initiators in cities for choosing and improving current and future climate adaptation processes and efforts.

5.3.1 Water drainage (Building level)

- The first thing that should be done is to find out if an area is suitable to start a disconnection project. For this purpose, a survey should be performed amongst citizens about desires and barriers. Once it is decided that an area is promising, the citizens should be given the opportunity to decide on several aspects of the project. Besides, the whole neighbourhood (instead of one street) should be involved right away in such a project to have a better result.
- It should be realised that money alone is not the right incentive for citizens to disconnect rainwater. A feeling of urgency among citizens is also important to have a successful project regarding disconnecting rainwater. Besides, efforts should be done or intended to do by the municipality in the public area first, from there see what can be done at private property. The less effort the citizens have to put in, the more successful the project will be.
- Before starting the project, raising awareness regarding climate adaptation and disconnecting rainwater should be started. Having citizen ambassadors within the neighbourhood to raise awareness and to engage other citizens works well. It is also useful to have an external project supervisor during all phases of the project because of the close communication of the municipality with the citizens. Besides, clear communication with citizens on all areas is crucial to meet their expectations and to have a smooth and successful process.

5.3.2 Additional flood defences or reinforcing existing ones (Street/quarter level)

- To decrease the risks of insufficient financing and to involve stakeholders, it should be ensured that there is a clear overarching overview during the planning phase of these large projects/strategies. This overview should include how the different projects or parts of the projects will connect to make the whole chain complete, when these (sub)projects will start, how the whole chain will be financed, and how this all will lead to the final objective(s). During the planning phase, there should also be focused on the small details (for example, the construction of cables and pipes) and the stakeholders and future managing stakeholders related to these small details should be involved from the start.
- To make this type of measures as cost efficient/effective as possible it should be ensured that the these will be integrated well into the environment and, in case this is possible, have other purposes as well (both main purposes with the measure as extra purpose or the measure as main purpose with other, extra purposes are possible in this). It depends on the environment how the measure can be integrated into the environment, thus how it will look like and if it is possible to give other purposes to the measure as well.

5.3.3 Drainage system (Street/quarter level)

- Spatial plans in which water and green is integrated should be made to make sure that water and green are included into redesign/renovation projects. Measures in a certain area/neighbourhood/city should be connected to each other to make all measures work effectively. This should be done by starting projects out of an overarching vision/plan.
- It should be realised that it is difficult to define at the start if the measure is sufficient to drain all the water during periods of heavy rainfall. This means that it is needed to monitor the measure

regarding levels of flooding during and after heavy rainfalls and apply extra measures in case this is needed.
- The situation/area should be assessed in combination with the capacities of the municipality and other initiators in order to decide which drainage measure is best to apply. In deciding this they should take in to account that green measures are relatively cheap compared to hard measures however green measures require more space compared to hard measures.

5.3.4 Measures for better water infiltration and water outlet (Street/quarter level)

- Permeable pavement should not be constructed in the parking lane, it should only be constructed it in the road.
- The construction of infiltration facilities should be guided really well because contractors might lack specific knowledge which is crucial for the measure to work well.
- It should be realised that it seems that permeable pavement can work well, however maintenance and management to keep the pavement function well, seem to be difficult and expensive. Pilots have to show if there are other possibilities regarding material and/or the way of maintenance, which might make the maintenance and management easier.

5.3.5 Water storage facility (Street/quarter level)

- To secure financing from the province or the national government it should be ensured that the Public Relations (PR) of this kind of projects will be excellent. The water authority and the municipality alone are not able to finance it. Besides, the costs of the current project and the future linking projects should be known before the start of the first project. Overall, before starting such a project the relation between goal efficiency and cost efficiency should be considered really well.
- This kind of projects should be started out of an overarching vision. This will ensure that it functions as it must be and that the project is integrally linked to other projects and interests. Examples of integral links are 1) disconnecting rainwater towards the brook, 2) ways to drain water from other areas towards the brook, 3) making water visible in the city to create water experience and water awareness. Making water visible also gives added value to quality of the public space because it creates possibilities for recreation, it looks beautiful and attractive, and it cools the city.
- It should be tried to get as much as possible for as much as possible stakeholders out of the project. This will make people more enthusiastic and the more social return will be realised. Do this by involving all stakeholders from the area within the design phase. Watersystem advice should also be involved during the planning phase to make sure management and maintenance level can be kept on a sufficient level in the future. Involving citizens and allowing them in helping to design the project and add their desires and ideas to improve the local environment will help in getting them involved and get their support.
- It should be realised that in implementing such projects, the technical aspect is already a difficult one. However, the process is the most difficult aspect because these projects are expensive, require a long period of time, require relatively much space (especially the ones constructed in existing area), require collaboration with a lot of stakeholders, and, in some cases, have to be constructed in several phases (especially the ones constructed in existing area). Sufficient capacities are needed to ensure a smooth process.

