

The North of the Netherlands: A flood resilient region?



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Abstract

In this study the northern provinces (Groningen, Friesland and the northern part of Drenthe) together form the research area, with exception of the Wadden Sea Islands. The goal of this study is to figure out if the North of the Netherlands is a flood resilient region. Therefore it is important to find out what are the characteristics of a flood resilient region, because those are not a clearly given. With the knowledge of these characteristics the North of the Netherlands can be assessed. This study tries to give an answer to the research question: *To what extend can the North of the Netherlands be characterized as a flood resilient region?*

Climate change is affecting the entire European territory according to the European Environment Agency (2012). Some effects of climate change are sea level rising, heavy rainfall, flood events, droughts, salinization and heat waves (e.g. Rozenzweig et al., 2018; European Commission, 2016). This is a growing problem in Europe and in the Netherlands as well (Rijksoverheid, 2018). Flood resilience is considered as a promising concept to deal with too much water and flooding (Restemeyer et al., 2015). A framework to assess flood resilience is created for cities (Restemeyer et al., 2015), but not yet for regions. The regional approach is important because the effects of climate change do not only effect cities, but entire areas. The North of the Netherlands collaborates in an administrative region (Rijksoverheid, 2018) and has the ambition to adapt to climate change (Noord Nederland Climate Initiative, 2017). Also in Groningen a Global Centre of Excellence on Climate Adaptation is opened in September 2018 (Global Centre of Excellence on Climate Adaptation, 2018). This shows the ambition of the region to deal with the effects of climate change.

For this study a heuristic conceptual framework is developed to assess the North of the Netherlands concerning flood resilience. Based on a literature review six characteristics have been defined for the conceptual framework and this framework is the base for the empirical research of this study. This empirical study, consisting of interviews and document analysis, leads to the findings of the research and gives an answer to the research question.

Key Words: Resilience; Flood Resilience; Region; Resilient Region; Regional Approach

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Chapter 1 - Introduction

The North of the Netherlands, a flood resilient region? The first part of the title explains the area of research, the North of the Netherlands. In this study the northern provinces (Groningen, Friesland and the northern part of Drenthe) together form the research area, with exception of the Wadden Sea Islands. This area is an administrative area of the Deltaprogram Spatial Adaptation (Rijksoverheid, 2018) and is the region of research in this study.

The second part of the title is 'a flood resilient region?' The goal of this study is to figure out if the North of the Netherlands is a flood resilient region. Therefore it is important to find out what the aspects of a flood resilient region are, because that is not a clearly given concept. With the knowledge of these aspects the North of the Netherlands can be assessed. In this way this study tries to give an answer to the question in the title: Is the North of the Netherlands a flood resilient region?

1.1 Problem statement

Climate change is affecting the entire European territory according to the European Environment Agency (2012). Some effects of climate change are sea level rising, heavy rainfall, flood events, droughts, salinization and heat waves (e.g. Rozenzweig et al., 2018; European Commission, 2016). This is a growing problem in Europe and in the Netherlands as well (Rijksoverheid, 2018). In this study the focus is on water quantity and specifically on problems concerning too much water in the North of the Netherlands. Flood resilience is considered as a promising concept to deal with flooding and too much water (Restemeyer et al., 2015). A framework to assess flood resilience is created for cities (Restemeyer et al., 2015), but not yet for regions. The regional approach is important because the effects of climate change do not only effect cities, but entire areas. The North of the Netherlands collaborates in an administrative region (Rijksoverheid, 2018) and has the ambition to adapt to climate change (Noord Nederland Climate Initiative, 2017). The area of Groningen, Friesland and the northern part of Drenthe is obliged to report to the national Delta commissioner about their progress on climate adaptation (Rijksoverheid, 2018). Also in Groningen a Global Centre of Excellence on Climate Adaptation is opened in September 2018 (Global Centre on Adaptation, 2018). This Centre supports with knowledge and advise concerning climate change. This presence of this Centre shows the ambition of the region to deal with the effects of climate change. Because in the North of the Netherlands flooding can be a serious problem, the Wadden Sea and the IJsselake are next to the provinces of Groningen and Friesland and heavy rainfall and inland waters can also cause flooding in the area. Can the regional ambition contribute to more flood resilience in the region?

The problems due to climate change, the obligation to report as a region and the ambition to collaborate as a region have led to the research questions of this study. Based on the problem statement the following primary research question is set up:

- To what extend can the North of the Netherlands be characterized as a flood resilient region?

There are two secondary questions to come to an comprehensive answer to this research question. These are:

- How can the concept of a flood resilient region be operationalized?
- How do measures in the North of the Netherlands contribute to the flood resilient region?

1.2 Theoretical Approach

There is already much literature about the concept of resilience and operationalization of resilience in relation to flood risk management. But there is no literature specifically about the flood resilient region. This study searches for the important aspects of the flood resilient region. There are multiple definitions that focus on the different meanings and aspects of resilience (Pendall et al., 2010). The most applicable definition of resilience from scientific literature is used for this study, this is evolutionary resilience. Also the characteristics of flood resilience are gained from the literature review (i.e. Restemeyer et al., 2015; Hegger et al., 2016). The definition of resilience and the characteristics of flood resilience are explained in Chapter 2. There are many scientific articles about the resilient region already, but these focus mostly on economic resilience (Hudson, 2010; Simmie & Martin, 2009). Not on the aspect of flood resilience for regions. Articles about flood resilience are mainly about governance for flood resilience (e.g. Driessen et al., 2016) or flood resilience specifically for cities (Restemeyer et al., 2015). For the concept of the flood resilient region, this study combines the most useful theories about flood resilience and the resilient region for the development of a heuristic framework for the flood resilient region. This framework consists of important aspects of a flood resilient region. The framework is the answer to the first secondary research question: 'How can the concept of a flood resilient region be operationalized?'

The framework in this study serves as a heuristic framework to assess the flood resilience of the North of the Netherlands. Important aspects of the flood resilient region are defined and the framework will help to determine to what extent the North of the Netherlands can be characterized as a flood resilient region. This study can be used for further research to improve the framework for flood resilient regions, to assess other regions as well and to improve the flood resilience of the North of the Netherlands.

1.3 Methodological Strategy

First, the demarcation of the region is important. The North of the Netherlands in this study is the area of Groningen, Friesland and the northern part of Drenthe. This is an area meeting of two working regions of the Delta program Spatial adaptation (Rijksoverheid, 2018). These working regions are 'Fries Bestuursakkoord Waterketen' and 'Waterketensamenwerking Groningen en Noord Drenthe' (Figure 1). Together they form one of the seven areas that report to the Delta commissioner about the findings and progress about climate adaptation.

In the Netherlands there is already for many years the Deltaprogram, a program that contains plans to protect the country from flooding and the consequences of extreme weather (Rijksoverheid, 2018). Since 2017 the Deltaprogram contains the Deltaplan Spatial Adaptation. This plan divides the country into working regions (Dutch: Werkregio's). These working regions have to map their vulnerabilities caused by climate change and the measures that will be taken. The goal of these working regions is that all governments in a working region area have an intensive collaboration to achieve the ambitions and goals of the Deltaprogram (Rijksoverheid, 2018). The working regions are combined into seven

area consultations (Dutch: Gebiedsoverleggen) in the Netherlands. These 7 areas report their findings and progress to the Delta Commissioner. The North of the Netherlands is one of these 7 areas.



Figure 1. Map of the working Regions in The Netherlands (Rijksoverheid, 2018) , 'Fries Bestuursakkoord Waterketen' and 'Waterketensamenwerking Groningen en Noord Drenthe' are clearly visible in the North of the Netherlands.

The conceptual framework that is created in Chapter 2 is the tool to find out if a region can be characterized as flood resilient. By using this framework the North of the Netherlands is assessed in this study. Experts working in Groningen, Friesland and Drenthe are interviewed and policy documents are analyzed. The aspects of the conceptual framework are used to analyze the North of the Netherlands. Different experts are approached for interviews that took place in the summer of 2018. The analysis of the interviews in combination with the analysis of the policy documents lead to an answer of the second secondary research question: 'How do measures in the North of the Netherlands contribute to the flood resilient region?'. Based on the findings of this empirical research an answer can be given to the primary research question: 'To what extent can the North of the Netherlands be characterized as a flood resilient region?'

1.4 Scientific and societal relevance

For this study a conceptual framework is created, based on the literature review in Chapter 2. This is a heuristic framework to assess the flood resilience of a region. This is a new framework, because it is specifically created and useful for regions. This is an addition to research about flood resilience and region and therefore of scientific relevance. The regional approach is very important in this study and this conceptual framework can be used to assess other regions as well.

By using the conceptual framework the strengths and weaknesses of the North of the Netherlands concerning flood resilience will become clear. This might show new points of attention for improvements in the region about flood resilience and regional collaboration. In this way this study can contribute to a more flood resilient North of the Netherlands.

1.5 Reading Guide

After this first introduction chapter there is a clear structure in the further parts of the study. The second chapter contains relevant theoretical aspects for this study and finalizes with the conceptual framework: 'towards the flood resilient region'. This framework combines the insights from the literature review and is a heuristic framework to assess the North of the Netherlands. Chapter 3 contains the methodology and the steps that are taken in the empirical research. The demarcation of the region is further explained because that is an important part of this research. Also the participants of the interviews and policy documents are introduced and their role in this research is explained. In the fourth chapter of this study the findings of the empirical research are explained. The aspects of the conceptual framework are assessed on the North of the Netherlands and there is elaboration about the findings. The fifth and final chapter contains the combined results of the findings, the conclusion and a reflection. Also recommendations are given for further research and the contribution to planning practice of this study.

Chapter 2 - Towards the flood resilient region

2.1 Introduction

This chapter is the theoretical basis of this thesis and is based on a literature review. This chapter combines two bodies of thought. On the one hand a literature review about resilience and flood resilience. On the other hand a literature review about the region and regional resilience. This theoretical chapter contains five parts. First (2.2), the ‘fuzzy concept’ of resilience is clarified, as it has multiple definitions and is a hot concept in science these days (Pendall et al., 2010; Davoudi, 2012). Resilience is seen as a useful approach for planning, because it helps to prepare for changes and uncertainties (Davoudi, 2012). Second (2.3), the concept of resilience is operationalized for flood risk management. Flood resilience is a concept to deal with flood risks. The important aspects of flood resilience are explained and also the preconditions that are required for flood resilience. The framework to assess flood resilience created by Restemeyer et al. (2015) is used as a starting point. Third (2.4), governing is an important aspect for achieving flood resilience. Driessen et al. (2016) give recommendations for governing for flood resilience and those recommendations are discussed in this part. The next section discusses the meaning of a region (2.5). There are multiple definitions of a region and it is not easy to define what ‘the’ region is (Paasi, 2002). There is a difference between the administrative and functional region. The next section (2.6) follows with a review of a regional approach and regional resilience. This leads to the understanding of a resilient region. Together the review of flood resilience, regional approach and the resilient region are important notions for the flood resilient region. The final part of this chapter (2.6) is the conceptual framework, ‘towards the flood resilient region’. This is an heuristic framework to assess to what extent a region is flood resilient. This framework combines the findings of the literature review in this chapter and is the basis for the empirical research later in this study.

2.2 Resilience

Resilience is often seen as a fuzzy concept (Pendall et al., 2010). Fuzzy in the way that there are multiple definitions for one concept. Pendall et al. (2010) describe that fuzzy concepts lack a clear definition and are difficult to operationalize. Resilience is used in both natural and social sciences and is used to describe places, systems and structures (Davoudi, 2012). The concept of resilience has been used more often in the last decade and is gaining popularity (Woods, 2015). Primary resilience was used only in the natural sciences, but later on the concept was adopted by the social sciences as well (Davoudi, 2012). To show and prove that resilience is gaining interest from all fields of study, the number of articles that have been published with ‘resilience’ in the title since 2008 are shown in Figure 2. This figure shows that the amount of articles with ‘resilience’ in the title per year has gone up from 705 in 2008 to 4663 in 2017 (Figure 2).

Davoudi (2012) describes three different conceptions of resilience. Namely engineering resilience, ecological resilience and evolutionary resilience. These are briefly explained in the next subsections.

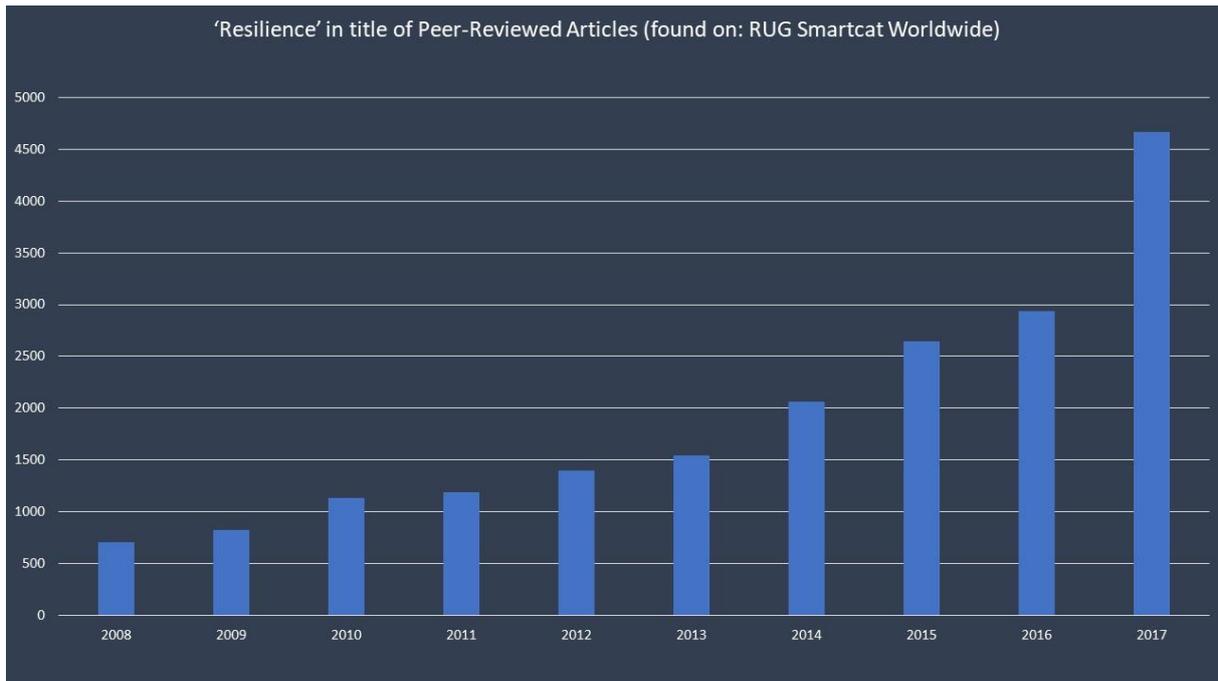


Figure 2. Number of Peer-Reviewed Articles with 'Resilience' in title (Source: Library Rijksuniversiteit Groningen, Smartcat Worldwide, 31-05-2018).

Engineering and ecological resilience

Engineering resilience is defined by Holling (1973) as the ability of a system to return to an equilibrium or steady-state after a disturbance. Examples of disturbances are natural disasters, such as storms or flood events. This concept defines resilience as the ability to recover. The faster the system recovers from the disturbance, the more resilient it is (Davoudi, 2012). Engineering resilience has the focus on the ability of a system to return to the original state (Hegger et al., 2016).

Ecological resilience is close to engineering resilience (Hegger et al., 2016), but it is slightly different from engineering resilience. Ecological resilience is the amount of disturbance a system can take and remain functioning in the same way (Holling, 1996; Davoudi, 2012). Here the example of a natural disaster is well applicable again. The more disturbance from a natural disaster (e.g. storm or flood event) a system can take and remain functioning in the same way, the more it is resilient. Ecological resilience is about the capacity of a system to undergo changes and still remain the same function (Hegger et al., 2016).

Evolutionary resilience

The concept of evolutionary resilience (also called: socio-ecological resilience) is the third and last definition of resilience given by Davoudi (2012). She defines it in this way: 'Evolutionary resilience is the ability of a system to change, adapt and transform in response to changing circumstances'. Different from the first two definitions is that change can happen from the inside as well and not only from external disturbances. In this definition systems have the ability to absorb disturbance, the ability of self-organization and the capacity to learn and adapt (Davoudi 2012; Restemeyer et al., 2015). Hegger et al. (2016) add to this that this concept includes adaptability and transformability as preconditions of resilience. This is important because the system has to respond to changes itself. This concept of resilience assumes that a system can reorganize (instead of recover) and develop after a disturbance (Larrue et al., 2013). In the report 'Researching Flood Risk Governance in Europe:

background theories' Larrue et al. (2013) define this type of resilience as follows: 'The ability to absorb disturbances, to be changed and then to reorganize and still have the same identity (retain the same basic structure and ways of functioning). It includes the ability to learn from the disturbance'.

The concept of evolutionary resilience is seen as the most promising for planning (Davoudi, 2012). The reason for this is that planning is about preparing for change and uncertainties according to Davoudi (2012) and Restemeyer et al. (2015; 2018). A key metaphor of evolutionary resilience is the Panarchy Model of Adaptive Cycle by Holling et al. (2002) (used from Davoudi, 2012) and is presented in Figure 3.

