Factors Influencing Success and Failure of Integrated Flood Risk Management

An Institutional Understanding of Flood Risk Management in Dordrecht and Valkenburg

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Abstract

Floods and flood risks in Europe have become a growing concern due to an increase in frequency and severity. It is recognized that there is a need for an integrated approach to flood risk management involving a variety of strategies and measures as structural and hard-engineered solutions to flood risks alone cannot guarantee protection and mitigation from floods. The need for an integrated approach is also advocated on the European level through the European Flood Risk Directive (2007/60/EC). However, the consistent application of integrated flood risk management lags due to several underlying causes such as institutional fragmentation, limited financing, and low public awareness.

An institutional analysis is conducted in this thesis to understand better why the implementation of integrated flood risk management is difficult to achieve in practice. Utilizing the politicized institutional analysis and development (IAD) framework, the StarFlood strategies classification, and relevant literature on integrated flood risk management, this thesis examines how institutional, contextual, political, and discursive factors influence the success or failure of integrated flood risk management in Dordrecht and Valkenburg to enhance integration of flood risk management. This is done by conducting qualitative deductive research. Specifically, a comparative case study has been conducted examining and comparing flood risk management in the cases of Dordrecht and Valkenburg. Dordrecht has been part of a pilot project for implementing integrated flood risk management. Therefore, it is assumed that the city is ahead of other cities in terms of prioritizing and developing integrated flood risk management. Contradictory, Valkenburg has not been part of this pilot study but has faced major and unexpected floods in 2021.

Data has been collected through a literature review, desk research, and 15 semi-structured interviews with key actors involved in flood risk management in Dordrecht or Valkenburg. The results show that institutional, contextual, political, and discursive factors influence the failure or success of integrated flood risk management in Dordrecht and Valkenburg in different ways. Institutional, political, and discursive factors were found to influence both success and failure of integrated flood risk management in Dordrecht and Valkenburg whereas contextual factors influence success of integrated flood risk management in Dordrecht and Valkenburg. However, how these factors influence integrated flood risk management exactly is area-specific. The results are critically discussed by providing five main considerations that stood out as interesting insights. These include (1) an attempted shift toward nature-based solutions, (2) a proposed shift toward the (socio-) ecological resilience discourse, (3) past flood events as catalysts for

integrated flood risk management, (4) mental recovery as an overlooked dimension of flood recovery, and (5) more financial resources due to changing discourses and an increasing sense of urgency. Based on the results, discussion, conclusion, and limitations, multiple recommendations for policymakers and future research are provided to enhance the implementation of integrated flood risk management.

Keywords

Institutional perspective, Integrated Flood Risk Management, Politicized Institutional Analysis and Development (IAD) Framework, StarFlood Flood Risk Management Strategies

Preface

Nijmegen, February 2024

Dear reader,

Hereby, I proudly present you my master's thesis ‘Factors Influencing Success and Failure of Integrated Flood Risk Management: an Institutional Understanding of Flood Risk Management in Dordrecht and Valkenburg’. By finishing this master's thesis, my master's Spatial Planning: Cities, Water, and Climate Change has come to an end. In this thesis, I gained insights into how institutional, contextual, political, and discursive factors influence success or failure of integrated flood risk management by looking at two cases in Dordrecht and Valkenburg.

During my bachelor of Geography, Planning, and Environment, I discovered that I was intrigued by climate change and how it influences the way in which the living environment is managed. To learn more about this, I decided to study Spatial Planning and specialize in Cities, Water, and Climate Change. Even though the subject of my research was close to my heart, the process of writing my thesis has not always been easy. After spending two years behind my laptop without a lot of real-life contact due to COVID-19, I was not eager to spend more time behind my laptop. Nevertheless, I was able to write my thesis with a lot of ideas, enthusiasm, and motivation. Even though it took me more time to finish my thesis than I expected, I am proud of the writing process.

I would like to express my gratitude to some people who have been very important to me in this period of writing my thesis. Firstly, I would like to thank my family and friends for always being supportive and patient and helping me plan. Of course, I would like to thank my supervisor, Dr. Corinne Vitale, for her support, time, and motivational words during my research. During the whole process of writing my thesis, she provided me with useful feedback and the conversations we had during our meetings were very enjoyable. I would also like to thank Dr. Iulian Barba-Lata for grading my thesis. Last but not least, I would like to thank the interviewees for taking the time to provide me with information and tips.

Enjoy reading my thesis,

Janne Goossens

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1. Introduction

1.1 Research Introduction

Climate change is caused by natural and human influences and leads to various effects such as rising sea levels and more precipitation (Neil Adger et al., 2005). Among these effects, there has been a rise in the frequency and severity of floods and an overall increase in flood risks (Ward et al., 2013). Floods in Europe have become a growing concern for citizens, authorities, insurance companies, and policymakers over the last decades. They cause serious threats to inhabited areas as the vulnerability and exposure of human settlements has grown dramatically (Ballesteros-Cánovas et al., 2013; Feyen et al., 2012; Hansson et al., 2008; Kaufmann et al., 2016; Van Alphen et al., 2009). These threats include both severe human and economic impacts such as deaths and enormous amounts of costs to repair damages (Jonkman & Dawson, 2012).

Given the increasing frequency and severity of floods, it is recognized that there is a need for an integrated approach to flood risk management involving a variety of strategies and measures. Recent flood events have shown that structural and hard-engineered solutions to flood risk alone cannot fully guarantee protection and mitigation from floods (Van Herk et al., 2011b; Zevenbergen et al., 2008). Structural measures can cause a false sense of security in populations and even though they are able to reduce flood risks in one location, they can potentially increase risks in another (Jha et al., 2012). Therefore, an integrated and adaptive approach to flood risk management is needed that combines both structural measures (i.e. drainage channels and embankments) and non-structural measures (i.e. early warning systems and flood awareness campaigns) (Jha et al., 2012; Van Herk et al., 2011b; Zevenbergen et al., 2008).

The need for an integrated and comprehensive approach to flood risk management is also advocated on a European level through the European Flood Risk Directive (2007/60/EC). This Directive is a legal tool for flood risk management aiming to increase flood resilience in Europe (Karrasch et al., 2021). The Directive has great potential to form a basis for a transboundary and common framework supporting integrated flood risk management in the European Union. It prescribes every European Union member state to prepare and publish integrated flood risk management plans by combining five different strategies including both structural and non-structural measures (Van Alphen et al., 2009). For sustainable and integrated policy, applying multiple strategies and measures simultaneously is necessary (Hegger et al., 2013; Wiering, 2019).

1.2 Problem Statement

Although the European Flood Risk Directive (2007/60/EC) tries to improve flood resilience by advocating the integration of different strategies in flood risk management, integrated flood risk management is not easily achieved. There is no consistent use of integrated flood risk management strategies and measures and their implementation yet (Priest et al., 2016; Watson & Adams, 2011). The lack of integration in flood risk management has several underlying causes. First of all, governance challenges are hampering the implementation of integrated flood risk management (Dieperink et al., 2016; Dieperink et al., 2018). The integration of flood risk management strategies in practice is difficult because there is a fragmented and multi-layered allocation of tasks across different authorities (Karrasch et al., 2021). Different flood risk management strategies are the responsibilities of different actors displaced at different governmental layers (Priest et al., 2016). In addition, effective governance arrangements and collaborations between different authorities are lacking. Without well-functioning coordination and governance mechanisms, integrated flood risk management cannot be implemented (Dieperink et al., 2016; Dieperink et al., 2018). To overcome these governance challenges, cooperation among actors in different policy sectors and different institutional levels is needed (Bosoni et al., 2023; Hegger et al., 2013; Karrasch et al., 2021; Ministerie van Verkeer en Waterstaat, 2009; Restemeyer et al., 2015; Sörensen et al., 2016; Wiering, 2019).

Secondly, limited financing hinders the implementation of integrated flood risk management. Integrated flood risk management strategies and measures serve multiple purposes such as defending against floods while simultaneously enhancing spatial quality and flood risk awareness. Even though the fact that there is an increasing acknowledgment that integrated flood risk management is beneficial in the long term, traditional and siloed strategies and measures are still preferred by financing authorities (Van Doorn-Hoekveld et al., 2019; Van Doorn-Hoekveld et al., 2020). This is because the functioning of integrated flood risk management strategies and measures is not completely widely known and their implementation requires more space and time than traditional strategies and measures like dike reinforcements (Van Doorn-Hoekveld et al., 2019; Van Doorn-Hoekveld et al., 2020; Wehn et al., 2015). Additionally, a low public awareness about integrated flood risk management hampers its implementation. Awareness regarding flood risks is limited to the responsible institutions and inhabitants tend to rely on the expertise of hydraulic engineers. As a consequence, inhabitants´ preparedness to engage in integrated flood risk management is low which could be a problem in case of floods (Wehn et al., 2015).

1.3 Research Aim and Research Questions

The challenges regarding the implementation of integrated flood risk management have to do with the current institutional settings. These encompass the complex web of regulations, administrative structures, and organizational frameworks that might impact decision-making, coordination, and awareness about integrated flood risk management among various actors. To better understand why the implementation of integrated flood risk management is difficult to achieve in practice, an institutional analysis is conducted in this thesis by using the politicized institutional analysis and development (IAD) framework by Clement (2010). An institutional analysis helps to understand how institutions work, evolve, and change over time and to what extent these institutions shape policy responses and the resulting flood risk management strategies and measures (Ostrom, 2005; Vitale & Meijerink, 2021a).

The politicized institutional analysis and development (IAD) framework is used in a comparative case study to examine flood risk management in Dordrecht and Valkenburg. Dordrecht has been a part of the Dutch Delta Program introducing a pilot project to improve flood safety. Therefore, the city is assumed to be ahead compared to other cities when talking about prioritizing and developing integrated flood risk management strategies and measures (Gersonius et al., 2016a; Van Herk et al., 2013). This is needed because Dordrecht is enclosed by rivers and is relatively densely populated. This makes it one of the areas with the highest flood risks in the Netherlands (Planbureau voor de Leefomgeving, n.d.). Valkenburg has not been part of this pilot but has faced major and unexpected floods recently. During the summer of 2021, 2300 houses, 270 restaurants, and 180 shops were damaged due to the flooding of the river Geul (1Limburg, 2021). The hills in South Limburg cause precipitation from surrounding areas to be funneled through a specific point in Valkenburg's city center, creating a bottleneck for the flow of water. Because of this, increasing the safety level in the area is harder (Trommelen et al., 2022).

So, both Dordrecht and Valkenburg face flood risks in their own way but differ in many other aspects like their physical conditions, demographical aspects, international collaborations, context, and discourse. I believe that examining these cases can help to get a better understanding of why the implementation of integrated flood risk management strategies and measures is hard to achieve in practice.

The aim of the research is the following:

To gain a better understanding of the institutional, contextual, political, and discursive factors supporting and/or hindering integrated flood risk management in Dordrecht and Valkenburg in order to enhance the implementation of integrated flood risk management.

To gain qualitative knowledge, the following main research question is drafted:

How do institutional, contextual, political, and discursive factors influence the failure or success of integrated flood risk management in Dordrecht and Valkenburg?

To be able to answer the main question, sub-questions are drafted:

1) *What is integrated flood risk management and how can this be achieved?*
2) *How is flood risk management currently organized in Dordrecht and Valkenburg?*
3) *What are the key challenges and opportunities in implementing integrated flood risk management in the specific contexts of Dordrecht and Valkenburg?*

1.4 Scientific and Societal Relevance

1.4.1 Scientific Relevance

Over the past decades, integrated flood risk management has become increasingly important as the frequency and severity of floods have increased due to climate change (Neil Adger et al., 2005). However, the implementation of integrated flood risk management is lagging (Priest et al., 2016). Several articles with a variety of perspectives (i.e. a social perspective, a discursive perspective and an economic perspective) have been published to examine the lack of integration in flood risk management strategies and measures (Cumiskey et al., 2019; Gersonius et al., 2016b; Gilissen et al., 2016; Hartmann & Jüpner, 2014; Hegger et al., 2018; Hegger et al., 2016a; Morrison et al., 2018; Patt & Jüpner, 2013; Ran & Nedovic-Budic, 2016; Samuels et al., 2010; Shah et al., 2018; Vinke-de Kruijf et al., 2015).

For instance, Hegger et al. (2018) use an economic perspective to look at integration in flood risk management strategies. In their article, they state that there is a lack of integration because of a lack of resources available to invest in a variety of flood risk management strategies. Additionally, path dependency influences the lack of integrated flood risk management strategies; the commitments made to the dominant strategies in the past make investments in other strategies less desirable and likely (Hegger et al., 2018). Shah et al. (2018, p. 356) acknowledge that previous flood events in Europe, North America, and Asia showed that “a combination of flood risk management strategies is required in all floodplains” as “no single strategy is enough to reduce a flood risk”. In their research, they adopt a physical geographical

perspective to state that the implementation of integrated flood risk management is difficult and lacking. According to Shah et al. (2018, p. 356), this is because "the benefits of structural interventions are immediately visible to the community, while non-structural measures are not". Additionally, achieving integrated flood risk management seems to be difficult due to hydrological uncertainties associated with climatic and morphological changes and the absence of easy access to integrated and high-quality information and the technologies and tools to use this information (Ran & Nedovic-Budic, 2016).

Another theoretical perspective to analyze flood risk management is the institutional perspective. The institutional perspective is of key importance in this thesis as it allows for an understanding of why achieving integrated flood risk management is difficult by taking into account administrative structures, regulations, and organizational frameworks impacting decision-making, coordination, and awareness. Several researchers have adopted an institutional perspective to examine the lack of integration in flood risk management (Cumiskey et al., 2019; Gersonius et al., 2016b; Gilissen et al., 2016; Morrison et al., 2018; Samuels et al., 2010; Vinke-de Kruijf et al., 2015). For instance, Gilissen et al. (2016) and Samuels et al. (2010) found out that the implementation of integrated flood risk management is currently lacking because current flood risk governance arrangements are fragmented and an evolution of policy and practice is needed. Subsequently, Vinke-de Kruijf et al. (2015) state that weak institutional and regulatory frameworks, poor financial management, and a lack of collaboration and capacity cause a lack of integrated flood risk management. With their research, they show that only changes in formal policies are insufficient. To effectively integrate flood risk management measures, additional efforts to improve the extent and coherence of the governance structure are required. For instance, discourses and collaborative practices need to change as well.

According to Gersonius et al. (2016b), difficulties regarding the implementation of integrated flood risk management particularly play a role in the Netherlands and Poland as the prevalent governance arrangements regarding resilient strategies in these countries mainly focus on flood protection and do not facilitate the integration of different measures. The reliance on hard-engineered flood protection and defense strategies is fundamentally incompatible with the need to manage increasing flood risks (Brown & Damery, 2002). This is also stressed by Morrison et al. (2018) who state that there is a lack of integration in flood risk management because transitioning to a more diverse set of strategies has been constrained by governance and the current institutions that are inherently resistant to change. As a solution, Morrison et al. (2018) advocate that more guidance for improving flood risk management governance should be

available from scholarly literature to enhance integration. To better understand these institutional challenges in achieving integrated flood risk management, Cumiskey et al. (2019) have introduced a framework for identifying degrees of integration in flood risk management. The framework shows the interconnectivity between governance capacity and the realization of integration. They state that actor relationships and influencing mechanisms such as policies and channels for the exchange of knowledge determine the realization of integrated flood risk management.

The studies mentioned above show that current research adopting an institutional perspective is mainly narrowly focused on governance capacity and arrangements. By drawing on this scholarship, this research adopts a broader institutional perspective to examine how institutional, contextual, political, and discursive factors influence the failure or success of integrated flood risk management.

1.4.2 Societal Relevance

Over the last decades, the number of floods has increased. Floods are among the most severe natural hazards in Europe causing threats to inhabited areas while the population living in these areas has increased (Ballesteros-Cánovas et al., 2013; Feyen et al., 2012; Kaufmann et al., 2016; Van Alphen et al., 2009). Floods might have numerous impacts on people. For instance, more than 180 lives were claimed and more than 40.000 people were affected by floods caused by heavy rain in Germany in July 2021 (Fekete & Sandholz, 2021). In April 2022, approximately 450 people died and more than 40,000 people became homeless due to enormous amounts of rainfall in South Africa (NOS, 2022). In the summer of 2023, many inhabitants and tourists had to evacuate due to floods in Slovenia which caused six casualties (NOS, 2023a). Additionally, the north-east of India faced floods as well in October 2023 which caused at least 10 deaths and more than 80 missing people (NOS, 2023b). Next to missing people and deaths, floods can have long-term indirect impacts on people and communities affected by them. Losing important personal belongings and experiencing damage to properties can lead – among others – to negative psychological effects on people (Bubeck et al., 2017). Fekete and Sandholz (2021) also state that, as climate change carries on, the severity and frequency of floods are expected to get worse in the future.

In addition, floods can cause economic losses such as the costs of economic and infrastructural recovery and production losses (Dottori et al., 2018; Levermann, 2014; Willner et al., 2018). The economic losses caused by floods are expected to increase for all global warming situations (Koks et al., 2019). These economic losses can even take an indirect form,

such as loss of turnovers due to disruptions in supply chains (Bubeck et al., 2017). For instance, the floods in Limburg in 2021 caused an estimated damage of 1.8 billion euros (Rijksdienst voor Ondernemend Nederland, 2021). The economic damage caused by floods increases due to socio-economic developments (Barredo, 2009; Seher & Löschner, 2018). Europe has experienced population growth in combination with improved life quality standards and increased wealth, which results in increased exposure to floods (Vitale & Meijerink, 2021c). The economic impacts of floods can even reach far beyond the affected regions through the interconnected transboundary trade flows (Koks et al., 2019).

As society is increasingly threatened by floods which cause damages and casualties, there is a call for a more integrated approach to the management of flood risks. An integrated approach to flood risk management can reduce the impacts of floods on human and socio-economic settings. This stresses the necessity and relevance of this research as a better understanding of how the institutional, contextual, political, and discursive factors allows us to learn more about the factors supporting and hindering integrated flood risk management in Dordrecht and Valkenburg.

1.5 Thesis Outline

This thesis proceeds with chapter 2 in which flood risk management and the politicized institutional analysis and development (IAD) framework are discussed. Subsequently, chapter 3 elaborates on the methodology used in this thesis by covering the research philosophy, the research strategy, data collection, data analysis, validity and reliability, and ethical considerations. In chapter 4, the results from the interviews and desk research are presented and illustrated using quotes. This is followed up by a critical discussion of the results in chapter 5. Subsequently, chapter 6 provides a conclusion by answering the sub-questions and main research question. Chapter 7 reflects upon the limitations of the theory, methodology, and the role of the researcher. Subsequently, recommendations for policymakers and future research are provided.

2. Literature and Conceptual Framework

2.1 Flood Risk Management

Due to its various environmental impacts, climate change is regarded as one of today's most pressing global issues. Urgent and drastic actions are needed to limit climate change and its impacts (IPCC, 2022). Such urgent and drastic actions fall under climate mitigation and adaptation. Climate mitigation can be defined as a response to climate change that involves reducing or stabilizing greenhouse gas emissions (Smit et al., 1999). However, climate mitigation alone is not a sufficient response to climate change as the concentration of greenhouse gas emissions is expected to continue increasing even though strong mitigation measures are implemented. Therefore, climate adaptation is also needed as a response strategy (Mata & Budhooram, 2007). Smit et al. (1999, p. 200) define climate adaptation as "adjustments in ecological, social or economic systems in response to actual or expected climate stimuli and their effects or impacts". Climate adaptation adjustments are generally considered in extreme events such as floods (Smit et al., 1999). Flood risk management is an example of climate adaptation.

Flood risk management is the process of decision-making involving flood risk management plans, strategies, and measures to reduce flood risks (Hall & Penning-Rowsell, 2010; Schanze et al., 2006). Flood resilience has been increasingly recognized as an essential aspect of flood risk management (Fu et al., 2020). The concept of resilience embraces the philosophy that society should learn to live with floods and manage flood risks instead of seeking to avoid them (Zevenbergen et al., 2020). Different features of flood risk management have been mentioned in scientific articles. Restemeyer et al. (2015) use robustness, adaptability, and transformability as three key characteristics of flood risk management strategies. According to Sörensen et al. (2016), flood risk management is about retreating, defending, and attacking. Karrasch et al. (2021) use the flood resilience rose which shows that flood risk management is about recovery, protection, prevention, and preparedness. According to StarFlood, flood resilience can be achieved by better integrating different types of measures, namely risk prevention, flood defense, flood mitigation, flood preparation, and flood recovery (Hegger et al., 2013; Wiering, 2019). StarFlood covers the most extensive diversification of flood risk management strategies which is why the StarFlood strategies classification will be used in this thesis.

The StarFlood strategies are illustrated in figure 1.

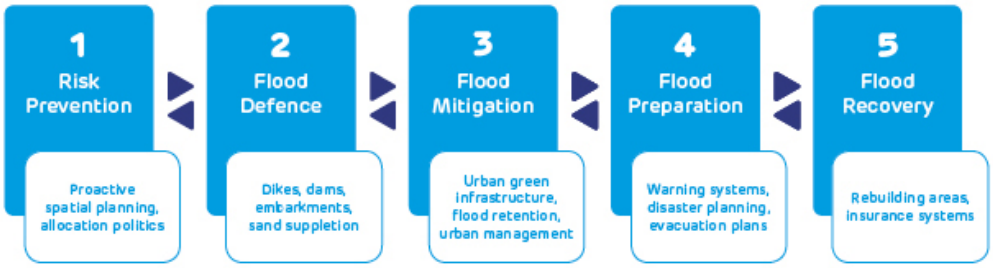

Figure 1: Overview of the five flood risk management strategies identified in StarFlood (Hegger et al., 2016b)

To begin with, risk prevention aims to decrease the consequences of flooding by decreasing the exposure of people and property through methods discouraging developments in floodplains (Hegger et al., 2016a). Flood defense decreases the probability of floods through infrastructural works creating space for water and increasing the capacity of channels. The next strategy is flood mitigation, focusing on decreasing the consequences of floods by implementing measures in vulnerable areas, such as water retention and (regulations for) flood-proof buildings (Hegger et al., 2016a). The fourth strategy is flood preparation, which is about preparing for possible floods through warning systems, disaster planning, and evacuation plans (Hegger et al., 2016b; Van Alphen et al., 2009). Flood recovery is the last strategy, which aims at facilitating a good and fast recovery after a flood event (Hegger et al., 2016a).

Integrated flood risk management can be achieved by combining both structural measures (i.e. flood defense and several flood mitigation measures such as retention basins) and non-structural measures (i.e. risk prevention, flood preparation, flood recovery and several flood mitigation measures such as regulations for flood-proof building) (Jha et al., 2012; Van Herk et al., 2011b). To achieve integrated flood risk management, and with reference to the StarFlood strategies, it is necessary to apply these five strategies simultaneously. Besides the actual measures, integrated flood risk management requires appropriate coordination. This means that the strategies should make efficient use of resources and should be considered legitimate by all actors involved (Hegger et al., 2013). However, the diversification of flood risk management into different strategies might confront institutional fragmentation as strategies are implemented within different policy domains and by various actors. For example, the Rijkswaterstaat is responsible for the strategy of flood defense like dikes, while municipalities and provinces are responsible for building parks with urban green which is an example of the strategy of flood mitigation. Enhancing the interconnectedness within this diversified and current fragmented institutional system is essential to achieve integrated flood risk management (Gilissen et al.,

2016; Samuels et al., 2010). Appendix 2 shows the operationalization table of StarFlood's five flood risk management strategies.