5.4 Lessons for Climate Adaptation Projects in General

The lessons learned for climate adaptation projects in general which are presented in this section are relevant for municipalities and other project initiators in cities for choosing and improving current and future climate adaptation processes and efforts.

5.4.1 Urban planning in a way that it reduces risks and its effects, and increases liveability

- The effects of climate change should always be realised at investments for the long term. When climate adaptation is not included into projects for the long term it is almost certain that in about 20 years measures have to be taken again. To make sure climate adaptation is included, preconditions regarding climate adaptation and/or water and green should be included into zoning plans and environmental plans.
- It is best to design measures in a way that water is visible. This makes it is easier to raise awareness regarding climate adaptation, it will increase the water experience in the area, it will increase the possibilities for recreation, and therefore it will improve the quality of life of the environment.

5.4.2 Ensure current and future needs regarding water supply and storage by preparing for extreme events

- Look past the administrative boundaries of the municipality: see the whole watersystem as one and connect with other cities within the same watersystem. Also, start with an overarching plan/vision before starting any project. Make sure all small/sub plans/projects fit into a bigger vision/plan. This is needed to make the city climate resilient in the end. In case one subproject does not function well, this influences the functioning of the other subprojects.
- In designing the measure think effect-oriented instead of norm-oriented (norms regarding sewage system). During the design phase watersystem advice and/or the future managers/maintainers of the measures should be involved to make sure management and maintenance will not be too difficult or expensive. The measures should also be designed in a way that it is ‘foolproof’: it will not lose its function over time due to changes in the area. Climate adaption measures are really vulnerable in this. Symbol tiles work well to make climate adaptation measures visible.

5.4.3 Effective leadership and urban management by government and the participation and awareness of communities

- One of the problems in some, mainly smaller, cities is that there is not enough budget and there are not enough people available within the municipality to implement climate adaptation well into the city. In the present situation, climate adaptation is mostly integrated into an area redesign/renovation projects, while large, sole measures are not a viable option. In some cases large, sole measures are however really necessary to reduce or solve high levels of nuisance/damage caused by for example flooding. It is important that this will be brought under attention within the municipality to create the feeling of urgency and to make sure this will change to ensure that the city really becomes resilient in the future. The internal process of the municipality should also be effective and efficient. This should be done by creating awareness within the municipality at all professional disciplines which connect to climate adaptation. Make sure to create a similar mind-set within these disciplines.

Chapter 6 Conditions for Successful Climate Adaptation Projects

This chapter identifies lessons learned on what common conditions are which define a successful project regarding climate adaptation in urban areas. This was done by grouping the conditions described in chapter 4 for each successful and unsuccessful project. This grouping was first done within the categories. The conditions that appeared two or more times within the same category are shown in section 6.1, Table 5. These conditions are linked to the principles identified out of literature in section 2.2. Here, four approaches to adapt urban water management to climate change are described 1) Water Sensitive Cities Framework, 2) Water Wise Cities, 3) Cities Resilience Index and, 4) City Blueprint. The principles of these approaches are linked to the conditions for success to clarify, explain, and generalize these. Next, the conditions of each category were grouped again, together with the remaining conditions of the other categories. In case a condition appeared two or more times in different categories it was identified as a common condition for success in section 6.2.

6.1 Conditions of Success per Category

In Table 5 the conditions of success per category are shown. Similar conditions are highlighted with a similar color. In section 6.2 the common conditions which are similar to the ones within categories are also given the same color. In this way it is easy to see were the common conditions are based on.