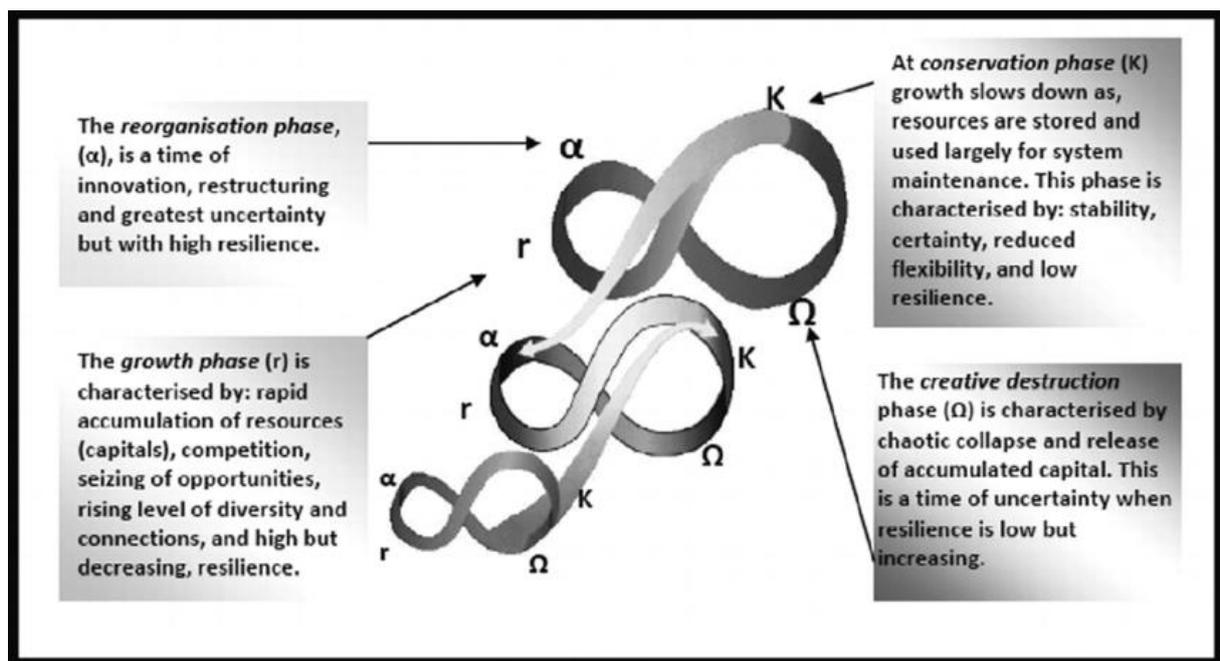


Figure 3. The Panarchy model of Adaptive Cycle. Source: Davoudi (2012) adapted from Holling and Gunderson (2002, pp. 34–41) and Pendall et al (2010, p. 76).

This Cycle contains four phases: the growth phase, the reorganization phase, the conservation phase and the creative destruction phase. These phases describe the situation a system can be in. According to Holling et al. (2002) systems do not function in a single cycle, but in multiple cycles that interact. These cycles can vary for example in scale, speed and timeframe. Davoudi (2012) argues that this interaction of systems explains the evolutionary meaning of resilience. In this view systems are interacting and continuously changing. An example is that a crisis can eventually lead to a better situation. After the crisis, the system shifts from the creative destruction phase towards the reorganization phase, that will lead to a positive situation for the system. So in this way a crisis can lead to a positive change. This is argued by Davoudi (2012) and Restemeyer et al. (2015; 2018). This study follows their way of thinking and uses the perspective of evolutionary resilience. The next section continues with the step from resilience in general towards the concept of resilience for flood risk management.

2.3 Flood Resilience

As explained in the previous section, resilience is increasingly considered as a promising concept to deal with risks and uncertainties in planning (Davoudi, 2012). The concept of resilience has made its way to flood risk management as well. In the case of flood resilience the disturbance to the system is a flood event and the area has to be able to restore the systems quickly (Rozenzweig et al., 2018). Resteyemer et al. (2015) elaborate about Flood Risk Management and describe the traditional resistance strategy and the newer resilience strategies.

The EU Floods Directive has made a distinction between five types of strategies for Flood Risk Management and are visible in Figure 4 (Driessen et al 2016; Klijn et al., 2009). These strategies aim to prevent a flood event (1. flood risk prevention), minimize the chance of flood events (2. flood defence), reduces the consequences of flood events (3. flood mitigation, 4. flood preparation) and recovery (5. flood recovery) after flood events (i.e. Djordjevic et al., 2011; Hegger et al., 2014; Klijn et al., 2009).

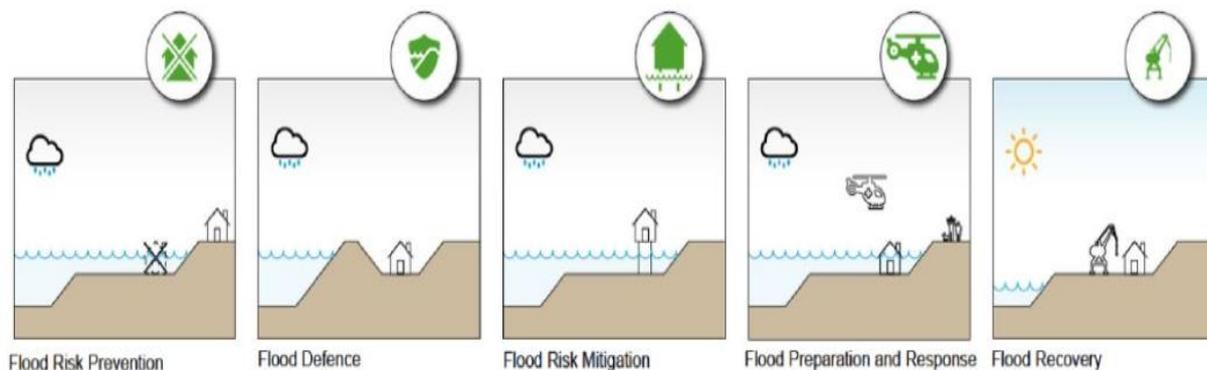


Figure 4. Five types of flood risk management strategies (Driessen et al., 2016)

Restemeyer et al. (2015) argue that resistance refers to reducing the probability of flooding. Resistance is a strategy to minimize the chance of flooding. Restemeyer et al. (2015) emphasize that resistance is an important part of flood resilience. Simplified this strategy of resistance tries to keep the water away by building and raising dikes. Traditionally flood control measures were these types of sectoral resistance measures. These measures are mostly technical 'hard' measures (Vis et al., 2003). The newer approaches use other types of measures (Restemeyer et al., 2015). In the conceptualization of flood resilience Restemeyer et al. (2015, p.47) explain that there are three important aspects of flood resilience. These are robustness (synonym of resistance), adaptability and transformability. This is in line with other authors that also distinguish these three aspects (e.g. Davoudi, 2012; Folke et al., 2010; Hegger et al., 2016; Scott, 2013). These three aspects are explained in the next sections.

Robustness

First, robustness is an important aspect of flood resilience. Robustness is a synonym of resistance. As mentioned earlier, resistance was seen as the traditional way of flood risk management as explained by Vis et al. (2003). For flood resilience it is also an important aspect and it is called robustness. Robustness aims to minimize the chance of flooding, which means that a system has to be able to withstand and resist flooding. This is similar to the second strategy of Flood Risk Management (Figure 4). This strategy aims to minimize the chance of flood events by flood defence. Minimizing the chance of flood events can be done by technical and spatial measures. Examples of this strategy are dikes,

storm barriers, dams and sluices. These are so called 'hard' measures. In the case of the Netherlands these measures are used a lot in the last decades and centuries (Vis et al., 2003). Examples of these 'hard' measures are the Delta Works in the South-West as a reaction of the disaster in 1953 (Lintsen, 2002). Hegger et al. (2016) and Klijn et al. (2004) explain that robustness (the capacity to resist) is seen as the ability to withstand disturbances. The ability to withstand a flood can be achieved by protecting the area with measures as dikes, dams and water retention areas (Hegger et al., 2016). These measures are called resistance-like measures.

Adaptability

The second aspect of flood resilience is adaptability (Restemeyer et al., 2015), which refers to the way to reduce the consequences of flooding. In the urban case of Restemeyer et al. (2015) this means that the hinterland of a city is planned in a manner that it can adapt to flood events. In this way the hinterland is prepared for flooding and in case a flood will happen, the damage is minimized due to the adapted land use and environment. Examples of this strategy are flood proof buildings and infrastructure, as well as regulations for building in vulnerable areas (Restemeyer et al., 2015). The aspects of adaptability are similar to the first (flood prevention) and third strategy (flood mitigation) of Flood Risk Management (Figure 4). For adaptability spatial planning is required. Planning is important to make or keep the area prepared for a flooding. Hegger et al. (2016) describe this second aspect of flood resilience as the capacity to absorb and recover. This is the capacity of an area to deal with a disturbance. In the case of flood resilience an area has to withstand a flood event and has to respond and recover (Hegger et al., 2016). The system has to remain functioning when a flood event happens and can recover from a flood event. Therefore there are measures necessary that prepare an area to respond and recover from flooding (Walker et al, 2004; Mens et al., 2011). Adaptability and the capacity to absorb and recover have the same meaning. It is all about reducing the consequences of flooding and being able to respond to a flood event so the area can remain functioning, which is in line with evolutionary resilience.

Transformability

Third, the measures that are necessary for flood resilience require not only a physical change, but also a societal change according to Restemeyer et al. (2015). This societal change is called transformability and this is the third aspect of flood resilience. Transformability can be seen as a shift in mind-set of people, the change in mind-set from 'fighting the water to living with the water'. Awareness and willingness to act are important for transformability. Transformability is a big social dimension in flood resilience (Restemeyer et al., 2015). Transformability can be defined as the capacity to change, with the awareness of all new developments. This should lead to the best way to deal with flood risks and become flood resilient. Transformability connects to the fourth strategy (flood preparation) of Flood Risk Management (Figure 4). The capacity to transform and adapt is defined by Hegger et al. (2016) as 'the ability of a system to adjust to climate change, to moderate potential damage, ... or to cope with the consequences.' Important is that a system can adjust to external events and benefits from opportunities that occur. For this, learning and innovation are important aspects that have to be present within the system. Important as well is that an area has to prepare for uncertainties (Folke et al., 2010) and therefore has to be flexible in its approaches. The capacity to change with the awareness of new developments and uncertainties is the key message of Restemeyer et al. (2015) Hegger et al. (2016) and Folke et al. (2010). For this study the three aspects (robustness, adaptability and transformability) are considered as the basis for flood resilience. The fifth and final measure of Flood

Risk Management (Driessen et al., 2016) is flood recovery. This strategy is not a part of flood resilience (Restemeyer et al., 2015) and therefore flood recovery is not part of the three aspects of flood resilience.

Flood Resilience		
Robustness	Reduce flood probability; Technical measures; Spatial measures	Restemeyer et al. (2015); Hegger et al. (2016); Vis et al. (2003); Klijn et al. (2014); Driessen et al. (2016)
Adaptability	Reduce consequences of flooding; Spatial planning; Flood mitigation and prevention	Restemeyer et al. (2015); Hegger et al. (2016); Mens et al (2011); Driessen et al. (2016)
Transformability	Societal change; Awareness; Willingness to act	Restemeyer et al. (2015); Hegger et al. (2016); Folke et al. 2010); Driessen et al. (2016)

Table 1. The three aspects of flood resilience.

Framework for flood resilience

Summarizing the above, flood resilience is a combination of physical and societal aspects. All three aspects are desired for flood resilience (Restemeyer et al., 2015; Hegger et al., 2016). The desired outcome is that all three aspects are present in an area. There can be a trade-off between the capacities in an area (Hegger et al., 2016). For example in an area there can be a lack of robustness and that needs to be improved. While in another area transformability needs improvements. Some aspects might be more present and more extended in an area than others, that depends on the context of an area (Hegger et al., 2016).

Restemeyer et al. (2015) have operationalized flood resilience into a heuristic framework to assess the flood resilience of cities. Although their study focusses on an urban scale, the framework developed by Restemeyer et al. (2015) is useful for this study as well. In the framework each aspect (robustness, adaptability and transformability) consists of content, context and process factors. The first factor is 'content', measures and policy instruments are examples of this. The second factor is 'context', containing the cultural, economic and institutional situations in a system. The third factor is 'process', which refers to the capacity-building of intellectual, social and political capital. Table 2 visualizes the framework of Restemeyer et al. (2015) for assessing the flood resilience of cities. This framework is created for cities but may also be important for regions.

	Robustness <i>'Reduce flood probability'</i>	Adaptability <i>'Reduce consequences of flooding'</i>	Transformability <i>'Foster societal change'</i>
Content Measures and policy instruments	<ul style="list-style-type: none"> - Technical measures (e.g. dikes, dams, barriers) - Spatial measures (e.g. river widening) 	<ul style="list-style-type: none"> - Discourage vulnerable land use in flood-prone areas - Flood-proofing existing buildings and infrastructure in flood-prone areas - Warning and evacuation schemes - Flood insurance/recovery funds 	<ul style="list-style-type: none"> - Risk communication and awareness raising among: <ul style="list-style-type: none"> - Private stakeholders (e.g. brochures, public campaigns, early education in school) - Public Stakeholders (e.g. consensus-building, partnership practices, decision support tools)
Context Strategic issues, Institutional structure and legislation	<ul style="list-style-type: none"> - Water and climate: water as threat - Strong public responsibility for water management - Collaboration between water management and spatial planning on specific projects 	<ul style="list-style-type: none"> - Land-use and socio-economic changes: need to create synergies - Shared legal responsibility public-private - Strong collaboration between water management, spatial planning and disaster management on all projects 	<ul style="list-style-type: none"> - Societal changes: need to establish water as asset - Informal networks fostering a new 'water culture' - New interdisciplinary networks (e.g. 'think tanks') and learning organizations
Process Intellectual capital Social capital Political capital	<ul style="list-style-type: none"> - Expert knowledge in engineering and planning - Good relations among water management and spatial planners - Strong political and financial support for bigger structures (public funds) 	<ul style="list-style-type: none"> - Expert knowledge and local knowledge (vulnerability reduction and adaptation options) - Good relations among water managers, spatial planners and disaster managers; civil awareness and willingness to invest in flood risk management measures - Strong political and financial support for adaptation and a risk-based approach 	<ul style="list-style-type: none"> - Creativity, openness towards new knowledge learning - Mutual trust between public and private stakeholders and social acceptance of new interdisciplinary networks - Change agents, leadership; financial support for informal and interdisciplinary networks

Table 2. A strategy-based framework for assessing the flood resilience of cities. Source: Restemeyer et al. (2015).

The framework of Table 2 gives a clear overview of all factors that are relevant. 'Content' factors refer to the concrete measures and policy instruments of robustness, adaptability and transformability. For robustness a distinction can be made between technical and spatial measures (like river widening). As mentioned before robustness means to reduce the chance of flooding and improves the strength of an area to resist a flood event. Adaptability lowers the consequences of a flood event. This occurs by improving vulnerable areas and buildings. Transformability is seen as a societal change and can be achieved by a change of mind-set of people and parties. The 'context' factors can be seen as an explanation why specific measures are taken and strategies are chosen. An example of this is that robustness measures are more taken in case of a system that has a traditional, sectoral water sector that always has been very strong. For adaptability measures, water management needs to be integrated in the spatial sector. The type of measures can be dependent on the context of an area and system. The third factor of the framework is 'process'. Restemeyer et al. (2015) explains this as

capacity-building. Three capitals are defined in the framework (Table 2), namely intellectual, social and political capitals. The capitals in Table 2 explain what is needed in the process to create more robustness, adaptability and transformability.

Intellectual capital relates to knowledge (Restemeyer et al., 2015; Khakee, 2002), in all manners. Knowledge for technical measures, spatial planning and new innovations. Robustness asks for technical and engineering measures for e.g. dikes, dams and sluices. Adaptability asks for spatial planning, knowledge of the area and options to reduce vulnerability within the area. Finally, transformability requires the knowledge to innovate and create new ideas. Social capital refers to involved stakeholders and the relationship between them (Healey et al., 1999). Relationships between civil engineers, water managers and spatial managers for example. Also relationships between local inhabitants, public and private stakeholders are examples of social capital. Participation, trust and relationships are key elements of social capital. Political capital is seen as the capacity to mobilize actions (Healey et al., 1999). This capital includes the capacity of policy-making and decision-making and the amount of financial resources there are available. Examples of this are public funds and political support actors that take and have leadership. Also the creation of long-term vision is seen as an important aspect of political capital (Gupta et al., 2010).

Regional context

The focus of this study is on flood resilience in a regional context. Therefore a notion concerning the framework of Restemeyer et al. (2015) is that cities and regions have a different scale. A city is an urban area that ends at the boundaries of a city. A region is larger and does not end at city boundaries. The provinces of Friesland, Groningen and the northern part of Drenthe cover a large spatial area. The surrounding areas of cities are part of the region as well. The hinterland of the city is not only of value to contribute to the city's resilience, but is now part of the object of the resilience strategy itself. In regions there can be different parties involved, there is a larger area and there are potentially different physical and societal aspects. Examples of this are the number of governments in the Netherlands (municipalities, provinces, water boards) and the different land users, for example nature and agricultural companies. But the basic aspects for flood resilience (robustness, adaptability and transformability) remain, also when the area changes.

2.4 Governing for flood resilience

Besides the debate about the operationalization of flood resilience, there is also the debate about how to govern for flood resilience. In the 20th century the mobilization of actions against flooding in the Netherlands was many times a reaction after a flood event. In this thesis this is called a reaction due to 'urgency'. By other authors also called the 'window of opportunity' (i.e. Rijke et al., 2012). Urgency was very important for flood defense measures in the Netherlands. An example of a urgent situation is the disaster of 1953, after which the Delta Works have been built and new safety norms were set for dikes (Lintsen, 2002). Also the flood events in 1993 and 1995 have led to a big reaction: the Room for the River projects (Rijke et al., 2012). In the North of the Netherlands a sense of urgency has led to measures after the problems in 1998. At that time there were flood events around and inside the city of Groningen (NRC, 1998). After this, a plan was made and executed for water storage areas in Groningen and Drenthe (Waterboard Noorderzijlvest, 2014). This shows that Dutch water management has been reactive in many occasions. Van der Brugge et al. (2005) state that Dutch water management in the 20th century can be seen as reactive. The reactive measures show that urgency is very important for the mobilization of measures and that political capital is an important aspect in flood measures. Governing flood risk management has been reactive in the Netherlands for a long period. But the focus is nowadays on proactive handling (Van der Brugge et al., 2015).