2.2 The Politicized Institutional Analysis and Development (IAD) Framework

There are different perspectives to look at integrated flood risk management. In this thesis, an institutional perspective is used which helps to understand how institutional, contextual, political, and discursive factors support and/or hinder integrated flood risk management. Institutions play a crucial role in shaping climate change adaptation measures like flood risk management (Agrawal, 2008). According to Ostrom (2005), institutions are defined as the prescriptions that humans use to organize all forms of repetitive and structured interactions including those within neighborhoods, markets, and governments at all scales. Institutional studies have developed extensively to identify, understand, and design rules enabling equitable, efficient, and sustainable people-environment interactions like in flood risk management (Ostrom, 2007). Several institutional frameworks have been developed for studying these people-environment interactions (Clement, 2008). For instance, the institutional analysis and development (IAD) framework by Ostrom et al. (1994) and other theoretical assumptions behind different approaches such as rational choice institutionalism, historical institutionalism, and discursive institutionalism.

According to Ostrom (1991), rational choice institutionalism is seen as a 'theory of advice' informing rational individuals about how to best achieve objectives. In this way, rational choice institutionalism assumes that political actors rank-order their goals in a transitive manner and use the best available means to pursue their ends and maximize their utility (Weyland, 2002). Historical institutionalism is an approach that focuses on path dependency and historical explanations to answer outcome-oriented questions about political phenomena (Amenta, 2012). Discursive institutionalism, instead, gives insights into the role of ideas and discourses in politics and provides a dynamic approach to institutional change (Schmidt, 2008). However, each of these approaches has its limitations making them unsuitable for examining how institutional, contextual, political, and discursive factors influence the failure or success of integrated flood risk management in Dordrecht and Valkenburg. For instance, rational choice institutionalism "ignores nonrational human behavior" in decision-making (Blau, 1997, p. 16) whereas historical institutionalism does not take into account the political contexts and factors as a means of initiating change (Peters et al., 2005). Moreover, discursive institutionalism fails to consider relations between power, political factors, and discursive factors to explain changes (Panizza & Miorelli, 2013).

Unlike other institutional frameworks, the institutional analysis and development (IAD) framework by Ostrom et al. (1994) enables a disentanglement of a rich set of rules-in-use (Vitale & Meijerink, 2021c). The framework helps analysts comprehend complex social situations and break them down into manageable sets of practical activities and is suitable for understanding how institutions work, change, and evolve (Van den Hurk et al., 2014; Vitale & Meijerink, 2021a). Clement (2010) changed the original IAD framework by adding two variables capturing the politico-economic context and discourses. In this way, the politicized IAD framework takes into account the role of discursive, political, institutional, and contextual factors in explaining the patterns of interactions within the action arenas and the outcomes from the decision-making processes (Vitale & Meijerink, 2021c).

According to Imperial (1999) and Carlsson (2000), the politicized IAD framework is one of the most distinguished and tested institutional frameworks. The politicized approach enables the identification and analysis of power asymmetries within the action arena by including discourses and the politico-economic context as two additional exogenous variables (Vitale & Meijerink, 2021c). The politicized IAD framework fits this research as it helps to better understand how institutional, contextual, political, and discursive factors support or hinder integrated flood risk management in Dordrecht and Valkenburg by providing insights into the role of and dynamics between actors.

According to Clement (2008), the framework holds two other key advantages compared to other institutional frameworks. Firstly, it has the potential to link the decisions of participants with higher governance levels, which is an essential feature in analyzing the impact of flood risk management policies on the cases of Dordrecht and Valkenburg. Secondly, the framework can define and link the exogenous factors affecting decisions and outcomes in flood risk management plans. The framework takes into account the co-actions of these exogenous factors on decision-making about flood risk management measures by actors in the action arena (Clement, 2008). Because of these advantages, the politicized institutional analysis and development (IAD) framework is considered suitable to examine flood risk management in Dordrecht and Valkenburg by paying attention to exogenous factors affecting the interaction between actors in the action arena. The politicized IAD framework is shown in figure 2. Each element will be elaborated on further in the following paragraphs.

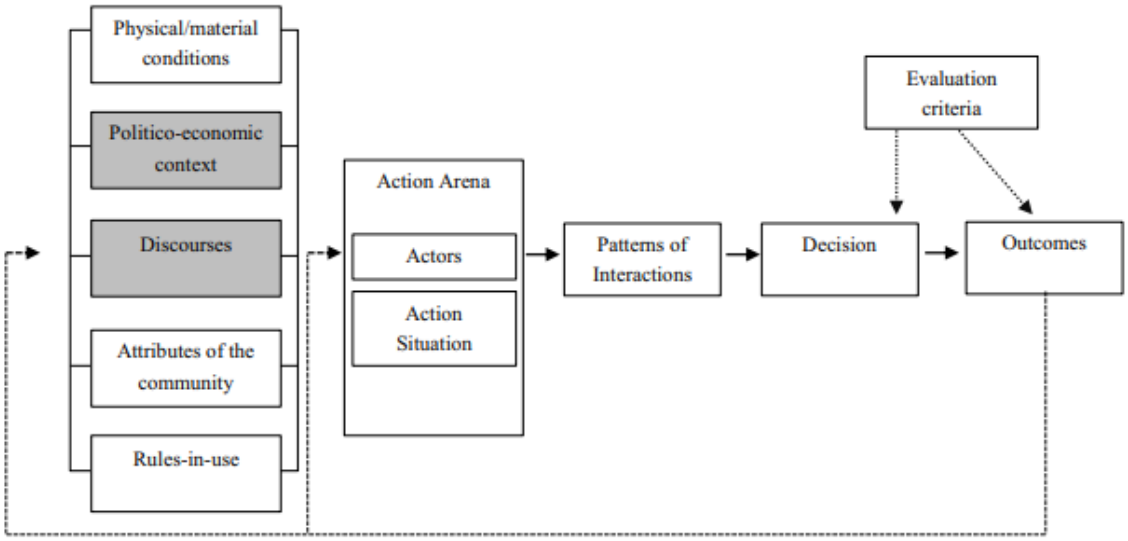

Figure 2: The Politicized Institutional Analysis and Development Framework (Vitale & Meijerink, 2021a)

2.2.1 The Action Arena

According to Polski and Ostrom (1999), the first step in analyzing a certain policy question or problem is to identify the action arena. The action arena is the core of the politicized IAD framework and is "a conceptual space in which actors inform themselves, consider alternative courses of action, make decisions, take action, and experience the consequences of these actions" (Polski & Ostrom, 1999, p. 20). Action arenas include an action situation and the actors involved in the situation (Ostrom, 2007; Van den Hurk et al., 2014). Both components are needed to diagnose, explain, and predict actions and their results (Ostrom, 2007).

According to Ostrom (2007, p. 11), action situations are "the social spaces where individuals interact, exchange goods and services, solve problems, dominate one another, and fight". Action situations involve participants in positions who have to decide between a diversity of actions using the information they possess about how actions are linked to potential outcomes (Van den Hurk et al., 2014). According to Clement and Amezaga (2009), the way in which power is distributed and how political and economic interests drive actors' decisions within a particular set of rules should be considered as well when analyzing the action situation. Within an action situation, actors occupy certain positions from which they make decisions between various possible actions (Anderies & Janssen, 2013). The actor in a situation can be a single individual or a group. Action arenas are affected by five interdependent types of exogenous factors which are covered below (Clement, 2010; Polski & Ostrom, 1999). Further details about the main features of the action arena are provided in the operationalization table in appendix 2.

2.2.2 Exogenous Factors

1) Physical and Material Conditions

According to Clement (2010), physical and material conditions are about aspects of the physical world around us. They determine policy choices and the likeliness that actions occur and outcomes are reached (Van den Hurk et al., 2014; Vitale & Meijerink, 2021a). By taking into account the variable of physical and material conditions, there is a better understanding of why the implementation of certain measures is decided upon (Vitale et al., 2021b). Material and physical conditions include the physical features of the environment and landscape, such as urbanization, hydrography, and surrounding nature (Polski & Ostrom, 1999). Further information is provided in the table in appendix 2.

2) Attributes of the Community

The attributes of the community are the social ties and cultural context in which the actors interact (Cole et al., 2019). By considering the attributes of the community, dominant discourses of resilience to which actors adhere, the measures that they propose and the extent to which they are likely to be implemented can be identified (Vitale et al., 2021b). Community attributes are likely to affect human behavior when interacting in decision-making processes and can be seen as potentially significant causal factors for institutions and the resulting policy outcomes (Van den Hurk et al., 2014). Community attributes include three dimensions: (1) the degree of common understanding and trust within a community, (2) shared norms, values, beliefs, and preferences, and (3) who belongs to the community (Clement, 2010; Ostrom, 2007). In appendix 2, the attributes of the community are further operationalized into indicators.

3) Discourses

Discourses consider the roles of values, beliefs, and norms in shaping the preferences of actors involved in decision-making (Clement, 2010). They can be seen as an "ensemble of ideas, concepts, and categories through which meaning is given to social and physical phenomena and which is produced and reproduced through a set of practices" (Hajer, 2005, p. 303). As actors are members of a community, they may support a specific discourse (Vitale & Meijerink, 2021a). According to Kaufmann et al. (2016), discourses and institutions influence each other as institutions are constituted by discourses and govern individuals' behaviors. This means that institutions influence the establishment of new discourses. Subsequently, discourses explain why certain policy options are favored to the detriment of others (Vitale & Meijerink, 2021c). Taking into account the politicized IAD framework, discourses are tightly connected to attributes of the community as a member of a community of actors may also support a specific discourse

including values, beliefs, and norms (Vitale & Meijerink, 2021a). In this thesis, by looking into the variable of discourses, I will explore the dominant resilience discourses actors adhere to and the flood risk management measures they propose and are likely to be implemented by these actors (Vitale et al., 2021b).

Resilience is defined as a "system's ability to resume functionality" after a flood event (McClymont et al., 2020, p. 1152). Within flood risk management, three discourses of resilience can be identified: engineering, ecological, and socio-ecological resilience. Engineering resilience is the more traditional form of resilience and concentrates on stability near an equilibrium steady state (Holling, 1996). It is about bouncing back to a normal safe state after a flood event (Chelleri et al., 2015). The goal for systems based on engineering resilience is to remain in the idealized state. Engineering resilience lacks a critical component of adaptation which refrains cities from learning how to better manage shocks. In this way, cities remain potentially vulnerable to disasters (Disse et al., 2020). Vitale and Meijerink (2021c) link the discourse of engineering resilience to measures that reduce flood hazards. These measures are generally technical measures (e.g. dams, dikes, and spillways) and spatial measures (e.g. water storage reservoirs and multi-functional flood defenses) that aim to "keep floods away from urban areas" (Oosterberg et al., 2005, p. 23). Concerning the StarFlood strategies, the engineering resilience discourse fits flood defense and flood mitigation.

Ecological and socio-ecological resilience deny the idea of a stable equilibrium as it is perceived as a new state towards which it strives (Davoudi et al., 2012). According to Holling (1996) and Folke (2006), these discourses suggest that resilience is about the ability of systems to absorb changes while developing new trajectories and evolve into a new system. Socio-ecological resilience explicitly focuses on the ability of people to face external disturbances and to cope with their changes (Adger, 2000). For instance, local communities may organize themselves, decide to flood-proof their houses, prepare for evacuations, and decide to no longer develop in flood-prone areas (Vitale et al., 2020). Both ecological and socio-ecological resilience aim to reduce flood vulnerability by "preparing urban areas for floods" (Oosterberg et al., 2005, p. 24). This can be done by for instance early warning and emergency measures or by adjusting the built environment (by for instance preventing urbanization in flood-prone areas) (Vitale & Meijerink, 2021c). In this way, the exposure to floods is minimized (Oosterberg et al., 2005). In terms of StarFlood strategies, ecological resilience includes risk prevention, flood mitigation, flood preparation, and flood recovery. The socio-ecological resilience discourse specifically fits StarFlood strategies of flood preparation and flood recovery. Discourses are further

operationalized in the operationalization table in appendix 2. In the results section, discourses are provided together with the attributes of the community as their meanings are tightly connected.

4) Rules-in-use

Rules-in-use are the "minimal but necessary set of rules that are needed to explain policy-related actions, interactions and outcomes" (Polski & Ostrom, 1999, p. 23). The rules-in-use have a dynamic character as a change in one rule can influence the working of other rules (Van den Hurk et al., 2014). By looking at the rules-in-use, there is a better understanding of which actors gain legitimacy and how they exercise their power (Vitale et al., 2021b). Seven types of rules-in-use can be identified (Ostrom, 2005). Position rules specify the positions and roles each actor in an action situation has and the number and type of participants holding each position. Additionally, position rules are about the collaborations between actors. Boundary rules specify which participants enter or leave positions and in what way they do this; authority rules specify the actions participants in a given position may take based on their tasks and roles (Polski & Ostrom, 1999). The fourth type of rules-in-use is aggregation rules, which specify the hierarchy in decision-making between actors and organizations. Aggregation rules are about how decisions are made, for instance by command, consultation, vote, or consensus (Vitale & Meijerink, 2021c). Scope rules identify intended policy outcomes (Polski & Ostrom, 1999); in this thesis, these are about the desired flood risk management plans and the actions that are linked to these (Smajgl et al., 2009). The next type of rules-in-use is the information rules which affect the amount and type of information available to participants in the action arena (Polski & Ostrom, 1999). Finally, payoff rules are about determining how costs and benefits are meted out in the action arena (Polski & Ostrom, 1999; Van den Hurk et al., 2014). The operationalization table in appendix 2 explains the rules-in-use in more detail.

5) Politico-economic Context

The politico-economic context is about how power is distributed among actors who make decisions and to what extent political and economic interests drive actors' decisions within the rules-in-use (Clement, 2010; Vitale & Meijerink, 2021a). A better understanding of how power is distributed can help elucidate who makes decisions and the power play between the actors involved (Vitale et al., 2021b). The distribution of power is measured by indicating which actors are involved in decision-making processes and which are not. To measure the distribution of power, an understanding of both the local and wider political and economic situation and how

this affects the behavior of actors is needed (Whaley & Weatherhead, 2014). In appendix 2, the operationalization of the politico-economic context is shown.

2.2.3 Patterns of Interactions

Patterns of interaction refer to structural characteristics of the action situations and behaviors of actors in the action arena (Polski & Ostrom, 1999). Patterns of interaction are influenced by decisions taken by individuals within the context of community norms. Key patterns of these structures typically include information flows and the structure of political participation (Polski & Ostrom, 1999). The complete operationalization of patterns of interactions is provided in appendix 2.

2.2.4 Outcomes

Outcomes are the results of the patterns of interactions within a certain policy system and can take the form of institutions, knowledge, and operational outcomes (McGinnis, 2011; Polski & Ostrom, 1999). These outcomes feed back into the exogenous variables and the action arena (Brodrechtova et al., 2018). In this research, the outcomes as stated in the politicized IAD framework are the strategies taken to help reduce flood risks in Dordrecht and Valkenburg. These strategies are those identified by StarFlood which have been mentioned above. Further information about the operationalization of outcomes is given in appendix 2.

According to Disse et al. (2020), the discourse of engineering resilience is suitable for strategies of flood protection and strategies allowing it to withstand the impacts of floods. Engineering resilience therefore suits the StarFlood strategies of flood defense and flood mitigation. Examples of infrastructure suiting the domain of engineering resilience are dikes, dams, water buffers, and spillways as these can be designed to withstand the impacts of floods and return to their former state (Wang et al., 2022). Ecological resilience denies the idea of a stable equilibrium as it is perceived as a new state towards which it strives (Davoudi et al., 2012). Ecological resilience suggests that resilience is about the ability of systems to absorb changes while developing new trajectories and evolving into a new system (Folke, 2006; Holling, 1996). This may lead to flood risk management strategies and measures such as subsidies, insurance systems, proactive planning, and allocation policies (Disse et al., 2020). The discourse of ecological resilience therefore fits the StarFlood strategies of flood mitigation, risk prevention, flood preparation, and flood recovery.

Social-ecological resilience also suggests that resilience is about the ability of systems to absorb changes while developing new trajectories and evolving into a new system (Folke, 2006;

Holling, 1996). In contrast to ecological resilience, social-ecological resilience is characterized by its focus on the ability of people to face external disturbances and cope with changes (Adger, 2000). In this way, social-ecological resilience fits StarFlood strategies in which humans can be involved and play an active role. These are especially flood preparation and flood recovery. For instance, local communities may organize themselves and prepare for evacuations (Vitale et al., 2020).

2.2.5 Evaluation Criteria

Integration is used as the evaluative criterion in this thesis to assess interactions and outcomes. As Verweij et al. (2021, p. 204) describe, integrated flood risk management implies that "measures take other land use functions (e.g. housing, recreation, and nature conservation), into account". A mix of structural and non-structural strategies and measures is needed to reach the goal of integrated flood risk management (Samuels et al., 2010; World Meteorological Organization, 2009). A diverse selection of flood risk management strategies means that a mix of risk prevention, flood defense, flood mitigation, flood preparation, and flood recovery should be included within the integrated flood risk management plans to minimize flood risks (Wiering, 2019). However, applying multiple strategies simultaneously might be difficult due to institutional fragmentation because they are implemented within different policy domains and by various actors. To prevent this and achieve integrated flood risk management, enhancing the interconnectedness between these different domains and actors is essential (Gilissen et al., 2016; Samuels et al., 2010).

The multi-layer safety approach to flood risk management strategies can be considered an ideal example of integrated flood risk management (figure 3). This approach is used to integrate flood risk management strategies across three different layers (Gilissen et al., 2016). Layer one is about defensive and preventive measures aiming to decrease the probability of floods. For instance constructing, raising, and strengthening dikes, dams, and embankments, reducing pressure on dikes, and using nature-based solutions (Bosoni et al., 2023). The flood defense strategy from StarFlood belongs to layer one. The Dutch government stimulates the innovation of new techniques in terms of defensive and preventive measures. One of the innovations is combining preventive and defensive functions with opportunities for recreation, living, and other spatial-economic developments (Bosoni et al., 2023).

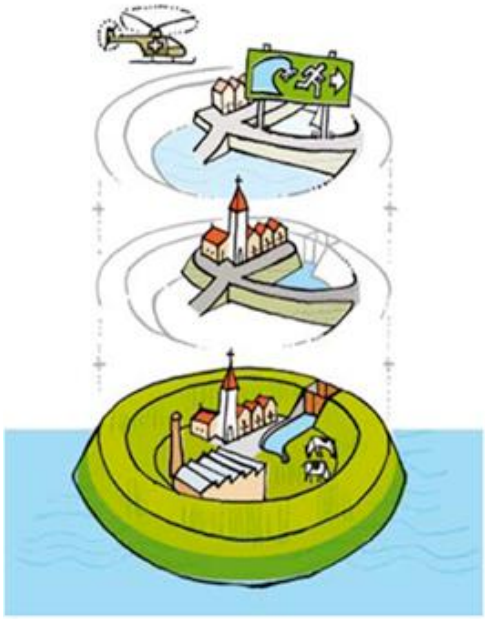

Figure 3: The multi-layer safety approach (Bosoni et al., 2023)

As it is impossible to fully rule out floods, attention is paid to limiting the effects of possible floods (Ministerie van Verkeer en Waterstaat, 2009). Flood risks should be taken into account when planning and developing vulnerable locations. This is done in layer two which comprises resilient spatial planning measures for the mitigation of losses and decreases the consequences of floods. As an example, this entails elevating buildings, introducing zoning plans, and protecting critical or fragile infrastructure like main roads and railways (Bosoni et al., 2023; Van Der Most et al., 2014). StarFlood's strategies of risk prevention and flood mitigation fall under this layer. According to Van Der Most et al. (2014), taking measures in layer two increases an area's physical resilience and society's self-resilience.

The third layer is about disaster management implying the organizational preparation for possible floods. Layer three aims to minimize the number of victims caused by floods by introducing effective and efficient disaster management plans (Van Buuren et al., 2013). Measures belonging to the third layer are for instance evacuation plans, emergency measures, communication systems, and increasing public awareness about floods and flood risks (Bosoni et al., 2023; Tsimopoulou et al., 2013; Van Der Most et al., 2014). Therefore, StarFlood's flood preparation fits this layer. The strategy of flood recovery as mentioned by Hegger et al. (2016a) however, is not covered by one of the layers in the multi-layer safety approach. Further information about the evaluation criteria is available in appendix 2.

2.3 Conceptual Framework

The conceptual framework drafted in figure 4 is based on the literature discussed in the theory section above. A conceptual framework displays the most important aspects of the research and shows their interconnectedness (Vennix, 2011). The five StarFlood strategies are displayed as outcomes as discussed in Clement's politicized institutional analysis and development (IAD) framework (Clement, 2010). Additionally, the outcomes and associated decisions are evaluated by looking at the extent to which the StarFlood strategies are or are not integrated.

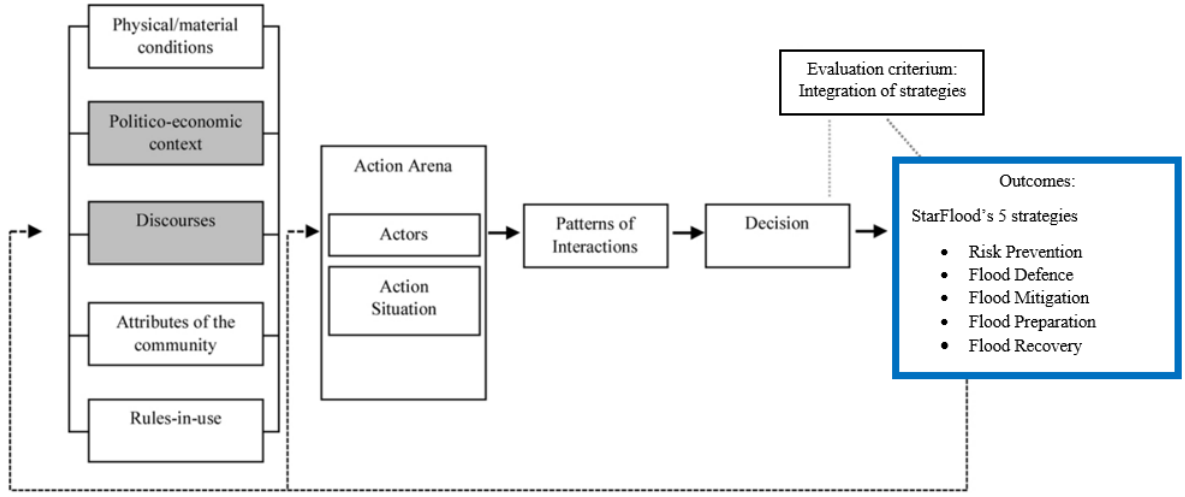

Figure 4: Conceptual framework (own design based on Clement (2010) and Vitale and Meijerink (2021a) (who draw on Ostrom et al. (1994))

3. Methodology

3.1 Research Philosophy

Research philosophy consists of paradigms and assumptions. A paradigm is "a set of basic beliefs and represents a worldview defining the nature of the world around us" (Guba & Lincoln, 1994, p. 107). The paradigm of critical realism was deemed to be the most fitting in this thesis. Critical realism distinguishes between the 'real' world and the 'observable' world. The 'real' world only exists independent of human perceptions, theories, and constructions and cannot be observed. The 'observable' world, however, is the world as we know and understand it. It is constructed through our perspective and experiences (Dean et al., 2006; Gorski, 2013; Scott, 2010). The 'observable' world is assumed to be apprehendable, but it is shaped over time through social, political, cultural, economic, ethnic, and gender factors and then crystallized into a series of structures that are then taken as 'real' (Guba & Lincoln, 1994). According to critical realism, unobservable structures cause observable events. This is the case in this thesis as well as we can analyze the institutional, contextual, political, and discursive factors influencing integrated flood risk management in Dordrecht and Valkenburg by using the politicized IAD framework. However, these factors are formed through underlying mechanisms which cannot always be easily observed.