Table 5. Conditions of success per category

Categories	Conditions for success
Water drainage (building level)	Municipality puts in effort into project: They show effective leadership and urban management.
	Efficiency of effort and measure is high: Not linked.
	Feeling of urgency among stakeholders: They are aware of the problem and are willing to participate in the process.
	Climate adaptation within the project is integrally linked to other projects and interests: Urban planning is done in a way that it reduces risks and its effects, and increases liveability. In this way stakeholders are also aware of the problem and are willing to participate in the process.
Additional flood defences or reinforcing existing ones (street/quarter level)	Excellent collaboration between all stakeholders within the project: They are aware of the problem and are more willing to participate in the process. Excellent collaboration is also crucial for defining the urban water problem and to develop a climate resilient city.
	High potential damage is reduced by the measures within the project: Current and future needs are ensured (amongst others for example water supply) by preparing for extreme events.
	The measures within the project fit well into the environment: Urban planning reduces risks and its effects, and increases liveability.
	The preparation phase of the project was excellent: Not linked.
	The project is innovative: Not linked.
Drainage system (street/quarter level)	Well integrated measures in the environment: Urban planning reduces risks and its effects, and increases liveability.
	The measures within the project add value to the quality of public space: Urban planning reduces risks and its effects, and increases liveability.
	There are integral links created with other projects and interests: Urban planning reduces risks and its effects, and increases liveability. In this way stakeholders are also more aware of the problem and are more willing to participate in the process.

Measures for better water infiltration and water outlet (street/quarter level)	The measures within the project keep functioning well over time: Current and future needs are ensured (amongst others for example water storage) by preparing for extreme events.
	Maintenance and management of the measures is easy and not too expensive: Current and future needs are ensured (amongst others for example water storage) by preparing for extreme events.
Water storage facility (street/quarter level)	Excellent collaboration between all stakeholders within the project: They are aware of the problem and are willing to participate in the process. Excellent collaboration is also crucial for defining the urban water problem and to develop a climate resilient city.
	Water awareness and water experience is created by the measures within the project: Urban planning reduces risks and its effects, and increases liveability.
	The measures within the project add value to the quality of public space: Urban planning reduces risks and its effects, and increases liveability.
	An integral approach is used in design regarding other projects and interests: Urban planning reduces risks and its effects, and increases liveability. In this way stakeholders are also aware of the problem and are willing to participate in the process.

6.2 Common Conditions of Success

The conditions for success per category lead to a set of conditions that define a successful project regarding urban climate adaptation in general. These conditions are as follows: A project on climate adaptation in urban areas is successful in case 1) the collaboration between all stakeholders is excellent from the planning phase until the end of the project, 2) climate adaptation within the project is integrally linked to other projects and interests, 3) the project/measure is well integrated into the environment, and 4) the project adds value to the quality of the public space by creating water experience and water awareness. These conditions can be used by governmental organizations like municipalities, water authorities, and provinces in choosing and improving current and future climate adaptation processes and efforts.

These conditions for success comply with a part of the definition for successful climate adaptation projects defined by Doria et al. (2009), see section 2.1.2. However, this definition is more an overarching definition for success. The conditions above can be seen as more practical conditions which will together lead to a successful climate adaptation project. However it is not clear if this set of conditions alone will lead to a successful project. By comparing the conditions of success above to the other literature in section 2.1.2 it can be concluded that the common conditions for success are certainly conditions which can belong to a successful project. However, it also seems that these common conditions do not present a complete picture of what a successful project should look like. A footnote has to be added to this reasoning, because the literature review also indicates that there are no general conditions of a successful project regarding climate adaptation.

Chapter 7 Discussion, Conclusions and Recommendations

This chapter discusses the process and the results of this research in section 7.1. Then section 7.2 contains the final conclusions of this research. At last, section 7.3 makes recommendations based on the results of this research.

7.1 Discussion

Due to restrictions in time it was chosen to just include cities in the province of Overijssel in this research. Due the fact that relatively a lot of the cities within Overijssel are active in adapting to climate change, the results of this research might be helpful for small and medium scale, and even large scale cities in other provinces in the Netherlands. The fact that per city minimal two persons from two different organizations were interviewed might give a good overview of successful and unsuccessful projects in each city. However, the list of climate adaptation projects per city is far from complete. The aim of this research was however not to create a complete picture of climate adaptation projects in each city. This was not possible due to time restrictions, either. Having a complete picture of all the measures within all the projects in each city would however give a more comprehensive view of what is successful and what not. Having information on the same type of measures within different cities instead of having information on the same type of measures within the same city was preferred for this research. Because one city might be experienced in implementing a specific measure and might have sufficient capacities while another city might be unexperienced in implementing that same specific measure and might not have sufficient capacities. In this way, you will probably identify more lessons learned, which is useful for the administrations of other cities as well.