Driessen et al. (2016) argue that there is a lack of clear understanding of what is the best way to govern flood risks. They mention that governance has an important role in flood resilience management. In their article Driessen et al. (2016) develop recommendations for flood risk management that are interesting to add to the findings of Restemeyer et al. (2015) and Hegger et al. (2016). These recommendations of Driessen et al. (2016) are focusing on the governance perspective of flood resilience. The most relevant recommendations that the governance approach needs are included in this paragraph.

First, for the governance of flood resilience it is important that the measures and approaches for flood risk management should fit within the existing context of the area (Driessen et al., 2016). It is important to understand the context before changes can be implemented. This is mentioned by Restemeyer et al. (2015) in their framework (Table 2) with the 'context' factor. Also Hegger et al. (2016) argue that measures have to fit within the area and that trade-offs between robustness, adaptability and transformability may be needed to fit within a system. This first recommendation shows that context is very important for what type of measures have to be executed in a specific area.

Second, multiple levels of government have their own tasks and responsibilities (Driessen et al., 2016). Depending on the scale of the area different governments are involved in flood risk management and their tasks and responsibilities have to be as clear as possible. Restemeyer et al. (2015) have included social capital in their framework, where relationships and responsibilities are important aspects. In a regional area (instead of a city) there are often multiple governments and parties involved.

Third, another important aspect of governing for flood resilience is that the approach should be multi-sectoral (Driessen et al., 2016). There has to be an integrated approach; different strategies and sectors need to be well coordinated. Flood risk management needs to be connected between all relevant policy domains, for example spatial planning. A strong collaboration between sectors is thus very important, for example between the water sector and the spatial planning sector.

Fourth, Driessen et al. (2016) emphasize that legitimacy is very important for flood risk governance, for which public acceptance and participation are essential. This fits with the aspect of transformability that Restemeyer et al. (2015) and Hegger et al. (2016) emphasize. The aspect of transformability requires a shift in mind-set of people.

Fifth and final, Driessen et al. (2016) argue that for flood risk management a long-term vision is required. With a long-term vision proactive handling is improved. Proactive handling comes than instead of reactive responses, like after the flood event in 1998 (NRC, 1998). Proactive actions stimulate adaptive approaches of flood risk management instead of responding to flood events. This long-term vision is not mentioned in the framework of Restemeyer et al. (2015) or by Hegger et al. (2016). But the presence of a long-term vision is according to Driessen et al. (2016) important to achieve flood resilience.

These recommendations of Driessen et al. (2016) add some important notions to the findings of Restemeyer et al. (2015) and Hegger et al. (2016) for flood resilience. The recommendations give a comprehensive overview of what is needed to govern for flood resilience. Instead of that there are only traditional reactive measures after flood events. For this study the following aspects of governance are considered requirements for flood resilience. These aspects are included in the conceptual framework later in this chapter. In the Table 3 the aspects are highlighted.

Recommendation for governing flood resilience		
Multi-sector and multi-level collaboration	Cooperation and coordination between multiple governments and sectors. This contributes to an integrated approach.	Driessen et al. (2016); Restemeyer et al. (2015)
The development of a Long-term vision	A long-term vision contributes to proactive handling, instead of reactive responses.	Driessen et al. (2016)
Sense of urgency	A sense of urgency helps for the mobilization of actions to prevent flooding and defend the area.	Lintsen (2002); Restemeyer et al. (2015); Rijke et al. (2012); Van der Brugge et al. (2005);

Table 3. Important aspects for governing for flood resilience.

2.5 The Region

Regional Approach

The next step is to determine what is important for flood resilience on a regional scale. The framework of Restemeyer et al. (2015) was created to assess the flood resilience of cities. This study focusses on a regional scale, so that implies differences. There are multiple views on what can be seen as a region. Geographers, economists, historians and lawyers have their own disciplinary view on what regions are (Newman, 2006). One thing is clear: a region is surrounded by borders (ibid.). Paasi (2002) explains the difficulty of defining 'the region', which according to him has to do with the different perspectives of a region. Differences in perspectives of a region, for example social, cultural or geographic perspectives. These differences make it very complex to have one definition for the region (Paasi, 2002) or as Fawn (2009) states: 'regions are difficult to theorize'. Schmitt-Egner (2002) presents the following definition of a region: 'spatial partial unit of medium size and intermediary character whose material substratum is based on territory.' According to Van Langenhove (2013) however a region is more than a territorial space, but it is difficult to grasp what is the non-geographical element of a region. Also Van Langenhove (2013) states that there is not one academic definition of a region.

Although there is not one definition for the region, there is an overall agreement that there are two main types of regions (Paasi, 2002; Gilbert, 1998; Klapka et al., 2016): the administrative (or formal) region and the functional region. The administrative region is defined by rules, for example a geographic border that spatially defines the region (Klapka et al., 2016). Examples of administrative regions are provinces and municipalities in the Netherlands that are separated by administrative borders. A functional region is based on relationships and interaction of flows (Klapka et al., 2016). This means that there are relationships within the region based on human behavior and interaction. Examples of a functional region are travelling flows, an internal mission or ambition. These examples bring interaction between people living in the region and form a functional region (Klapka et al., 2016). These regions are different from the administrative region, because there is the own will for a regional approach, which is not obliged by rules. For the significance of a region it is important to have a regional approach: a region needs a regional approach (Lagendijk, 2007).

First, an important aspects of a regional approach is common goal- and strategy setting according to Lagendijk (2007). Second, also important for a region is leadership according to Sotarauta et al. (2017). Leadership is necessary for getting fragmented or shared actions done. When there is a shared responsibility, leadership is helpful to get things done (Sotarauta et al., 2017). Leadership is important for representing the entire region, not only own places or organizations (Gupta, 2010). A third important aspect of regional importance is identity (Agnew, 2013). A conclusion of Agnew (2013) is that a region is stronger when there is a shared identity within the region. This is also emphasized by Paasi (2003) who argues that regional identity leads to harmony and unity within the region and leads to a stronger regional agenda. For a regional approach goal-and strategy setting, leadership and a shared identity are important aspects.

The difference between the functional and administrative region is important, because the presence of a functional region is much more helpful for a regional approach. In an administrative region, defined by administrative borders, the aspects of common goal- and strategy settings, leadership and regional identity are assumed to be less present. While in a functional region, where the region was

defined by common activity or a shared mission, these aspects are assumed to be more likely to be present, because there are more voluntary relationships. So for a regional approach, the starting point of a functional region (instead of an administrative region) would be very useful. This is also assumed in this study.

Regional Approach		
Goal- and strategy setting	Common goal and strategies are important for a regional approach.	Legendijk (2007)
Shared regional identity	A region is stronger with a shared identity, it helps for a stronger regional agenda.	Agnew (2013) ; Paasi (2003)
Leadership	Leadership helps to get fragmented, shared and common actions done.	Gupta (2010); Sotarauta et al. (2017)

Table 4. Important aspects of a regional approach.

The Resilient Region

Multiple authors (e.g. Christofferson et al., 2010; Dawley et al., 2010; Simmie & Martin, 2009; Hudson, 2010;) have written about regional resilience and resilient regions. However, their work is not about flood resilient regions, but about regional economic resilience. The basic notion about resilient regions is useful for this study as a starting point for the flood resilient region. The combination of the concepts of flood resilience and the resilient region form the backbone of the conceptual framework of the next section.

Simmie and Martin (2009) also use the definition of evolutionary resilience for their work. They argue that a region can become economically resilient when it follows the phases of the adaptive cycle (see Figure 3, p. 11). For a region to become resilient there are key attributes, these are innovation and the connections between institutions (Simmie & Martin, 2009, p. 34). The connection between institutions (organizations) is important for a resilient region in general and fits well with one of the recommendations of Driessen et al. (2016) for governing for flood resilience. Namely that steering at different levels of government is essential for reducing flood risks. In a regional resilience approach multiple governments have to work together.

Hudson (2010) elaborates on the economic resilience of regions. Two important aspects according to Hudson (2010) for the resilient region are (1) the development of strategies to anticipate for changes and (2) the capacity to learn and innovate mentioned by Hudson (2010) as the ‘learning region’. The first condition that Hudson (2010) mentions is that regions must develop long-term strategies and anticipate for changes. This implies the importance of a long-term vision as well: a long-term vision is important to be proactive instead of reactive (Hudson, 2010). The importance of a long-term vision in the case of flood resilience was already mentioned by Driessen et al. (2016) and is now also emphasized by Hudson (2010) for the resilient region in general. A long-term vision helps to develop strategies for the entire region and helps to anticipate to future problems. The second condition, to learn and innovate, connects to the idea of Simmie and Martin (2009) that innovation is important for a resilient region. For the development of strategies and measures regions have to be able to learn and innovate for the best solutions to their problems (Hudson, 2010). Knowledge, innovation and creativity are also

seen as important aspects for flood resilience (Khakee, 2002; Restemeyer et al., 2015) and for resilient regions as well (Simmie & Martin, 2009; Hudson, 2010). Hudson (2010) argues that with these aspects regions should create benefits that will ‘spill over’ to all the communities in the region, so the entire region benefits from the regional approach (Hudson, 2010).

To summarize, according to Hudson (2010) and Simmie & Martin (2009) important aspects of a resilient region are the connection between organizations, learning and innovation and a (long-term) strategy to deal with changes. This all should lead to benefits for the entire region due to the ‘spill-over effect’ (Hudson, 2010). These findings focused on the economic resilience of region. But these aspects are considered as important for this study as well.

Resilient region		
Connection between organizations	Collaboration between multiple governments.	Simmie & Martin (2009); Driessen et al. (2016); Restemeyer et al. (2015)
Learning and innovation	Knowledge, innovation and creativity are an important aspect to develop solutions and strategies.	Simmie & Martin (2009); Hudson (2010)
Long-term vision	A long-term vision helps to develop strategies for the entire region and helps to anticipate for future problems.	Hudson (2010); Driessen et al. (2016);

Table 5. Important aspects of a resilient region.

In this section key characteristics have been described for a regional approach towards a resilient region. These are goal- and strategy setting (Lagendijk, 2007), regional identity (Agnew, 2013; Paasi, 2003), connection of institutions (Simmie & Martin, 2009) and the presence of a long-term vision (Hudson, 2010). In the next and final section of this chapter all these characteristics are combined with the aspects of flood resilience into a conceptual framework.

2.6 Towards the flood resilient region - Conceptual Framework

Based on the literature review in this chapter, the important characteristics of a flood resilient region can be defined. The framework of Restemeyer et al. (2015) of Table 2 is used as a starting point for the conceptual framework (Table 6). This new heuristic framework can be used to assess the flood resilience of regions. It contains aspects that are considered important for flood resilient region. The choice has been made to create a framework that contains the most relevant aspects to answer the first secondary research question, namely 'how to operationalize a flood resilient region? Totally the framework contains of six characteristics. These characteristics have been subdivided into 2 or 3 sub criteria.

The relevant aspects of flood resilience according to Restemeyer et al. (2015) and Hegger et al. (2016) are maintained. These are (1) robustness, (2) adaptability and (3) transformability. Hegger et al. (2016) argue that all three aspects are desired for flood resilience. The desired outcome is that all three aspects are present in an area. Robustness is subdivided into two sub criteria: technical and spatial measures. Adaptability has been subdivided into spatial planning and mitigation and prevention. Transformability has been subdivided into awareness and willingness to act.

Added in the conceptual framework are the following characteristics that are required for a flood resilient region: (4) a regional approach, (5) a long-term vision and (6) a sense of urgency. The last three characteristics are explained in paragraphs 2.4 and 2.5. In the conceptual framework the regional approach has been subdivided into three sub criteria: common goals- and strategies, shared identity and leadership and collaboration and coordination. Long-term vision has been subdivided into common (long-term) vision and proactive handling. A sense of urgency has been subdivided into mobilizations of actions and constant political and financial support.

The conceptual framework 'Towards the flood resilient region' of Table 6 contains the important characteristics of the flood resilient region, it gives an overview of what characteristics are required for a flood resilient region and is the basis for the empirical research of this study. Figure 5 is a visualization of the conceptual framework.

Flood Resilient Region	Description	References
1. Robustness - Technical measures - Spatial measures	Reduce the probability of flooding by flood defense, using spatial and technical measures.	Driessen et al. (2016); Hegger et al. (2016); Restemeyer et al. (2015)
2. Adaptability - Spatial planning - Mitigation and prevention	Reduce consequences of flooding, by rules, mitigation and preventing measures.	Driessen et al. (2016); Hegger et al. (2016); Restemeyer et al. (2015)
3. Transformability - Awareness - Willingness to act	Creating a societal change that brings flood preparation, awareness and willingness to act against flood risks.	Driessen et al. (2016); Hegger et al. (2016); Restemeyer et al. (2015)
4. Regional Approach - Common goals and strategies - Shared identity and leadership - Collaboration and coordination	An approach with a common goal- and strategy setting, a shared identity and leadership that leads to a stronger regional agenda. This implies the a good collaborations and coordination between parties.	Agnew (2013); Driessen et al. (2016); (Gupta et al., 2010) Lagendijk (2007); Simmie & Martin (2009);
5. Long-term vision - Common (long-term) vision - Proactive handling	The development of a long-term vision that leads to adaptive long-term flood risk management measures. Proactive handling is improved, instead of reactive responses.	Driessen et al. (2016); Hudson (2010)
6. A sense of urgency - Mobilization of actions - Constant political and financial support	The mobilizations of actions against to prevent flooding and defend the area. Therefore financial support is needed as well as the political agenda.	Lintsen (2002); Restemeyer et al. (2015); Rijke et al. (2012); Van der Brugge et al. (2005);

Table 6. Conceptual framework: Towards the Flood Resilient Region.

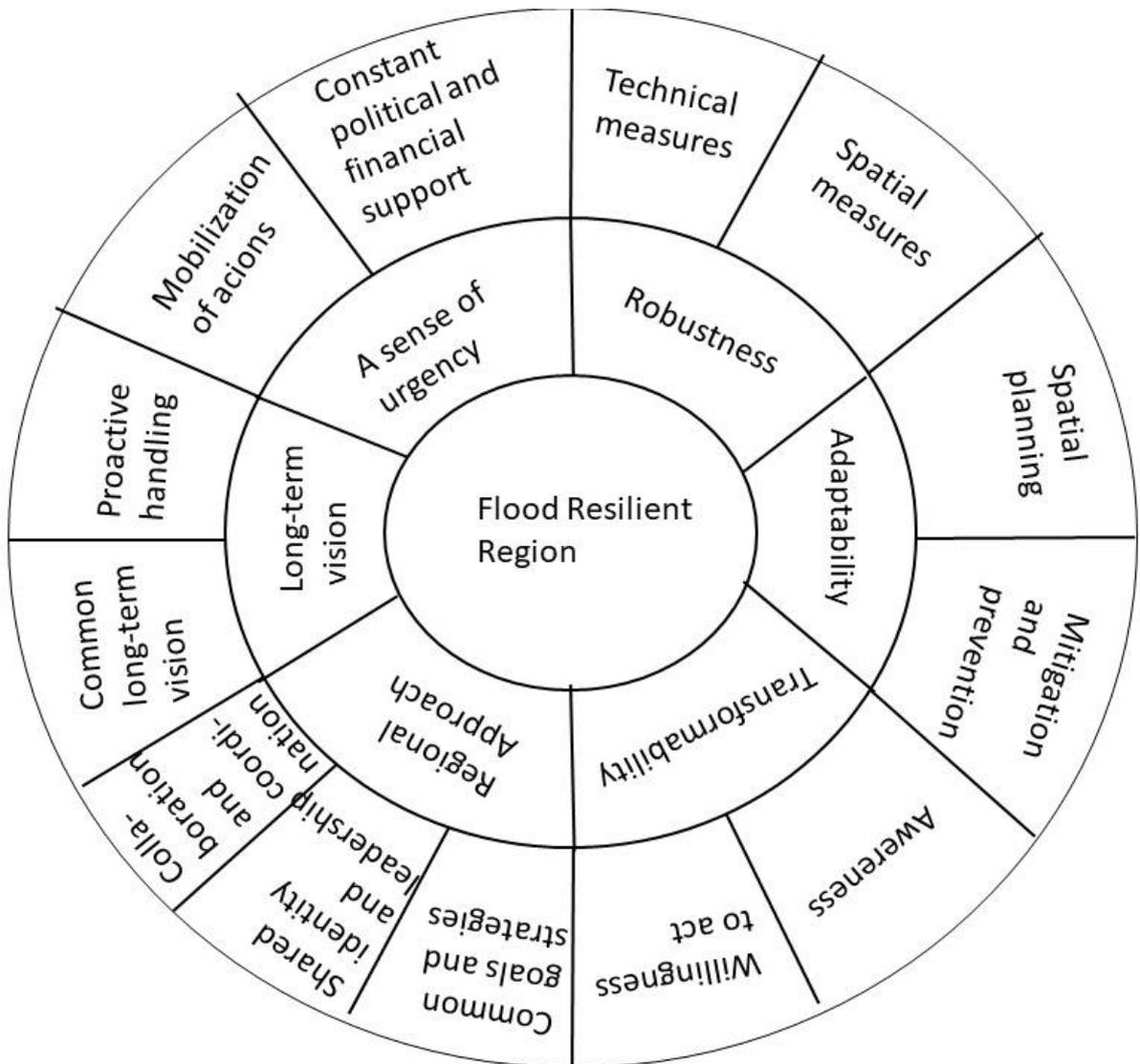


Figure 5. Visualization of the conceptual framework (inspired by Gupta et al., 2010): Towards the Flood Resilient Region.

Chapter 3 - Methodology

3.1 Research Approach

This study focusses on flood resilience in the North of the Netherlands. Chapter 2 already gave a theoretical background of the concept of the flood resilient region. The conceptual framework (Table 6) shows six characteristics that are considered important for a flood resilient region. The focus of the research lies on the aspects of the framework and to what extent these aspects are present in the North of the Netherlands, the region of this study. The methods that are used to do this research are explained in this chapter.