3.2 Research Strategy

The research strategy is the overall logical procedure and design that will be followed when doing research (Van Thiel, 2014). This master's thesis aims *to gain a better understanding of the institutional, contextual, political, and discursive factors supporting and/or hindering integrated flood risk management in Dordrecht and Valkenburg in order to enhance the implementation of integrated flood risk management.* The main research question is phrased as follows: *How do institutional, contextual, political, and discursive factors influence the failure or success of integrated flood risk management in Dordrecht and Valkenburg?*

To achieve this aim and answer the main research question, qualitative research was done as it enables the necessary in-depth insights and respondents' meanings, experiences, and perspectives (Verschuren & Doorewaard, 2021). According to Guba and Lincoln (1994), methodology based on dialogue between the researcher and objects under research suits the critical theorist paradigm best. Qualitative research is an iterative process, which means that doing qualitative research involves going back and forth between the components of a research design (Geertz, 1974).

As mentioned by Van Thiel (2014), research can be either inductive or deductive depending on the amount of knowledge available and the research philosophy. In inductive research, a theory is developed through the empirical phase (Van Thiel, 2014). In deductive research, a certain theory or hypothesis is set after which it is tested in the empirical phase (Niu et al., 2007). This thesis adopts a deductive research strategy because existing theories and frameworks were suitable to gather the information needed to answer the main research question. In this case, pre-existing theories about the politicized institutional analysis and development (IAD) framework, StarFlood, and integrated flood risk management were used.

Case study selection

There are many qualitative research methods such as grounded theory, case studies, ethnography, and action research (Gibson, 2010). The case study research method has been considered extremely suitable for this thesis. According to Baskarada (2014) and Yin (2017), a case study allows for a deep holistic view and comprehensive understanding of a complex phenomenon (i.e. flood risk management) and is the preferred research method for answering how and why question, such as this thesis' main research question. In this thesis, the two cases of Dordrecht and Valkenburg have been examined and compared, making it a comparative case study. Even though both Dordrecht and Valkenburg face relatively high flood risks, they are very different in terms of physical conditions, demographical aspects, international collaborations, context, and discourse. By comparing these cases, their differences are emphasized. First, both cases were examined separately using the politicized institutional analysis and development (IAD) framework by Clement (2010). To follow, the empirical findings were comparatively analyzed.

The selection of cases in a case study plays a crucial role (Verschuren & Doorewaard, 2021). These cases were selected for the following main reasons. Dordrecht has been part of a pilot project for implementing integrated flood risk management through the multi-layer safety approach (Gersonius et al., 2014). Therefore, it is assumed that the city is ahead of other cities in terms of prioritizing and developing integrated flood risk management strategies and measures (Gersonius et al., 2016a; Van Herk et al., 2013). Valkenburg has been selected in this case study because it was not part of the pilot study. Besides that, the city faced major and unexpected floods in 2021 (1Limburg, 2021). This makes both cases suitable for this comparative case study and to examine how institutional, contextual, political, and discursive factors influence the failure or success of integrated flood risk management. Below, a more extensive description of the cases is provided.

Case study description

In figure 5, Dordrecht is located at the yellow dot while Valkenburg is located at the red dot. Dordrecht is a city in the province of Zuid-Holland and has been a part of the Dutch Delta Program introducing a pilot project to improve flood safety which is needed because it is one of the areas with the highest flood risks in the Netherlands. This is because Dordrecht is enclosed by rivers, is below sea level, and is relatively densely populated (Gersonius et al., 2016a; Planbureau voor de Leefomgeving, n.d.). The last major unexpected flood in Dordrecht took place in 1421. As a consequence, many people drowned and villages disappeared (Kleinhans et al., 2021; Van Asperen et al., 2021).

Figure 5: Map of the Netherlands with location of Dordrecht and Valkenburg (own design based on (Vereniging Transport Begeleiders, 2016))

Valkenburg is located in the south of the province of Limburg has faced unexpected floods more recently, as the flooding of the river Geul in July 2021 damaged a large part of the city (1Limburg, 2021). These floods were caused by an extreme amount of precipitation and the associated high river discharges (Abi Aad et al., 2022). The damage was calculated to be approximately 400 million euros (NOS, 2021). The municipality estimated that it could take up to two years for the area to fully recover as not all damage is covered by insurance and claims take a long time to be handled. Valkenburg is located in the densely populated area of Zuid Limburg and is above sea level, but still has a relatively low safety level in terms of floods (Trommelen et al., 2022). The hills in Zuid Limburg cause precipitation from surrounding areas to be funneled through a specific point in Valkenburg's city center, creating a bottleneck for the flow of water. Because of this, increasing the safety level in the area is harder.

3.3 Data Collection

Case studies typically include multiple qualitative data collection methods, which enhances the quality of data collection (Yin, 2017). In this thesis, a literature review, desk research, and semi-structured interviews have been conducted to answer the main research question and associated sub-questions.

3.3.1 Literature Review

To answer sub-question 1 (*What is integrated flood risk management and how can this be achieved?)* existing knowledge on integrated flood risk management and how to achieve it

was collected through a literature review. A literature review provides extensive information on the subject and allows for the identification of existing relationships and other relevant insights. Literature such as conference papers, books, and journal articles were selected through the databanks Web of Science, RuQuest, and Google Scholar. The search terms used to gather information include integrated flood risk management, diversification flood risk management strategies, integration flood risk management strategies, and achieving integrated flood risk management.

To answer sub-question 2 (*How is flood risk management currently organized in Dordrecht and Valkenburg?),* desk research and semi-structured interviews have been conducted. More information about these research methods is provided below. Sub-question 3 *(What are the key challenges and opportunities in implementing integrated flood risk management in the specific contexts of Dordrecht and Valkenburg?*) is answered by comparing the answers of sub-questions 1 and 2.

3.3.2 Desk Research

Desk research was done in which secondary data sources (i.e. policy documents, newsletters, and articles) were used to answer the main research question and sub-question 2. Especially policy documents have been used as secondary data source as these contain information about the physical and material conditions, politico-economic context, and outcomes. In 2009, integrated flood risk management was advocated for the first time in the Netherlands through the Water Act (Hoss et al., 2013). Therefore, a decision was made to only include secondary data sources published in or after 2009. By doing so, a better understanding of the institutional, contextual, political, and discursive factors supporting or hindering integrated flood risk management in Dordrecht and Valkenburg can be achieved. The data sources were found using Google. Only data sources published by actors from the action arena or knowledge institutes hired by actors from the action arena were selected Additionally, several interviewees provided policy documents and allowed me to use them in this thesis. Table 1 provides an overview of the key documents that have been selected for Dordrecht and Valkenburg. Remarkably, relatively a lot of secondary data sources used for Valkenburg have been published after the floods of 2021. This might be due to an increase in urgency and awareness as a result of these floods.

Table 1: Overview of secondary data sources used in this thesis (own design)

National policy document		
Title	**Author**	**Year**
Nationaal Waterplan 2009-2015	Ministerie van Verkeer en Waterstaat	2009

Dordrecht		
Title	**Author**	**Year**
Convenant klimaatadaptief bouwen in Zuid-Holland	Provincie Zuid-Holland	2018
Proeftuin Zelfredzaam Eiland van Dordrecht: Deltaprogramma Nieuwbouw & Herstructurering	Ministerie van Infrastructuur en Milieu	2013
Buitendijkse waterveiligheid	Gemeente Dordrecht	2016
Calamiteitenregeling Eiland van Dordrecht	Waterschap Hollandse Delta	2015
Deltaprogramma Rijnmond-Drechtsteden: Concept Gebiedsrapportage Eiland van Dordrecht	Ellen Kelder, Berry Gersonius & Martin Hulsebosch	2013

Valkenburg		
Title	**Author**	**Year**
Analyse overstroming Valkenburg	Deltares (van Heeringen et al.)	2022
Rampbestrijdingsplan Hoogwater Limburg 2022-2025	COT Instituut voor Veiligheids- en Crisismanagement	2022
Nieuwsbrief Waterveiligheid en Ruimte Limburg (WRL)	Waterveiligheid en Ruimte Limburg (WRL)	2023
Projectplan Waterwet project: herinrichting Geul benedenstrooms kern Valkenburg fase 2	Waterschap Limburg	2018

3.3.3 Semi-structured Interviews

Semi-structured interviews were conducted to complement the desk research. For instance, the interviews provided information about power dynamics and actors' perspectives which could not be gathered by doing desk research. In a semi-structured interview, an interview guide is used as a guideline which includes several topics and questions that need to be discussed (Van Thiel, 2014). The interview guides used in this thesis are provided in Appendix 3. Semi-structured interviews also provide space for other questions and topics that pop up during the interview to clarify and gain deeper insights (Vennix, 2011). The order in which the questions

were asked can vary depending on how the conversations develop and the questions listed can vary per respondent. As this is a deductive study, the interview questions were based on the operationalization of the variables discussed in the theoretical framework. This means that the interview guide revolved around the politicized institutional analysis and development (IAD) framework, integrated flood risk management, and the StarFlood strategies.

To provide an answer to the research questions, arranging interviews with actors from the action arena was an important step. Multiple actors have been interviewed to collect information using different perspectives from different actors from the action arenas in Dordrecht and Valkenburg. This means that for Dordrecht, 6 interviews have been conducted with actors from the action arena to get a better picture of the institutional, contextual, political, and discursive factors influencing the failure or success of integrated flood risk management in Dordrecht. For Valkenburg, 9 interviews have been conducted with actors. The recent floods in 2021 have increased awareness and the sense of urgency to manage flood risks in Valkenburg. As a result, WRL and Natuurkracht were founded and became key actors in flood risk management in Valkenburg. Because of this, more interviews have been conducted for the case of Valkenburg than Dordrecht. There has been chosen to interview a mix of experts, policy advisors, and councilors to get a good image of the measures taken, the action arena, and the exogenous factors influencing the action arena. Policy advisors and experts know about the measures that have been taken while councilors know about and are involved in the decision-making process.

To start with, contact was made with employees from the municipalities of Dordrecht and Valkenburg aan de Geul through e-mail and LinkedIn. These interviews were an important source of information about the exogenous factors and outcomes. The further selection of respondents was done through a snowball sampling technique. The interviewees were asked whether they knew someone else who might be able to provide useful and insightful information and possibly wanted to participate in the interviews as well. Subsequently, these actors (mainly from water boards, safety regions, and provinces) were sent an e-mail asking them whether they wanted to participate or not. All e-mails and LinkedIn messages contained information about the time needed for the interview and how the data was going to be used and protected. Informed consent was addressed before, during, and after the interviews. This will be pointed out in section 3.6.

In table 2, an overview of the interviewees is provided. Appendix 1 provides a clear overview with more extensive and detailed information about the interviews.

Table 2: Overview of interviewees (own design)

Dordrecht		
Named	**Organization**	**Profession**
D1	Municipality of Dordrecht	Policy advisor
D2	Water board Hollandse Delta	Policy advisor
D3	Water board Hollandse Delta	Policy advisor calamity organization
D4	Safety region Zuid-Holland Zuid	Policy advisor
D5	Province of Zuid-Holland	Policy advisor
D6	Municipality of Dordrecht	Councilor

Valkenburg		
Named	**Organization**	**Profession**
V1	Municipality of Valkenburg aan de Geul	Policy advisor
V2	Municipality of Valkenburg aan de Geul	Policy advisor
V3	Water board Limburg	Policy advisor
V4	Programma Waterveiligheid en Ruimte Limburg	Policy advisor
V5	Water board Limburg	Expert/ Policy advisor
V6	Province of Limburg and Programma Waterveiligheid en Ruimte Limburg	Policy advisor
V7	Water board Limburg and Programma Waterveiligheid en Ruimte Limburg	Councilor and program manager
V8	Municipality of Valkenburg aan de Geul	Councilor
V9	Water board Limburg	Expert calamity organization

3.4 Data Analysis

After collecting the data necessary to answer the main research question, the next step was to analyze the data. The data retrieved by conducting the literature review and desk research have been analyzed manually by coding relevant pieces about integrated flood risk management, institutional, contextual, political, and discursive factors, and flood risk management in Dordrecht and Valkenburg.

Analyzing the interviews started with transcribing the interviews. As transcribing and conducting interviews happened simultaneously, new knowledge and insights were gained that could be used during the next interviews. This led to an improvement in the data collection and analysis process (Miles et al., 2019). The interviews from this thesis were transcribed using Amberscript, a program that simplifies the transcribing process by automatically converting

recordings into transcripts. As these transcripts were not accurate, they were manually adjusted afterward. Once the transcripts were finished, they were analyzed through coding to find patterns in the data. Coding is dividing the text into smaller pieces which will be labeled to a specific category (Attride-Stirling, 2001; Creswell & Poth, 2016). This was done using the program Atlas.ti. In this thesis, the dimensions from the operationalization schemes (appendix 2) formed the pre-determined codes used in the coding process. Fragments from the transcripts were assigned to the indicators and eventually the dimensions and theoretical concepts from the operationalization schemes. A detailed overview of the codes was established in the codebook (appendix 4). Important to note is that only indicators that have been coded are included in this appendix. Indicators that were not used as a code have been deleted. Below, a partial and simplified version of the coding scheme from Atlas.ti is provided (figure 6).

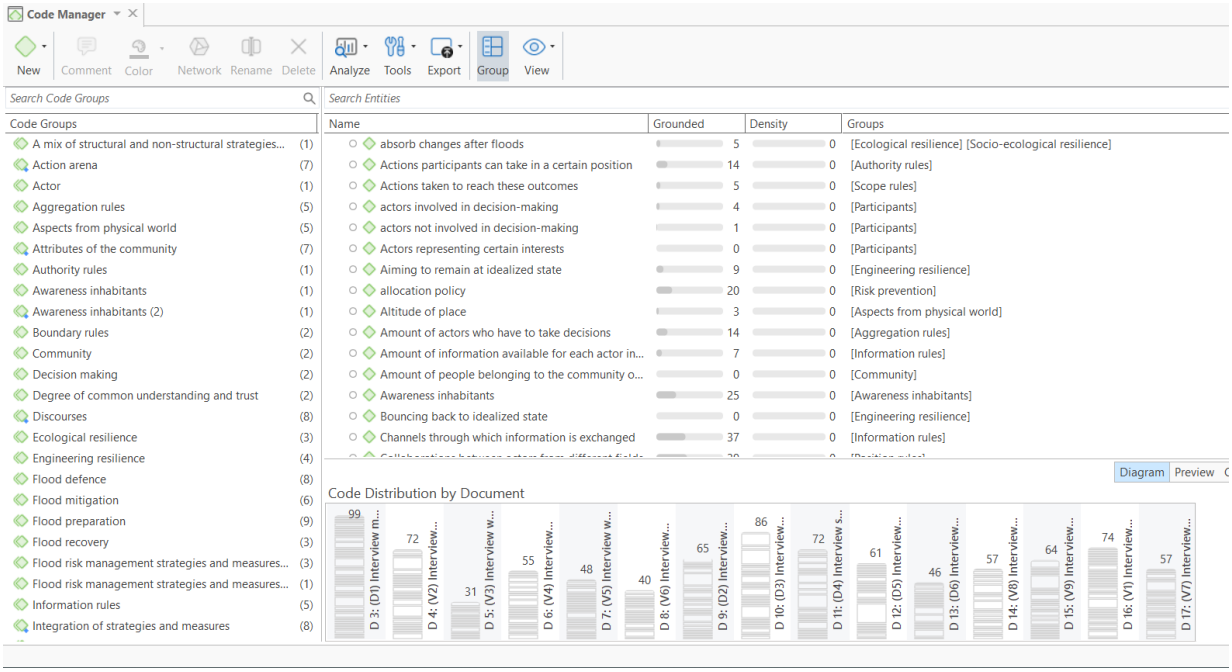

Figure 6: Partial and simplified coding scheme from Atlas.ti (own design)

3.5 Validity and Reliability of the Case Study

The term 'validity' is divided into internal validity and external validity. Internal validity is about whether or not the instruments used are measuring what is intended to be measured (Vennix, 2011). The small number of cases in a study endangers the internal validity of the case study (Van Thiel, 2014). This can be overcome by using multiple research methods (Vennix, 2011). In this thesis, this was done by conducting semi-structured interviews with actors participating in the decision-making process and doing desk research using policy documents, newsletters, and articles about institutional, contextual, political, and discursive factors and flood risk management in Dordrecht and Valkenburg. Internal validity can also be increased by interviewing multiple interviewees. By interviewing multiple interviewees about the same topic,

information from different perspectives is gathered which makes it easier for a researcher to measure what should be measured (Verschuren & Doorewaard, 2021).

External validity is about the generalizability of the research results (Vennix, 2011). In this research, this means that the answer to the question would apply to other cities as well. The results cannot simply be copied to other processes (Vennix, 2011), but the actors participating in flood risk management in other cities can learn from and apply the results from this thesis. Many cities worldwide face flood risk issues and even though each of these cities requires specific ad-hoc solutions, they also share many similarities in flood risk-related matters.

Besides validity, it is important that a research is reliable. According to Van Thiel (2014), reliability is about accuracy and consistency. They state that "a measurement instrument is reliable if – under similar conditions – it shows the same results every time it is used" (Van Thiel, 2014, p. 185). The more accurate and consistent the research is, the more certain it is that results are not a coincidence but show a representative picture. Accuracy refers to the measurement instruments that are used, such as interview guides. The interview guides should capture the necessary information as correctly and precisely as possible (Van Thiel, 2014). Consistency is about repeatability; the same measurements under similar circumstances should lead to similar results. Repeatability increases the reliability of a study as it provides the certainty that the results are indeed right. However, Van Thiel (2014) also points out that repeatability is hard to achieve in social sciences as people can learn from past experiences. In this way, repeating a study will not always lead to the same results. To make research more reliable, it is important that the research strategy is applied consistently and that interviews take place under the same circumstances (Vennix, 2011). In this research, the reliability was secured due to the usage of the same interview guide for every interview and by making sure the settings were as much alike as possible. In this way, the whole process can be reviewed and checked afterward (Van Thiel, 2014).

3.6 Ethical Considerations

Increased attention has been paid to academic research ethics in recent years because of cases of research misconduct (Arnold, 2021). As Stacey and Stacey (2012) and Arnold (2021) mention in their articles, there are several principles and approaches common in research ethics protocols and standards in social science. These principles and approaches are taken into account when conducting this research. The principles are important to ensure that the researcher follows ethical procedures and respects the participants. In this thesis, informed consent procedures were considered to protect the confidentiality and anonymity of participants. Before the interviews,

the interviewees were informed through e-mail about the purpose and content of this research and they could ask questions and decide whether or not they wanted to participate. During the interviews, the interviewees were asked permission to record the interviews. Additionally, the possibility to withdraw from the research at any time was emphasized. At the end of the interviews, they were asked whether or not they wanted to receive the results as soon as the thesis was finished. When analyzing and writing down the results, the interviewees were mentioned anonymously.

Data-related considerations have to be taken into account as well when conducting this research. According to Stacey and Stacey (2012), data should only be used for restricted purposes and should be confidentially stored. The data retrieved for this thesis was confidentially stored on the Radboud University OneDrive which only the research has access to. Furthermore, the data are only shared with the first and second examiners to enable them to grade this thesis properly. The data will be deleted 6 months after this thesis has been handed in.

4. Results

As discussed in the previous chapter, this research is based on a comparative case study. This chapter presents the empirical findings of this research based on the politicized institutional analysis and development (IAD) framework as presented in the conceptual framework in chapter 2.3.

4.1 The Action Arena

Multiple actors play a role in flood risk management in Dordrecht and Valkenburg on local, regional, and provincial levels. This thesis focuses on the main actors for each case. These actors play different roles in the decision-making process regarding flood risk management. For Dordrecht, the main actors in flood risk management are the municipality of Dordrecht, the water board Hollandse Delta, the safety region Zuid-Holland Zuid, and the province of Zuid-Holland. In Valkenburg, the action arena consists of more key actors because of increased awareness regarding flood risk management stemming from the floods in 2021. Here, flood risks are mainly managed by the municipality of Valkenburg aan de Geul, water board Limburg, safety region Zuid-Limburg, the province of Limburg, Waterveiligheid en Ruimte Limburg (hereafter named WRL) and Natuurkracht. More information about each actor is provided in paragraph 4.2.2.

4.2 Exogenous Factors

4.2.1 Physical and Material Conditions

With approximately 120.000 inhabitants, Dordrecht is a relatively densely populated municipality and city in the province of Zuid-Holland (Gersonius et al., 2016a). The city is located on an island enclosed by multiple waterbodies and is connected to the surrounding areas via a limited number of bridges and tunnels (Gersonius et al., 2014; Kelder et al., 2013). The areas located on the inside of the dikes are below sea level while the areas outside of the dikes are slightly higher. Dordrecht lies in the transition zone between tidal reach and river regime reach, both influencing extreme water stages (Gersonius et al., 2016a; Van Herk et al., 2013). Besides coastal and tidal flood risks, Dordrecht has to deal with both pluvial and fluvial flood risks (D4, personal communication, November 9, 2023; D5, personal communication, November 16, 2023). The soil consists of calciferous marine clay which is poorly permeable to water (Claessens & Van der Wal, 2008; Steeghs & Westerveld, 1971). The surrounding areas consist of polder landscapes, such as the Biesbosch. The osier beds and reedlands form separate landscape units that are surrounded by trees. The vast majority of these landscape units are used as grassland with a few farms, nature, waters, dikes, and orchards (Steeghs & Westerveld, 1971).

The municipality of Valkenburg aan de Geul counts 16,400 inhabitants and is located in the densely populated south of the province of Limburg (CBS, 2023; Gemeente Valkenburg aan de Geul, n.d.; Provincie Limburg, 2017). The municipality is relatively close to the borders of Belgium and Germany (V7, personal communication, December 18, 2023). Valkenburg lies above sea level in the middle of a hilly landscape with steep and deep valleys, also called the Geul Valley *(Geuldal)* (CBS, 2023; Gemeente Valkenburg aan de Geul, n.d.; Provincie Limburg, 2017). The Geul Valley is one of the biggest Natura2000 areas in the Netherlands. Agricultural fields are located at the plateaus whereas the slopes are covered by trees and the valleys by grasslands. Due to its decline, the river Geul is a fast-flowing river that forces precipitation from upstream areas to flow downstream (Van Heeringen et al., 2022). The Geul flows through a bottleneck which is exactly located in the low-lying city center of Valkenburg (V1, personal communication, October 3, 2023). The built-up area in the center of Valkenburg blocks the Geul severely which limits the discharge capacity of the river and makes Valkenburg prone to flooding (Van Heeringen et al., 2022). Besides fluvial flood risks, Valkenburg faces pluvial flood risks as well (V4, personal communication, November 9, 2023; V1, personal communication, October 3, 2023). The soil deposition in the Geul Valley is mostly loess which has a low permeability. In combination with the hilly landscape, this leads to water running off the hills into the Geul (Provincie Limburg, 2017).