The lessons learned on successes and failures per category are based on two to four projects per category. This might give a reliable picture of which measures within the projects are actual successes and failures. However, success and failure of the measures within projects are dependent on so many aspects that it is possible that a by this research identified failure is actually successful in another province for instance. It might therefore be useful to perform a similar type of research as this one for a larger area and for more cities.

The approach of this research of identifying lessons learned on successes and failures by identifying differences and similarities on the successes and failures is a structured, systematic way of performing such an exploratory research. Because the analytical framework (section 3.5.3) was followed step by step the required results were reached to give an answer to the main research question in the end.

The interviewees included in this research are all experts within their organization. All of them have a function in which they have knowledge on and/or are involved in different projects regarding climate adaptation within their area/city. Because the interviewees had this overarching view on climate adaptation projects within their area/city it can be said that the successes and failures within this research are probably one of the most successful and one of the least successful projects within the different cities. Therefore, these probably give quite comprehensive lessons learned. Bias of the interviewees might be possible on the self-assessment of the projects. It might be possible that for instance the water authority had a different interest in a specific project compared to the municipality which resulted in the water authority assessing the project as a failure while the municipality assessed it as a success. This has been crosschecked for a couple of projects within this research and this was not the case for these projects.

Bias might also be possible in the perception of success. Not one organization within this research developed official conditions for a successful climate adaptation project. Therefore, the self-assessment of success and failure might differ between different persons within the same

organization but also between different persons from different organizations. For this research two or more persons were interviewed per organizations within five organizations and only one person was interviewed per organization within four organizations. To avoid bias between different persons within the same organization it might be recommended to interview at least two persons for each organization. This research tried to avoid this bias by asking the interviewees about the general perception within the organization. Minimizing the bias between persons from different organizations might however never be completely possible because this is highly dependent on the organizations view on climate adaptation projects and their progress in getting climate resilient. For instance, when a municipality is just starting implementing climate adaption they might already define something a success when one small measure is constructed while the process was really difficult and expensive, and the results were way less than expected. At the same time, a municipality which is already doing really well on climate adaptation and they already implemented several measures, might assess the exact same measure as a failure. Within this research, the perceptions of success of eight of the nine organizations which have been interviewed were quite similar with only minor differences. Only the municipality of Kampen had a different perception on success. This however, did not have major effects on the results of this research because in comparing the projects identified during this interview to the perceptions of success of the other interviewees it could be concluded that these projects could also be defined a success by the interviewees of the other organizations.

Based on the discussion of the process and the results of this research three recommendations on follow-up research can be made, 1) it is recommended to perform a similar type of research as this one for a larger area and for more cities. The main reason for this is that it will give a more comprehensive view than this research identified on successful and unsuccessful measures as well as on lessons learned of the different types of measures, 2) it is recommended to interview more than one person for each organization to avoid bias on the self-assessment of successful or unsuccessful of projects and, 3) it is recommended to only compare project to each other within cities which have the same perception of successful climate adaptation projects. This will ensure that the results on lessons learned on successes and failures are most reliable.

7.2 Conclusion

Today, climate change is one of the most challenging problems for urban areas. Periods of heavy rainfall and periods of droughts do have large negative effects, especially within the urban areas. Several cities worldwide have done or are already doing efforts towards becoming more climate resilient. Also, several cities in the province of Overijssel, the Netherlands did or are already doing efforts towards climate resilience. In their efforts they have used certain approaches to develop and design these efforts. There was however no comprehensive overview of the approaches adopted by these cities, to develop and design the efforts they made so far. Furthermore, there was little knowledge about the results of the application of these approaches so far, and about the successes and failures of these results. This study addressed these knowledge gaps as its research problem in order to identify lessons learned on the successes and failures which can be used by governmental organizations like municipalities, water authorities, and provinces in choosing and improving current and future climate adaptation processes and efforts.