In this methodology chapter is explained why and how the data has been collected and which data has been collected. Multiple methods have been used to answer the research question; namely to find out to what extent the north of the Netherlands is a flood resilient region. This is done by semi-structured interviews, which are a way to do qualitative research (Clifford et al., 2010). Besides the interviews this study also contains research of policy documents. The use of these multiple methods lead to stronger results of the research, which leads in the end to a stronger conclusion (Clifford et al., 2010). This chapter contains information about the used methods, the data collection, the respondents of the interviews, the policy documents and the data analysis. Besides the interviews this study uses literature, news articles and policy documents to come to comprehensive results.

3.2 The case: Demarcation of the region

As explained in Chapter 1, the region of study contains the area of Friesland, Groningen and North-Drenthe, with exception of the Wadden Islands. This area is the combination of two working regions existing from the Delta Program (Rijksoverheid, 2018). Although the different provinces may differ in their problems, approaches and plans, they report as one administrative region to the Delta commissioner (Rijksoverheid, 2018). This study views the area as one region. The two working regions are 'Fries Bestuursakkoord Waterketen' and 'Waterketensamenwerking Groningen en Noord Drenthe' (Figure 6). Together they form one of the seven administrative areas that report to the Delta commissioner about the findings and progress concerning climate adaptation (Rijksoverheid, 2018).

In this study this area (Groningen, Friesland and the northern part of Drenthe) is considered as the North of the Netherlands. The collaboration between the governments in this area is a main topic of interest. This study aims to gain insights in the collaboration and progress in the North of the Netherlands concerning flood resilience. The reason that this study views this area as one region is because the area already has to report as one region on the aspect of climate adaptation to the Delta commissioner.



Figure 6. Map of the working Regions in The Netherlands (Rijksoverheid, 2018) , 'Fries Bestuursakkoord Waterketen' and 'Waterketensamenwerking Groningen en Noord Drenthe' are clearly visible in the North of the Netherlands.

3.3 Data collection

To assess the flood resilience of the North of the Netherlands, two methods have been used: semi-structured interviews and document analysis. The literature review in Chapter 2 is the basis for the empirical research of this study. The literature study combines flood resilience and a regional approach, to develop a framework for the assessment of the flood resilience of regions. The literature used in Chapter 2 was obtained from books, scientific journals and (some) non-scientific sources.

Gordon & Yuki (2004) recommend to combine multiple methods when doing qualitative research. Therefore this study uses the method of semi-structured interviews and document analysis. The aim of the interviews is to collect in-depth information (Clifford et al., 2010). The interviews are semi-structured, so that the participants have the possibility to show their knowledge. The choice for semi-structured interviews was made to collect the most relevant information from the participants. The sources of the data are spoken conversations. These conversations are recorded and fully transcribed. These texts are primary data (Clifford et al., 2010). During the interviews the participants have been asked about the important aspects of the flood resilient region. In Appendix 1 the interview guide is added for the transparency of the research. For the entire transcripts the author can be contacted.

The policy analysis focusses on the presence of aspects of the flood resilient region in policy documents. For each aspect research has been done in policy documents of organizations in the North of the Netherlands. When policy documents contained important information this is included in the results in Chapter 4. The data of the policy analysis are from official sources of the organizations (water boards, national government and provinces). These data are used to add to the interviews and verify the information obtained from the interviews. The findings from the interviews and policy analysis form the answer to the second secondary research question, namely: *How do measures in the North of the Netherlands contribute to the flood resilient region?*

The framework of the flood resilient region (Table 6) is used to assess the North of the Netherlands. The interview guide contains questions about the characteristics of the conceptual framework. The data that is collected from the interviews and document analysis are analyzed and the results of it are given in Chapter 4. The conclusions are drawn in Chapter 5, to answer the primary research question, namely: *To what extend can the North of the Netherlands be characterized as a flood resilient region?* In the final chapter the use of the conceptual framework is discussed and evaluated.

Question	How	Source	Method
How can the concept of a flood resilient region be operationalized?	Review of existing literature to create a theoretical framework with the important aspects of a flood resilient region.	Literature about flood resilience and regional studies	Literature study by reviewing scientific articles.
How do measures in the North of the Netherlands contribute to the flood resilient region?	Reading policy documents and interviews with responsible government officials.	Official policy documents and interviews	Analysis of transcripts and documents by use of coding

Table 7. Data collection framework.

3.4 Selection of respondents

For this study ten interviews are held. The interviews have been fully transcribed and the texts have been coded. These interviews are the primary data of this study. The respondents are all experts in the water field and are divided over multiple organizations in the North of the Netherlands. In Table 8 the respondents and their function and organization are showed, as well as the date of the interview. The participants are experts in this study, therefore the choice was made for semi-structured interviews to give them time and space to talk about their knowledge about flood resilience. In this manner the participants had more own contribution during the interview. In this way there was as much relevant information collected as possible.

There is chosen for these participants (Table 8) because they all represent organizations in the region. For this study there was the need to interviews experts from the three provinces (Groningen, Friesland and Drenthe) and three water boards in the area (Noorderzijlvest, Friesland and Hunze en Aa's). Also the municipality of Groningen was important to interview, because this is the biggest municipality in the region. From the province of Groningen three respondents have been interviewed, because they have very different knowledge. The first respondent of the Province Groningen works on water and spatial planning, the second on coastal protection and the third works on climate adaptation in the region. As a tip from a policy officer of the province of Groningen an interview also has been held with the Water Company of Groningen, to understand the side of another party that has to deal with future water questions. So the main focus is the entire region, with extra interviews held with the municipality of Groningen and the Water Company of Groningen. The respondents together have knowledge on water safety, climate adaptation, future water challenges and spatial planning. They are all working inside the region. Together they are seen as a reflection of the water experts in the North of the Netherlands and they therefore give an impression of the current situation in the North of Netherlands. The participants have been asked about important policy documents of their organization.

#	Organization	Function	Datum
1	Waterboard Noorderzijlvest	Manager Project Overstijgende Verkenning (POV) Waddenzeedijken	17 May 2018
2	Province Groningen	Policy officer water	17 May 2018
3	Province Drenthe	Policy officer water	1 June 2018
4	Municipality Groningen	Policy officer spatial planning & design	7 June 2018
5	Waterboard Hunze en Aa's	Hydrologist	7 June 2018
6	Province Groningen	Policy officer water and coastal development	13 June 2018
7	Province Groningen	Policy officer space and community	15 June 2018
8	Province Friesland	Water ambassador Friesland/frontrunner spatial adaptation	4 July 2018
9	Water company Groningen	Policy advisor water	5 July 2018
10	Waterboard Fryslân	Policy advisor water protection and theme coordinator water safety	11 July 2018

Table 8. Interview participants, in chronological order of the date of the interview.

3.5 Selection of policy documents

For this study policy documents have been analyzed to add information to the findings of the interviews. The policy documents are from the organizations where the participants of the interviews work. These organizations are the provinces and the water boards. Also added is the Dutch Delta Program, that adds information from a national point of view. The analysis of the policy documents is done to add findings to the interviews and to find contradictions and similarities between the interviews and policy documents.

#	Name of policy document	Author / Organization
1	Project Droge Voeten 2050	Province Groningen (2010)
2	Waterhuishoudingsplan 2016-2021	Province Friesland (2016)
3	Beekdalenvisie 2030	Province Drenthe (2013)
4	Deltaprogramma 2019	Dutch Government (2018)
5	Beheerprogramma 2016-2021	Water Board Hunze en Aa's (2015)
6	Fries bestuursakkoord waterketen 2016-2020	Water Board Friesland (2016)
7	Waterbeheerprogramma 2016-2021	Water Board Noorderzijlvest (2015)

Table 9. Policy documents used for the analysis.

3.6 Codes

The interviews and policy documents have been coded them based on the six characteristics of the theoretical framework (Table 6). The aspects that are important for the flood resilient region are analyzed from the transcripts of the interviews and the policy documents. The analysis is done by coding. Key words are defined from the theory and from the interviews and policy documents, so inductive and deductive coding is used (Clifford et al., 2010). Together the keywords which are relevant for the aspects of the flood resilient region are combined in table 10. The keywords are a combination

of inductive and deductive coding. Appendix 9 shows how the coding has been done. Appendix 9 is one page of coded transcribed text of an interview. The respondent of that interview is anonymized.

The analysis of the data gives an answer to the question if the North of the Netherlands can be seen as a flood resilient region. If there are differences between organizations, they will become clear from the data as well as similarities. The same codes have been used to analyze the interviews and the policy documents. In this way the interviews can be checked, so the policy documents are either way supporting the interviews or contradicting the interviews. Also the policy documents give supportive information from aspects that have not been discussed during the interviews. The aspects from the theoretical framework (Table 6) are the same as the aspects in Table 10. Each aspect of the theoretical framework has been analyzed separately (Appendix 3-8) and have been given a score (Appendix 9). These scores are explained with the findings in Chapter 4. Chapter 4 describes each characteristic in a separate section. The colors of the codes (Table 10) correspond to the colors they have been given in the transcripts of the interviews. Some codes are from both theoretical and empirical findings.

Characteristics from the conceptual framework (Table 6)	Codes from theory	Codes from interviews/ policy documents
Robustness	Reduce flood probability; Spatial and technical measures; Flood Defense	Basic safety; Flood; Flood defenses; Norm; Quay Elevation; Robust; Storage area; Risk; Water safety.
Adaptability	Reduce consequences of flooding; Rules and preventing measures; Mitigation	Adaptive planning; Building in low areas; Minimalize; Multiple goals; Nature; Natural organizing; Spatial planning; Spatial solutions; To add; To link.
Transformability	Societal Change; Awareness; Willingness to act; Preparation	Accept; Alive; Awareness; Change; Fear; Prepare; Sense; Signals; Working on it.
Regional Approach	Common goal- and strategy setting; Shared identity; Regional Agenda; Connection of institutions; Collaborations; Coordination.	Central; Control; Discuss; Direction; Frontrunner; Manage Regional; Priority; Pull up together; Responsibility; Sharing knowledge; Supervision; Support; Together; Trigger.
Long-term vision	Development of a long- term vision; Adaptive measures; Proactive handling.	Common vision; Delta Program; Develop; Future; Long-term; Prepare; Strategy; Vision; 2050.
Sense of urgency	The need of action; Financial support; Political Agenda.	Actual; Budget; Costs; Disaster; Extreme; Fear; Finance; Financial; Investments; Money; Urgent.

Table 10. Codes of the analysis of the characteristics of the flood resilient region.

3.7 Scoring system

The sub criteria of the conceptual framework (Table 6) have been scored based on the codes of table 10. The possible scores are + (positive, green color) +/- (neutral, yellow color) and – (negative, red color). These scores are adopted from the adaptive capacity wheel from Gupta et al. (2010). The aggregated scores of the sub criteria form the score of the 6 characteristics. The scores are the translation of the interpreting of the findings of the researcher.

The scores per characteristic and sub criteria are explained in Chapter 4. A score is based on the judgement concerning the presence and importance of the sub criteria in the region. Together these scores form the conclusion about the North of the Netherlands as a flood resilient region. Important quotes of the interviews are given in Appendix 3 to 8. The quotes from the interviews per sub criteria of the theoretical framework, that are considered as most important, are the key quotes. These key quotes are included in Chapter 4 to strengthen the findings.

3.8 Transparency and Ethics

The ethical aspects of scientific research are followed (Clifford et al., 2010). The participants have been sent the questions some time before the interviews, so they knew the subjects of the interview. The interviews were well prepared. There was permission to record the interviews and to use the information for this study. The participants are kept anonymous in this study. When a participant has mentioned to have interest in the results of the study, these will be sent to the participant. A database has been created to keep all data collected. This is done for the certainty of the transparency. All documents, articles and transcripts of the interviews are stored in this database. This collection is only used for the purpose of this specific study and will be deleted one year after finishing this study.

Chapter 4 - Findings

4.1 Introduction

This chapter contains the findings of this research. The results are based on the analysis of interviews with experts, news documents and policy documents available of the organizations in the North of the Netherlands. This chapter is divided in sections that contain the characteristics that together form the conceptual framework (Table 6, p.24). These are (1) robustness, (2) adaptability, (3) transformability, (4) regional approach, (5) long-term vision, and (6) a sense of urgency. In Chapter two it is explained that these six characteristics are required for the flood resilient region. Each sub criteria of the characteristics is scored in this chapter. Based on the findings from the analysis Chapter 5 finalizes with the conclusion of this study.

In the first chapter the demarcation of the region is explained. For clarity: the North of the Netherlands is the area of Groningen, Friesland and the northern part of Drenthe. This is an area meeting of 2 working regions of the Delta program Spatial adaption (Rijksoverheid, 2018). These working regions are 'Fries Bestuursakkoord Waterketen' and 'Waterketensamenwerking Groningen en Noord Drenthe'. Together they form one area that reports to the Delta commissioner about their findings and progress concerning climate adaptation.

4.2 Robustness

Sequent of the conceptual framework (Table 6), robustness is divided in two sub criteria: technical measures and spatial measures. As explained in Chapter 2 robustness is defined as minimizing the chance of flooding (i.e. Restemeyer et al., 2015; Hegger et al., 2016). This is an important aspect of the flood resilient region. From the analysis of the interviews and policy documents it becomes clear that robustness is the starting point for water safety and flood resilience in the research area of Groningen, Friesland and the northern part of Drenthe. From each respondent of water boards, provinces and the Municipality of Groningen it becomes clear that robustness has a very high priority concerning water safety and flood risk (Appendix 3). In appendix 3 the quotes of the interviews are given of the robustness aspect. This shows that spatial and technical measures for flood resilience have an important role in the region. The importance of norms for primary and regional flood defenses to minimize the chance of flooding show that. Also the solution of the water storage in Groningen and Drenthe (Appendix 2) is an example of a robustness measure. Safety is a very important aspect turns out of the interviews (Appendix 3) and policy documents. This is not surprising in a country as the Netherlands, where flood defense is important for a long time already (i.e. Lintsen, 2002; Rijke et al., 2012; Van der Brugge et al., 2005; Vis et al., 2003).

Technical measures

The most important water protection measures of the Netherlands are the primary flood defenses (Rijksoverheid, 2018). These are the defenses that protect the Netherlands from water of among others the North Sea, the Waddensea, the IJssellake and big rivers as the Rhine and the Meuse. The

responsibility for these primary flood defenses is of the national government and the water boards. The national government sets norms for these flood defenses and the water boards maintain these defenses, so they meet the standards. These norms are newly set in the National Flood Protection Program (2017). Figure 7 shows the defenses, the different colors show the different norms. These norms are based on the risk (probability and consequences) of a flood event. These norms have to be realized by water boards and Rijkswaterstaat in 2050 (Rijksoverheid, 2018). According to the policy advisor water protection and theme coordinator water safety of Water Board Friesland: ‘This is the basic safety level to protect from floods from the IJssellake, North Sea and Waddensea. That is the responsibility of the national government and water boards.’ Besides these primary flood defenses there are regional flood defenses. Examples of these regional flood defenses are inland rivers, channels and lakes. These regional flood defenses also has norms (Beheerprogramma 2016-2021, Water Board Hunze and Aa’s, 2015; Waterbeheerprogramma 2016-2021, Water Board Noorderzijvest, 2015). These norms are set by the provinces of the Netherlands for their own areas. The management of these regional flood defenses is done by the water boards in the area. The respondents of the water boards and provinces confirm that this is the way measures are taken for regional flood defenses.

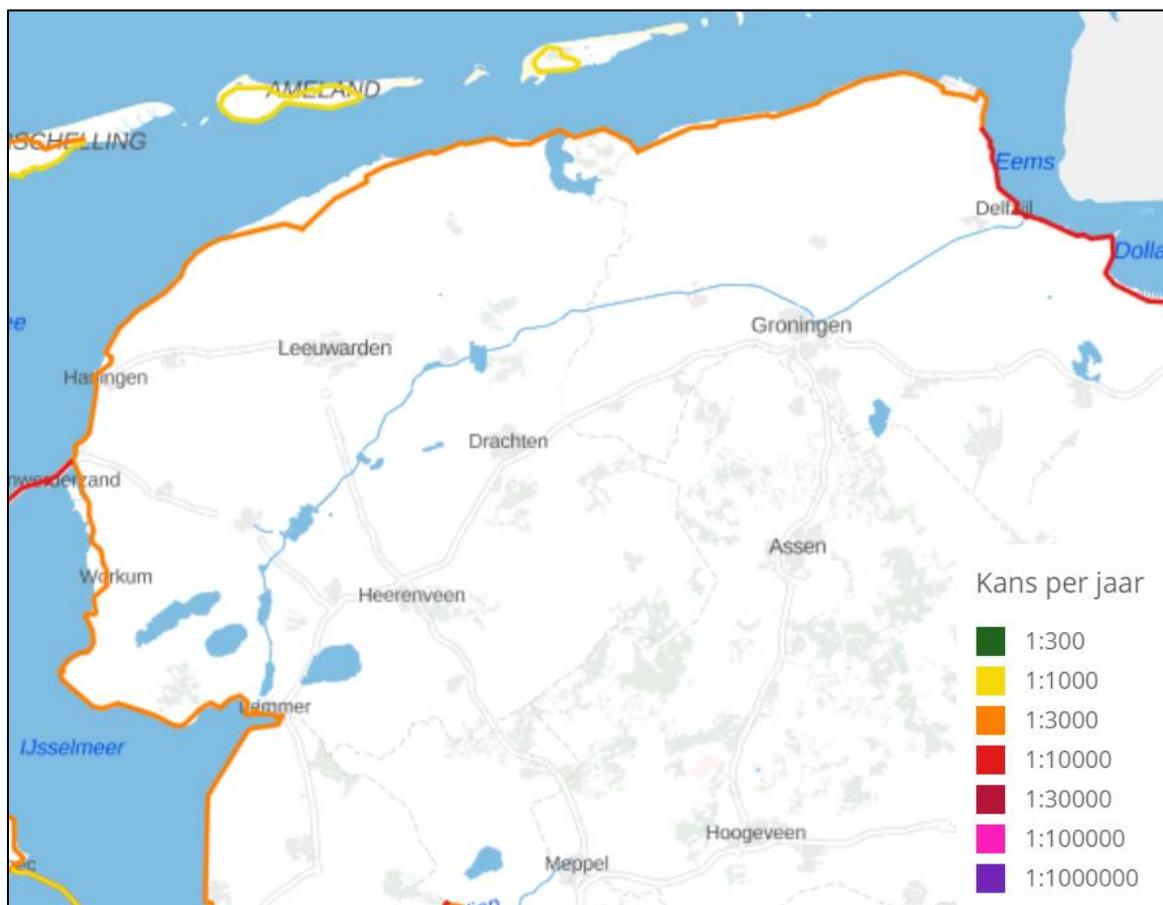


Figure 7. The flood defenses of the North of the Netherlands of the National Flood Protection Program ‘Hoogwaterbeschermingsprogramma’ (2017).