4.2.2 Rules-in-use

Dordrecht:

Position rules and boundary rules

Position rules specify the positions and roles of each actor and are about collaborations between actors. Position rules are linked to boundary rules that specify which and how actors enter or leave these positions (Polski & Ostrom, 1999). The municipality of Dordrecht mainly focuses on spatial planning and spatial adaptation in flood risk management (D1, personal communication, October 17, 2023). During floods, the municipality shifts its focus to population and environmental care, taking responsibility for public warning and sharing information (D3, personal communication, November 13, 2023). The municipality of Dordrecht can affect decision-making regarding flood risk management through the municipal council which serves as a driving force overseeing and adjusting the actions of the municipal organization (D6, personal communication, December 8, 2023).

Safety regions are executing bodies and part of municipalities. Municipalities provide them with instructions to work on safety levels and warning stages (D2, personal communication,

October 26, 2023). As mentioned by D1 (personal communication, October 17, 2023) and Van Herk et al. (2013), the safety region Zuid-Holland Zuid is responsible for emergency planning and increasing preparedness and communication. The safety region is a network organization that tries to maintain contact with other actors and bring actors together (D3, personal communication, November 13, 2023; D4, personal communication, November 9, 2023).

Another key actor in flood risk management in Dordrecht is the water board Hollandse Delta which manages and maintains the water systems and dikes around Dordrecht. They also test flood barriers in the city center (D1, personal communication, October 17, 2023). During floods, the primary focus of the water board lies on water safety, the water system tasks, and the water chain. In addition, the water board Hollandse Delta has a role in preventing floods (D3, personal communication, November 13, 2023). The organization also plays a role in ensuring more connections between different organizations: "we are looking at how to collaborate better as spatial planning becomes more complex" (D2, personal communication, October 26, 2023). Moreover, the water board has its calamity organization which keeps the flood risk assessments up to date. They look at crisis scenarios and measures, plan for evacuations, and provide information and communication in collaboration with the safety region. The calamity organization plays an important role in network management as their measures and plans need to align with the plans from crisis partners (D3, personal communication, November 13, 2023).

The province of Zuid-Holland advises actors based on their flood risk calculations. "As a province, we do not have an operational role. We truly have a framework-setting role. Legally, we are obligated to set standards for regional barriers such as compartmentalized dikes. (…) It is about evaluating the regional barriers in Zuid-Holland, setting the norms and then they *[the water board]* have to be addressed again." (D5, personal communication, November 9, 2023). Additionally, the province has a supervisory role over the water board. If something goes wrong with a barrier or a regional barrier, an investigation is started by the province. The province can also make connections between overlapping policy fields such as housing, nature, and mobility "because they have a lot of area-specific knowledge" (D5, personal communication, November 9, 2023). In this way, they can provide professional viewpoints on flood risk management in Dordrecht without playing a substantive role in decision-making (D5, personal communication, November 9, 2023).

Together, these key actors involve inhabitants in flood risk management in Dordrecht. For instance, the municipality and water board organize resident meetings where inhabitants can provide feedback on the ideas and plans proposed. Additionally, inhabitants are provided with

action perspectives to manage flood risks themselves (D1, personal communication, October 17, 2023; D2, personal communication, October 26, 2023; D5, personal communication, November 9, 2023). By providing feedback, inhabitants influence decision-making as well.

Authority rules and aggregation rules:

Aggregation rules specify the hierarchy in decision-making between actors and organizations. Besides that, they are about how decisions are made and they specify the hierarchy in decision-making between actors (Vitale & Meijerink, 2021c). They are closely linked to authority rules, which are about the actions actors can take in certain positions (Polski & Ostrom, 1999). Together, these rules explain "what actions participants are allowed to take, depending on their positions in the action arena" (Vitale & Meijerink, 2021c, p. 609). The proposal of measures is done by policy advisors from the municipality of Dordrecht and the water board Hollandse Delta separately, but also in collaboration through consultation and discussion (D1, personal communication, October 17, 2023). The actual responsibility and decision-making power of those actors lies within their boards. For the municipality, this is the municipal council. The municipal council steps in if they perceive risks or if there is a policy change (D6, personal communication, December 8, 2023). After policy advisors have discussed and consulted about multiple considerations, ideas about measures are presented at the municipal council (D1, personal communication, October 17, 2023). Before voting, the municipal council follows the so-called 'BOB process' consisting of three stages. First, there is a meeting where all information about the proposed measure is gathered to get a clear picture of the subject. Then, there is a meeting where opinions are formed and where parties discuss their opinions to try and find common ground. After that, the decision-making phase starts where the council votes on the proposed measures (D6, personal communication, December 8, 2023).

For the water board, decisions are made by the daily board and general board. The daily board consists of 5 *heemraden* and the *dijkgraaf*. If a proposed measure falls within the frameworks made by the general board, the daily board can make decisions themselves. However, proposed measures that for instance need extra funding have to be justified to the general board. The policy advisors then have to explain why they want a certain measure and this is followed by a vote. Depending on the results of the votes, the measure either passes or not (D2, personal communication, October 26, 2023). The *dijkgraaf* has the authority to solely take measures in case of danger to water defenses or water systems. However, ultimately the choices have the be justified to the general board. Therefore, this does not mean that the *dijkgraaf* has the most power (D3, personal communication, November 13, 2023).

Decisions within the safety regions are made by the council which consists of ten mayors from the municipalities belonging to the safety region. When decisions about flood risk management have to be made, the water board Hollandse Delta and the police are involved as well. Before the actual decision-making, documents are presented and discussed in the council meeting. Then, the councilors can ask questions and after that, decisions are made in consensus through good consultation. In essence, every member of the board has the same amount of power. However, the safety region is funded by the municipalities depending on the resident's contribution. This means that larger municipalities pay proportionally more because they have more residents and there are discussions about whether they have more power or not (D4, personal communication, November 9, 2023). Even though they are a key actor, the province of Zuid-Holland is not actively involved in the decision-making process about flood risk management measures. They do provide their perspectives and advice on the proposed measures which is appreciated and taken into account by the actors who make decisions. Additionally, the province can decide to set a new safety norm, with which the water board must comply (D5, personal communication, November 16, 2023).

The councils mentioned above consist of multiple parties. After elections, parties can enter or leave the action arena or parties can step out of the council themselves. D6 (personal communication, December 8, 2023) mentioned to the municipal council that "the entering of new parties does not impact the decision-making process itself, but it does affect the quality of the municipal council. (..) If you are a one-person faction, then you have to do everything (…) and they simply cannot do everything, so they have to choose. Therefore, not in the decision-making itself, but it does have consequences for the substantive quality".

Scope rules

Scope rules are about the desired outcomes and what actions are taken to reach these outcomes (Polski & Ostrom, 1999). The overall desired outcome is to be a 'self-reliant island' by 2035 (Gersonius et al., 2016a). Several actors also have their own additional desired outcomes. The municipality of Dordrecht aims "to make a positive contribution to the environment and the health of people, as well as enhancing biodiversity in the surrounding area" (D1, personal communication, October 17, 2023). As mentioned by D2 (personal communication, October 26, 2023), the water board's desired outcome is to limit flood risks as much as possible while the safety region's main desired outcome is to prepare inhabitants for floods and provide them with actionable perspectives. "We want to incorporate safety aspects

early on, so that we can benefit from it in case of an incident" (D4, personal communication, November 9, 2023).

Information rules

General information about flood risk management measures is exchanged through different channels. For instance, D1 (personal communication, October 17, 2023) mentioned that there have been knowledge sessions and meetings with different national and international actors to share existing knowledge and experiences. Other ways to get information is by conducting stress tests looking at the effects of climate change to identify flood risks (D2, personal communication, October 26, 2023). These stress tests are often conducted by knowledge institutes such as Deltares. For council members to make decisions about flood risk management measures, inhabitants are a crucial source of information to get to know what is going on in the city. Council members also retrieve information during informative sessions where they can ask questions, for instance, to experts or inhabitants. In this way, council members can form opinions. All council members have access to the same information. Open communication is a requirement. There is a specific system in place and the same information must be available to everyone. All proposals or contributions are available to the entire council, for all parties. There is transparency regarding information (D6, personal communication, December 8, 2023).

Several implemented flood risk management measures only enter into force in case of high water levels, such as evacuation plans. Information about weather forecasts and water levels is needed to decide when to enter these measures into force. This information is provided by Rijkswaterstaat, water boards, and the KNMI (D3, personal communication, November 13, 2023; D4, personal communication, November 9, 2023; D5, personal communication, November 16, 2023). When high water levels are expected, the calamity organization of the water board Hollandse Delta has to inform the safety region on what areas, how quickly, and how deeply they might be affected. In crises, information is exchanged through phone calls within the water board (D3, personal communication, November 13, 2023).

Payoff rules

Flood risk management measures are initially aimed at decreasing flood risks and therefore provide advantages for society. However, it might be possible that new and innovative flood risk management measures cause difficulties as they might not work optimally directly. However, D1 would not call those drawbacks, as ultimately the goal is to improve the situation. D1 adds that implementing climate adaptive and greening flood risk management measures might increase overall costs which might make overall development costs, including houses,

more expensive. This could be a drawback for potential house buyers (D1, personal communication, October 17, 2023). As mentioned by D3 (personal communication, November 13, 2023), there might also be people experiencing drawbacks from measures at the moment when there are high water levels. “In case of high water levels, there might be limited inconveniences in low-lying areas outside the dikes where sometimes people live or businesses are located because this is flooded then. (…) Also, we might close certain roads which might create inconvenience. If we really have to evacuate areas or get people to safety, then there is an even greater impact and societal disruption beyond the daily routine. You can bind a sort of impact score to each set of measures; is it a local effect, or even a regional effect?”.

Valkenburg:

Position rules and boundary rules

The municipality of Valkenburg aan de Geul is mainly responsible for spatial developments such as deciding upon zoning plans. They collaborate with the province of Limburg and the water board to do so (V3, personal communication, November 2, 2023; V7, personal communication, December 18, 2023). Safety region Zuid-Limburg is involved in flood risk management in Valkenburg as well through the municipality. They are an important actor during floods but are also essential in preventing floods (V4, personal communication, November 9, 2023). Water board Limburg is responsible for adhering to the flood standards set by the province of Limburg as well as monitoring and managing the Geul. They take care of disaster plans, manage and improve dikes, construct rainwater buffers, and redesign streams. In addition, the water board assesses whether construction plans from the municipalities, businesses, and individuals are waterproof (Waterschap Limburg, n.d.). “Water board Limburg has a kind of legal obligation to protect people from floods. We engage in area processes to reduce flood risks and what we do is for instance establish rainwater buffers in collaboration with partners” (V5, personal communication, November 16, 2023). Within the water board Limburg, there is a lot of knowledge and expertise that they opt to share with various parties. Therefore, it is the water board’s task to establish contacts with other actors (V3, personal communication, November 2, 2023; V9, personal communication, December 4, 2023).

After the floods of 2021, two actors entered the action arena; WRL and Natuurkracht. The national government recognized that not enough measures had been taken in the streams and tributaries of the Meuse such as the Geul. As a result, they allocated 600 million euros to Limburg to address it. This initiative culminated in the program ‘Waterveiligheid en Ruimte Limburg’ (WRL). WRL brings together different actors such as the province of Limburg, the

water board Limburg, the safety regions, and the 31 municipalities from Limburg (V4, personal communication, November 9, 2023; V6, personal communication, November 23, 2023) to provide appropriate solutions that enhance water safety, awareness and self-sufficiency for the inhabitants of Limburg (Waterveiligheid en Ruimte Limburg (WRL), 2023). Within this program, contracts for partnerships with Belgian actors were signed as well. "We explore the possibility of implementing measures across the border that are beneficial for both Belgium and the Netherlands. The other way around is also possible. If we develop measures here, foreign actors can also collaborate or we can organize things together" (V6, personal communication, November 23, 2023). This makes Belgian actors involved in flood risk management in Valkenburg as well. The plan is to end WRL at a certain moment and give back the responsibilities to the water board, province, safety regions, and municipalities (V4, personal communication, November 9, 2023). Natuurkracht is a collaboration of multiple organizations such as Natuurmonumenten, Limburgs Landschap, Postcodeloterij, Wereldnatuurfonds, and Stichting Ark. They provide funds for green projects enhancing flood protection (Natuurkracht, n.d.; Natuurmonumenten, n.d.). The program works independently of the government (V1, personal communication, October 3, 2023).

These key actors collaborate and organize structural meetings. In these meetings, the Limburgse Land- en Tuinbouwbond (LLTB) is also involved. They manage agriculture and represent the agricultural sector. The land is often owned by farmers. If a measure has to be implemented on their land, it requires purchasing their land. Therefore, they are involved in flood risk management as well. Additionally, the firefighters and ambulance services are involved and they assist with incidents. Both are not involved in decision-making, but they do take a look at the accessibility of roads and utilities during floods and flood risks (V1, personal communication, October 3, 2023; V7, personal communication, December 18, 2023). Inhabitants of Valkenburg are getting more and more involved in the flood risk management debate as well. Resident meetings are organized where inhabitants also have the opportunity to give inputs. Additionally, a large survey has been sent out by the water board where inhabitants could indicate the problems they face and the solutions they envision (V3, personal communication, November 2; V5, personal communication, November 16, 2023; V6, personal communication, November 23, 2023). The actors also engage in conversations with inhabitants and incorporate inhabitants' feedback into the execution and planning of measures. Measures are validated with residents and even developed through collaborations with inhabitants (V4, personal communication, November 9, 2023).

Authority rules and aggregation rules

Flood risk management plans are made by policymakers and experts. “During the drafting phase, we try to engage in collaboration with partners so that they know what is in our plans, allowing them to align with their own plans” (V9, personal communication, December 4, 2023). The formal decision-making process ultimately rests with the boards (V9, personal communication, December 4, 2023). For the municipality and the water board, the formal decision-making process takes place within the council. All the measures that have been proposed to the councilors have been developed by policy advisors and program teams collaboratively and in good consultation to achieve consensus (V2, personal communication, October 6, 2023; V4, personal communication, November 9, 2023; V5, personal communication, November 16, 2023).“ There is no policy advisor who has the upper hand or has the final say. Everyone is equally valuable and we aim for consensus” (V6, personal communication, November 23, 2023).

Before the councils make a decision, they are informed about the proposed measures by the board. As explained by V8 (personal communication, November 27, 2023), the municipal council attends informational sessions about the measures where they can ask questions. Then, the board writes a proposal for the municipal council which then gets discussed. “You read the proposal, ask questions and then, during the council meeting, you express whether you are in favor or against the proposal” (V8, personal communication, November 27, 2023). Ultimately, decisions are made through voting. In case of sub-plans or minor adjustments that fall within the guidelines set by the daily board, decisions are made within the program teams by the management or by the daily board (V7, personal communication, December 18, 2023; V8, personal communication, November 27, 2023; V9, personal communication, December 4, 2023). Decision-making at WRL is done at the *Regionale Actietafel* (RAT) which is a steering committee comprising the municipalities, national government, province, and the water board (V7, personal communication, December 18, 2023). Proposed measures are made by the program teams and are then judged on chances of success and urgency. If these are high, the proposed measures proceed to the RAT. Within the RAT, “all decisions should be made based on unanimity. (…) If it is not unanimous, then it simply does not proceed. But often, you see that the importance of the measure is perceived and felt to such an extent that there is always unanimity (V4, personal communication, November 9, 2023).

In case flood risk management measures are made by the actors in collaboration, the water board, province, and municipality are involved in decision-making. Decision-making is

done through good communication. The water board is often the actor carrying out the implementation. So, they determine what actions should be taken. As mentioned by V1 (personal communication, October 3, 2023) "as a municipality, you contribute thoughts, but the details and actual execution lie with the water board. Everyone has an equal say, however. It is a give-and-take, but everyone is on the same page essentially".

The composition of councils influences how power is distributed when making decisions. For instance, the municipal council in Valkenburg is more right-wing oriented but has left-wing accents. There is one party having the 'upper hand' as they are represented by 5 council members and they have also provided two aldermen on the board. The other parties have fewer council members. Just like in Dordrecht, the parties involved in the councils mentioned above can change. For instance, parties can leave the council if they do not gather enough votes during elections. This does not seem to have a substantial influence on decision-making, however (V8, personal communication, November 27, 2023).

Scope rules

In Valkenburg, the overall desired outcome of flood risk management is lower water levels and a limited flow velocity that lead to a decreased risk of drowning and damage in Valkenburg (V2, personal communication, October 6, 2023). During the interviews, respondents mentioned actor-specific desired outcomes as well. Water board Limburg aims to meet the safety standards and go beyond that as much as possible to protect people from floods as much as possible in areas with standards. By doing so, they want to shape the landscape in a future-proof manner making it both safer and more beautiful (V5, personal communication, November 16, 2023; V7, personal communication, December 18, 2023; V9, personal communication, December 4, 2023). WRL's desired outcome is to make Valkenburg and Limburg as a whole resilient to extreme weather conditions and enhance water safety. Additionally, they aim to break the compartmentalized thinking of the separate actors by bringing together the actors and restoring trust in the government on all levels (V4, personal communication, November 9, 2023; V6, personal communication, November 23, 2023). The Natuurkracht program aims to inspire, challenge, and support citizens, entrepreneurs, and governments to use nature as a source for ideas and plans that sustainably combat climate change and water-related issues in the Geul Valley (Natuurkracht, n.d.; Natuurmonumenten, n.d.).

Information rules

There are multiple sources of information for actors to prepare flood risk management measures. The municipality of Valkenburg aan de Geul gets its information from Deltares while

the water board Limburg uses hydrological models stress tests from internal and external experts which show them what areas would flood with certain amounts of excess water (V2, personal communication, October 6, 2023; V3, personal communication, November 2, 2023; V5, personal communication, November 16, 2023). Additionally, information about measures is shared during meetings. For instance, before decision-making, there are information sessions where councilors can ask anything they want to know about the proposed measures (V6, personal communication, November 23, 2023; V7, personal communication, December 18, 2023; V8, personal communication, November 27, 2023). In the action arena, there is open communication and everyone has access to the same amount of information. But, as mentioned by V5 (personal communication, November 16, 2023): "I think that everyone within the program team has different types of information according to their expertise. The idea is that you search for information and share that with the team. There is open communication but it is not necessary to share all the information with everyone if the rest will not benefit from it".

Similarly to Dordrecht, there are flood risk management measures that only enter into force in case of high water levels. To keep informed about expected rainfall and water levels, actors communicate with the KNMI and they use Buienradar and specialized programs that predict the exact location where rain will fall (V1, personal communication, October 3, 2023; V4, personal communication, November 9, 2023; V9, personal communication, December 4, 2023). In case of potential water overflow, the water board informs the safety region. When there is no threat, the water board sends weekly water news to the safety regions. The water board's control room is both a physical and digital space where all data is centralized (V9, personal communication, December 4, 2023).

Payoff rules

Landowners like Natuurmonumenten and farmers face drawbacks from the flood risk management measures as their lands are needed to create more space for the Geul. Sometimes it is challenging when measures affect someone's land. Landowners lose their land and farmers could also lose (part of) their income (V1, personal communication, October 3, 2023; V2, personal communication, October 6, 2023; V5, personal communication, November 16, 2023). As mentioned by V5 (personal communication, November 16, 2023): "suddenly, someone gets a dam next to their property, reducing their view or impacting their yield. However, this is done through consultation and if someone accommodates it on their land, they receive compensation. But it might be unsettling for someone living right next to a water buffer since there is a lot of water behind it, and in case of a breach or mishap there is a higher risk".

4.2.3 Discourses and Attributes of the Community

The flood risk management measures that have been taken in both Dordrecht and Valkenburg support both the engineering and (socio-) ecological resilience discourses. As mentioned in the interviews, everyone involved in decision-making supports water safety and the multi-layer safety approach. Measures taken that support the engineering resilience discourse include technical and spatial measures to protect against floods and withstand their impacts such as dikes, barriers, flood walls, and embankments. V2 (personal communication, October 6, 2023) mentioned that space should be given to water as we are not able to "win the fight" by only defending against water. To complement these defensive measures, measures aiming for diversification of flood risk management strategies have been implemented in Dordrecht and Valkenburg. This is in line with Vis et al. (2003), who state that there has been a transition from a flood-controlling policy aiming to "fight against water" to an advocated policy of integrated flood risk management aiming to "live with water".

As mentioned by D1 (personal communication, October 17, 2023), "we are currently facing a lot of droughts, so we cannot only focus on keeping the water away because we also need it at certain times". Therefore, retaining water is important which can be done through water buffers. Other flood risk management measures in Dordrecht and Valkenburg include for instance disaster plans, the allocation of inundation areas, and increasing awareness among inhabitants. Respondents have mentioned multiple measures that focus on the ability of inhabitants to cope with floods and adapt to changes. As an example, communication means have been made which provide inhabitants with actionable perspectives before, during, and after floods. They can for instance store groceries and place heating and installations on the first floor (V1, personal communication, October 3, 2023). As mentioned by D4 (personal communication, November 9, 2023) "in terms of actionable perspectives for evacuation, it is up to the individuals to seek their safety haven". These measures support the (socio-) ecological resilience discourse.

These implemented flood risk management reflect the respondents' personal opinions on how to deal with flood risks. Multiple respondents mentioned that how to deal with floods is area-specific and that measures supporting the engineering resilience discourse and the (socio-) ecological should be implemented (D1, personal communication, October 17, 2023). Even though both discourses are supported by the actors in the action arenas and there is a shared belief that flood risks can only be managed in collaboration, there sometimes are difficulties in managing flood risks as actors face clashing interests. As an example, V2 (personal communication, October 6, 2023) mentions that sometimes water board Limburg wants to use

certain pieces of land to retain water and achieve the safety norm. However, the municipality does not want that piece of land to be used in that way because it has another crucial purpose which is important for livability. According to V4, WRL helps to break this compartmentalized thinking in flood risk management in Valkenburg by ensuring that better protecting and preparing Limburg against extreme water overflow is considered the most important instead of organizational interests (V4, personal communication, November 9, 2023).

4.2.4 Politico-Economic Context

An understanding of the politico-economic context is extremely important to understand power relationships between the actors involved in flood risk management in Dordrecht and Valkenburg. As mentioned by D5 (personal communication, November 16, 2023), Gemeente Dordrecht (2016), and Gersonius et al. (2014), Dordrecht consists of a densely populated area outside the dikes, which includes many residents as well as great cultural and touristic value and significant economic interests. Many (international) companies have chosen to locate in Dordrecht due to its location on the southern side of the Randstad. The city is part of the industrial complex of the main port of Rotterdam and serves as a 'gateway to Europe' in this way. Connections to the hinterland are available through waterways, roads, and railways. As mentioned by D3 (personal communication, November 13, 2023), a transportation development of the corridor from the main port of Rotterdam to Antwerp is taking place. Transportation modes and flows are increasing which prompts the safety region to examine its safety profile and look at possible impacts of floods.

According to Provincie Limburg (n.d.) and V7 (personal communication, December 18, 2023), Valkenburg is known as the tourist capital of Limburg due to its historic city center, surrounding nature, and recreational opportunities. Economic aspects have been considered more important than the physical aspects in spatial developments. "Everything was arranged to be easily maintainable and clean, ensuring that many entrepreneurs, shops, and businesses could thrive in Valkenburg. Not much consideration was given to creating interconnected green spaces or placing more greenery, but that is gradually changing now" (V8, personal communication, November 27, 2023). The political context in Valkenburg is also determined by its location close to Belgium and Germany. International collaborations in flood risk management are challenged by differences in legislation and regulations in the different countries. As mentioned by V6 (personal communication, November 23, 2023) "implementing measures across borders in collaboration with Belgian actors involves different legislation and regulations. We need to assess the obstacles we encounter. (…) The challenge is when it is about making investments

across borders. I am curious whether they are willing to invest Dutch funds abroad". The Interreg program by the European Union is designed to tackle such issues.