The main question of this research was ‘What are the lessons learned on successes and failures of the approaches used within cities in Overijssel towards becoming climate resilient?’. In giving an answer to this question this research established a comprehensive understanding of a number of efforts that Enschede, Zwolle, Hengelo, Almelo, Deventer, and Kampen are making towards becoming climate resilient. This comprehensive understanding consists of the assessment of the approaches and in-depth results of twenty projects regarding climate adaptation in the urban area. This data was collected through interviews. The research also aimed to generate comparative

insights for exchanging lessons learned on the successes and failures of the different approaches. For this purpose, the identified projects were divided into nine categories based on the nature of the measure that was implemented within each project. This resulted in five different categories which included two or more projects. Of these categories one is based at the building level and four are based on the street/quarter level. After this, differences and similarities were identified of the successes and failures of the projects within each category. This was done by comparing the projects within each category in a comparison matrix based on the approaches and in-depth results. Within the category 'water drainage' at the building level, a lot of differences were identified while almost no similarities could be identified. The projects within the category 'additional flood defences or reinforcing existing ones' were quite similar in several ways. Within the category 'drainage system' at street/quarter level, the projects differed quite a lot, while almost no similarities could be identified. The projects within the category 'measures for better water infiltration and water outlet' were rather similar. The category 'water storage facility' also includes projects which had quite a lot of similarities.

As described, the projects within three categories were quite similar to each other. The main reason for this is that the measures within the projects within these categories were actually really similar in nature. The measures within the category 'measures for better water infiltration and water outlet' were for example both permeable pavement while the measures within the category 'water storage facility' were all brooks or a similar large water storage which is connected to the whole water system. On the other hand, the projects within two categories had almost no similarities. The main reason for this is that the nature of the measures within these projects differed a lot. Both of these categories were about water drainage (one at the building level, one at the street/quarter level) and there are different ways of water drainage applied in the cities included in this research.

The differences and similarities, together with the knowledge elicited from the interviewees, were used to identify lessons learned on the successes and failures per category. One of the most important lessons learned within the category 'water drainage' at building level is that money alone is not the right incentive for citizens to disconnect their rainwater. Among others a feeling of urgency and other efforts of the municipality in the area seem to be crucial to motivate citizens to do climate adaptation efforts at private property. Regarding the projects within the category 'additional flood defences or reinforcing existing ones', it seems important to have an excellent planning/design phase and to start the project out of an overarching vision/plan. Besides, it is important that this kind of measures are integrated well in the environment. An important lesson learned from the projects within the category 'drainage system' at the street/quarter level is that these measures should be started out of an overarching vision because it is important that these connect to other measures to make them work most effective. The measures within the category 'measures for better water infiltration and water outlet' seem to be difficult to manage and maintain and therefore are vulnerable for losing their function. Within the category 'water storage facility', the process of the projects seems to be the most important and difficult aspect of the project. The main reason for this is that these projects are large-scale, requiring a lot of money and a large area, and involve various stakeholders. Therefore, it is best to integrally link other projects and interests to such climate adaptation projects.

Based on the lessons learned per category in combination with the data collected through the interviewees, general lessons were drawn as well. Four of these apply to the planning/design phase. One of these applies to the municipal processes and progress regarding climate adaptation. Since the municipality is in most cases the main initiator and manager of climate adaptation measures, either by integrating it into an existing renovation/redesign project of the area or as sole measure, these recommendations are especially useful for them. These could however also be useful for water authorities, and provinces in choosing and improving current and future climate adaptation processes and efforts.

Another insight created by this research is how a successful project regarding climate adaptation in the city should look like. At first, conditions were identified for the projects within each category. These conditions for success per category led to a set of conditions that define a successful project regarding climate adaptation in urban areas in general. These conditions are as follows: A project regarding climate adaptation in the urban area is successful in case 1) the collaboration between all stakeholders is excellent from the planning phase until the end of the project, 2) climate adaptation within the project is integrally linked to other projects and interests, 3) the project/measure is well integrated into the environment, and 4) the project adds value to the quality of the public space by creating water experience and water awareness. These conditions can be used by governmental organizations like municipalities, water authorities, and provinces in choosing and designing future climate adaptation efforts and to improve the process of such projects. Based on literature it can be concluded that these conditions indeed lead to a successful project regarding climate adaptation in the urban area. However, it seems that these do not represent a complete set of conditions for success.

Overall, this research identified lessons learned mainly on the planning/design phase, on the process of the projects, and on the actual results. This research did identify little lessons learned on the actual functioning of the measures regarding the reduction of the negative effects of climate change. The main reason for this is that the vast majority of the measures has not yet been or will not be monitored and/or officially evaluated on the actual functioning. To identify lessons learned on the functioning more monitoring and evaluations should be done.