Spatial Measures

After a flooding in 1998 (NRC, 1998) in the city and area of Groningen, there has been chosen to create water storage areas to prevent that flooding happens more often. An example of a spatial robustness measure in the North of the Netherlands are the water storage areas. These are spatial measures, which fit within the robustness aspect (Restemeyer et al., 2015). Multiple storage areas in the North

of the Netherlands are located in the provinces of Drenthe and Groningen and in area of the water boards of Noorderzijlvest and Hunze and Aa's (Appendix 2). These storage areas were created in the last two decades. These storage areas are there to store water when there is the threat of flooding. Especially for the province of Groningen these areas are important and that is also shown by their program Dry Feet 2050 (Droge Voeten 2050, Province Groningen, 2010). The policy officer water of the Province Groningen explained: 'The solution for flooding was the combination of water storage in the outside lying area and more water storage of the existing water by quay elevation. The water storage areas are a very strong solution.' That appears also from the statement of the hydrologist of the water board Hunze and Aa's: 'The large drain capacity combined with a large storage capacity makes the system very robust. If a pumping station collapses, there is the option to use the storage system and the other way around. That makes it very strong.'

For the robustness of the Netherlands there are responsibilities for the national government, provinces and water boards (Rijksoverheid, 2018). This also becomes clear from the analysis of the interviews. The norms are set by a province or the national government and the task to manage these flood defenses is for the water boards.

The robustness aspect that Restemeyer et al. (2015) and Hegger et al. (2016) describe by reducing the probability of flooding by using spatial and technical measures is very present in the region. This aspect comes forward in the policy document Dry Feet 2050 (Province Groningen, 2010) and the interviews (Appendix 3). Lintsen (2002), Rijke et al. (2012), Van der Brugge et al. (2005) and Vis et al. (2003) explain that water defense always was important in the Netherlands and this analysis shows it is still very important in the North of the Netherlands. The score for both sub characteristics of robustness are positive. Because of the important presence of robustness in the policy documents and the quotes of the respondents. Technical and spatial measures are present and important in the region judging by the documents and interviews.

Flood Resilient Region	Sub characteristic	Key quotes	Score
1. Robustness	Technical measures	<ul style="list-style-type: none"> - There is a high water protection program in the Netherlands. Each dike that doesn't meet the standards, has to be improved. - We call it a robust system, a system needs to meet the water safety standards. 	+
	Spatial measures	<ul style="list-style-type: none"> - The choice from the water storage areas came from multiple studies. The combination of the new storage and the existing water drainage is really strong. - You want a basic safety in the whole country and for important areas a sort of economic addition. 	+

Table 11. Score of robustness in the region.

4.3 Adaptability

Following the conceptual framework of Table 6, adaptability is divided into two sub criteria. These are on the one hand spatial planning and on the other hand mitigation and prevention. Adaptability is defined as minimizing the consequences of flooding. This is an important aspect of flood resilience according to i.e. Restemeyer et al. (2015) and Hegger et al. (2016). The quotes from the interviews of the aspect of adaptability are given in Appendix 4. The analysis of the interviews and policy documents emphasize the importance of adaptability. The respondents of the interviews show that adaptability can be interpreted in different ways. The first way is mitigation and prevention for the effect of climate change. That means that organizations adapt themselves to the climate, climate change and its consequences. Examples of this are measures and rules against flooding, heavy rainfall, heat and drought. The second view is that adaptability is considered purely as spatial planning by multiple respondents. Spatial planning contains more than only water. It is a combination of planning of cities, nature, agriculture, water, road infrastructure and many more aspects.

Mitigation and prevention

Flood mitigation and prevention are the measures to minimize the consequences of flood events as explained by Driessen et al. (2016). 'It is needed to prevent problems caused by climate change' was stated by the policy advisor water protection and theme coordinator water safety of Water Board Friesland. The water storage areas (Appendix 2) created after the flood events of 1995 and 1998 (NRC, 1998) are an example of these measures to prevent problems caused by climate change. These measures minimize the consequences of a flood event.

The strength of the North of the Netherlands for spatial solutions is that there is space for these solutions. Other parts of the Netherlands are much denser populated and built. A quote from a hydrologist of the Water Board Hunze and Aa's is that the strength of the area is used very well: 'There is made use of the space there is here. So actually there is a spatial solution used for flooding instead of a technical, the storage solution is used. It shows that using the strength of an area is very important. This is highly context dependent of course.' In the North of the Netherlands the space there is, is used for spatial measures for flood defense. That may be seen as logical, but this solution uses the space in a clever way. This strategy uses the strength of the area.

Spatial planning

What makes this sub characteristic difficult in the opinion of the policy advisor water protection and theme coordinator water safety of the Water Board of Friesland is that spatial planning in the region is the responsibility of the provinces. 'The province has spatial planning as its primary function. Because water aspects are not the only factors in spatial planning, a way to get things done is to link water solutions to other solutions.' An example of spatial planning is the redesigning of creeks in Drenthe. There was the plan to redesign creeks in a natural way, so the creeks can handle more water. This is stated in the Beekdalensvisie 2030 (2013) of the province of Drenthe. This plan was done by the help of a touristic, recreative element. The first approach was to handle more water as response to the climate, but this was only possible by adding the recreative goal to get the support for the measures. This shows that climate adaptability has not always the highest priority, but by smart linking of area-based planning, the climate adaptability measures can be achieved. In this way working on flood resilience can create multifunctional benefits.

Linking solutions was also the case at the water storage areas in Groningen and the northern part of Drenthe (Appendix 2). The policy officer spatial planning and community of the Province Groningen mentioned there almost always has to be a link between measures: ‘Measures to deal with climate change always have to link with other developments in an area. Solely, it hardly succeeds. If you only construct a water storage area, people will not support it. If you link it to nature and recreation, than people like it and support it.’ In other words linking and combining solutions is the key to success of adaptability measures according to the policy officer water of the Province Groningen. Dry Feet 2050 (Province Groningen, 2010) emphasizes that a combination between the nature (EHS) and water retainment is really important and can only be done by spatial planning. This is also emphasized by the Province of Drenthe (Beekdalensvisie 2030, 2013) where the redesigning of the creeks improves safety, but also improves recreation while at the same time the measures have to deal with agricultural interests.

By respondents in the North of the Netherlands adaptability is seen as mitigation, prevention and spatial planning to reduce the consequences of flooding. In that way adaptability is an important aspect of measures in the region. Because of the importance of the sub characteristics in the interviews (Appendix 4) and the policy documents (Dry Feet 2050, Province Groningen, 2010; Beekdalensvisie 2030, Province Drenthe, 2013), both got a positive score concerning their presence and importance in the region.

Aspect of the Flood Resilient Region	Sub characteristic	Key quotes	Score
2. Adaptability	- Spatial planning	<ul style="list-style-type: none"> - We are giving this area an extra function. This project is not only water safety, but also innovation for agriculture and nature. - We want to combine other functions with water safety, for example recreation and nature. 	+
	- Mitigation and prevention	<ul style="list-style-type: none"> - Spatial planning is important, because spatial adaptability is needed to prevent problems caused by climate change. 	+

Table 12. Score of adaptability in the region.

4.4 Transformability

Transformability is divided into two sub criteria, these are awareness and willingness to act. Transformability is seen as a societal change by i.e. Hegger et al. (2016) and Restemeyer et al. (2015) and is the third characteristic of the theoretical framework of this study. The change towards more awareness of the risks of flooding and towards active citizens in protecting themselves from flooding. In the case of the North of the Netherlands there is the notion in the interviews with the respondents that the awareness of citizens is very important and that the awareness is raising slowly. In Appendix 5 the quotes of the interviews are given concerning transformability.

Awareness

Awareness of citizens in the North of the Netherlands is something that might be expected to be there already. The area is partly located below sea level and is protected by many flood defense measures, such as the dikes at the Waddensea and the IJsselake. Water safety in the Netherlands has always been a matter of public responsibility, of the state and the water boards (Lintsen, 2002). The policy advisor water protection and theme coordinator water safety of the Water Board of Friesland mentions that some citizens do not have any awareness at all. That is also the case within the Municipality of Groningen according to the policy officer spatial planning and design. The policy officer spatial planning & design said: 'The expectation is that the stresstests will strengthen the awareness, also from municipalities.' That implies that even in municipalities there is not always awareness for water safety and flooding.

The 'stresstest' is a new phenomenon in the Netherlands. All municipalities in the Netherlands are obliged to execute a stresstest within their municipality and report the results to the national Delta commissioner before 2020 (Rijksoverheid, 2018). The stresstest has to show the vulnerabilities within a municipality in case of heat, drought, heavy rainfall and flooding. The goal of the stresstest is that the vulnerable parts in the municipalities get attention and ultimately are adapted to the risk (Rijksoverheid, 2018).

What is striking to see is that organizations do not precisely know what they want when it comes to awareness raising. 'This means that when the awareness is bigger, the acceptance is bigger as well', said the policy advisor water protection and theme coordinator water safety of the Water board of Friesland. 'On the other side, don't scare people', was the view of the water ambassador of Friesland. 'If you tell people they have a problem, they start looking for the one who caused it.' So organizations are not sure what they want to reach with awareness and awareness raising, while they all acknowledge that it is an important issue. In Fries Bestuursakkoord Waterketen 2016-2020 the Water Board Friesland (2016) addresses the importance of awareness for water safety, but also notices that it is not present in the area. This strengthens the analysis of interviews that the awareness among citizens in the region is something to work on.

Willingness to act

Another aspect of the analysis of the interviews is that the responsible organizations have protected the country so well, that there are hardly any problems in the Netherlands. Also in the North of the Netherlands many people don't even know that a flood event can occur (NOS, 2016). That makes the awareness much lower than in other countries in Europe. But the respondents also notice that the

willingness to act is changing due to heavy rainfalls and the attention for climate change. The policy advisor of the water company in Groningen stated: ‘There are certain effects occurring, heavy rainfall and longer dry periods. People thought that climate change will not be happening in their lives, but you can see the effects already. Due to these effects people actually see the effects of climate change and therefore the awareness for flooding raises.’ The project manager of the water board Noorderzijlvest notices this as well. The project manager mentions: ‘When people notice effects of climate change, they want the organizations to solve these problems. And that is what is happening now already with the stresstests.’

The main finding of this aspect is that the awareness is raising already because of the effects of climate change, heavy rainfall, heat and drought. But because flood defense is a public task in the Netherlands, it is expected that the government deals with these problems. The governments are taking measures already, with the stresstest and the plans to make areas as safe as possible. The policy officer water of the Province Drenthe summarizes this as follows: ‘Governing is looking to the future, there are many signs of climate change and we have to deal with it. That is our task, but it is very difficult to work with that vision when parties don’t see the same problem. Therefore the awareness of the citizens is important, because they might be needed in the near future.’ In this system the awareness and willingness of the public is necessary to take the measures that are required to deal with climate change. Therefore transformability is confirmed to be a very important aspect of the flood resilient region.

The score for awareness is neutral, because awareness is not always presence in the area, but is growing according to the respondents. Also the willingness to act got a neutral score. People are expecting the responsible organizations to deal with possible problems, but the current circumstances (heavy rainfall, dry periods) make people more aware and willing to help. Because both sub criteria are judged as important, but not always present in the region, the scores are not negative. But both sub criteria are not present enough in the region to obtain a positive score.

Aspect of the Flood Resilient Region	Sub characteristic	Key quotes	Score
3. Transformability	Awareness	<ul style="list-style-type: none"> - Climate change is often in the news and now the new stresstests are there, so we notice that there is more awareness of people and governments for climate change and water safety. - The awareness is raising slowly. That is partly due to heavy rainfall and dry periods. 	+/-
	Willingness to act	<ul style="list-style-type: none"> - The willingness of the citizens is very important, citizens, companies and agriculture, everyone will see the consequences. - People support plans until it comes to their own living spaces. 	+/-

Table 13. Score of transformability in the region.

4.5 Regional approach

In the conceptual framework the regional approach is divided into three sub criteria, these are goal and strategy setting, shared identity and leadership, collaboration and coordination. A regional approach is a key principle in realizing a flood resilient region and therefore is part of the theoretical framework. Primarily the provinces have the role for spatial planning, while water boards have the responsibility for water safety. Both work together to come to good results for both spatial planning and water safety. Water boards and provinces are not covering the same areas, while there are 12 provinces and 21 water boards in the Netherlands (Unie van Waterschappen, 2019). In the research area North of the Netherlands - the area of Friesland, Groningen and the northern part of Drenthe - there are three provinces and three water boards. All the respondents mention that the provinces and water boards work together a lot and are dependent of each other. The provinces are dependent of the water boards to manage water safety well and water boards are dependent of the provinces to set norms and give permits for projects. But the presence of common goals and strategies as explained in the theoretical framework are not present. This is further explained in the next section of the long-term vision (4.6). The quotes from the interviews of the aspect of the regional approach are given in Appendix 6.

Goal and strategy setting

The administrative region of Groningen, Friesland and the Northern Part of Drenthe is a working region and has to report to the Delta commissioner (Rijksoverheid, 2018). It is an administrative region like Klapka et al. (2016) describe. The region is obliged by the national government to report its progress concerning climate adaptation. There is no other real strategy from a regional point of view apart from the obligations to report to the Delta commissioner, although the region has the ambition to adapt to climate change (Noord Nederland Climate Initiative, 2017). Also in Groningen a Global Centre of Excellence on Climate Adaptation is opened in September 2018 (Global Centre on Adaptation, 2018) as explained in the introduction. This does show the ambition of the region to deal with the effects of climate change. But a real common goal and strategy like Lagendijk (2007) describes does not come forward from the administrative region.

Shared identity and leadership

In the administrative region there is not a party (one of the three provinces) that takes the leadership role according to the policy officer space and community of the province of Groningen. She also mentions that the three provinces in the region do not have a regional identity, which is emphasized by Agnew (2013) and Paasi (2003). All provinces have their own policy documents (Dry Feet 2050, Groningen; Waterhuishoudingsplan 2016-2021, Friesland; Beekdalenvisie 2030, Drenthe) and not a common one. The aspect of shared identity and leadership does not seem to be present in the administrative region judging by the interviews and the policy documents.

In the case of the stresstest of the municipality of Groningen, the municipality shares its knowledge with other municipalities and the province. The policy officer spatial planning and design of the Municipality of Groningen said: 'The municipality of Groningen is often a frontrunner as it is a big municipality in the region. There is the willingness to take that frontrunner role and share the knowledge. In the case of the stresstest this may be very important. Sharing knowledge of earlier stresstests can help other municipalities a lot in their stresstest and understand better what they have

to take into account.’ Together the water boards and provinces help the municipalities with support in the stresstests. So the municipalities are responsible for the stresstests, but they get support from the administrative region. This shows that responsibilities are divided, but cooperation is very important in the aspect of flood resilience. The provinces are actively involved in the stresstests in the way that they give input and organize meetings to discuss the progress of the stresstests. In this way the provinces stimulate and motivate the municipalities to do good work. In Friesland there is already much more progress with the stresstests. ‘The municipalities in Friesland are already finished with the stresstests, while in Groningen and Noord-Drenthe the stresstest still have to be done’ mentioned the water ambassador of Friesland.

Collaboration and coordination

As explained, the provinces work together in a regional area to report to the Delta commissioner. The water ambassador of Friesland mentioned: ‘Everyone has his own responsibilities. In the urban areas the cities have to take the frontrunner role and in the rural areas the water boards have to be the frontrunner in climate adaptation. They are searching for the role the province has to take in this.’ This shows that provinces are still looking for the role that they want in this process for climate adaptation. There is a shared responsibility between all public parties to keep the area safe from flooding. There is supervision from the state and the provinces on the municipalities and the water boards to see if they manage everything right, the responsibility is shared according to the respondents. New is the Delta Program that concerns spatial adaptation concerning climate change (Rijksoverheid, 2018). Here the cooperation between the provinces is important. An example of this is given by the policy officer space and community of the Province Groningen: ‘The region Groningen, Friesland and the northern part of Drenthe is an administrative region.’ So the region is an administrative region (Klapka et al., 2016) as explained in Chapter 2. It is defined by a top-down decision that Groningen, Friesland and Northern-Drenthe have to report to the Delta commissioner (Rijksoverheid, 2018). This is also confirmed by the water ambassador of Friesland and the policy officer space and community of the Province Groningen.

Sometimes there is discussion about the responsibilities between water boards and municipalities, for example about the regional flood norms. ‘Water boards sometimes don’t agree with the norms of the province’, was mentioned by the policy officer water of the Province Groningen. But when there is a matter of urgency cooperation goes often better. The water storage areas are a special case in the North of the Netherlands, both the spatial solution and the cooperation between the organizations are special. The policy officer water of the Province Groningen gives the example of the flooding of 1998. ‘A look at the flood event of 1998 shows that was a disaster situation. That is perfectly solved by the different governments. This was a common project by the provinces of Drenthe and Groningen and the water boards Noorderzijlvest and Hunze and Aa’s. The water storages areas were realized very fast, that is because the organizations all worked together.’ In this case a disaster situation caused a very fast and good cooperation between organizations. An example of discussion between water boards and provinces are the setting of the norms. The provinces set the norms for regional water defenses and the water boards have to manage them. The policy officer water of the Province Groningen mentioned: ‘We search for good solutions and search for them together. But formally the province set the norms and the water boards manage it, but the organizations do it together.’