Subsequently, overarching developments are influencing the politico-economic contexts of Dordrecht and Valkenburg. During the last decade, a transition from a flood-controlling policy aiming to "fight against water" to a policy of integrated flood risk management aiming to "live with water" has been advocated throughout Europe on national levels (Vis et al., 2003). Policies attempting to implement integrated flood risk management in Europe are particularly established through the European Flood Directive (2007/60/EC) (Buchecker et al., 2016; Yannopoulos et al., 2015). Countries have developed different approaches on the national level to implement the European Flood Risk Directive (Karrasch et al., 2021). A framework for modernizing Dutch water management through providing requirements and setting standards has been advocated (Ministerie van Infrastructuur en Waterstaat, 2008). As a consequence, the national political context regarding flood risk management is changing to a proposed *water- en bodemsturend* approach. The national government is providing stricter regulations on where spatial developments should or should not be allowed. For instance, there is a spatial assessment framework that says 'at this level of water, you should not build anymore, or at this level, you should take damage-limiting measures'. "Since *water- en bodemsturend* has been introduced, the subject *[spatial planning]* is becoming more important because we have more insights. Not everything is possible anymore" (V3, personal communication, November 2, 2023; D2, personal communication, October 26, 2023). The floods in Limburg in 2021 have brought a bigger sense of urgency that we need to take action to manage flood risks in the Netherlands (V1, personal communication, October 3, 2023).

Together with the economic importance of both Dordrecht and Valkenburg these developments may explain the increase of financial resources that are made available for flood risk management. For instance, 300 million euros have been allocated for managing flood risks of smaller rivers in Limburg like the Geul. The municipality of Valkenburg aan de Geul also increased the funding of flood risk management (V4, personal communication, November 9, 2023; V5, personal communication, November 16, 2023; V7, personal communication, December 18, 2023). The increased availability of financial resources for flood risk management does not necessarily mean that more flood risk management measures can be taken, however. Over the past few years, there has been an extraordinary height of inflation. As mentioned by the respondents, inflation does not influence flood risk management in Valkenburg. However, several respondents have mentioned that inflation does influence flood risk management in

Dordrecht. For instance, measures related to greening and climate adaptation might be more likely to be omitted in area development and projects. This also has to do with the fact that these measures are currently not firmly established and enforceable (D1, personal communication, October 17, 2023). D2 (personal communication, October 26, 2023) adds that "inflation has consequences, everything that is purchased becomes more expensive. (…) If you have the same budget but there is a 10% inflation, it means that you can implement 10% fewer measures".

Another development influencing the politico-economic context in both Dordrecht and Valkenburg is the national shortage of houses. In Dordrecht for instance, there was a strong sentiment to refrain from developing houses and constructions in polders in the last ten years as people wanted to preserve green spaces because we need them to manage water. Now, there is a counter-movement going on where houses are built in polders again because people simply need a place to live (D6, personal communication, December 8, 2023). According to D5 (personal communication, November 16, 2023), this counteracts the *water- en bodemsturend* approach and could increase flood risks. What could also counteract this approach is the results from the recent national elections. According to V3 (personal communication, November 2, 2023), "a new cabinet might come in which could easily push aside the *water- en bodemsturend* approach". V4 (personal communication, November 9, 2023) also expresses concerns about the recent elections: "if elections are won by a political party which does not prioritize flood risk management, there is a chance it will fall low on the political agenda". However, as mentioned by D5 (personal communication, November 9, 2023) "I believe that the legal responsibilities of water boards, Rijkswaterstaat, and provinces in terms of flood risk management always continue, regardless of our government. (…) So, it does not matter whether the PVV or GroenLinks becomes the largest party, those legal duties remain unchanged (…) But I do think that there is a difference in what you do to manage flood risks beyond legal duties".

4.3 Outcomes: Flood Risk Management Strategies in Dordrecht and Valkenburg

Dordrecht:

In Dordrecht, multiple actors have taken measures in terms of **risk prevention**. Flood risks are prevented through proactive spatial planning and policies regarding allocation and reallotment. For instance, utilities like electricity transformer stations, drinking water supplies, main stations of the gas network, and wastewater treatment plans are located at elevated levels outside the dikes to ensure that Dordrecht can be self-reliant (Gemeente Dordrecht, 2016). Additionally, building excessive constructions in polders is not allowed (D6, personal communication, December 8, 2023). When new construction activities take place, the water

board will provide water advice through the *watertoets*. This means that the water board looks at whether it is smart to build something at a certain place and what effects the new construction has on the climate. By doing so, the aim is to build water-conscious and water-safe constructions. Lastly, municipalities coordinate zoning plans and proactive spatial planning by giving out permits on behalf of various authorities (D2, personal communication, October 26, 2023; D4, personal communication, November 13, 2023). In addition, multiple **flood defense** measures have been implemented in Dordrecht. These measures include flood barriers, primary and compartmentalization dikes, embankments, surge barriers, and valves (D1, personal communication, October 17, 2023; D3, personal communication, November 13, 2023; D4, personal communication, November 9, 2023; D5, personal communication, November 16, 2023).

Current flood risk management in Dordrecht includes measures for **flood mitigation** as well such as the Biesbosch which is intentionally maintained as a landscape with groves and reeds to absorb floods (D6, personal communication, December 8, 2023). In addition, the municipality commissioned the redesign of the Sterrenburgpark where the water was given more space by turning the park into a natural climate-resilient and water-rich playground (Groen Blauw Dordrecht, n.d. b). The Biesbosch and Sterrenburgpark also allow for other land use functions such as recreation and nature conservation. The municipality of Dordrecht and the province of Zuid-Holland are involved in the *Convenant Klimaatadaptief Bouwen,* which sets out minimum requirements within new construction projects to comply with climate-adaptive building principles by covering topics like water excess and water retention (Provincie Zuid-Holland, 2018). In the Amstel district in Dordrecht, these regulations are included in the zoning plan (D1, personal communication, October 17, 2023). In addition, the outlying housing project Plan Tij has been established by using flood risks as a design variable. Space is given to water here as the ground floor of these houses is elevated allowing for tidal flows beneath the houses (Groen Blauw Dordrecht, n.d. a). The municipality also encourages inhabitants to green their gardens (Groen Blauw Dordrecht, n.d. b). Additionally, regulations for flood-proof buildings for municipalities are introduced by the province of Zuid-Holland. In these instructions, the province states that municipalities must consider the changing climate in their environmental plans. However, this is not legally binding yet (D5, personal communication, November 16, 2023).

A wide variety of measures have been taken in Dordrecht in terms of **flood preparation.** The municipality of Dordrecht and the water board Hollandse Delta have introduced a water safety campaign to make inhabitants more aware of flood risks. For instance, a poster was

designed telling inhabitants to check how high water might rise at their location, how they can find a place to shelter, what should be in their emergency kits, and how they can help each other. Additionally, a website, application, and mail service were launched with a list of things needed to prepare for floods. People also receive a letter about this every year (D1, personal communication, October 17, 2023; D3, personal communication, November 13, 2023; D5, personal communication, November 16, 2023; D6, personal communication, December 8, 2023). In September, the festival *Voor de Vloed* was organized by the municipality of Dordrecht and the water board Hollandse Delta aiming to prepare people for floods and increase awareness (D3, personal communication, November 13, 2023). These water safety campaigns have resulted in the fact that some inhabitants have started preparing themselves for floods as well. Several have installed pumps in their basements or waterproofed their houses for instance. However, still much work has to be done to increase awareness amongst residents living at places that are protected by dikes (D5, personal communication, November 16, 2023).

Water board Hollandse Delta has designed specific safety levels with a corresponding warning structure (Waterschap Hollandse Delta, 2015). This was done in collaboration with safety region Zuid-Holland Zuid (D2, personal communication, October 26, 2023). Additionally, the water board developed calamity plans, crisis plans, and contingency response plans detailing scenarios and measures for water crises. For each scenario, measures are prepared (D3, personal communication, November 13, 2023). The province of Zuid-Holland also has a disaster plan that covers routes to evacuate and evacuation strategies. However, evacuating all inhabitants from the island of Dordrecht is unfeasible as there is no capacity (Ministerie van Infrastructuur en Milieu, 2013). This was also mentioned by D4 (personal communication, November 9, 2023): "we cannot handle an overflow in terms of capacity so there is no way to prepare for that. Hence, it is really about actionable perspectives and it is up to the individuals to seek their haven". Other measures taken by the actors in terms of flood preparation are filling sandbags, testing, and inspecting measures (D1, personal communication, October 17, 2023; D2, personal communication, October 26, 2023; D3, personal communication, November 13, 2023; D6, personal communication, December 8, 2023). During the data collection, no measures regarding the **flood recovery** strategy were mentioned.

We can conclude that flood risk management in Dordrecht is mainly focused on flood preparation, risk prevention, flood defense, and flood mitigation. The StarFlood strategy of flood recovery is the least prominent.

Valkenburg:

Concerning StarFlood's **risk prevention** strategy, the municipality of Valkenburg aan de Geul has not taken measures in terms of allocation policies in the city center on a large scale yet. "This feels paradoxical as you can build in an area that will simply get flooded" (V2, personal communication, October 6, 2023). Water board Limburg and province Limburg can guide the municipality in determining zoning plans, however. The province has outlined regulations where certain functions can or cannot be allocated while water board Limburg has allocated inundation areas which are zones along the Geul reserved as flood areas (V3, personal communication, November 2, 2023; V9, personal communication, December 4, 2023). As mentioned by V1 (personal communication, October 3, 2023) there is one thing to consider when allocating plots of land, however: "the land does not belong to the government. It often belongs to farmers, private individuals, and nature organizations. (..) They are willing to give their land away, but the government needs to compensate them and give them financial support or offer other land".

Current flood risk management in Valkenburg includes multiple measures for **flood defense**. There are no dikes along the Geul, but there are elevations in areas to divert water away (V9, personal communication, December 4, 2023). Dams are built in lower areas and often form a part of a rainwater buffer (V5, personal communication, November 16, 2023). Additionally, there are quays, quay walls, a high-water tunnel, and embankments. However, the quay walls cannot serve as a water barrier as there are several openings in them (Van Heeringen et al., 2022; Waterschap Limburg, 2018). Moreover, Valkenburg is located in a Natura2000 area which is why "people do not want to add all sorts of technical measures such as large dams and weirs. It does not contribute positively to the natural landscape" (V1, personal communication, October 3, 2023).

In terms of **flood mitigation**, measures implemented in Valkenburg include water buffers, overflow areas, and modified streams to address water excess issues (V1, personal communication, October 3, 2023; V3, personal communication, November 2, 2023; V5, personal communication, November 16, 2023; V8, personal communication, November 27, 2023). These overflow areas and water buffers are often combined with room for recreation and nature conservation. To be able to retain more water in agricultural fields, methods to cultivate a field in such a way that it retains as much water as possible have been developed together with Wageningen University. Additionally, greenery such as grass is planted in and around Valkenburg (V7, personal communication, December 18, 2023).

Flood risk management in Valkenburg is very focused on **flood preparation**. For instance, websites have been launched to increase awareness and provide inhabitants with information about what to do before, during, and after floods. Inhabitants are increasingly thinking about what measures they can take to prepare themselves and their houses for floods (V4, personal communication, November 9, 2023; V7, personal communication, December 18, 2023). As mentioned by V8 (personal communication, November 27, 2023), inhabitants who have personally experienced the floods in 2021 are aware of the flood risks. However, other inhabitants still lack awareness. Additionally, water board Limburg uses warning stages consisting of four classification phases for water nuisance. Alerts are sent out in the application and on the municipal website (V1, personal communication, October 3, 2023). In terms of disaster planning, emergency response plans are made in which actions are outlined such as additional inspections of technical measures, providing sandbags, and informing livestock farmers to relocate their livestock if water levels rise (V9, personal communication, December 4, 2023). The safety region has prepared an evacuation plan in which vulnerable objects and evacuation routes are mapped out (COT Instituut voor Veiligheids- en Crisismanagement, 2022). The town hall and other higher-lying facilities function as shelter locations for inhabitants (V1, personal communication, October 3, 2023).

In contrast to the case of Dordrecht, respondents have mentioned the presence of **flood recovery** measures in Valkenburg. After floods, companies are called in to help with reconstruction and rebuilding. Inhabitants are told to put broken furniture and appliances on the streets. The municipality collects them and starts cleaning and repairing the public spaces afterward. Damages inside private homes are sometimes not covered by the insurance. In that case, inhabitants have to pay themselves. However, compensations for damages have not been sorted out yet. The mayor of Valkenburg aan de Geul is closely involved in making money from insurance available and ensuring that it reaches the people who have suffered damage from the floods in 2021 (V1, personal communication, October 3, 2023; V4, personal communication, November 9, 2023).

We can conclude that the StarFlood strategies of flood defense and flood mitigation are most prominent in flood risk management in Valkenburg. Measures in terms of risk prevention are less prominent.

5. Discussion

This discussion chapter serves as a critical and analytical juncture where the empirical results covered in chapter 4 are compared and interpreted. In this way the discussion endeavors to unveil correlations, detect underlying patterns, and identify relationships. Based on the data analyzed, the discussion is based on five main considerations which are important to reflect upon in my perspective. First, two considerations are provided that interpret empirical results that stood out as interesting insights. This is followed by three considerations reflecting shortcomings or disparities regarding the literature used in this thesis.

5.1 An Attempted Shift Toward Nature-Based Solutions?

The importance of implementing flood defense measures is widely supported among actors in Dordrecht and Valkenburg. However, the empirical results show that which flood defensive measures are taken is determined by contextual factors, such as surrounding nature and economic interests. For example, the implementation of hard technical measures is prevented in Valkenburg to maintain the surrounding nature and its attractiveness to tourists. Instead, defensive measures that positively contribute to the maintenance of the natural landscape are preferred. This is in line with the proposed evolution of defense strategies toward nature-based solutions as mentioned by Chiu et al. (2022). In their article, they state that strategies for flood defense have transformed from hard-engineered systems to nature-based solutions that prioritize sustainability to align with today's environmental, social, and economic goals. While providing resilience against floods, nature-based solutions simultaneously enhance community benefits, protect nature, and deliver affordable flood resilience (Werritty, 2006).

In my perspective, the implementation of nature-based solutions as flood defense strategies contributes to the implementation of integrated flood risk management in two ways. First of all, it contributes to the implementation of a variety of measures. Secondly, nature-based solutions inherently combine the land use function of nature conservation by enriching biodiversity and improving landscape benefits. Therefore, I believe the implementation of nature-based solutions is important to achieve integrated flood risk management in Dordrecht and Valkenburg.

5.2 A proposed shift toward the (socio-) ecological resilience discourse

In both Dordrecht and Valkenburg, a variety of flood mitigation measures are taken to manage flood risks. The great presence of mitigation measures might be explained by the proposed shift in discourse mentioned in the literature. According to Vis et al. (2003), there has

been a proposed transition from a flood-controlling policy aiming to “fight against water” which supports the engineering resilience discourse to an advocated policy of integrated flood risk management aiming to “live with water” which supports the (socio-) ecological resilience discourse. The presence of flood mitigation measures in Dordrecht and Valkenburg could also be an indication of the growing recognition of the limitations of engineering solutions. Engineering solutions require continual maintenance and renovations and negatively impact the environment (Chiu et al., 2022).

In my perspective, the transition to an advocated policy of integrated flood risk management also underscores the importance of collaboration between actors and community engagement. Active participation of local communities, policymakers, and stakeholders is needed to “live with water”. This is also in line with Vis et al. (2003) who state that there is a crucial role for inhabitants in flood risk management. In Dordrecht and Valkenburg, inhabitants play a crucial role in flood preparation measures. For instance, a water safety campaign was designed in Dordrecht drawing attention to inhabitants to prepare for floods by listing what should be in their emergency kits and providing actionable perspectives to evacuate and find a place to shelter. In my opinion, these measures focus on the ability of people to cope with and adapt to floods and consequential changes which fits the socio-ecological resilience discourse as covered by Adger (2000).

However, implementing measures that support the socio-ecological resilience discourse might be risky in Dordrecht and Valkenburg in my perspective. Multiple interviewees mentioned the lack of public awareness regarding flood risks. A considerable amount of inhabitants is unaware of the existing flood risks and corresponding measures. Despite the lack of awareness, the current focus of flood preparation measures revolves around people’s capacity to cope with and adapt to floods themselves. I believe the danger lies in the potential disconnect between the lack of public awareness and the reliance on individuals to cope with and adapt to floods themselves. If inhabitants are not adequately informed about flood risks and flood risk measures in place, they might be unprepared to respond before, during, and after flood events. This could lead to delays or inadequate responses which puts lives and properties at greater risk.

5.3 Past Flood Events as Catalysts for Integrated Flood Risk Management

The politicized institutional analysis and development (IAD) framework focuses on institutional, contextual, political, and discursive factors shaping decision-making among actors in flood risk management. However, the perceived differences in the adoption of risk prevention measures between Dordrecht and Valkenburg suggest an additional influencing factor: past flood

events. I believe that these events can serve as pivotal moments, creating a window of opportunity to implement a diversity of flood risk management measures. Past flood events act as catalysts for the implementation of integrated flood risk management in multiple ways. Firstly, they increase the urgency and awareness among policymakers, exerting influence on decision-making regarding flood risk management. Moreover, past flood events increase political pressure (Pahl-Wostl et al., 2013), shed light on the limitations of existing flood risk management strategies and collaborative governance arrangements, and reaffirm the importance of adaptive management in policymaking (Tortajada et al., 2021).

Even though risk prevention measures are not taken to a large extent in Valkenburg, the recent floods can be a window of opportunity to implement a broader array of risk prevention measures. In this way, the implementation of integrated flood risk management can be enhanced. Interesting to note here is that after the recent floods, many policy documents about flood risk management measures in Valkenburg have been published. This indicates a rise in urgency and awareness among policymakers.

5.4 Mental Recovery: The Overlooked Dimension of Flood Recovery

Another main consideration concerns the perceived difference between the empirical results and literature about what flood recovery should entail. According to the literature, flood recovery consists of reconstruction and rebuilding plans, insurance systems, and compensations (Hegger et al., 2013; Hegger et al., 2016a). However, I want to shed light on a critical aspect often overlooked: the mental dimension of recovery. Contrary to the literature, I believe that flood recovery should not only revolve around measures of rebuilding and reconstructing materials such as houses and roads. Instead, a more comprehensive interpretation is needed that emphasizes the importance of mental recovery, underscoring the psychological impacts of floods on individuals. Floods can be traumatic events and people might need to deal with the consequences for a long time. This was also mentioned by V8 (personal communication, November 27, 2023) “so, I think that the people who have experienced it themselves, they are undoubtedly still largely dealing with trauma. Because even if heavy rainfall is predicted somewhere, they are already moving their cars to higher ground and they cannot sleep. So I think it *[traumas and mental reconstruction]* is an issue that remains somewhat overlooked because people are hesitant to express how much it affects them”. Recommendations about how to include mental recovery in the flood recovery strategy are provided in paragraph 7.2.

5.5 More Financial Resources Due to Changing Discourses and an Increasing Sense of Urgency

There appears to be a disparity between the literature and the empirical findings regarding the availability of financial resources. As highlighted in the problem statement, the implementation of integrated flood risk management is lagging because of limited financing (Van Doorn-Hoekveld et al., 2019; Van Doorn-Hoekveld et al., 2020). However, multiple interviewees have mentioned that the financial resources made available for flood risk management are increasing. I believe that the increase in financial resources is underpinned by discursive and political factors. First of all, the increasing financial resources might be explained by changing discourses in the policy landscape. The European Flood Directive (2007/60/EC) led to the establishment of policies attempting to implement integrated flood risk management throughout Europe (Buchecker et al., 2016; Yannopoulos et al., 2015). Consequently, the Dutch political context signifies a shift regarding flood risk management, embracing a *water- en bodemsturend* approach that accentuates the role of spatial planning in flood risk management. This implies that the approach proposes more attention for the implementation of risk prevention measures within the policy landscape which, in turn, paves the way for more financial resources. Moreover, the increase in financial resources could be linked to the aftermath of the floods in Limburg in 2021. I believe that these floods have brought a bigger sense of urgency that we need to take action to manage flood risks in the Netherlands, which, in turn, has led to increased availability of financial resources.

6. Conclusion

6.1 Sub-question 1

What is integrated flood risk management and how can this be achieved?

Integrated flood risk management combines both structural measures and non-structural measures to minimize flood risks (Jha et al., 2012; Van Herk et al., 2011b; Zevenbergen et al., 2008). With reference to StarFlood, this means that measures supporting strategies of risk prevention, flood defense, flood mitigation, flood preparation, and flood recovery have to be applied simultaneously to achieve integrated flood risk management (Hegger et al., 2013; Wiering, 2019). Measures should also take other land use functions to increase spatial quality such as housing, recreation, and nature conservation (Verweij et al., 2021). The multi-layer safety approach can be considered an ideal example of how to achieve integrated flood risk management by integrating flood risk management strategies across three different layers: (1) defensive and preventive measures, (2) resilient spatial planning measures, and (3) disaster management (Bosoni et al., 2023; Gilissen et al., 2016). Important to note here is that StarFlood's strategy of flood recovery is not covered in one of these layers.

However, applying multiple strategies simultaneously might mean facing institutional fragmentation because they are implemented within different policy domains and by various actors. To prevent this and achieve integrated flood risk management, enhancing the interconnectedness between these different domains and actors is essential as well (Gilissen et al., 2016; Samuels et al., 2010).

6.2 Sub-question 2

How does flood risk management look like in Dordrecht and Valkenburg?

Multiple measures have been implemented in Dordrecht and Valkenburg to manage flood risks. In Dordrecht, multiple measures were taken in terms of risk prevention. These measures include proactive spatial planning, allocation policies, and reallotment policies. For instance, crucial infrastructures such as electricity transformer stations are located at elevated levels outside the dikes, and excessive construction in polders is not allowed. In addition, a variety of technical flood defense measures such as flood barriers, dikes, and valves form a pivotal component of Dordrecht's flood risk management. There are also measures for flood mitigation that facilitate the controlled absorption and retention of excess water. Illustrative of this approach are the intentional maintenance of the Biesbosch landscape as a flood-absorbing feature and the construction of the Sterrenburgpark which is turned into a natural climate-resilient and water-rich playground to give water space. Supplementary flood mitigation measures include the

promotion of green gardens, regulations for flood-proof buildings such as the *Convenant Klimaatadaptief Bouwen,* and flood-proof buildings such as Plan Tij. These mitigation measures take other land use functions as well. For instance, the Biesbosch provides opportunities for recreation and nature conservation whereas Plan Tij combines flood risk management measures with housing. The results from the interviews and desk research also show that Dordrecht has focused on implementing flood preparation measures. A comprehensive water safety campaign has been instituted to increase awareness and inform inhabitants about flood management, including guidance on finding suitable places to shelter and assembling emergency kits. However, public awareness is still lacking. In addition, warning structures, disaster plans, and contingency response plans have been prepared which also include routes to evacuate and evacuation strategies. Actors have also filled sandbags and structurally test measures as a preparation.