7.3 Recommendations

This research makes four recommendations to governmental organizations which initiate, are involved, and/or manage climate adaptation measures.

Firstly, it is recommended to officially monitor all climate adaptation measures and to perform an official evaluation for each climate adaptation project. This will make it easier in the future to identify whether a measure is a success or not and how to climate adaptation project and the measures should be improved.

Secondly, it is recommended to apply the lessons learned by this research per category in case similar project as the ones in the categories will be implemented. Doing so, will increase the success of the process of the project and will increase the success of the measures within the project.

Thirdly, it is recommended to apply the general lessons learned at each climate adaptation project. Doing so, will increase the success of the process of the project and will increase the success of the measures within the project.

Lastly, it is recommended to ensure that the conditions for successful projects are fulfilled at each climate adaptation project. Doing so, will increase the success of the process of the project and will increase the success of the measures within the project.

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Appendices

Appendix I Interview Guide

University of Twente
CSTM - Department of Governance and Technology for Sustainability
MEEM - Master of Environmental and Energy Management (2017-2018)

Interviewer
Jelle Reitsma (j.reitsma@student.utwente.nl)

Begeleiders
Dr. Gül Özerol, Dr. Kris Lulofs

Achtergrond
Klimaatverandering vormt een van de grootste uitdagingen voor stedelijke gebieden. Droogtes en periodes van hevige regenval komen vaker voor en de gevolgen hiervan worden erger. Het conventionele stedelijk watermanagement is niet geschikt om de huidige en toekomstige gevolgen van klimaatverandering aan te kunnen. Om steden bestendig te maken voor deze gevolgen zal het stedelijk watermanagement moeten veranderen. Verschillende steden in Nederland en in Overijssel leveren al inspanningen op het gebied van klimaatbestendigheid. Dit doen zij onder andere door middel van het verbeteren van het stedelijk watermanagement systeem. Dit masteronderzoek focust op de steden Enschede, Zwolle, Hengelo, Deventer, Almelo en Kampen. Het onderzoek heeft als doel om een uitgebreide kennis te creëren van enkele van de inspanningen die deze steden in Overijssel leveren om een klimaatbestendige stad te worden. Het onderzoek beoogt ook om door middel van een vergelijking van de verschillende projecten in elke stad kennis te verkrijgen over welke lessen er geleerd zijn en uitgewisseld kunnen worden over succesvolle en niet succesvolle projecten.

DAG MAAND 2018, TIJD, LOCATIE:……

Formaliteiten
1. Mag ik het gesprek opnemen?
2. Invullen toestemmingsformulier
3. Dit interview zal ongeveer 1 uur duren
4. Afspraak maken over communicatie van het transcript
5. Afspraak maken over communicatie van de resultaten/rapport vóór en na definitieve versie
6. Mag ik eventueel contact met u opnemen na het interview als ik nog vragen heb?

Introductie
1. Van het onderzoek (masteronderzoek, het resultaat zal een groot rapport zijn dat afgerond zal worden eind augustus/begin september)
2. Van de geïnterviewde (functie binnen zijn/haar organisatie en binnen welke afdeling)

Vragen om het interview in te kaderen
Ik zal starten met een aantal vragen over klimaatadaptieve projecten in de stad om het verdere interview in te kaderen.
1. Wanneer/waarom wordt in het algemeen een project aangaande klimaatadaptatie als succesvol gedefinieerd?
2. Wanneer/waarom wordt in het algemeen een project aangaande klimaatadaptatie als niet succesvol gedefinieerd?
3. Welk project kan gedefinieerd worden als het meest succesvol? Waarom? (Kanttekening: inhoudelijke kennis over het desbetreffende project is nodig voor dit interview, en de implementatie moet gestart zijn)
    - Wat heeft er geholpen om het project succesvol te maken?

4. Welk project kan gedefinieerd worden als het minst succesvol? Waarom? (Kanttekening: inhoudelijke kennis over het desbetreffende project is nodig voor dit interview, en de implementatie moet gestart zijn)
    - Wat waren obstakels of knelpunten bij niet succesvolle projecten?

Vragen over ontwerp en planning

Ik zal verder gaan met vragen over het ontwerp en de planning van de beide projecten.