A collaboration with mutual trust is an important aspect emphasized by Restemeyer et al. (2015) and Driessen et al. (2016) in flood resilience and part of the theoretical framework for the flood resilient region. It is clear that water boards have the responsibility of managing water safety and that provinces

set the norms for this. The provinces also have the responsibility of spatial planning. The municipalities have to examine the stresstests and work with the outcomes, while the provinces stimulate the municipalities to do so. In the end there is the supervision of the national government on the water boards and the administrative region of Friesland, Groningen and Noord-Drenthe needs to report to the national Delta commissioner about the progress of the stresstests. Summarizing: a quite complex system, where working together and having good relationships is very important. A situation of urgency like in 1998 in Groningen gives an enormous boost to collaboration and reaching mutual goals.

A regional approach is an important aspect of the flood resilient region. Relationship and collaborations are important in flood defense in the North of the Netherlands. The collaboration between water boards, provinces, municipalities and the state are of big value for a good process and good results for water safety. The collaboration is present, partly by an obliged administrative region. What is missing is leadership, a common identity and common goal- and strategy setting. All governments have their own policies with future goals, the provinces have the Beekdalenvisie 2030 (Province Drenthe, 2013) Droge Voeten 2050 (Province Groningen, 2010), Fries Bestuursakkoord Waterketen (Province Friesland, 2010). The water boards have all an own water control program 2016-2021 (Water Board Noorderzijlvest, 2015; Water Board Hunze and Aa's, 2015; Water Board Friesland, 2015). But there is no common plan which all the organization work on together. They only report together from the administrative region to the Delta commissioner (Rijksoverheid, 2018). Not because of own initiative, but because they are obliged to do so (Rijksoverheid, 2018). The next paragraph about long-term vision continues about these findings. The score for goal- and strategy setting is negative, because of the lack of common goals and strategies. The same counts for shared identity and leadership: within the region this is not present. Collaboration and coordination on the other hand is very present in the region, therefore this sub characteristic has a positive score.

Aspect of the Flood Resilient Region	Sub characteristic	Key quotes	Score
4. Regional Approach	Goal- and strategy setting	<ul style="list-style-type: none"> - The function of our region is to act where measures are not taken or where stresstests are not going correctly. - A challenge is to have a structural flow of projects, that is a continuing challenge. 	-
	Shared identity and leadership	<ul style="list-style-type: none"> - It is often the case that a big municipality is a frontrunner, that is now happening with the stresstest as well. - The role of the province is really different from the water boards. But there are discussions about who is responsible in some cases. - When there is the common support in the region, measures can happen. 	-
	Collaboration and coordination	<ul style="list-style-type: none"> - The situation in 1998 was dealt with by multiple governments , all said: this is our project. And that was done perfectly - Everything that is done with water, has to be done in consultation. Everyone has its own interest. 	+

Table 14. Score of a regional approach in the region.

4.6 Long-term vision

Following the conceptual framework (Table 6) the characteristic of long-term vision is divided into two sub criteria. These are common long-term vision and proactive handling. As explained in the theoretical framework the presence of a long-term vision is important for a flood resilient region. When multiple actors with responsibilities - such as municipalities, provinces and water boards - aim for the flood resilient region, these actors in the region should aim for it together. Therefore a common vision for the long term is useful and important (Driessen et al., 2016; Hudson, 2010). That there is no common goal and strategy in the region is further explained here. The quotes of the interviews of the aspect of the long-term vision are given in Appendix 7.

Common long-term vision

The respondents explain that there is a national vision, in the way of the National Delta program. The collaboration within the administrative region contributes to a regional approach, but all actors still have their own goals. These are mostly goals from long-term visions with the focus on 2050. But it is not a regional vision for a flood resilient North of the Netherlands. These visions are only made for the actors own areas. In this paragraph some examples of these findings are given. From a national perspective, there is the Delta program. This program contains water safety and climate adaptation on a national scale (Rijksoverheid, 2018). The program has a vision concerning water problems in the Netherlands for the long term. As a region the North of the Netherlands does not have such a vision. The respondents of the interviews acknowledge this as well. This is also visible from the quotes in Appendix 7. There is only the regional administrative group that reports to the Delta commissioner about climate adaptation in the region (Rijksoverheid, 2018). But on its own the region does not have a long-term vision for water safety and climate adaptation. All three northern provinces have their own vision about this subject. They set their own norms and have their own strategy to deal with water problems. Friesland has the Frisian water administrative agreement (2010), Drenthe has the Beekdalenvisie (2013) and Groningen has Dry Feet 2050 (2010). So there are long term plans in the provinces, but not on the regional scale of the three provinces. The water boards contribute in managing plans of the provinces.

The Delta program spatial adaptation (2018) has obliged the municipalities to examine the stresstests in 2019. These stresstests have to lead to an analysis of critical zones when it comes to heat, drought and water problems. The policy officer water from the province of Groningen stated: 'A sort of comprehensive plan for the region concerning flooding in the region will follow from the stresstests. The stresstest is done for each municipality, but water doesn't stop at municipality borders and goes everywhere.' The expectation is that municipalities will work together on the results of the tests and make a plan together to deal with possible flooding. In municipalities there are already plans about water issues, for example the sewerage plans. But now the stresstests are there, it becomes obliged for every municipality to work on this with a focus on the future. Climate adaptation and water safety is now an actual subject in each municipality. What is mentioned by multiple respondents is that some municipalities, mostly the bigger ones, are much further already with the stresstest than smaller ones. 'These frontrunners are asked to share their progress and help others with it', said the policy officer spatial planning and design of the Municipality of Groningen.

Proactive handling

These stresstest are very helpful in becoming a more flood resilient region. With these tests, the view is on the future. Governments may help each other and benefit from each other. The hydrologist of water board Hunze and Aa's mentions: 'With this approach on climate change the municipalities are working proactive now. There is the check if the system is ready for 2050. That is a positive impact of climate change, that there is anticipation.'

Anticipating and working with long-term plans is part of working on flood resilience in the area. But it does not appear to happen on a regional scale. The national plans are there (Rijksoverheid 2018) and these have impact on municipalities with the entry of the stresstest. As well as the provinces and water boards all have their own vision on the future. 'Each water board thinks about the future and the consequences of climate change', said by the project manager of water board Noorderzijlvest. There are norms for water safety and governments are all working on climate adaptation. But from a regional perspective, there is no common long-term vision and strategy.

The score of the common long-term vision is negative, because there is no such vision on a regional level. This is explained by the respondents and becomes clear from the policy documents. Each organization (provinces, water boards) have their own visions, but there is no common policy and vision. Proactive handling has a positive score. The stresstests that are emphasized by the respondents stimulate proactive handling on a local scale. This is brought forward by the respondents and is present and important in the region. Therefore proactive handling has a positive score.

Aspect of the Flood Resilient Region	Sub characteristic	Key quotes	Score
5. Long-term vision	Common (long-term) vision	<ul style="list-style-type: none"> - We don't have a common vision about water safety regionally. - Because of the regional administrative group there is now the start of a regional vision. 	-
	Proactive handling	<ul style="list-style-type: none"> - With climate change measures we are really working proactive now. That is something you can only do when the current water system is working well. - That is a positive side issue, because of the climate change, we start thinking more about the future. 	+

Table 15. Score of a long-term vision in the region.

4.7 Urgency

What appears to be very important for working on water safety and climate adaptation is a sense of urgency. A sense of urgency really gives a boost to all plans and collaborations. The respondents in the interviews emphasize that when a problem is urgent, plans get a high priority. Urgency is divided into two sub criteria (Table 6), these are the mobilization of actions and a constant political and financial support. The quotes of the interviews concerning the aspect of urgency are in Appendix 8. A sense of urgency is also called the window of opportunity by i.e. Rijke et al. (2012). The sense of urgency really helps to get things done (Van der Brugge et al., 2005). From the interviews there was clearly the notion that after a flood event there is a lot of priority for flood defense and protection. But this priority disappears again after a while. Priority for flood resilience raises after flood events: the sense of urgency.

Mobilization of actions

The obligation for municipalities to examine a stresstest creates urgency as well. Now municipalities have to act. In this way the vulnerabilities of the area become clear. This is a new development according to the policy officer water of the province of Groningen: 'Now municipalities are involved in the aspect of flooding as well, not only the provinces and the water boards anymore.' Also a new development is the notion of a sense of urgency from citizens. People seem to understand more the consequences of climate change. 'Heavy rainfall and periods of drought make people more aware of the possible problems. Extreme situations as heavy rainfall make people awake and governments as well, it makes them act', according to the policy advisor water of the Water Company Groningen.

The policy officer water and coastal protection of the Province Groningen mentioned: 'Water safety has always been important and is high on the list.' But this is a very general statement. What is interesting to see is that political priority in the region of Groningen and the northern part of Drenthe came especially after the flood event in the area of Groningen in 1998. That was a real trigger and created political support for action. After this event the water storage areas were created to prevent this from happening again. This flood event raised the awareness of policy makers and created political priority (NRC, 1998).

The water storage areas around the city of Groningen created after the flooding of 1998 are an example of the importance of urgency. The view from the hydrologist of the water board Hunze and Aa's explains this very well: 'The flood event in 1998 was actually great for the water system, because then there was political priority for big measures and permission to spend a large amount of money. Because after a disaster everyone is convinced that a reaction is necessary.' The policy advisor spatial planning and design of the Municipality of Groningen emphasizes this: 'After municipalities experience heavy rainfall, they respond much faster. Sometimes you need a small calamity, then the urgency is back on the map.'

Constant political and financial support

The real challenge for flood resilience is a structural priority for this according to the policy advisor water protection and theme coordinator water safety of the Water Board of Friesland. Not only the support after a flood event, but during the time. However many respondents acknowledge that this is something difficult. In this perspective the stresstests that are obligated now, are a way to create

structural management for climate problems in areas. So now not only the water boards in the area are working on flood resilience, but also municipalities are on it now.

In the regional perspective there is a large difference visible between Groningen and Drenthe on one side and Friesland on the other side. 'In Friesland many stress tests are already done, and they are working on the results already. While in Groningen and Drenthe they have started with the first ones, for example the stress test of the city of Groningen,' mentioned the water ambassador of Friesland. Friesland, Groningen and the northern part of Drenthe are in one region to report their progress to the Dutch Delta commissioner. In this regional group they share the data they have from the stress tests and report it together. But the progress is very different in the different provinces. That shows that in Friesland this subject has much more priority than in Groningen and in the northern part of Drenthe, while they operate in one administrative region together.

Financial resources don't seem to be a problem when it comes to water safety in the North of the Netherlands. The respondents give some examples about how they work with their budgets, but no single respondent mentioned that there are financial troubles or not enough resources for their projects. 'The primary water defenses are being paid from a national dike budget, that is a very well organized program', according to the project manager of Water Board Noorderzijlvest. When there is a project, the project first has to be developed and then the budget follows. The policy officer water of the province of Drenthe states: 'The consideration is always if the investment is worth it. Sometimes the hindrance of water is not worth the investment. Then the question is, what is the line between acceptable and not acceptable hindrance? Municipalities have to decide this. It is a matter of interpretation if the problem is acceptable or not and if it is worth the investment.' An interesting example given by the policy officer water of the province of Drenthe. The province tries to realize projects with multiple goals, so budgets can be combined. For example: a project has both a nature goal and a water safety goal, then both budgets can be used. So organizations are creative by finding budget.

The score of mobilization of actions is positive. That is two folded. First, actions are always there after a flood event happens, such flood events raise the urgency and stimulates to take action. Second, now this happens also with the new stress tests. Organizations are obliged to seek for vulnerabilities in their area and that leads to actions and safety measures, that was not the case before. Constant political and financial support got a neutral score because flood resilience does not always get the highest priority in the region from a financial point of view, but because financial resources are available this sub criteria got a neutral score.

Aspect of the Flood Resilient Region	Sub characteristic	Key quotes	Score
6. Sense of urgency	Mobilization of actions	<ul style="list-style-type: none"> - The water problems of 1998 were actually great for the water system. Because then there was support for measures and investments. - What is very positive is that municipalities now have to make actions, because of the stresstests. Before that was not the case. 	+
	Constant political and financial support	<ul style="list-style-type: none"> - Because of the stresstests, the intensive rainfall and dry periods there is a sense of urgency. - In Groningen there are other problems, for example the earthquakes. Those cost much energy and time of the organizations. So urgency for water safety and climate adaptation is than not the highest priority. 	+/-

Table 16. Score of a long-term vision in the region.

Chapter 5 - Conclusion

5.1. Introduction

As explained in the introduction of this study: climate change is affecting the entire European territory. Some effects of climate change are sea level rising, heavy rainfall, flood events, droughts, salinization and heat waves (e.g. Rozenzweig et al., 2018; European Commission, 2016). Flood resilience is considered as a promising concept to deal with flooding and too much water (Restemeyer et al., 2015). In this study flood resilience is used as starting point for the research. The North of the Netherlands is assessed based on the theoretical framework that has been created in this study. The area of Groningen, Friesland and the northern part of Drenthe is obliged to report to the national Delta commissioner about their progress on climate adaptation (Rijksoverheid, 2018). Because in the North of the Netherlands flooding can be a serious problem, coastal floods, heavy rainfall and inland waters can cause flooding in the area. The problems due to climate change, the obligation to report as a region and the ambition to collaborate as a region have led to the research questions of this study.

The conceptual framework that is created in Chapter 2 is the tool to find out if a region can be characterized as flood resilient. Based on the literature review, six characteristics are assumed important for the flood resilient region. These six characteristics have been researched in the North of the Netherlands. Each characteristic is scored in this study. By using the framework the North of the Netherlands is assessed in this study. The conceptual framework is the answer to the first secondary research question: *How can the concept of a flood resilient region be operationalized?* Experts working in Groningen, Friesland and Drenthe are interviewed and policy documents are analyzed. The aspects of the conceptual framework are used to analyze the North of the Netherlands. The analysis of the interviews in combination with the analysis of the policy documents lead to an answer of the second secondary research question: 'How do measures in the North of the Netherlands contribute to the flood resilient region?'. Based on the findings of this empirical research an answer is given on the primary research question: 'To what extent can the North of the Netherlands be characterized as a flood resilient region?'

5.2. Conclusion of the findings

Robustness

The robustness aspect that Restemeyer et al. (2015) and Hegger et al. (2016) describe by reducing the probability of flooding by using spatial and technical measures is very present in the region. This aspect comes forward in the policy document Dry Feet 2050 (Province Groningen, 2010) and the interviews (Appendix 3). Lintsen (2002), Rijke et al. (2012), Van der Brugge et al. (2005) and Vis et al. (2003) explain that water defense always was important in the Netherlands and this analysis shows it still is very important in the North of the Netherlands. Robustness is an important aspect of flood resilience and also in water safety in the North of the Netherlands. The presence of norms of primary and regional flood defenses show that. The national government, provinces and water boards are all together responsible for the robustness of the region. The analysis of the interviews and policy documents show

that there is much attention for the aspect of robustness. An example of this are the water storage areas in Groningen and Drenthe, those are technical and spatial measures for water safety and contribute to the safety of the region. The scores for both sub characteristics (technical and spatial measures) are positive. Because of the important presence of robustness in the policy documents and the quotes of the respondents. Technical and spatial measures are present and important in the region judging by the documents and interviews.

Adaptability

The second aspect of the analysis is adaptability. This is considered as reducing the consequences of flooding (Restemeyer et al., 2015; Hegger et al., 2016). By respondents in the North of the Netherlands adaptability is seen as mitigation, prevention and spatial planning to reduce the consequences of flooding. The analysis of the interviews shows that adaptability is an important aspect in the region. Provinces, water boards and the municipality of Groningen emphasize its importance. Examples of this are again the water storage areas and the redesigning of the creeks in Drenthe, where reducing the consequences of flood is linked to recreation and tourism in the Creek Vision (Dutch: Beekdalensvisie) (Province Drenthe, 2013). In that way adaptability is an important aspect of measures in the region. Because of the importance of the sub characteristics in the interviews (Appendix 4) and the policy documents (Dry Feet 2050 and Beekdalensvisie 2030), both got a positive score concerning their presence in the region.

Transformability

The third aspect of the theoretical framework is transformability. This is creating a societal change that brings awareness and willingness to act against flood risks (Restemeyer et al., 2015; Hegger et al., 2016). In the North of the Netherlands the awareness of citizens and organizations is raising already because of the effects of climate change; heavy rainfall, heat and drought. Flood defense has always been a public task in the Netherlands (Lintsen, 2002), it is expected for the government to deal with these problems. The governments are doing it already, for example by executing a stresstest and make plans to make areas as safe as possible.

There is a growing awareness of the risk of flooding and other effects of climate change, but the responsible organizations have not decided what is the best to collaborate with the citizens in the region. The score for awareness is neutral, because awareness is not always present in the area, but is growing according to the respondents. Also willingness to act got a neutral score. People are expecting for the responsible organizations to deal with problems, but the current circumstances (heavy rainfall, dry periods) make people more aware and willing to help. Because both sub criteria are seen as important by the respondents the scores are not negative, but they are not present enough in the region to obtain a positive score.

Regional Approach

A regional approach is an important aspect of the flood resilient region. Relationships and collaborations between organizations are important in flood defense in the North of the Netherlands. The collaboration between water boards, provinces, municipalities and the state are of big value for a good process and good results for water safety. The collaboration is present, partly by an obliged administrative region. What is missing is leadership, a common identity and common goal- and strategy setting. All governments have their own policies with future goals. The provinces have the

Beekdalenvisie 2030 (Province Drenthe, 2013) Droge Voeten 2050 (Province Groningen, 2010), Fries Bestuursakkoord Waterketen (Province Friesland, 2010). The water boards have all an own water control program 2016-2021 (Water Board Noorderzijlvest, 2015; Water Board Hunze and Aa's, 2015; Water Board Friesland, 2015). But there is no common plan which they work on together. They only report together from the administrative region to the Delta commissioner (Rijksoverheid, 2018). Not from an own initiative, but because they are obliged to do so (Rijksoverheid, 2018). The score for goal- and strategy setting is negative, because of the lack of a common goal and strategy. The same counts for shared identity and leadership, within the region this is not present. Collaboration and coordination on the other hand is present in the region. This turns out from the interviews and policy documents, therefore this sub characteristic has a positive score. This seems contradictory: the organizations do not have a common goal and leadership, but they do collaborate.