Flood risk management in Valkenburg also encompasses a variety of strategies and measures. Concerning risk prevention, water board Limburg and the province of Limburg guide the municipality in determining zoning plans. The municipality does not actively take measures in terms of allocation policies yet, however. Nevertheless, the province has outlined allocation regulations and the water board has allocated inundation areas. The fact that land does not belong to the government creates a difficulty in allocation policies. This means that the government needs to compensate landowners to allocate their land for flood risk management purposes. Current flood risk management in Valkenburg also focuses on flood defense through the construction of dams, quays, quay walls, embankments, and a high-water tunnel. Moreover, flood mitigation measures are implemented to absorb and retain excess water. These include water buffers, overflow areas, and modified streams. The overflow areas and water buffers are often combined with room for recreation and nature conservation. In addition, more urban green is planted. Flood risk management in Valkenburg has focused on flood preparation as well. For instance, websites have been launched to increase awareness and inform inhabitants about what to do before, during, and after floods. However, interviewees have mentioned that there is still a lack of public awareness. Additionally, actors make use of warning stages and disaster plans. The disaster plan includes evacuation plans and locations for shelter. Despite the measures mentioned above, floods could still take place with potentially big impacts. To manage these impacts, measures have been taken in terms of flood recovery. For instance, plans are made to call in companies to help reconstruct and rebuild. The municipalities also keep close contact with insurance companies to make money available for people who suffer from damage.

In terms of interconnectedness between different policy domains and actors, flood risk management in Dordrecht and Valkenburg is relatively similar. Provinces emerge as pivotal agents for fostering interconnectedness among diverse policy domains. This is due to their possession of area-specific expertise allowing them a comprehensive understanding of various domains and enabling them to make connections between them. In both cases, structural meetings are organized involving different actors to share information and learn from each other. These meetings help increase interconnections between actors. The crucial role of water boards is evident in both Dordrecht and Valkenburg, where they hold a central position in ensuring the interconnectedness of actors. This is also the case for WRL regarding flood risk management in Valkenburg and the safety region Hollandse Delta is seen as a 'network organization' that tries to bring actors in Dordrecht together and maintain contacts. However, the individual interests of actors and policy domains sometimes clash. This hampers the implementation of flood risk management measures as it makes the decision-making process more difficult and also negatively influences interconnectedness between actors and different policy domains.

6.3 Sub-question 3

What are the key challenges and opportunities in implementing integrated flood risk management in the specific contexts of Dordrecht and Valkenburg?

In this paragraph, key challenges and opportunities in implementing integrated flood risk management in the specific contexts of Dordrecht and Valkenburg are provided. Subsequently, the degree of integration of flood risk management in Dordrecht and Valkenburg is discussed by comparing the results to academic literature about what integrated flood risk management is and how it can be achieved. Five key challenges for the implementation of integrated flood risk management have been identified:

1) Institutional fragmentation

Even though actors and different policy domains involved in flood risk management in Dordrecht and Valkenburg collaborate and cooperate through meetings, institutional fragmentation hampers the implementation of integrated flood risk management. Applying multiple flood risk management strategies simultaneously and combining measures with other land use functions might be difficult because strategies are implemented within different policy domains and by various actors. There is a diverse distribution of competencies and responsibilities across different actors and institutional layers. This causes conflicting interests and priorities which slows down and complicates the creation of synergies, and the decision-

making process regarding flood risk management measures while also negatively influencing interconnectedness between actors and different policy domains.

2) Differences in legislation and regulations between countries

In the specific case of Valkenburg, disparities in legislation and regulations between different countries form a barrier to the implementation of integrated flood risk management. The Geul flows through Belgium shortly before reaching Valkenburg. To diminish fluvial flood risks in Valkenburg, measures could be implemented in Belgium. However, implementing measures across borders in collaboration with Belgian actors involves different legislation and regulations. These could form obstacles in the implementation of integrated flood risk management as it is more challenging to make investments across borders.

3) The housing shortage

The shortage of housing on a national scale forms another challenge in the implementation of integrated flood risk management. This was specifically mentioned by actors involved in flood risk management in Dordrecht. In Dordrecht, there used to be a strong sentiment to refrain from developing houses in flood-prone areas which were used to retain high water levels. However, the housing shortage caused a counter-movement as an increasing amount of houses were planned and built in these flood-prone areas. This decreases opportunities for the implementation of flood mitigation measures such as areas that retain water. What makes the housing shortage more challenging is that flood risk management measures are regularly left out of these new housing plans as they increase development costs.

4) Lack of awareness among inhabitants

A variety of flood preparation measures have been taken in Dordrecht and Valkenburg that specifically focus on increasing awareness among inhabitants. However, results show that public awareness in both cases is still low. The lack of awareness among inhabitants is problematic in current flood risk management in Dordrecht and Valkenburg, as multiple measures have been taken that focus on the ability of inhabitants to cope with and adapt to floods themselves. The fact that inhabitants are not aware of flood risks makes them unable to cope with and adapt to floods themselves. For instance, they are less likely to take flood preparation measures themselves which hampers the implementation of integrated flood risk management.

5) Land reallotment

Challenges regarding land reallotment hamper the implementation of integrated flood risk management. This was specifically noted by actors involved in flood risk management in Valkenburg. Land is needed to implement flood risk management measures such as water buffers and dikes. However, often land does not belong to the government but to farmers, private individuals, and nature organizations. The government could buy these pieces of land, but this can lead to far-reaching consequences. For instance, farmers could lose their income when they accommodate their land and it might be mentally unsettling for private individuals to live next to a water buffer that retains a lot of water due to higher flood risks in case of breaches or mishaps. Adequate compensations such as financial support or alternate land are needed to successfully reallot land. However, how to do this is still challenging which hampers the implementation of integrated flood risk management.

On the other hand, some opportunities support the implementation of integrated flood risk management in the specific contexts of Dordrecht and Valkenburg:

1) Economic developments

Economic developments increase flood risks in a specific area which in turn increases the need for a integrated flood risk management. This was specifically mentioned in the case of Dordrecht as a transportation development of the corridor from the main port of Rotterdam to Antwerp is taking place. As a consequence, transportation modes and flows are increasing which prompts the examination of safety profiles, increased impacts of floods, and necessary flood risk management measures.

2) The *water- & bodemsturend* approach

Recently, national policies have been developed that advocate the *water- en bodemsturend* approach. By doing so, the national government provides stricter regulations on where spatial developments should or should not be allowed by taking flood risks into account. This enhances the implementation of risk prevention measures such as allocation policies and can therefore be seen as an opportunity to implement integrated flood risk management Dordrecht and Valkenburg.

3) The variety of discourses brought in by actors

Actors involved in flood risk management in Dordrecht and Valkenburg believe that the flood risk management measures required should be tailored to the specific characteristics of

each area. In some areas, flood defense measures such as dikes and embankments are most suitable whereas other areas demand more flood mitigation measures such as water retention areas to manage flood risks. Moreover, actors support the implementation of a variety of measures. This shared consideration of what is important creates an opportunity to implement integrated flood risk management in Dordrecht and Valkenburg.

These underpinning challenges and opportunities influence the current degree of integration in flood risk management in Dordrecht and Valkenburg, which is discussed in the following paragraphs. Regarding StarFlood's strategies, Dordrecht has widely implemented flood risk management measures regarding risk prevention, flood defense, and flood mitigation. However, for flood risk management to be considered integrated, more flood preparation and flood recovery measures have to be implemented. Flood risk management in Dordrecht includes a great variety of measures to prepare for floods but there is a lack of measures that adequately increase awareness among inhabitants. Moreover, flood recovery measures have not been mentioned in the interviews and desk research and therefore seem to be lacking as well. This means that measures regarding reconstruction and rebuilding plans, insurance systems, and compensations have to be implemented for flood risk management to be considered integrated.

In terms of the multi-layer safety approach, current flood risk management in Dordrecht shows the presence of the layer of defensive and preventive measures and the layer of resilient spatial planning measures through measures in terms of flood defense, flood mitigation, and risk prevention. However, improvements can be made in terms of the layer of disaster management and organizational preparation as flood preparation measures that adequately increase awareness among inhabitants are lacking. Moreover, there are combinations of flood risk management measures and other land use functions in Dordrecht. For instance, water retention and overflow areas are combined with nature conservation, recreation, and housing. Different policy domains and actors are interconnected through structural meetings and 'network organizations'. However, as discussed in the previous paragraph, there are clashing interests that influence collaborations between actors and the decisions made in terms of flood risk management measures.

Similarly, results have shown that there is interconnectedness between different policy domains and actors as well in Valkenburg through structural meetings and 'network organizations'. However, here actors also experience clashing interests that negatively influence interconnectedness and the decisions made in terms of flood risk management measures. Considering the implementation of StarFlood strategies in Valkenburg, it can be concluded from the desk research and interviews that flood mitigation and flood defense have been widely

implemented. Improvements have to be made in terms of risk prevention, flood preparation, and flood recovery, however. Measures regarding allocation policies have not been taken on a large scale yet which results in construction plans in flood-prone areas. Concerning flood preparation, there is a lack of measures that increase awareness among inhabitants. In contrast to Dordrecht, flood recovery measures have been implemented in Valkenburg. There are plans for reconstruction and rebuilding but compensations for damages have not been sorted out yet.

Regarding the multi-layer safety approach, flood risk management in Valkenburg cannot be considered integrated. Improvements should be made in the layer of resilient spatial planning measures and the layer of disaster management and organizational preparation. This means that more measures should be taken to prevent risks and to prepare for floods. Examples are allocation policies and measures that increase public awareness. Another condition for flood risk management to be integrated is the combination of flood risk management measures with other land use functions. In Valkenburg, flood risk management measures such as water buffers are combined with other land use functions such as nature conservation and recreation. However, for flood risk management to be considered more integrated, more combinations with other functions such as housing have to be made as well. In table 3, an overview of the degree of integration in flood risk management in Dordrecht and Valkenburg is provided.

Table 3: Presence of aspects determining integration in flood risk management in Dordrecht and Valkenburg according to desk research and interviews (own design)

	Dordrecht	Valkenburg
Risk prevention	+	+/-
Flood defense	+	+
Flood mitigation	+	+
Flood preparation	+/-	+/-
Flood recovery	-	+/-
Combinations with other land use functions	+	+/-
Interconnectedness between policy domains and actors	+/-	+/-
Layer of defensive and preventive measures	+	+/-
Layer of resilient spatial planning measures	+	+/-
Layer of disaster management and organizational preparation	+/-	+/-

6.4 Answering the Main Research Question

How do institutional, contextual, political, and discursive factors influence the failure or success of integrated flood risk management in Dordrecht and Valkenburg?

The results have shown that institutional, contextual, political, and discursive factors influence patterns of interactions within the action arenas of Dordrecht and Valkenburg. In turn, these patterns of interactions impact the decision-making process related to the implementation of flood risk management measures. Stated differently, institutional, contextual, political, and discursive factors influence the failure or success of integrated flood risk management in Dordrecht and Valkenburg in different ways. How this influence manifests is described in the following paragraphs.

In Dordrecht and Valkenburg, institutional factors significantly shape both the success and failure of integrated flood risk management. Water boards Hollandse Delta and Limburg, safety region Zuid-Holland Zuid, and WRL play a crucial role in fostering collaboration between actors through structural knowledge exchange sessions and meetings that allow for open and transparent communication and equal access to information. This enhances both the diversification of flood risk management measures and interconnectedness among actors, mitigating institutional fragmentation and thus influencing the success of integrated flood risk management. However, there are challenges in implementing multiple strategies simultaneously and combining measures with other land functions due to the diverse competencies and responsibilities of actors. Even though actors share desired outcomes of flood risk management in Dordrecht and Valkenburg, individual actors try to achieve their own goals as well. This leads to clashes of interests and priorities that hinder the implementation of integrated flood risk management.

In Valkenburg specifically, challenges in land reallotment are a significant institutional obstacle to the implementation of integrated flood risk management. Acquiring land to implement measures is often complicated as it belongs to farmers, private individuals, or nature organizations. Purchasing this land has consequences for them such as a loss of income or discomfort. Addressing this issue is complex as successful resolutions require adequate compensation. This hinders the implementation of integrated flood risk management in Valkenburg. In a broader context, institutional factors play a pivotal role in shaping the success or failure of integrated flood risk management. Collaborative efforts and knowledge exchange sessions contribute to a diversity of flood risk management measures and interconnectedness among actors. Yet, challenges in implementing strategies simultaneously and conflicting

interests can hinder the implementation of integration. This underscores the importance of overcoming institutional fragmentation.

Contextual factors contribute to the successful implementation of integrated flood risk management in both Dordrecht and Valkenburg. The relatively higher flood risks in these densely populated areas necessitate the implementation of diverse flood risk management measures. The need for a diverse set of measures is higher due to the altitudes of both Dordrecht and Valkenburg. Dordrecht is below sea level while Valkenburg is located in the Geul Valley. The presence of surrounding nature in both Dordrecht and Valkenburg creates opportunities to implement measures that retain and absorb water, facilitating the implementation of a variety of flood risk management measures. Furthermore, Dordrecht holds great cultural and touristic value and significant economic interests due to its location near the corridor from the main ports of Rotterdam and Antwerp. Valkenburg is known as the tourist capital of Limburg due to its historic city center and surrounding natural landscape. These touristic and economic interests increase flood risks and therefore the need for the implementation of integrated flood risk management. Interesting to point out is the importance of maintaining natural landscapes in Valkenburg is reflected in their flood risk management approach. Actors prefer the implementation of natural defensive measures that positively contribute to their natural surroundings instead of hard technical defensive measures. More generally, geographical features and economic interests influence the height of flood risks in a specific area and determine what measures are taken to a certain extent. High flood risks underscore the necessity for the implementation of integrated flood risk management.

Political factors play a significant role in influencing the success or failure of integrated flood risk management in Dordrecht and Valkenburg as well. Governmental bodies have increased the availability of financial resources for flood risk management, allowing for the implementation of more diverse measures. This enhances the implementation of integrated flood risk management in both Dordrecht and Valkenburg. However, the national housing shortage poses challenges to the successful implementation of integrated flood risk management. Specifically in Dordrecht, the housing shortage has led to an increase in houses planned and built in flood-prone areas, limiting the opportunities for flood mitigation measures. In addition, flood risk management measures are often excluded from these new housing plans due to higher development costs. This influences the failure of integrated flood risk management. In Valkenburg, economic considerations have been prioritized in political decision-making instead of physical aspects, hindering the implementation of mitigation measures and therefore

integrated flood risk management. Moreover, disparities in legislation and regulations between countries, such as in the case of international collaborations, create barriers to cross-border investments for flood risk management influencing the failure of integrated flood risk management in Valkenburg. From a wider perspective, political factors significantly shape the success or failure of integrated flood risk management through the allocation of financial resources, governmental choices, legislation, and regulations.

In Dordrecht and Valkenburg, discursive factors influence both the success and failure of integrated flood risk management. Actors involved in flood risk management in Dordrecht and Valkenburg support both the engineering resilience discourse and the (socio-) ecological resilience discourse. Overall, actors share the belief that the best way to deal with flood risks through measures is area-specific. This is in line with the proposed shift in discourse that proposed not only to focus on 'fighting against water' with defensive measures but to 'live with water' by implementing a variety of measures. This discursive shift is reflected in the *water- en bodemsturend* approach introduced by the national government which emphasized the importance of considering spatial planning and flood risks in construction plans by providing stricter regulations. In this way, the discursive shift influences the success of integrated flood risk management in Dordrecht and Valkenburg.

A variety of measures implemented in Dordrecht and Valkenburg specifically support the socio-ecological resilience discourse by focusing on the ability of inhabitants to cope with and adapt to floods themselves. However, results have shown that public awareness regarding flood risks is still very low in both cases. This can be problematic for the implementation of integrated flood risk management as several implemented measures assume that inhabitants can cope with flood risks themselves while in practice, inhabitants are not aware of flood risks. For instance, measures have focused on providing inhabitants with actionable perspectives to prepare an emergency kit. However, inhabitants do not prepare emergency kits as public awareness is lacking. Therefore, the lack of awareness among inhabitants influences the failure of integrated flood risk management in Dordrecht and Valkenburg. In a broader context, the discourses brought in by the actors and the level of awareness play an important role in the success and failure of integrated flood risk management.

In conclusion, institutional, contextual, political, and discursive factors influence both the success and failure of integrated flood risk management in Dordrecht and Valkenburg in different ways. How these factors influence integrated flood risk management, is area-specific.

7. Limitations and Recommendations

7.1 Limitations

Limitations of Methods

In this paragraph, multiple limitations regarding the methods used in this thesis are pointed out. A comparative case study was carried out in this thesis which focused on how institutional, contextual, political, and discursive factors influence the failure or success of integrated flood risk management in Dordrecht and Valkenburg. The external validity of this thesis is rather low as the results are not generalizable and representative of other places. However, flood risk issues are being faced by many cities worldwide. Despite that each of these cities requires specific and ad-hoc solutions, they also share many similarities in flood-related matters. Moreover, actors participating in flood risk management in other cities can learn from and apply the results of this thesis.

The second limitation focuses on the reliability of this thesis, specifically the accuracy. Semi-structured interviews have been conducted in this thesis, which means that an interview guide was used to guide the interviews. However, the order and questions asked may partially differ per interview. Even though the main line is similar in the interviews, the depth in which specific subjects are covered may differ per interview. This negatively influences the accuracy of the research. In addition, there are a lot of actors involved in flood risk management in Dordrecht and Valkenburg. It was impossible to conduct interviews with all actors for this master's thesis. Therefore, the decision was made to only include key actors. As a result, this thesis might not provide a complete picture involving all actors and measures. This negatively influences this thesis' accuracy and reliability as well.

Limitations of Theory

This research has been conducted by using the politicized institutional analysis and development (IAD) framework, StarFlood's flood risk management strategies, and theories about integration in flood risk management. Even though these theories have been suitable and contributed to answering the main research question, several limitations were noticed. First of all, the politicized institutional analysis and development (IAD) framework does not include historical contexts as an exogenous factor. This is a limitation as historical events such as floods could also influence decisions made by actors in the action arena. For instance, floods could act as a window of opportunity to implement a greater variety of flood risk management measures. This limitation might be overcome in future research by combining the politicized institutional analysis and development (IAD) framework with historical institutionalism or with the multiple

streams approach by Kingdon (1995). Further information on recommendations for future research is provided below.

Other limitations were found in the theories about the five StarFlood strategies and the multi-layer safety approach. The theory about StarFlood strategies lacks in providing measures that focus on raising awareness among inhabitants. Multiple interviewees have mentioned ways in which they (tried to) raise awareness about flood risks among inhabitants when they were asked about what measures were taken to prepare for floods. Actors involved in flood risk management in Dordrecht and Valkenburg also mentioned that they face challenges in raising awareness about flood risks among inhabitants. However, the theory does not mention measures to raise awareness as a part of flood prevention. Besides that, StarFlood does not include mental recovery as part of the flood recovery strategy. According to the literature, flood recovery is about reconstruction and rebuilding plans, insurance systems, and compensation (Hegger et al., 2013; Hegger et al., 2016a). However, mental recovery is also really important as floods can be traumatic events and people might need to deal with the consequences for a long time. These limitations might be overcome in future research by combining StarFlood with research on how to raise public awareness and how to mentally recover from traumatic events like floods. Examples of research about such issues are provided in paragraph 7.3.

The multi-layer safety approach lacks in incorporating measures to increase awareness as well as flood recovery measures. This was also pointed out by Algemene Rekenkamer (2023) who stated that two more layers should be added to the approach; a layer of creating awareness and a layer of flood recovery. Another limitation is that the literature about integrated flood risk management used in this thesis does not take into account the efficiency and quality of flood risk management measures. The theory considers flood risk management to be integrated when certain measures are present without considering how well these measures function. For instance, disaster plans can be present but if they are not well thought out they do not contribute to managing flood risks. Therefore, integration in flood risk management does not necessarily mean that flood risks are managed well when considering these theories.

Limitations of my role as a researcher

When reflecting on my role as a researcher, a feeling of pride predominates. Even though writing this thesis has taken longer than I expected, I enjoyed it and thanks to the interviewees, I learned a lot about the roles actors play, collaborations between actors, and decision-making in flood risk management. Nevertheless, my role as a researcher also includes some limitations. For instance, the interview guide I made lacked a logical order which made me struggle sometimes

during the interviews. At certain times, it felt like I was jumping from one topic to the other during the interviews. Because of this, I feel like I missed some opportunities to dive deeper into some subjects. This could have led to more detailed information which could have enriched this thesis. In addition, I noticed that I felt awkward during moments of silence during the interviews. To prevent moments of silence, I started asking follow-up questions rather early. This might have been unpleasant for respondents as I did not give them enough time to think about and formulate their answers. This could negatively affect the amount of information the interviewees provided me. However, I started to notice this after a few interviews which allowed me to improve myself for the remaining interviews.

7.2 Recommendations for Policymakers

Based on the discussion, conclusion, and limitations, six recommendations for policymakers in Dordrecht and Valkenburg are provided to support them in achieving integrated flood risk management.

1) Overcome institutional fragmentation

Overcoming institutional fragmentation is needed to apply multiple flood risk management measures simultaneously, create synergies with other land use functions, and enhance interconnectedness between actors and different policy domains. In both Dordrecht and Valkenburg, actors face clashing interests and priorities in flood risk management as they try to achieve their own goals as well besides shared desired outcomes. Driessen et al. (2018) provide ways to overcome institutional fragmentation which can function as an example for Dordrecht and Valkenburg. They recommend establishing links between different sectors. Besides water management, other sectors are also necessary to cover a diverse range of flood risk management strategies by providing adequate policy instruments. For this reason, enhancing connections between policy sectors and administrative levels is required. These connections can be enhanced by bridging mechanisms that "entail information exchange, coordination of policies and cooperation mechanisms" (Driessen et al., 2018, p. 5). These bridging mechanisms can also help to link different governance levels by combining top-down and bottom-up policy processes. Laws and policy instruments can establish these mechanisms. Financial backing and the establishment of knowledge infrastructures can further encourage bridging mechanisms.

2) Combine flood risk management measures with housing

For flood risk management to be integrated, measures should also take other land use functions such as housing. Next to influencing the success of integrated flood risk management,

combining flood risk management measures with housing also contributes to solving the housing shortage. Results have shown that especially in Valkenburg, measures are not combined with housing yet. Therefore, policymakers in Valkenburg are recommended to implement more measures that also take the land use function of housing. They could use Plan Tij in Dordrecht as an example.

3) Implement more nature-based solutions

Thirdly, policymakers are recommended to implement more nature-based solutions. Nature-based solutions are measures that provide resilience against floods and simultaneously enhance community benefits, protect nature, and deliver affordable flood resilience (Werritty, 2006). Examples are re-meandering rivers and removing obstacles. As explained in the discussion, the implementation of nature-based solutions as flood defense strategies contributes to the implementation of integrated flood risk management in two ways. First of all, it contributes to the implementation of a variety of measures. Secondly, nature-based solutions inherently combine the land use function of nature conservation by enriching biodiversity and improving landscape benefits.

4) Increase public awareness about flood risks

Moreover, policymakers in both Dordrecht and Valkenburg are recommended to start implementing measures that successfully increase public awareness about flood risks. Even though attempts are made in both cases, it seems that not all inhabitants are aware of the flood risks yet. Increasing public awareness is especially essential in both cases as current flood risk management measures focus on the ability of people to cope with and adapt to flood risks themselves. Increasing public awareness can be done in several ways. As discussed by Maidl and Buchecker (2015), information regarding flood risks should be distributed regularly and multiple target groups should be specifically addressed. Especially the distribution of detailed information on the benefits of flood risk management, how to implement measures and hazard maps is important in increasing public awareness. Awareness of flood risks relies on media and campaigns that attract public attention. A specific example of how to increase public awareness is a public consultation event during non-working hours to disseminate information in flood hazard areas to address site-specific issues and measures. Important to note here is that the use of non-technical language is important for ensuring inhabitants' understanding. Furthermore, interactive websites enable inhabitants to identify the areas prone to flooding which, together with surveys and subsidies, can increase public awareness (Charalambous et al., 2018).