1. Op basis van welk idee zijn deze projecten gekozen? *(bijvoorbeeld: KAS, Living Lab, wet en regelgeving)* LET OP: zorg ervoor dat het volgende behandeld is:
    - Zijn de projecten gebaseerd op interne kennis, of op regionale, nationale of internationale netwerken?
    - Waarom die locatie?
    - Waarom die maatregel?
2. Kunt u beide projecten kort omschrijven? LET OP: zorg ervoor dat het volgende behandeld is:
    - Wat is de aard van het project? *(bijvoorbeeld: harde: dijken, verlaging van wegen, ontkoppeling van regenwater en afvalwater, andere infrastructurele veranderingen; groen-blauw: opslag en opvang van regenwater, toename van de infiltratie; zachte: informatie, burgerparticipatie, (financiele) aansporing)*
    - Welke gevolgen van klimaatverandering willen jullie aanpakken met dit project? Alleen huidige effecten of ook gekeken naar toekomstige? Was dit ook de aanleiding? *(bijvoorbeeld: overstromingen, droogtes, hittegolven, schade aan het milieu, gezondheidsrisicos, onzekerheden in de aanvoer van water)*
    - Heeft het project meer functies?
    - Zijn het op zichzelf staande projecten of zijn ze onderdeel van een groter plan of strategie? Zo ja, welke projecten en welk plan of strategie?
    - Toen het project gepland werd, welke stakeholders werden toen geïdentificeerd als deelnemers?

Vragen over implementatie en resultaten

Ik zal nu verdergaan met vragen over de implementatie en resultaten van de beide projecten.

1. Wat is de voortgang van het project tot nu toe? *(in het begin, klaar)*
    - Wanneer is het project gestart en, als dit het geval is, afgelopen (jaar)?
2. Kan het project worden gedefinieerd als kleinschalig of grootschalig?
    - Welke criteria gebruiken jullie om de schaal van een project te bepalen? *(bijvoorbeeld: hoeveelheid uitgegeven budget, hoeveelheid inwoners waarop het invloed heeft)*
3. Zijn de uiteindelijke resultaten hetzelfde als de beoogde resultaten tijdens de projectplanning? Wat zijn de verschillen? Waarom? *(bijvoorbeeld: veranderingen aan de infrastructuur, bewustwording verhoogd, meer groene gebieden gecreëerd, het gehele budget is uitgegeven)*
4. Zijn de stakeholders die deel hebben genomen aan het project dezelfde als degene die in het begin geïdentificeerd werden? Wat zijn de verschillen? Waarom?

Vragen over monitoring en evaluatie

Ik zal nu verdergaan met vragen over de monitoring en evaluatie van de beide projecten.

1. Wat waren de doelstellingen van de beide projecten? En zijn deze behaald?
    - Welke criteria worden gebruikt om te bepalen in hoeverre de doelstellingen zijn behaald? Hoe worden gegevens verzameld om deze criteria te beoordelen?
    - Wanneer wordt beoordeeld in hoeverre de doelstellingen behaald zijn? *(bijvoorbeeld: elke maand, alleen aan het einde, willekeurig)*
2. Zijn er tijdens of na de implementatie van het project officiële momenten waarbij wordt geëvalueerd of het project succesvol verloopt/verlopen is of niet en wat er verbeterd kan

worden? Zo ja, wanneer en hoe? *(bijvoorbeeld: stop elke maand tijdens het project, schrijven van een evaluatie rapport, stakeholder vergadering)*
    - Wie voeren deze evaluatie uit? Hoe wordt interne expertise *(eigen personeel)* en externe expertise *(consultants en kennisinstellingen)* hierin gebruikt?
    - Waar focust de evaluatie op? *(bijvoorbeeld: het proces, de aard van het project, de doelstelling)*
    - Hoe worden de resultaten van de evaluatie gebruikt? *(bijvoorbeeld: gelijk zaken veranderen, onthouden en gebruiken voor de volgende keer, helemaal niet)*
3. Hoe kan elk project de volgende keer verbeterd worden? Welke lessen zijn er geleerd?
4. Zijn er plannen om het project op te schalen en/of op andere plekken te implementeren? Of is dit al gebeurd?