Long-term vision

The Delta Program is the national long-term vision about water safety in the Netherlands (Rijksoverheid, 2018). On a regional level, the collaboration in de administrative region contributes to a regional approach. But all actors still have their own long-term vision and goals. All organizations have their own vision, while there is no regional long-term vision. These are mostly long-term visions with the focus on 2050 from the provinces, while the water boards have five year plans. The provinces have the Beekdalenvisie 2030 (Province Drenthe, 2013) Droge Voeten 2050 (Province Groningen, 2010), Fries Bestuursakkoord Waterketen (Province Friesland, 2010). The water boards all have an own water control program 2016-2021 (Water Board Noorderzijlvest, 2015; Water Board Hunze and Aa's, 2015; Water Board Friesland, 2015). These policies show that the organizations are working with a vision for the future.

The score of the common long-term vision is negative, because there is no such vision. This is explained by the respondents and becomes clear from the policy documents. Each organization (provinces, water boards) have their own visions, but there is no common policy and vision. Proactive handling has a positive score. The stresstests that are emphasized by the respondents stimulate proactive handling on a local scale. This is brought forward by the respondents and is present in the region. Therefore proactive handling has a positive score.

Sense of Urgency

A flood event wakes up the responsible governments to act, that has always been the case (Lintsen, 2002; Rijke et al., 2012). Flood events raise the urgency and stimulate responsible governments to take action, like the situation of 1998 in Groningen (NRC, 1998). Also extreme weather situation stimulate awareness of citizens, and may help to stimulate transformability as well. The new stresstests also stimulate municipalities to work on water safety, in this way it is an actual theme for municipalities. All these findings show that disasters and obligated tasks stimulate urgency for flood resilience measures and open 'the window of opportunity' for measures for the flood resilient region.

The score of mobilization of actions is positive. That is two folded: first, actions are always there after a flood event happens, such flood events raises the urgency and stimulates to take action. Second, now there are also the new stresstests executed by municipalities. Organizations are obliged to seek for vulnerabilities in their area and that leads to actions and safety measures, what wasn't the case before. Constant political and financial support got a neutral score because flood resilience does not

always get the highest priority in the region, but because financial resources are available this sub criteria got a neutral score.

Aggregated table

The scores of all the sub characteristics mentioned above give an answer to the primary research question: *To what extent can the North of the Netherlands be characterized as a flood resilient region?* The scores of the sub criteria and characteristics answer this question. For robustness and adaptability there is a positive score, but for the four other characteristics there is a neutral score. Therefore this study concludes that the area is doing well on robustness and adaptability, but needs improvements for the other four flood resilient region characteristics. In the next paragraph recommendations are given for the region.

Flood Resilient Region	Score per sub criteria	Overall core
1. Robustness	- Technical measures + - Spatial measures +	+
2. Adaptability	- Spatial planning + - Mitigation and prevention +	+
3. Transformability	- Awareness +/- -Willingness to act +/-	+/-
4. Regional Approach	-Common goals and strategies - -Shared identity and leadership - -Collaboration and coordination +	+/-
5. Long-term vision	-Common (long-term) vision - -Proactive handling +	+/-
6. A sense of urgency	- Mobilization of actions + - Constant political and financial support +/-	+/-

Table 17. Aggregated score of the characteristics.

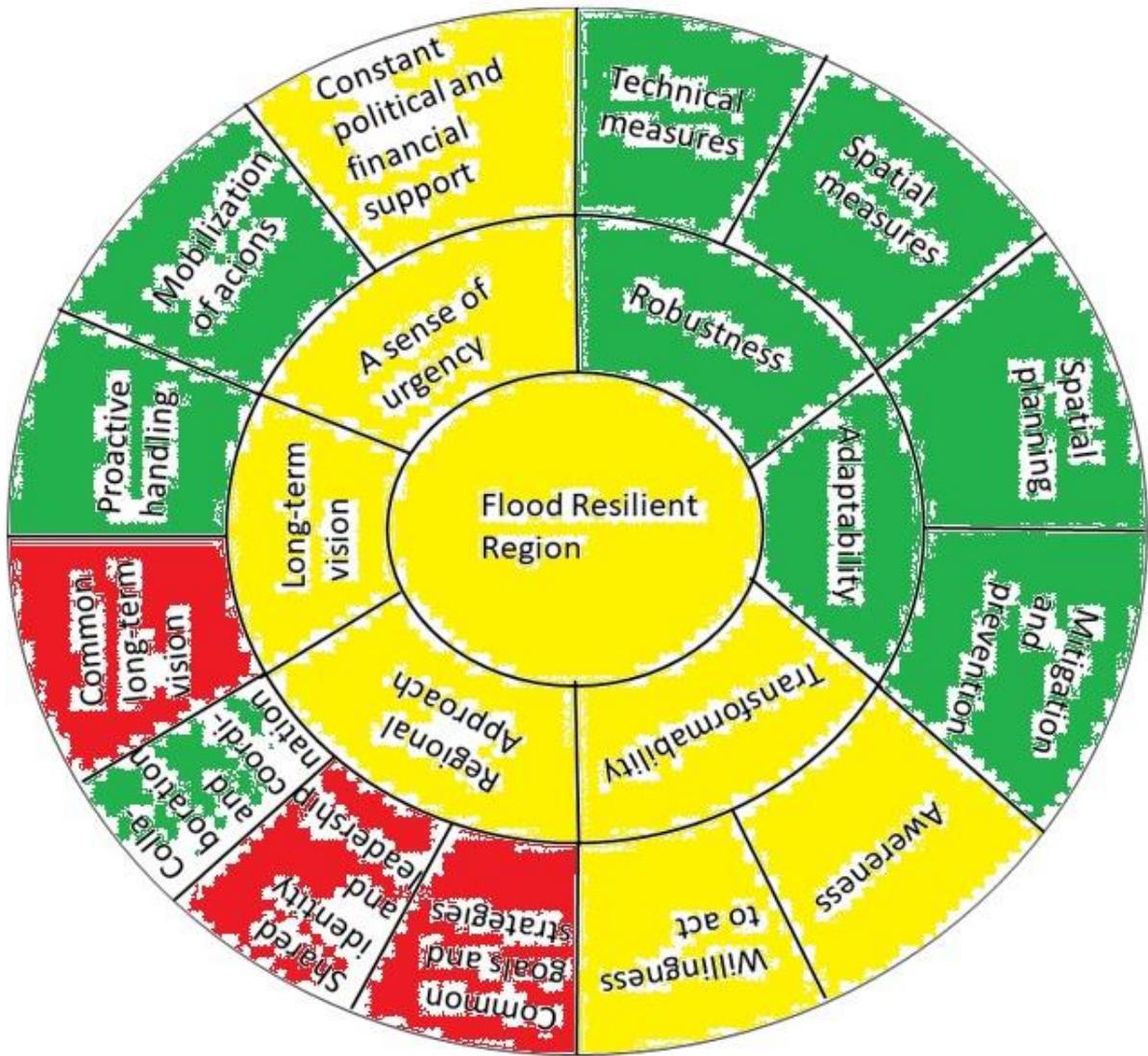


Figure 8. Visualization of the aggregated scores.

5.3 Theoretical and methodological reflection

In this reflection notions are made about the research: What could have been done better? The literature review lead to the conceptual framework. Theoretically seen, there are more characteristics that could have been used in the theoretical framework. There can be assumed that other characteristics are important for the flood resilient region as well. In further studies more characteristics can be researched. This study can then be used for as a starting point in further research to improve the conceptual framework to assess the flood resilient region. The framework consists of multiple characteristics that are divided in sub characteristics, but there can be assumed that there are more important characteristics for the flood resilient region.

Methodologically seen, more respondents could have been approached for interviews of more organizations for a more extended research. Although the combination of policy documents and interviews gave enough data to come to findings and to finalize with the conclusion. Also a more extended policy document analysis can give more comprehensive research findings. A last notion is that respondents of other organizations may have given other answers and important examples of flood resilience measures in the region. Also the respondents are working at governmental organizations, not at private companies. That may have given a colored view. All respondents were approachable and very helpful. The interviews were very important for this study, more interviews could have contributed to a better conclusion of this study.

In general, with more respondents and more relevant characteristics of the flood resilient region this study could have given a more complete and comprehensive conclusion. The study remained feasible for the author with the number of six characteristics in the conceptual framework and ten interviews. With these numbers there still were plenty of findings to be written down.

5.4 Contribution for planning theory and practice

This study gives a contribution to planning theory and practice. In the case of planning theory, this study adds the conceptual framework for regions to the already existing framework for cities (Restemeyer et al., 2015). This is a new framework especially developed for this study and is an addition to planning theory. This framework was developed after a literature review that is explained in Chapter 2. The conceptual framework in this study serves as a heuristic framework to assess the flood resilience of the North of the Netherlands. Important characteristics of the flood resilient region have been selected based on the literature review of this study. By using this conceptual framework improvements are given for the North of the Netherlands to be made. The conceptual framework of this study can be used for other regions as well. In this way this study is generalizable for other regions that are willing to work on flood resilience.

For planning practice the findings and conclusion of Chapter 4 and 5 explain the current situation of the North of the Netherlands concerning flood resilience and shows which characteristics need improvements. These improvements are also explained in the form of recommendations in the next section. Table 17 and Figure 8 show clearly that improvements can be made in the region.

Recommendations

The conclusion of the findings shows that four of the six characteristics in the North of the Netherlands got a neutral score. Improvements are recommended for these characteristics to be made. Firstly on the sub criteria with a negative score, these are (1) common goal and strategy setting, (2) shared identity and leadership and (3) common long-term vision. Also the sub criteria with a neutral score can be improved, these are (1) awareness, (2) willingness to act and (3) constant political and financial support. This means that these six sub criteria should be improved to meet the requirements for a flood resilient region.

The starting point should be to create a common long-term vision for the North of the Netherlands concerning flood resilience. Based on shared thoughts and with a common goal. This could be done from the already administrative region of climate adaptation. From this starting point the constant political and financial support can be expected to grow, as well as the awareness and willingness to act inside the region.

To improve the flood resilient region a common starting point is needed for flood resilience in the region. The region needs leadership to create a common long-term vision. With a vision the regional approach can be improved, as well as a long-term plan for the region. For transformability, both awareness and willingness to act can be improved. The awareness can be raised by campaigns in municipalities, these campaigns can also stimulate citizens to start acting. So it does not seem very difficult to achieve these improvements, but it needs starting actions from a frontrunner that takes the lead and organizations that creates campaigns for water safety and climate adaptation. When this all happens - a raise of awareness, willingness to act, leadership and a long-term vision – it is likely that the financial and political support in the region will grow as well.

Seen from the findings there is work for the region to improve the four characteristics that have a neutral score. Water safety is important in the North of the Netherlands, but from this study it becomes clear the region can become even more flood resilient.

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Appendix 1

Interview guide (in Dutch)

Samenwerking en prioriteit

In de regio hebben provincies, waterschappen en gemeenten elk hun eigen opgaven, prioriteiten en administratieve grenzen.

1a. Wie draagt de verantwoordelijkheid met betrekking tot wateroverlast en waterveiligheid in de regio? – Hoe is de verdeling tussen provincie, gemeenten en waterschappen?

1b. Is er binnen de Provincie en het waterschap een hoge prioriteit voor de problemen van wateroverlast en waterveiligheid?

1c. In hoeverre is er financiële en politieke prioriteit in de regio voor plannen tegen wateroverlast?

1d. Is er naar uw idee sprake met van een overkoepelend plan tegen wateroverlast in de regio?

Huidig en toekomstig beleid

2a. Wat is kenmerkend voor het beleid van ... met betrekking tot wateroverlast en waterveiligheid?

2b. Verwachten jullie (nieuwe) problemen voor jullie gebied in de nabije toekomst? (Door bijvoorbeeld een veranderend klimaat en daarmee gepaard gaande droogte of intensieve neerslag?)

2c. Is klimaatverandering een belangrijk thema voor jullie?

Resilience en bewustwording

3a. Wordt er binnen ... gewerkt aan de beperking van wateroverlast aan de hand van een concept als Resilience (of een ander soortgelijk concept)?

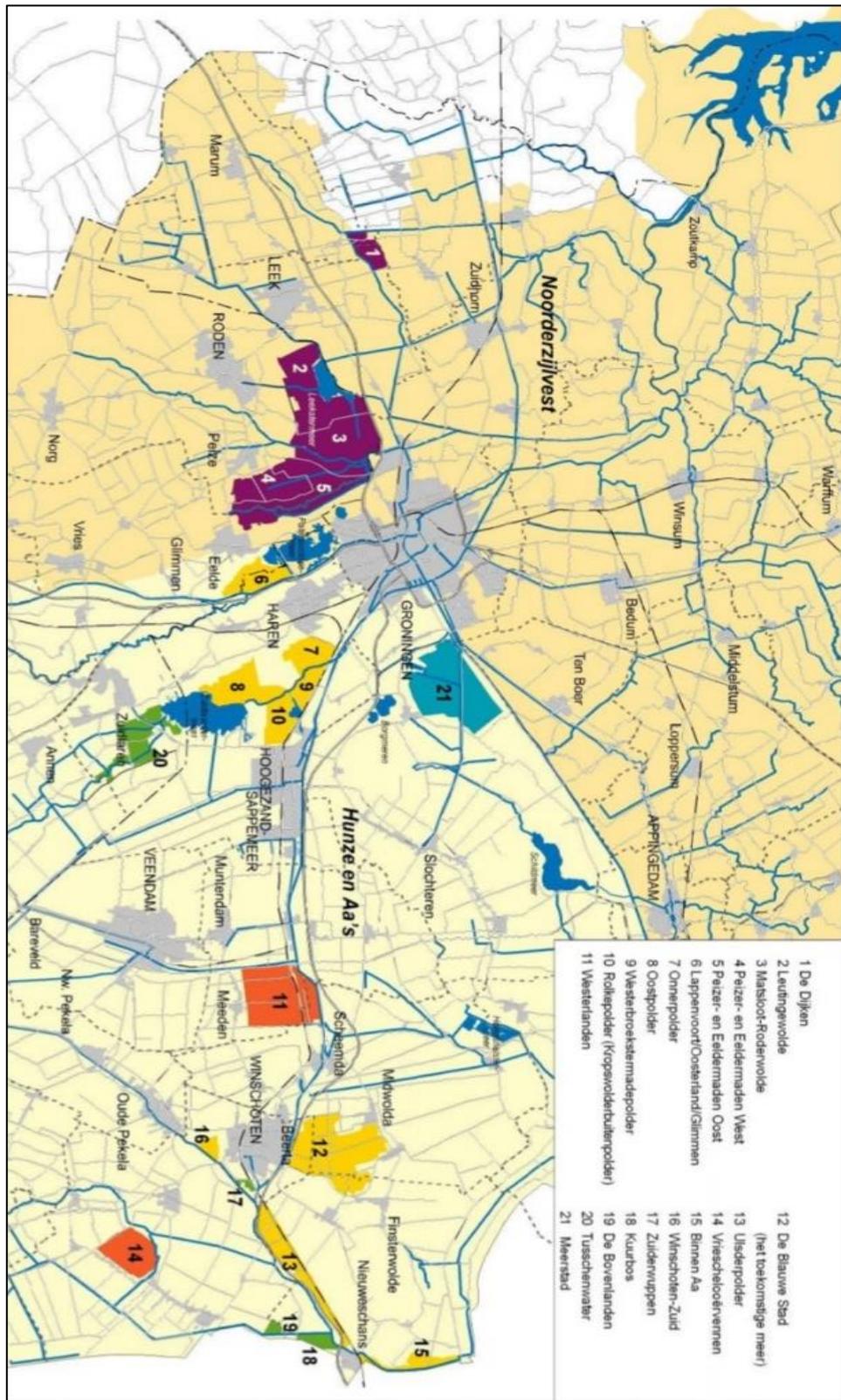
Binnen de wetenschappelijke literatuur wordt 'Resilience' met betrekking tot wateroverlast uitgelegd aan de hand van 3 kenmerken. Dat zijn 'Robustness' (beperken van overstromingsrisico), 'Adaptability' (beperken van de gevolgen van overstromingen door middel van ruimtelijke planning) en 'Transformability' (bevorderen van maatschappelijke verandering). De laatste kan worden gedaan door middel van communicatie en een hoger bewustzijn creëren van de risico's. Een manier hiervoor kan een publiek-private samenwerking zijn met bedrijven of het betrekken van inwoners bij het nemen van maatregelen tegen wateroverlast.

3b. Wordt er aan projecten binnen de regio gewerkt aan de beperking van wateroverlast aan de hand van een kader met soortgelijke kenmerken?

3c. Merken jullie meer bewustwording in de regio voor de problemen die kunnen ontstaan door wateroverlast en daarmee ook een maatschappelijke verandering?

Appendix 2

Map of the water storage areas around Groningen (Province Groningen, 2010)



Appendix 3

Quotes of the aspect of robustness from the interviews.