5) Implement material and mental flood recovery measures

Policymakers in both cases, but specifically Dordrecht, are recommended to focus on implementing flood recovery measures. These measures should not only focus on material recovery such as reconstructing and rebuilding, but also on mental recovery. Mental recovery should be tailored to individual needs and should particularly focus on societal groups that are socially vulnerable (Bubeck & Thieken, 2018). Support for mental health should be available for a prolonged period after the initial floods (Butler et al., 2018). Mental recovery could for instance include professional psychological help and connection through supportive communities. Policymakers are recommended to allocate resources for mental health services such as therapy, support groups, and community outreach programs. Additionally, crisis helplines and support services should be established after floods. To diminish mental potential consequences of floods, mental resilience among individuals and communities can also be enhanced through (1) coordinating the sharing of efficient public information and actionable perspectives for flood risks, (2) developing protection capabilities such as early warning systems, (3) designing insurance procedures for a faster recover, and (4) learning from personal experiences as memories stimulate future adaptation to floods (Foudi et al., 2017).

6) Overcome challenges in international collaborations

Lastly, as mentioned in the results, actors from Belgium are involved in flood risk management in Valkenburg. However, the differences in legislation and regulations between the Netherlands and Belgium cause difficulties. Actors in Valkenburg are recommended to look for ways to overcome these challenges so that international collaborations can be more efficient and effective in managing flood risks. Implementing measures across borders could potentially be less expensive and more effective. To overcome challenges in international collaborations, policymakers are recommended to share ideas and take good practices as an example, establish clear communication channels and a common set of aims and guidelines that can be adopted in both countries.

7.3 Recommendations for Future Research

Based on the results and limitations mentioned above, several directions for future research are provided. First of all, the narrow scope of this research resulted in a relatively low generalizability. Future scholars could look at how institutional, contextual, political, and discursive factors influence the failure or success of integrated flood risk management in a broader context. For instance, examining this in a national context would provide factors that

hamper the implementation of integrated flood risk management on a national scale. In turn, policymakers from the national government could adapt policies to overcome these challenges and consequently support the implementation of integrated flood risk management. Furthermore, research can be conducted on the ideal institutional, contextual, political, and discursive factors for implementing integrated flood risk management. This research could for example focus on what way of making decisions supports the implementation of integrated flood risk management best. Subsequently, the research could function as an example for cities in achieving integrated flood risk management. Thirdly, this thesis focuses on the key actors involved in flood risk management in Dordrecht and Valkenburg. A more comprehensive analysis of all actors involved in flood risk management may provide a fuller picture of how institutional, contextual, political, and discursive factors influence the success or failure of integrated flood risk management in Dordrecht and Valkenburg. Examples of actors that should be included in this research through semi-structured interviews are the fire departments, LLTB, the police force, and Rijkswaterstaat.

Another recommendation for future research involves an investigation of what other exogenous factors influence decision-making about flood risk management in the action arena. Even though the politicized institutional analysis and development (IAD) framework used in this thesis seemed a suitable theory, there might be more exogenous factors that have an influence. This thesis already pointed out that historical events also influence decision-making regarding flood risk management. As mentioned above, future research on how historical events influence decision-making can combine the politicized institutional analysis and development (IAD) framework with historical institutionalism. Historical institutionalism focuses on path dependency and historical explanations to answer outcome-oriented questions about political phenomena (i.e. decision-making about flood risk management) (Amenta, 2012). Another recommendation for future research on how historical events influence decision-making is to combine the politicized institutional analysis and development (IAD) framework with the multiple streams approach by Kingdon (1995). According to this framework, a certain event can be a window of opportunity for policy changes. The framework recognizes the role of individual actors, institutions, and external events such as flood events in policy changes. In addition, the framework is concerned with why ideas ‘have their time’ and how issues get the attention of policymakers (Penning-Rowsell et al., 2019).

Furthermore, future research could focus on what other exogenous factors influence decision-making regarding flood risk management. Moreover, this thesis pointed out that both

Dordrecht and Valkenburg attempt to increase inhabitants' awareness of flood risks. However, these attempts have not been completely successful. Therefore, research on how to successfully increase inhabitants' awareness regarding flood risks is recommended. This can be done by combining StarFlood with research on how to increase public awareness by Charalambous et al. (2018) and Maidl and Buchecker (2015). Last but not least, this thesis has also shown the lack of attention to mental recovery in StarFlood's strategy for flood recovery. Even though floods can have far-reaching mental consequences such as traumas, StarFlood solely focuses on material recovery such as rebuilding and reconstructing. Research on what measures are needed for victims to recover mentally from floods is recommended. This can be done by combining StarFlood with research conducted by Bubeck and Thieken (2018), Butler et al. (2018), and Foudi et al. (2017) on ways to mentally recover from flood events.

Also, this thesis provides key challenges and opportunities in implementing integrated flood risk management in Dordrecht and Valkenburg. Future scholars could focus their research on how to overcome these challenges and how to take advantage of these opportunities to enhance the implementation of integrated flood risk management. One of the challenges pointed out in this thesis is the lack of adequate compensation in case of land reallotment. Sometimes, land is needed to implement certain flood risk management measures. Often the land does not belong to the government but to farmers, private individuals, and nature organizations. They need to be compensated as they accommodate their land. However, policymakers have mentioned that they experience difficulties in providing adequate compensation. Therefore, future research could focus on adequate ways to compensate farmers, private individuals, and nature organizations. Examples could include financial compensation or offering alternative pieces of land.

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9. Appendices

9.1 Appendix 1: Overview Interviews

Appendix 1: Overview of interviewees (own design)

Interviewee	Profession	Date	Interview setting	Duration
D1	Policy advisor municipality of Dordrecht	17-10-2023	Teams meeting	58:36
D2	Strategic advisor water board Hollandse Delta	26-10-2023	Teams meeting	54:13
D3	Policy advisor calamity organization water board Hollandse Delta	13-11-2023	Teams meeting	01:07:16
D4	Policy advisor safety region of Zuid-Holland Zuid	09-11-2023	Teams meeting	1:01:00
D5	Policy advisor province of Zuid-Holland	16-11-2023	Teams meeting	57:23
D6	Municipal Councilor Dordrecht	08-12-2023	Teams meeting	43:41
V1	Policy advisor municipality of Valkenburg aan de Geul	03-10-2023	Teams meeting	57:52
V2	Policy advisor municipality of Valkenburg aan de Geul	06-10-2023	Teams meeting	44:54
V3	Policy advisor water board Limburg	02-11-2023	Teams meeting	44:14
V4	Program manager and policy advisor Waterveiligheid en Ruimte Limburg (WRL)	09-11-2023	Teams meeting	53:25
V5	Policy advisor and expert water board Limburg	16-11-2023	Teams meeting	45:05
V6	Policy advisor province of Limburg and Waterveiligheid en Ruimte Limburg (WRL)	23-11-2023	Teams meeting	50:22
V7	Councilor and program manager water board Limburg and WRL	18-12-2023	Teams meeting	52:31
V8	Municipal Councilor Valkenburg aan de Geul	27-11-2023	Teams meeting	46:22

V9	Expert calamity organization water board Limburg	04-12-2023	Teams meeting	54:36

9.2 Appendix 2: Operationalization Tables

Operationalization table action arena:

Appendix 2: Operationalization action arena (own design). Information retrieved from (Ostrom, 2007, 2011; Polski & Ostrom, 1999; Smajgl et al., 2009)

Theoretical concept	Dimensions	*Indicators*
Action situations	Participants	*Actors involved in decision-making* *Number of participations* *Actors representing certain interests*
	Decision-making	*How power is distributed in making decisions* *How political and economic interests drive decision-making*
The actor	Actor	*Single individual or a group*

Operationalization table physical and material conditions:

Appendix 2: Operationalization of physical and material conditions (own design). Information retrieved from (Polski & Ostrom, 1999)

Theoretical concept	Dimensions	*Indicators*
Physical and material conditions	Aspects from the physical world	*Urbanization* *Hydrography* *Altitude of place* *Soil types* *Surrounding nature*

Operationalization table attributes of the community:

Appendix 2: Operationalization attributes of the community(own design). Information retrieved from (Clement, 2010; MacIntosh-Murray, 2007; Polski & Ostrom, 1999; Vitale & Meijerink, 2021a)

Theoretical concept	Dimensions	*Indicators*
Attributes of the community	Degree of common understanding and trust	*Shared interpretations by decision-makers* *Level of trust among decision-making actors*
	Shared norms, values, beliefs, and preferences	*What the current situation is like according to decision-makers together* *Considerations of what is important by decision-makers together* *Shared opinions by decision-makers*
	Community	*Amount of people belonging to the community of decision-makers* *Who belongs to the community?*

Operationalization table rules-in-use:

Appendix 2: Operationalization rules-in-use (own design). Information retrieved from (Polski & Ostrom, 1999; Smajgl et al., 2009; Van den Hurk et al., 2014; Vitale & Meijerink, 2021c)

Theoretical concept	Dimensions	*Indicators*
Rules-in-use	Position	*Positions and roles of actors* *Number of actors holding each position* *Type of participant holding positions* *Collaboration between actors from different levels*
	Boundary	*Participants entering or leaving a position*

		Way of entering or leaving a position
	Authority	*Actions participants can take in a certain position*
	Aggregation	*Amount of actors who have to make decisions* *How decisions are made in action situations* *How is power distributed* *Interdependence of actors* *Who makes the final decisions*
	Scope	*Desired outcomes* *Actions taken to reach these outcomes*
	Information	*Amount of information available for each actor in the action arena* *Type of information available for each actor* *Channels through which information is exchanged* *Opportunity for open communication* *Objectivity information*
	Payoff	*Who will benefit from the decisions* *Who will pay for the chosen decisions*

Operationalization table politico-economic context:

Appendix 2: Operationalization politico-economic context (own design). Information retrieved from (Clement, 2010; Vitale & Meijerink, 2021a; Vitale et al., 2020)

Theoretical concept	Dimensions	*Indicators*
Politico-economic context	Distribution of power	*Actors involved in decision-making* *Amount of power of each actor involved in the action arena* *Type of actor making decisions*
	Situations influencing decisions	*The local and wider political situation* *How political situation influences decisions* *Local and wider economic situation* *How economic situation influences decisions*

Operationalization table discourses:

Appendix 2: Operationalization discourses (own design). Information retrieved from (Adger, 2000; Chelleri et al., 2015; Davoudi et al., 2012; Disse et al., 2020; Folke, 2006; Holling, 1996; Oosterberg et al., 2005; Vitale & Meijerink, 2021c; Vitale et al., 2020)

Theoretical concept	Dimensions	*Indicators*
Discourses	Engineering resilience	*Aiming to remain at idealized state* *Bouncing back to idealized state* *Lacking the ability to adapt after floods* *Technical and spatial measures aiming for flood protection and withstand impacts*
	Ecological resilience	*Absorb changes after flood* *Developing new trajectories* *Reduce flood vulnerability by measures preparing areas*

	Socio-ecological resilience	*Focusing on the ability of people to cope with and adapt to changes* *Absorb changes after flood* *Developing new trajectories* *Reduce flood vulnerability by measures preparing areas*

Operationalization table patterns of interactions:

Appendix 2: Operationalization patterns of interactions (own design). Information retrieved from (Polski & Ostrom, 1999)

Theoretical concept	Dimensions	*Indicators*
Patterns of interactions	Structure of political participation	*Political participation of actors* *Behaviour and interactions of participants when participating on a political level*
	Information flows	*Type of information flows*

Operationalization table outcomes:

Appendix 2: Operationalization outcomes; StarFlood's five flood risk management strategies (own design). Information retrieved from (Hegger et al., 2013; Hegger et al., 2016a; Van Alphen et al., 2009; Wiering, 2019)

Theoretical concept	Dimensions	*Indicators*
STAR-Flood flood risk management strategies	Risk Prevention	*Proactive spatial planning* *Allocation politics* *Reallotment policy* *Expropriation policy*
	Flood Defense	*Dikes* *Dams* *Embankments* *Sand suppletion* *Weirs*
	Flood Mitigation	*Urban green* *Water retention* *Flood-proof building* *Regulations for flood-proof building* *Infrastructure*

		Urban management
	Flood Preparation	*Warning systems* *Disaster planning* *Evacuation plans* *Locations to shelter* *Warning stages* *Managing floods* *Routes to evacuate* *Emergency kit*
	Flood Recovery	*Reconstruction and rebuilding plans* *Insurance systems* *Compensation*

.

Operationalization table evaluation criteria integration:

Appendix 2: Operationalization evaluation criteria integration (own design). Information retrieved from (Bosoni et al., 2023; Gilissen et al., 2016; Samuels et al., 2010; Tsimopoulou et al., 2013; Van Buuren et al., 2013; Van Der Most et al., 2014; Verweij et al., 2021; Wiering, 2019)

Theoretical concept	Dimensions	*Indicators*
Integrated flood risk management	Flood risk management strategies and measures combined with other land use functions increase spatial quality	*Housing* *Recreation* *Nature conservation*
	A mix of structural and non-structural strategies and measures (Mix of StarFlood strategies)	*A mix of risk prevention, flood defense, flood mitigation, flood preparation, and flood recovery*
	Multi-layer safety approach	*Layer of defensive and preventive measures to decrease the probability of floods (Dikes and dams)* *Layer comprising resilient spatial planning measures to mitigate and decrease consequences (spatial*

		planning, location, design, and accessibility) *Layer of disaster management and organizational preparation (evacuation plans, crisis management plans, flood insurance)*
	Interconnectedness	*Interconnectedness between policy domains* *Interconnectedness between different actors*

9.3 Appendix 3: Interview Guides

Appendix 3: Interview guide councilors (own design)

INTRODUCTIE	**INTERVIEW COUNCILORS**
Introductie	Heel erg bedankt dat u tijd heeft vrijgemaakt om met mij in gesprek te gaan.
Uitleg over scriptie	Op dit moment volg ik de master Spatial Planning aan de Radboud Universiteit in Nijmegen en schrijf ik mijn masterscriptie over overstromingsrisicomanagement in Dordrecht en Valkenburg. Ik ben voornamelijk nieuwsgierig naar de samenwerking tussen verschillende partijen en hoe er besluiten worden gemaakt om overstromingsrisico's aan te pakken.
U of je	Vindt u het fijner als ik u met 'u' of met 'je' aanspreek?
Vertrouwelijkheid en anonimiteit	Uw naam zal niet worden genoemd bij het uitwerken van de data zodat de data niet te herleiden is.
Als respondent wil stoppen	Wanneer u een pauze wilt inlassen of wilt stoppen met het interview dan kunt u dit op elk moment aangeven. We lassen dan direct een pauze in of beëindigen het interview.
Duur	Het interview zal ongeveer 45 tot 60 minuten duren. Het kan echter ook zo zijn dat het minder lang duurt wanneer we zijn uitgesproken of wanneer u eerder wilt stoppen.
Toestemming opnemen	Vindt u het goed als ik dit gesprek opneem zodat ik het later kan uittypen en de resultaten beter kan verwerken? Enkel ik en mijn scriptiebegeleider zullen de opname terug kunnen luisteren en het zal voor geen andere doeleinden gebruikt worden.
MIDDENSTUK	
Algemeen	- Kunt u mij vertellen over uw studieachtergrond en huidige functie als gemeenteraadslid? Kunt u mij vertellen over uw werkzaamheden als gemeenteraadslid? - Uit welke partijen bestaat de gemeenteraad? Hoe is de verdeling qua linkse, rechtse, progressieve en conservatieve partijen in de gemeenteraad? - Hoe vaak gaat de gemeenteraad in overleg? - Hoe vaak wordt er gesproken over maatregelen die overstromingsrisico's aanpakken?

Samenwerking	- In hoeverre wordt er samengewerkt door de betrokken partijen? - In hoeverre ervaart u vertrouwen tussen de betrokken partijen? - In hoeverre heeft u het gevoel dat betrokkenen een gedeelde visie hebben over wat belangrijk is bij het aanpakken van overstromingsrisico's? En ook over wat minder belangrijk is?
Besluitvorming	- Wie zijn er betrokken bij het besluitvormingsproces over maatregelen die overstromingsrisico's aanpakken? - In hoeverre kunnen andere partijen ook invloed krijgen op de besluitvorming? - Zijn er partijen die eerst betrokken waren in het besluitvormingsproces en nu niet meer? Hoe is dit gegaan? Wat waren de consequenties? - Zijn er partijen die eerst niet betrokken waren in het besluitvormingsproces en nu wel? Hoe is dit gegaan? Wat waren de consequenties? - In hoeverre zijn bewoners betrokken bij het besluitvormingsproces? - Wie hebben er voordeel bij de genomen besluiten? - Wie ondervinden nadelen bij de genomen besluiten? - Hoe worden beslissingen uiteindelijk genomen in de gemeenteraad? Wordt er bijvoorbeeld gestemd? Of worden er beslissingen gemaakt in goed overleg? - Wat is uw rol in het besluitvormingsproces? Welke besluiten heeft u dit jaar gemaakt? En voorgaande jaren?
Verhoudingen	- In hoeverre heeft iedereen die betrokken is bij het besluitvormingsproces een stem? Heeft een bepaalde betrokken partij het laatste woord? Wie maakt uiteindelijk de beslissingen? - In hoeverre heeft u bepaalde bevoegdheden in uw rol? Waar mag u over beslissen en waarover niet? - Zijn er bepaalde aspecten waar u de eindverantwoordelijkheid over heeft? - Wat vindt u van de invloed die u heeft op de besluitvorming en maatregelen die worden genomen? - In hoeverre moeten beslissingen gemaakt worden in overleg met anderen?

	- Welke informatie gebruikt u om beslissingen te maken over maatregelen? - Hoe komt u aan deze informatie? - Hebben alle betrokken partijen toegang tot dezelfde informatie?
Politieke en economische context	- In hoeverre zijn er economische ontwikkelingen die invloed hebben op overstromingsrisicomanagement? - In hoeverre zijn er politieke ontwikkelingen die invloed hebben op overstromingsrisicomanagement?
Visie	- In hoeverre denkt u dat bewoners van Dordrecht/Valkenburg zich bewust zijn van overstromingsrisico's? Hoe merkt u dat? - Hoe kijkt u zelf tegen overstromingsrisico's aan? Vindt u dat we water zoveel mogelijk weg moeten houden of moeten we water juist de ruimte geven? - Wat is voor u het beoogde resultaat van overstromingsrisicomanagement in Dordrecht/Valkenburg?
SLOT	
Afsluiting	- Wat vond u van het interview? - Is er nog iets wat u wilt toevoegen aan het gesprek? Zijn er dingen niet aan bod gekomen die u nog kwijt wilt?
Eindresultaat	Wilt u het eindresultaat van mijn scriptie zien? Zo ja, waar kan ik deze te zijner tijd naartoe sturen?
Bedanken	Heel erg bedankt voor uw deelname aan dit gesprek en de tijd die u hiervoor heeft vrijgemaakt. Ik heb veel waardevolle informatie gekregen en kan hiermee goed vooruit.
Andere contactpersonen	Kent u nog collega's of andere betrokken partijen die ik kan interviewen over dit onderwerp?

Appendix 3: Interview guide policy advisors and experts (own design)

INTRODUCTIE	**INTERVIEW POLICY ADVISORS AND EXPERTS**
Introductie	Heel erg bedankt dat u tijd heeft vrijgemaakt om met mij in gesprek te gaan.
Uitleg over scriptie	Op dit moment volg ik de master Spatial Planning aan de Radboud Universiteit in Nijmegen en schrijf ik mijn masterscriptie over overstromingsrisicomanagement in Dordrecht en Valkenburg. Ik ben voornamelijk nieuwsgierig naar de samenwerking tussen verschillende partijen en hoe er besluiten worden gemaakt om overstromingsrisico's aan te pakken.
U of je	Vindt u het fijner als ik u met 'u' of met 'je' aanspreek?
Vertrouwelijkheid en anonimiteit	Uw naam zal niet worden genoemd bij het uitwerken van de data zodat de data niet te herleiden is.
Als respondent wil stoppen	Wanneer u een pauze wilt inlassen of wilt stoppen met het interview dan kunt u dit op elk moment aangeven. We lassen dan direct een pauze in of beëindigen het interview.
Duur	Het interview zal ongeveer 45 tot 60 minuten duren. Het kan echter ook zo zijn dat het minder lang duurt wanneer we zijn uitgesproken of wanneer u eerder wilt stoppen.
Toestemming opnemen	Vindt u het goed als ik dit gesprek opneem zodat ik het later kan uittypen en de resultaten beter kan verwerken? Enkel ik en mijn scriptiebegeleider zullen de opname terug kunnen luisteren en het zal voor geen andere doeleinden gebruikt worden.
MIDDENSTUK	
Algemeen	- Kunt u mij vertellen over uw studieachtergrond en loopbaan? Kunt u mij vertellen over uw werkzaamheden in uw huidige functie?
Maatregelen	- Kunt u mij vertellen over de maatregelen die getroffen zijn om het overstromingsrisico in Dordrecht/Valkenburg aan te pakken? - In hoeverre gaan deze maatregelen samen met het vervullen van andere doelen? Denk aan recreatie, huisvesting, het behouden van natuur etc.
Samenwerking	- Met welke partijen werkt u samen om deze maatregelen vorm te geven? - In hoeverre wordt er samengewerkt door de betrokken partijen? - Hoe vaak gaat u in overleg met andere betrokkenen?

	- In hoeverre ervaart u vertrouwen tussen de betrokken partijen? - In hoeverre heeft u het gevoel dat betrokkenen een gedeelde visie hebben over wat belangrijk is bij het aanpakken van overstromingsrisico's? En ook over wat minder belangrijk is?
Besluitvorming	- Wie zijn er betrokken bij het besluitvormingsproces over maatregelen die overstromingsrisico's aanpakken? - In hoeverre kunnen andere partijen ook invloed krijgen op de besluitvorming? - Zijn er partijen die eerst betrokken waren in het besluitvormingsproces en nu niet meer? Hoe is dit gegaan? Wat waren de consequenties? - Zijn er partijen die eerst niet betrokken waren in het besluitvormingsproces en nu wel? Hoe is dit gegaan? Wat waren de consequenties? - In hoeverre zijn bewoners betrokken bij het besluitvormingsproces? - Wie hebben er voordeel bij de genomen besluiten? - Wie ondervinden nadelen bij de genomen besluiten? - Hoe worden beslissingen uiteindelijk genomen in de gemeenteraad? Wordt er bijvoorbeeld gestemd? Of worden er beslissingen gemaakt in goed overleg? - Wat is uw rol in het besluitvormingsproces? Welke besluiten heeft u dit jaar gemaakt? En voorgaande jaren?
Verhoudingen	- In hoeverre heeft iedereen die betrokken is bij het besluitvormingsproces een stem? Heeft een bepaalde betrokken partij het laatste woord? Wie maakt uiteindelijk de beslissingen? - In hoeverre heeft u bepaalde bevoegdheden in uw rol? Waar mag u over beslissen en waarover niet? - Zijn er bepaalde aspecten waar u de eindverantwoordelijkheid over heeft? - Wat vindt u van de invloed die u heeft op de besluitvorming en maatregelen die worden genomen? - In hoeverre moeten beslissingen gemaakt worden in overleg met anderen? - Welke informatie gebruikt u om beslissingen te maken over maatregelen?