In het geval de bovenstaande vragen niet beantwoord kunnen worden, vraag het volgende:
1. Wie is er verantwoordelijk voor het doen van de monitoring en de evaluatie van de projecten?
2. Zou u meer betrokken willen worden bij de monitoring en evaluatie van de projecten? Op welke manier?

Afsluiten
1. Is er misschien van een of beide projecten informatie digitaal beschikbaar?
2. Heeft u zelf nog iets toe te voegen of te vragen?
3. Bevestigen afspraak over communicatie van het transcript
4. Bevestigen afspraak over communicatie van de resultaten/rapport

Appendix II List of Interviewees and Interview References

Case	Function	Organization	Type of interview
Enschede	Anonymous	Municipality of Enschede	Personal interview
Enschede	Designer water1	Municipality of Enschede	Personal interview
Enschede	Designer water2	Municipality of Enschede	Personal interview
Hengelo	Policy officer water management and sewerage	Municipality of Hengelo	Personal interview
Almelo	Policy advisor sewerage and water	Municipality of Almelo	Personal interview
Almelo	Project manager	Municipality of Almelo	Personal interview
Enschede, Hengelo, Almelo	Strategic advisor	Waterboard Vechtstromen	Personal interview
Enschede, Hengelo, Almelo	Senior policy advisor water chain	Waterboard Vechtstromen	Personal interview
Zwolle	Advisor urban water management	Municipality of Zwolle	Personal interview
Zwolle	Program secretary IJssel-Vechtdelta	Province of Overijssel	Personal interview
Zwolle	Communication advisor IJssel-Vechtdelta	Province of Overijssel	Personal interview
Kampen	Advisor water and sewerage1	Municipality of Kampen	Personal interview
Kampen	Advisor water and sewerage2	Municipality of Kampen	Personal interview
Deventer	Senior advisor sewerage and water	Municipality of Deventer	Personal interview
Zwolle, Kampen, Deventer	Policy advisor spatial planning and climate adaptation	Waterboard Drents Overijsselse Delta	Personal interview

Interview references

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Advisor water and sewerage1, & Advisor water and sewerage2. (2018, June 22). Climate Adaptation in Kampen [Personal interview].

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Designer water2. (2018, June 1). Climate Adaptation in Enschede [Personal interview].

Policy advisor sewerage and water, & Project manager. (2018, July 9). Climate Adaptation in Almelo [Personal interview].

Policy advisor spatial planning and climate adaptation. (2018, June 28). Climate Adaptation in Zwolle, Deventer, and Kampen [Personal interview].

Policy officer water management and sewerage. (2018, July 11). Climate Adaptation in Hengelo [Personal interview].

Program secretary IJssel-Vechtdelta, & Communication advisor IJssel-Vechtdelta. (2018, June 14). Climate Adaptation in Overijssel [Personal interview].

Senior advisor sewerage and water. (2018, July 12). Climate Adaptation in Deventer [Personal interview].

Strategic advisor, & Senior policy advisor water chain. (2018, June 13). Climate Adaptation in Enschede, Hengelo, and Almelo [Personal interview].

Appendix III Consent Form

Toestemmingsverklaringformulier afstudeeronderzoek voor de Master of Environmental and Energy Management

Titel onderzoek: *Climate Resilience and Urban Water Management: A Comparative Analysis of Cities in the Province of Overijssel, the Netherlands*

Verantwoordelijke onderzoeker: *Jelle Reitsma*

Hierbij verklaar ik dat ik op een duidelijke wijze ben ingelicht over de aard, methode, en het doel van het onderzoek. Ik stem geheel vrijwillig in met deelname aan dit onderzoek. Ik behoud me daarbij het recht voor om op elk moment zonder opgaaf van redenen mijn deelname aan dit onderzoek te beëndigen.

Mijn antwoorden mogen alleen gebruikt worden voor dit onderzoek. In de publicaties van dit onderzoek mogen mijn antwoorden:

- Gerefereerd worden met mijn naam of functie
- Anoniem gerefereerd worden
- Alleen gebruikt worden als bron van informatie

Tijdens het interview heb ik het recht om aan te geven dat bepaalde antwoorden niet of gedeeltelijk gebruikt mogen worden.

Naam deelnemer: ……..

Datum: …… Handtekening deelnemer: ……

Ik verklaar dat ik me volledig aan het bovenstaande houd.

Naam onderzoeker: ……..

Datum: …… Handtekening onderzoeker: ……..