Robustness	Codes: Basic safety; Flood; Flood defenses; Norm; Quay Elevation; Robust; Storage area; Risk; Water safety; Reduce flood probability; Spatial and technical measures.
Respondent	Quote
1. Waterboard Noorderzijlvest - Manager Project Overstijgende Verkenning (POV) Waddenzeedijken	<ul style="list-style-type: none"> - The primary task of water boards is water safety. - There is a high water protection program in the Netherlands. Each dike that doesn't meet the standards, has to be improved.
2. Province Groningen - Policy officer water	<ul style="list-style-type: none"> - As a province, we set the norms for regional water safety.
3. Province Drenthe - Policy officer water	<ul style="list-style-type: none"> - We set the norms for water safety in the rural area. - We call it a robust system, a system needs to meet the water safety standards.
4. Municipality Groningen - Policy officer spatial planning & design	<ul style="list-style-type: none"> - Our role in water safety is to put problems on the agenda. - It is mostly a task for provinces and water boards, but we also have input. For example in the flooding in 1998.
5. Waterboard Hunze en Aa's - Hydrologist	<ul style="list-style-type: none"> - We are really about water safety, that is different from water nuisance. - The choice from the water storage areas came from multiple studies. The combination of the new storage and the existing water drainage is really strong.
6. Province Groningen - Policy officer water and coastal development	<ul style="list-style-type: none"> - The task for water safety is one of the water boards. - We set the norm for the regional barriers. The national government for the primary barriers.
7. Province Groningen - Policy officer space and community	<ul style="list-style-type: none"> - The part of the dike between Delfzijl and Eemshaven was not strong enough, we are working on that concerning the worst case scenario.
8. Province Fryslân - Water ambassador Friesland/frontrunner spatial adaptation	<ul style="list-style-type: none"> - It is some sort of business case. When an area is less important because there are few people or few important buildings, then more floodings are allowed.
9. Water company Groningen - Policy advisor water	<ul style="list-style-type: none"> - No coded quote
10. Waterboard Fryslân - Policy advisor water protection and theme coordinator water safety	<ul style="list-style-type: none"> - The safety from the IJssellake, North Sea and Waddensea is the responsibility of the national government and the water boards. - The norms for the regional barriers are set by the provinces. - You want a basic safety in the whole country and for important areas a sort of economic addition.

Appendix 4

Quotes of the aspect of adaptability from the interviews.

Adaptability	Codes: Adaptive planning; Building in low areas; Minimalize; Multiple goals; Nature; Natural organizing; Spatial planning; Spatial solutions; To add; To link; Reduce consequences of flooding; Rules and preventing measures.
Respondent	Quote
1. Waterboard Noorderzijlvest - Manager Project Overstijgende Verkenning (POV) Waddenzeedijken	<ul style="list-style-type: none"> - The province has the primary task of spatial planning. They have to make sure that the space is used in a good way. - We are giving this area an extra function. This project is not only water safety, but also innovation for agriculture and nature. - We want to combine other functions with water safety, for example recreation and nature.
2. Province Groningen - Policy officer water	<ul style="list-style-type: none"> - You always have to link measures. For example climate adaptation measures, to get support you have to add for example recreation and nature. That appeals to people.
3. Province Drenthe - Policy officer water	<ul style="list-style-type: none"> - The measures for creeks has meant a lot to the appearance of Drenthe. It also adds to the touristic and recreational value. - So our intention was climate adaptation, but we wanted also a touristic boost. That is also done by spatial measures, not only sectoral water measures.
4. Municipality Groningen - Policy officer spatial planning and design	<ul style="list-style-type: none"> - Adaptive planning is starting to finds its way. That means that for the inner city we are working with it.
5. Waterboard Hunze en Aa's - Hydrologist	<ul style="list-style-type: none"> - We used the strength of our area very well, that is de space of our area. We used a spatial solution for water safety.
6. Province Groningen - Policy officer water and coastal development	<ul style="list-style-type: none"> - When the water boards starts with a water safety project, we want to do more with the area. We try to link other activities with water safety.
7. Province Groningen - Policy officer space and community	<ul style="list-style-type: none"> - No coded quotes
8. Province Fryslân - Water ambassador Friesland/frontrunner spatial adaptation	<ul style="list-style-type: none"> - No coded quotes
9. Water company Groningen - Policy advisor water	<ul style="list-style-type: none"> - No coded quotes
10. Waterboard Fryslân - Policy advisor water protection and theme coordinator water safety	<ul style="list-style-type: none"> - Because of climate change you keep working on it. We check the norms every 12 years and that makes us adaptive. - Spatial planning is important, because spatial adaptability is needed to prevent problems caused by climate change. - Spatial planning and water management need to be linked more in my opinion.

Appendix 5

Quotes of the aspect of transformability from the interviews.

Transformability	Codes: Accept; Alive; Awareness; Change; Fear; Prepare; Sense; Signals; Working on it; Societal Change; Awareness; Willingness to act.
Respondent	Quote
1. Waterboard Noorderzijlvest - Manager Project Overstijgende Verkenning (POV) Waddenzeedijken	<ul style="list-style-type: none"> - People expect the governments to deal with flooding. Most Dutch people don't know what a flood event is. We are spoiled in comparison to people in other countries.
2. Province Groningen - Policy officer water	<ul style="list-style-type: none"> - No coded quotes
3. Province Drenthe - Policy officer water	<ul style="list-style-type: none"> - Governing is looking to the future, there are many signals of climate change and we have to deal with it, that is our task. - The willingness of the citizens is very important, citizens, companies and agriculture, everyone will see the consequences.
4. Municipality Groningen - Policy officer spatial planning & design	<ul style="list-style-type: none"> - The awareness is raising in some cases, but not in all cases. - People support plans until it comes to their own living spaces.
5. Waterboard Hunze en Aa's - Hydrologist	<ul style="list-style-type: none"> - No coded quotes
6. Province Groningen - Policy officer water and coastal development	<ul style="list-style-type: none"> - Climate change is often in the news and now the new stresstests are there, so we notice that there is more awareness of people and governments for climate change and water safety.
7. Province Groningen - Policy officer space and community	<ul style="list-style-type: none"> - No coded quotes
8. Province Fryslân - Water ambassador Friesland/frontrunner spatial adaptation	<ul style="list-style-type: none"> - Don't scare people, often if you tell people they have a problem, they start searching for the one who caused it. - The awareness is raising slowly. That is partly due to heavy rainfall and dry periods.
9. Water company Groningen - Policy advisor water	<ul style="list-style-type: none"> - The heavy rainfall and droughts help in raising awareness. Many people thought that climate change would only happen in the future, but it is happening already. - It think the awareness is raising, but we work in a sort of bubble, we only work with professionals in the water sector, so that may give a distorted view.
10. Waterboard Fryslân - Policy advisor water protection and theme coordinator water safety	<ul style="list-style-type: none"> - Some citizens don't have that awareness at all. - The stresstests will raise the awareness of municipalities. - When the awareness is bigger, the acceptance is bigger as well. - Mostly after 2-3 years a flood event will be in the mind of the people, but after that it disappears. - In the Netherlands people are not much aware. That implies that the governments are doing a good job.

Appendix 6

Quotes of the aspect of regional approach from the interviews.

Regional Approach	Codes: Central; Control; Discuss; Direction; Forerunner; Manage Regional; Priority; Pull up together; Responsibility; Sharing knowledge; Supervision; Support; Together; Trigger; Common goal- and strategy setting; Shared identity; Regional Agenda; Connection of institutions; Collaborations; Coordination.
Respondent	Quote
1. Waterboard Noorderzijlvest - Manager Project Overstijgende Verkenning (POV) Waddenzeedijken	- No coded quotes
2. Province Groningen - Policy officer water	- The role of the province is really different from the water boards. But there are discussions about who is responsible in some cases. - The situation in 1998 was dealt with by multiple governments , all said: this is our project. And that was done perfectly.
3. Province Drenthe - Policy officer water	- The high priority is not only water safety, but also climate adaptation. Water safety is more a task of the water boards, as a province we are more concerned about climate adaptation. - Water problems within urban areas are a task of the municipality is our view. We try to collaborate, but everyone has its own responsibility.
4. Municipality Groningen - Policy officer spatial planning & design	- It is often the case that a big municipality is a frontrunner, that is now happening with the stresstest as well. - I would not be surprised if we will share more knowledge soon.
5. Waterboard Hunze en Aa's - Hydrologist	- That is a difference between water boards and provinces. We have no spatial planning in our tasks, they do have it. - When there is the common support in the region, measures can happen.
6. Province Groningen - Policy officer water and coastal development	- Water safety is always important in the Netherlands and that was always a responsibility of the national government, water boards, provinces and municipalities.
7. Province Groningen - Policy officer space and community	- Within our administrative region, Groningen, Northern Drenthe and Friesland, we agreed that the stresstests are a responsibility of the municipalities. - We are very actively participating with the municipality of Groningen with its stresstest, to be able to help other municipalities as well. - The function of our region is to act where measures are not taken or where stresstests are not going correctly.
8. Province Fryslân - Water ambassador Friesland/frontrunner spatial adaptation	- Everyone has a responsibility, provinces, water boards and municipalities. - The role of the province is very small so far. - In our working group, with Groningen and Northern Drenthe, we have to collaborate.
9. Water company Groningen - Policy advisor water	- We collaborate mostly with the province, because they give the permits. - Everything that is done with water, has to be done in consultation. Everyone has its own interest. - We give our input and show the potential risks, then problems have to be dealt with by spatial planning for example.
10. Waterboard Fryslân - Policy advisor water protection and theme coordinator water safety	- There is a common responsibility between the national government and the water boards. - A challenge is to have a structural flow of projects, that is a continuing challenge.

Appendix 7

Quotes of the aspect of long-term vision from the interviews.

Long-term vision	Codes: Common vision; Delta Program; Develop; Future; Long-term; Prepare; Strategy; Vision; 2050; Development of a long-term vision; Adaptive measures; Proactive handling.
Respondent	Quote
1. Waterboard Noorderzijlvest - Manager Project Overstijgende Verkenning (POV) Waddenzeedijken	<ul style="list-style-type: none"> - Each water board has long-term plans, because each water board thinks about the future. That is caused by climate change as well. - Many times you have to do short-term measures and those measures have to be done first. But you also think about the long-term, which is connecting to the resilience topic.
2. Province Groningen - Policy officer water	<ul style="list-style-type: none"> - The Delta program is a common plan. That is a vision that will be used to find out what the regional problems are.
3. Province Drenthe - Policy officer water	<ul style="list-style-type: none"> - We have vision as a province, the Beekdalenvisie. That is not an actual plan, but more a vision of what we want to achieve.
4. Municipality Groningen - Policy officer spatial planning & design	<ul style="list-style-type: none"> - Because of the regional administrative group there is now the start of a regional vision. - What is new is that it goes broader, we always only did the sewerage, but the stresstest makes us look for vulnerabilities in the city.
5. Waterboard Hunze en Aa's - Hydrologist	<ul style="list-style-type: none"> - With climate change measures we are really working proactive now. That is something you can only do when the current water system is working well. - That is a positive side issue, because of the climate change, we start thinking more about the future.
6. Province Groningen - Policy officer water and coastal development	<ul style="list-style-type: none"> - For water safety we have the norms, these are obligated rules. And for water nuisance there is no common long-term vision.
7. Province Groningen - Policy officer space and community	<ul style="list-style-type: none"> - There is no common plan for water problems. But the Delta program and the stresstests will be important and can lead to a common approach to water problems in the region.-
8. Province Fryslân - Water ambassador Friesland/frontrunner spatial adaptation	<ul style="list-style-type: none"> - We don't have a common vision about water safety regionally. We only have the national norms for the primary defenses. - With climate change in mind, you want to aim for the future.
9. Water company Groningen - Policy advisor water	<ul style="list-style-type: none"> - We have to make sure we are aware of the challenges and prepare for them. - We are doing research about those challenges and how we can deal with them with our partners.
10. Waterboard Fryslân - Policy advisor water protection and theme coordinator water safety	<ul style="list-style-type: none"> - From the stresstests comes awareness and that will lead to a common vision. - Together with the province we will think about a long-term vision for the Frisian waters. - A long-term vision for water safety is something you want to link to spatial planning.

Appendix 8

Quotes of the aspect of urgency from the interviews.

Urgency	Actual; Budget; Costs; Disaster; Extreme; Fear; Finance; Financial; Investments; Money; Urgent; The need of action; Financial support; Political Agenda.
Respondent	Quote
1. Waterboard Noorderzijlvest - Manager Project Overstijgende Verkenning (POV) Waddenzeedijken	- No coded quotes
2. Province Groningen - Policy officer water	- What is very positive is that municipalities now have to make actions, because of the stresstests. Before that was not the case. - For example when we have a couple of dry years, we can take measures quicker for that problem.
3. Province Drenthe - Policy officer water	- The new extreme situation bring new challenges for municipalities. - A dilemma is that is sometimes difficult to get financial investments for measures that are not actual yet, but are for future problems.
4. Municipality Groningen - Policy officer spatial planning & design	- Because of the stresstests, the intensive rainfall and dry periods there is a sense of urgency. - The storage areas were actually pretty special. There were many investments and it went very fast.
5. Waterboard Hunze en Aa's - Hydrologist	- The water problems of 1998 were actually great for the water system. Because then there was support for measures and investments.
6. Province Groningen - Policy officer water and coastal development	-
7. Province Groningen - Policy officer space and community	- In Groningen there are other problems, for example the earthquakes. Those cost much energy and time of the organizations. So urgency for water safety and climate adaptation is than not the highest priority.
8. Province Fryslân - Water ambassador Friesland/fronrunner spatial adaptation	- We recognize that the situation gets worse. But people forget evenly quick.
9. Water company Groningen - Policy advisor water	- Sometimes you need a small calamity to achieve something, then the urgency is back on the agenda. - Most people are on the short term, therefore period of drought like this summer or heavy rainfall are helpful for urgency.
10. Waterboard Fryslân - Policy advisor water protection and theme coordinator water safety	- The heavy rainfall can be very extreme. You have to be prepared for that.

Appendix 9

One page of coded transcript.

I= interviewer R= Respondent

R: burgers bij ons komen om erover te klagen, zou dat voor ons wel aanleiding kunnen geven. Het is niet zo dat wij een politieke trigger krijgen dat wij daar als provincie nu hard op inzetten. En dat heeft er denk ik mee te maken dat de gemeentes en de waterschappen zich hier heel erg van bewust zijn. En daar ook behoorlijk aandacht aan geven, en dat vinden we ook prima. En of je daarmee snel genoeg bent, je altijd een beetje achter de feiten aan. Je moet er ook altijd bewust van zijn dat je de maatregelen die je neemt, ook goed doet. En je kunt dat geld ook maar 1x keer uitgeven. Het is wel belangrijk dat je niet te veel ad hoc denkt, en altijd goed nadenkt over de robuustheid van je maatregel. Soms heb je hele simpele maatregel voor weinig geld, dat is eigenlijk een no- regret maatregel, die moet je altijd doen. Baat het niet, schaadt het ook niet bij wijze van spreken. Als je met water aan de gang gaat praat je over substantiële investeringen, met een beetje project ben je toch al een half miljoen tot een miljoen kwijt. En bij de riolering kost het geloof ik 1000 euro per meter. Dat is een soort vast bedrag wat je daarvoor hebt, maar als het bedrag 2x zo hoog gaat worden, dan gaat meteen over tonnen verschil. Dus als gemeente moet je je maatregelen goed afwegen, dat betekent vaak dat je iets meer moet accepteren in hinder en iets minder ver gaat in alle risico's proberen weg te nemen.

I: Klimaatverandering staat dus wel echt op de agenda van de provincie?

R: Ja, maar dat gaat verder he. Daar loopt de CO2 discussie doorheen. Dus we zien dat er politiek heel veel energie wordt gestoken in het terugdringen van CO2 emissies. Dus projecten die daarop gefocust zijn. Allemaal methodes om het gas- en elektriciteitsverbruik te verminderen. Daar zit veel letterlijk veel energie op in het uitvoeren van die projecten. Alleen dat is meer proberen dingen te sturen aan de voorkant. Daarnaast heb je de effecten van het klimaat als zodanig. Dat zit bij ons zelf als provincie, de beekdal visie is daar mede een uitvloeisel van geweest. We zien dat er meer water gaat vallen, wij zitten meer op het regionale vlak, van hoe kunnen we nu proberen om wateroverlast te sturen. Dat we de overlast daarheen brengen waar het water het minst kwaad kan. Dat is een van de basisgedachten geweest van de beekdalvisie destijds, dat als er regen valt, dat het wordt afgevoerd in een beekdalsysteem. Dat is hoe het water hier zijn weg zoekt. Dus je kunt de beekdalen zien als de ultieme opvangplek van water. Daar verzamelt het zich, en daar moet je heel goed over nadenken hoe je die gebieden door een iets andere inrichting en gebruik, de ruimte kunnen geven om meer water te kunnen bufferen. Langer vasthouden en geleidelijk laten weglopen, en daarmee de overlast te voorkomen. Door het water te verzamelen op de lage plekken in het beekdal zelf. Het tweede wat er bij zat was het natuurlijker inrichten van beken. Dus het ook te maken met kwalitatieve maatregelen op het vlak van ecologische en chemische waterkwaliteit. Als je natuurlijker systeem hebt, heb je meer natuurlijke zuiveringscapaciteit. Daarmee voldoen we ook aan de Europese KRW. En omdat Drenthe eenmaal veel beken heeft, hebben Drentse beken ook een uitstraling van het toeristische, recreatieve element. Dus de insteek voor ons was vooral het sturen van klimaatbenadering, maar er zaten ook gedachtes bij dat je tevens aan de KRW kunt voldoen en een toeristische boost kunt doen. En dat is ook wel het beleid steeds meer doet, niet alleen sectoraal denken, maar ook breder denken. Zo zit je eigenlijk ook een beetje aan het RO element, want je ziet nu ook dat ruimtelijke plannen die gemeentes en provincies maken, dat het omgaan met water veel gemeengoed is geworden. Volgens mij mag een gemeente geen plan meer goedkeuren waarin geen rekening is gehouden met de opvang van water wat kan vallen. Dus je ziet heel veel projecten waar een vijver, wadi of bassin bij zit. Dus dat zijn allemaal bijna wettelijke verplichten. We zitten in dit soort trajecten wel heel veel met gezamenlijke uitwerkingen en het delen van kosten, waterschap de helft, wij de helft. We proberen projecten te realiseren met meerdere doelen, zodat we bestaande geldstromen bij elkaar kunnen brengen. En dan kun je bijvoorbeeld een natuurdoel en een waterdoel dienen. Dan kun je beide potten gebruiken. Daar zit klimaat denken ook nadrukkelijk bij.