	- Hoe komt u aan deze informatie? - Hebben alle betrokken partijen toegang tot dezelfde informatie?
Politieke en economische context	- In hoeverre zijn er economische ontwikkelingen die invloed hebben op overstromingsrisicomanagement? - In hoeverre zijn er politieke ontwikkelingen die invloed hebben op overstromingsrisicomanagement?
Visie	- In hoeverre denkt u dat bewoners van Dordrecht/Valkenburg zich bewust zijn van overstromingsrisico's? Hoe merkt u dat? - Hoe kijkt u zelf tegen overstromingsrisico's aan? Vindt u dat we water zoveel mogelijk weg moeten houden of moeten we water juist de ruimte geven? - Wat is voor u het beoogde resultaat van overstromingsrisicomanagement in Dordrecht/Valkenburg?
SLOT	
Afsluiting	- Wat vond u van het interview? - Is er nog iets wat u wilt toevoegen aan het gesprek? Zijn er dingen niet aan bod gekomen die u nog kwijt wilt?
Eindresultaat	Wilt u het eindresultaat van mijn scriptie zien? Zo ja, waar kan ik deze te zijner tijd naartoe sturen?
Bedanken	Heel erg bedankt voor uw deelname aan dit gesprek en de tijd die u hiervoor heeft vrijgemaakt. Ik heb veel waardevolle informatie gekregen en kan hiermee goed vooruit.
Andere contactpersonen	Kent u nog collega's of andere betrokken partijen die ik kan interviewen over dit onderwerp?

Interview questions per element from the politicized institutional analysis and development (IAD) framework:

Action arena:

- Wat is uw rol in overstromingsrisicomanagement in Valkenburg/Dordrecht?
- Welke partijen zijn er nog meer betrokken bij overstromingsrisicomanagement? Hoe spelen zij een rol?

Rules-in-use

Position rules:

- In hoeverre wordt er samengewerkt door de betrokken partijen?

Boundary rules:

- Kunt u mij vertellen welke partijen er betrokken worden bij het besluitvormingsproces over hoe overstromingsrisico's worden aangepakt?
- In hoeverre zijn bewoners betrokken bij het besluitvormingsproces? In hoeverre zijn er bewonersinitiatieven?
- Zijn er partijen die eerst betrokken waren in het besluitvormingsproces en nu niet meer? Hoe is dit gegaan? Wat waren de consequenties?
- Zijn er ook partijen die eerst niet betrokken waren in het besluitvormingsproces en nu wel? Hoe is dit gegaan? Wat waren de consequenties?

Authority rules:

- Wat vindt u van de invloed die u heeft op de besluitvorming en maatregelen die worden genomen?
- In hoeverre heeft u bepaalde bevoegdheden in uw rol? Waar mag u over beslissen? Waarover niet?
- Zijn er bepaalde aspecten waar u de eindverantwoordelijkheid over heeft?
- In hoeverre moeten beslissingen gemaakt worden in overleg met anderen?

Aggregation rules:

- Hoe worden beslissingen uiteindelijk genomen? Wordt er bijvoorbeeld gestemd?
- Hebben alle betrokken partijen een stem? Heeft een bepaalde betrokken partij het laatste woord? Wie maakt uiteindelijk de beslissingen?
- Wat was uw rol in het besluitvormingsproces? Welke besluiten heeft u gemaakt dit jaar? En voorgaande jaren?

Scope rules:

- Wat is voor u het beoogde resultaat van overstromingsrisicomanagement in Dordrecht/Valkenburg?
- Wat doet u om dit resultaat te bereiken?

Information rules:

- Welke informatie gebruikt u om beslissingen te maken over maatregelen?
- Hoe komt u aan deze informatie?
- Hebben alle betrokken partijen toegang tot dezelfde informatie?

Pay-off rules:

- In hoeverre zijn er betrokken partijen die het niet eens zijn met de besluiten die zijn genomen?
- Wie hebben er voordeel bij de genomen besluiten?
- Wie ondervinden nadelen bij de genomen besluiten?

Attributes of the community

- In hoeverre ervaart u vertrouwen tussen de betrokken partijen?
- In hoeverre heeft u het gevoel dat betrokkenen een gedeelde visie hebben over wat belangrijk is bij het aanpakken van overstromingsrisico's? En ook over wat minder belangrijk is?
- Wat vindt u zelf belangrijk bij het managen van overstromingsrisico's in Dordrecht/Valkenburg? Zijn er meerdere partijen met deze mening?
- Wat vindt u van de huidige manier waarop overstromingsrisico's worden aangepakt? Wat kan er veranderd worden naar uw mening?

Community

- Hoe worden bewoners betrokken bij het aanpakken van overstromingsrisico's? En bij het maken van beslissingen hierover?
- In hoeverre denkt u dat bewoners zich bewust zijn van overstromingsrisico's? Hoe merkt u dat?

Politico-economic context

- In hoeverre zijn er economische ontwikkeling die invloed hebben op overstromingsrisicomanagement?
- In hoeverre zijn er politieke ontwikkelingen die invloed hebben op overstromingsrisicomanagement?

Discourses

- Hoe kijkt u zelf tegen overstromingsrisico's aan? Vindt u dat we water zoveel mogelijk weg moeten houden of moeten we water juist de ruimte geven?
- Wat zijn volgens u de beste manieren waarop het overstromingsrisico in Dordrecht/Valkenburg aangepakt kan worden?

Outcomes

- Kunt u mij vertellen over de maatregelen die getroffen zijn om het overstromingsrisico in Dordrecht/Valkenburg aan te pakken?
- In hoeverre gaan deze maatregelen samen met het vervullen van andere doelen? Denk aan recreatie, huisvesting, het behouden van natuur etc.

9.4 Appendix 4: Codebook Interviews

Appendix 4: Codebook interviews (own design)

Theoretical concept (Smart groups code groups)	Dimensions (code groups)	Indicators (codes)	Number of codes	Exemplary quotes	Description
Action Arena	Participants	Actors involved in decision-making	4	"Dat is de provincie Limburg, daar is ook de voorzitter van de actietafel, hij is daar ook de voorzitter zeg maar, en Waterschap Limburg en we hebben alle 31 Limburgse gemeenten die daarbij zitten, en we hebben het ministerie erbij, Ministerie I en W" (V4)	The province of Limburg, water board Limburg, Ministery of Infrastructuur en Waterstaat, and all 31 municipalities are involved in Waterveiligheid en Ruimte Limburg (WRL). WRL is involved in the decision-making process regarding flood risk management in Valkenburg
	Decision-making	How power is distributed in making decisions	2	"Dat bepaalt de politiek in het college. De raad is de hoogste baas dus die bepaalt wat er uiteindelijk wel en niet gebeurt" (D1)	The councils have the most power so they essentially decide what decisions are made
Physical and material conditions	Aspects from the physical world	Urbanization	1	"In een beperkte ruimte, want Zuid Limburg is dichtbevolkt, het is naast de Randstad een van de dichtstbevolkte gebieden" (V7)	Valkenburg is located in Zuid-Limburg which is a densely populated region

		Hydrography	7	"We zitten eigenlijk in een uniek gebied waar zowel de hoofddreiging vanuit zee komt, de stormvloed" (D3)	Dordrecht faces flood risks from the sea, the storm surge
		Altitude of place	3	"We zitten eigenlijk in een laag gebied" (V1)	Valkenburg is located on a relatively low altitude
		Surrounding nature	1	"Er is ook nationaal landschap. Mensen willen niet dat je allemaal rare elementen gaat toevoegen om water vast te houden. Regenwaterbuffers, grote dammen, stenen, stuwtjes… Dat doet het landschap niet ten goede. Dan krijg je hele rare elementen in het landschap" (V1)	There are natural landscapes surrounding Valkenburg
Attributes of the community	Degree of common understanding and trust	Shared interpretations by decision-makers	9	"Iedereen ziet ook wat er moet gebeuren, maar om de slag te maken naar uitvoering met maatregelen waardoor je overlast kunt verminderen, voorkomen kun je nooit, dat heeft nog wel een paar jaar nodig" (V1)	In Valkenburg, every actor sees what should happen in terms of flood risk management. However, some time is needed for the actual implementation

		Level of trust among decision-making actors	1	"Ja, zeker. Ja, ik ervaar het als een hele fijne sfeer. We willen het gewoon allemaal oplossen" (V2)	In Valkenburg, there is a high level of trust among decision-making actors. The atmosphere is perceived as very pleasant
	Shared norms, values, beliefs, and preferences	Shared opinions by decision-makers	5	"Natuurlijk, het waterschap ziet dat, de provincie ziet dat, gemeente ziet dat en iedere organisatie ziet dat het anders ingericht moet worden" (V1)	All actors involved in decision-making in Valkenburg realize that reallotment should be approached differently
		Considerations of what is important by decision-makers together	29	"Ja, die meerlaagsveiligheid wordt breed gedragen" (D1)	In Dordrecht, the multi-layer safety approach is considered important by decision-makers together
Rules-in-use	Position rules	Positions and roles of actors	85	"De waterschappen beheren en onderhouden de dijken" (D1)	Water boards manage and maintain dikes
		Number of actors holding each position	1	"Water in Balans, waar ik bij zit, bestaat nu vijf jaar en dat is het afgelopen jaar gegroeid. We begonnen met een groepje van vijf en nu zijn we met veertig" (V5)	The number of people involved in flood risk management in Valkenburg is increasing. Five years ago, five people were involved in a program within water board Limburg, now there are 40 people involved

		Collaboration between actors from different levels	39	"Met name in de deelplannen zie je dus de afstemming met de gemeenten over wanneer zij waarover geïnformeerd worden, welke taken er liggen bij het waterschap en welke taken er liggen bij de gemeenten" (V9)	Actors from different levels coordinate responsibilities, tasks, and when to inform each other about flood risk management in Valkenburg
	Boundary rules	Participants entering or leaving a position	40	"Propositie aangeboden aan het Rijk, namens de Limburgse gemeentes, veiligheidsregio's en de provincie en het waterschap, daarin hebben we eigenlijk gezegd: 'nou, we hebben eigenlijk heel veel gedaan voor het hoofdwatersysteem, de Maas hé (…) Maar nooit heeft iemand rekening gehouden met het regionale watersysteem. (…) Nou, het Rijk heeft dat onderkend, dat probleem, en heeft toen ook gezegd" Nou we geven jullie 600 miljoen. (…) En dat is samengekomen in het programma Waterveiligheid en Ruimte Limburg" (V4)	After the floods of 2021 in Limburg, WRL was founded and entered Valkenburg's action arena

		Way of entering or leaving a position	34	"Op 14 juli 2021 hebben we dat bekrachtigd in een convenant" (V4)	WRL has entered the action arena on the 14th of July 2021 through signing a covenant
	Authority rules	Actions participants can take in a certain position	14	"Ja, en als wij dus zeg maar een nieuwe norm stellen, dan betekent dat wel dat het waterschap ook moet voldoen aan die norm. Dus dat is dan zeg maar wettelijk ook zo bepaald" (D5)	The province can set new safety norms to which the water board should adhere to
	Aggregation rules	How power is distributed	35	"Je kunt niet zeggen: 'die is de overhand of die heeft het voor het zeggen'. We doen het met acht partijen. Wat mij betreft zijn al die partijen even waardevol" (V6)	In the municipal council of Valkenburg aan de Geul, power is equally distributed
		Amount of actors who have to make decisions	14	"Kijk, wij hebben in Nederland 25 veiligheidsregio's. En iedere veiligheidsregio heeft een algemeen bestuur. Dat ligt ook gewoon bij wet vastgelegd, in de wet Veiligheidsregio. En dat algemene bestuur bestaat uit de deelnemende partijen, de burgemeesters, die	Within the safety region Zuid-Holland Zuid, there are ten mayors involved in the general board who make decisions

				behoren tot die veiligheidsregio. Dus bij ons zijn dat er tien" (D4)	
		How decisions are made in action situations	74	"Dan moeten zij een pleidooi houden waarom ze dat willen. Dan wordt er ook gestemd. En, nou ja, afhankelijk van hoe die stemmen vallen gaat het wel of niet door" (D2)	Policy actors have to present their ideas to the board. Subsequently, the board votes. The outcomes of the votes determine whether the proposed measures will be implemented or not
		Interdependence of actors	2	"Eerst dacht ik altijd, nou daar moet een hele raad mee eens zijn. Maar ik was eigenlijk de enige samen met *raadslid* die zich daar zorgen om maakten of daar wat van zei" (D6)	Members of the municipal council in Dordrecht can independently shed light on a subject
		Who makes the final decisions	8	"Dat bepaalt de politiek in het college. De raad is de hoogste baas dus die bepaalt wat er uiteindelijk wel en niet gebeurt" (D1)	The councils eventually make the final decisions. They decide what is going to happen
	Scope rules	Desired outcomes	21	"Het doel is gewoon de waterstand te verlagen en de stroomsnelheid te beperken" (V2)	The desired outcome of flood risk management in Valkenburg is to lower water levels and flow rate

		Actions taken to reach these outcomes	5	"En binnen het programma Waterveiligheid en Ruimte Limburg, doen we dat aan de hand van drie pijlers" (V4)	Within WRL actions are taken based on three pillars to reach their desired outcomes
	Information rules	Amount of information available for each actor in the action arena	7	"Ja, die hebben wij gewoon gedeeld met z'n allen" (D2)	Information is widely shared with all actors in Dordrecht
		Type of information available for each actor	13	"Bepaalde modellen kunnen waar mogelijk extreme activiteiten die in de lucht gaan plaatsvinden voorspellen en waar mogelijk dus regenbuien en onweersbuien gaan vallen" (V4)	Models are available for each actor in Valkenburg which show where precipitation is expected
		Channels through which information is exchanged	37	"Het zijn vaak kennisnetwerken waarin je de kennis uitwisselt en deelt en die gebruik je dan ook zelf weer in het werk en in de projecten die binnen de gemeente spelen" (D1)	In flood risk management in Dordrecht, information is exchanged and shared through knowledge networks
		Opportunity for open communication	4	"Er is wel openheid naar iedereen, maar het is niet nodig om alle info te delen, omdat de rest er niets aan heeft" (V5)	There are opportunities for open communication. However, it is not necessary to share all information as others would not benefit from it

	Payoff rules	Who will have drawbacks for the chosen decisions	12	"Ik denk dat vooral bijvoorbeeld Natuurmonumenten, dat zijn ook grondbezitters. En wij hebben natuurlijk ook hun grond nodig om de Geul ruimte te geven. Dus zulke partijen natuurlijk en landbouw" (V2)	Natuurmonumenten and farmers could face drawbacks from decisions made in terms of flood risk management measures in Valkenburg as their land could be needed to give de Geul space
Politico-economic context	Situations influencing decisions	The local and wider political situation	27	"Als we kijken in de ruimtelijke inrichting naar hoeveel woningen er gepland zijn alleen al in Zuid Holland om te bouwen en op welke plek ze dat willen doen. Ja, dat is alles behalve water- en bodemsturend" (D5)	As a reaction to the housing shortage in the Netherlands, there is a new policy that focuses on developing a large number of houses. Also at locations prone to floods which is not in line with the *water- en bodemsturend* approach
		How political situation influences decisions	20	"Maar wat je ziet natuurlijk zijn de landelijke ontwikkelingen, zoals water- en bodemsturend (…) Al die ontwikkelingen, ja, die leggen ook weer druk op de werkregio" (D2)	The development of the *water- en bodemsturend* approach on a national level increases pressure which can influence decisions
		Local and wider economic situation	13	"Nou, ja. En waar is dat aan te wijten? Dat is aan inflatie te wijten natuurlijk" (D2)	Actors have to deal with inflation when making decisions

		How economic situation influences decisions	13	"Die economische ontwikkelingen hebben altijd invloed (…) Je middelen, het geld wat je hebt, kan je maar een keer uitgeven" (D6)	Economic developments – such as inflation – always influence decisions made in terms of flood risk management as you can only spend money once
Discourses	Engineering resilience	Aiming to remain at idealized state	9	"Ik denk dat we er alles aan moeten doen om het water zoveel mogelijk uit de bebouwde omgeving te houden" (V6)	One of the actors of flood risk management in Valkenburg brings in the engineering resilience discourse by stating that everything should be done to keep the water away
		Technical and spatial measures aiming for flood protection and withstand impacts	3	"In het proces gaan we vaak naar technische oplossingen, maar dat komt vaak voor mijn gevoel omdat het gewoon makkelijker te kwantificeren is" (V5)	Often, choices are made for technical measures that aim for flood protection and withstanding impacts because they are easy to quantify
	Ecological resilience	Absorb changes after flood	5	"Dat inwoners van Limburg niet meer zou overstromen, er is altijd wel een risico. Je kunt niet alles regelen" (V6)	After floods, there is an increasing realization that we cannot fully prevent floods. There are always flood risks
		Developing new trajectories	27	"Ik denk dat je water zoveel mogelijk de ruimte moet geven, ja" (V4)	One of the actors of Valkenburg brings in a (socio-) ecological resilience discourse by pleading

					that water should be given space as much as possible
		Reduce flood vulnerability by measures preparing areas	27	"We hebben die inundatiegebieden" (V3)	There are inundation areas in Valkenburg to reduce flood vulnerability
	Socio-ecological resilience	Focusing on the ability of people to cope with and adapt to changes	30	"Dat noemen we risicocommunicatie en daarmee willen we onze bewoners bewust maken van waterveiligheid en eventueel de kans op overstromingen, hoog water en wateroverlast en daar ook handelingsperspectief bieden" (D1)	Flood risk management measures in Dordrecht are focused on providing inhabitants with actionable perspectives and raising awareness among inhabitants to cope with floods themselves
		Absorb changes after flood	5	"Dat inwoners van Limburg niet meer zou overstromen, er is altijd wel een risico. Je kunt niet alles regelen" (V6)	After floods, there is an increasing realization that we cannot fully prevent floods. There are always flood risks
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		Reduce flood vulnerability by measures preparing areas	27	"We hebben die inundatiegebieden" (V3)	There are inundation areas in Valkenburg to reduce flood vulnerability
StarFlood flood risk management strategies	Risk prevention	Proactive spatial planning	7	"Wij doen nu watertoets" (D2)	Water boards carry out a *watertoets* in which they examine negative effects on water systems caused by for instance new housing projects
		Allocation policy	20	"Die mensen die dus niet in een genormeerd gebied wonen, ja die kunnen dan wel wateroverlast krijgen omdat die gebieden altijd mogen onderlopen. Die gebieden zullen dan ook onder water gezet worden als daar noodzaak toe is" (V9)	Some pieces of land are allocated as inundation areas in Valkenburg because they are not grated with a safety norm
		Reallotment policy	2	"Alleen, er komt een ding bij kijken: de grond is niet van de overheid. Het is vaak van agrariërs, particulieren en natuurorganisaties" (V1)	Pieces of land needed for flood risk management measures are often owned by farmers, private individuals, and nature organizations and reallotment is needed to implement flood risk

					management measures in Valkenburg
	Flood defense	Dikes	7	“We hebben een aantal, ja, overstromingsdijkringen” (D4)	In Dordrecht, there are multiple dikes
		Dams	1	“Een dam is vaak een onderdeel van een regenwaterbuffer” (V5)	In and around Valkenburg, dams are often part of water buffers
		Embankments	1	“Het zou zomaar kunnen zijn dat de kades niet voldoende zijn” (V1)	There are embankments in Valkenburg, but it could be that they do not provide enough protection
		Flood locks	3	“Bepaalde havens afgesloten worden met keersluizen en dat soort type maatregelen” (D3)	Around Dordrecht, flood locks can lock ports for instance
		Flood walls	4	“Dus wij hebben ook maatregelen als vloedschotten, zodat de dijk verhoogd kan worden met vloedschotten” (D1)	There are flood walls in Dordrecht which can make dikes higher
	Flood mitigation	Urban green	1	“Denk aan het aanleggen van wadi’s of het afkoppelen van die regenpijpen, het stimuleren van groen” (V7)	Actors encourage the planting of urban green

		Water retention	16	"Daarnaast hebben we ook nog een waterberging, in het Volkerak-Zoommeer" (D3)	There is a water storage facility near Dordrecht called the Volkerak-Zoommeer
		Flood-proof building	1	"De vierde knop is, stel dat je heel veel kunt doen, maar aan de normopgave net niet komt voor die laatste twee woningen, dan proberen we die woningen op individuele manieren te beschermen" (V7)	In case single houses do not comply with the safety norm, they are individually made flood-proof
		Regulations for flood-proof building	1	"We hebben natuurlijk ook zelf wel een omgevingsverordening (..) Daar hebben wij een regel instaan en dat is de instructieregels voor gemeenten waar instaat dat ze in hun omgevingsplannen het veranderende klimaat mee moeten nemen" (D5)	The province of Zuid-Holland has an environmental regulation which includes regulations for municipalities stating that they must incorporate the changing climate in their spatial plans
	Flood preparation	Warning systems	15	"Op pandniveau is er ook een goed waarschuwingssysteem" (V2)	Warning systems have been developed on the level of individual properties in Valkenburg
		Disaster planning	37	"We hebben wel een waterveiligheidscampagne" (D1)	There is a water safety campaign in Dordrecht

		Evacuation plans	9	"Er is ook onderzoek gedaan naar; hoeveel mensen zijn dat dan en hoe kunnen we die verplaatsen en waarheen moeten die dan? Nou, dat zijn dan wel die evacuatiestrategieën" (D4)	Strategies for evacuation have been developed in Dordrecht
		Locations to shelter	3	"Het gemeentehuis is er eentje, maar ook de hoger gelegen accommodaties zoals gymzalen en het gemeenschapshuis. Dus daar kunnen mensen naartoe" (V1)	The town hall and other accommodations such as gymnasiums can be used as locations to shelter in Valkenburg
		Warning stages	4	"Bepaalde veiligheidsniveaus, zeg je, 1, 2, 3, 4" (D2)	There are warning stages ranging from 1 to 4 in Dordrecht
		Managing floods	19	"Ja dan proberen we zoveel mogelijk zichtbaar te zijn in het gebied dat omwonenden ook direct onze medewerkers de vragen kunnen stellen waar zij mee zitten" (V9)	During floods, employees from the water board try to be visible so that inhabitants can easily find them and ask questions in Valkenburg
		Routes to evacuate	1	"Maar ik weet wel dat er naar gekeken is van hoe vol de snelwegen dan lopen en, ja, kunnen die	They have looked at whether and to what extend highways can be used as routes to evacuate in Dordrecht

				überhaupt nog wel gebruikt worden? Hoe hoog liggen die?" (D4)	
		Emergency kit	3	"Op de poster staat ook wat je in het noodpakket moet hebben" (D1)	A poster has been designed in Dordrecht which shows inhabitants what should be present in an emergency kit
		Testing measures	3	"Die worden elk jaar op de derde woensdag van september. Dat is in beheer van het waterschap. In één dag testen ze of die vloedschotten er nog zijn en of ze functioneren" (D2)	The flood walls in the center of Dordrecht are tested and inspected every year by the water board
	Flood recovery	Reconstruction and rebuilding plans	6	"Na een paar dagen valt het schoonmaken ook onder de acties" (V9)	As a part of the reconstruction and rebuilding plans, cleaning Valkenburg is done a few days after the floods
		Insurance systems	2	"Heel veel liep gewoon via de verzekering van mensen. Maar de openbare ruimte is, ja van de gemeente" (V1)	A lot of damage is handled through insurance systems. However, the municipality is responsible for damage in public spaces in Valkenburg
		Compensation	4	"Welke middelen hebben we daarvoor en wie gaat ervoor zorgen dat die middelen ook tijdig daar	Compensation has not been sorted out yet in Valkenburg

				terechtkomen? Dat is nu allemaal nog niet geregeld en daardoor zie jet dat, met name in Valkenburg, heel vaak heel veel schade optreedt en dat willen we echt wel met dat stukje proberen te verminderen” (V4)	