Relying on dykes while preparing for the worst

The value of visioning and backcasting for long-term strategic planning on a local level to break existing trends and use a wide range of flood risk management strategies in an area with high and increasing flood risks: the case of Dordrecht, the Netherlands

Figure 1. Part of the city of Dordrecht area outside of the dykes (source: https://beeldbank.rws.nl).

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Abstract

This Master's thesis research investigates the use of a backcasting approach for long-term strategic planning in flood risk governance on a local level. The extreme case of the city of Dordrecht in the Netherlands is used. Dordrecht is an area below sea level in the Netherlands, that has to deal with high flood risks that increase in the future due to climate change. The municipality of Dordrecht has put effort in broadening the use of flood risk management strategies in an institutional environment that has a strong focus on the single strategy of defence by dykes and is currently starting implementation of several flood risk management strategies. This research designs a backcasting approach for the flood risk governance arrangement in Dordrecht. The design is based on a literature review of backcasting practices and an analysis of the flood risk governance arrangement in Dordrecht using the policy arrangements approach as analytical framework and interviews with actors from the flood risk governance arrangement in Dordrecht. The backcasting approach is tested in a workshop with actors from the flood risk governance arrangement in Dordrecht. The results of the research show that a backcasting approach in this case that is already in an advanced stage, can serve the purpose of aligning a long-term vision for flood risk governance and find oversights in identified flood risk management strategies. More fruitful would be the use of the later steps in a backcasting approach, in which policies for flood risk management strategies are tested for robustness using exploratory scenarios, and their feasibility and public support is improved by elaboration of the policies with citizen and company actors. The results implicate that long-term strategic planning for flood risk governance on a local level benefits from a strong vision for the future and an extensive network for using knowledge and expertise. Barriers for a local actor that breaks with dominant trends are the lack of financial resources and the lack of recognition of the newly identified flood risk management strategies by the institutional environment in the Netherlands. Embedding a broader range of flood risk management strategies in the Dutch national flood risk governance arrangement is a strong recommendation of this research. An application of backcasting in a less advanced local flood risk governance arrangements is needed to test the results of this study.

Keywords:

Flood risk management strategies, flood risk governance arrangements, backcasting, visioning, exploratory scenarios

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Glossary

FRG	Flood Risk Governance
FRGA	Flood Risk Governance Arrangement
FRMS	Flood Risk Management Strategy
GA	Governance Arrangement
Living Lab	A location and way of working between governmental actors, research bodies, students, and citizens
LL	Living Lab
MIRT	*Meerjarenprogramma Infrastructuur, Ruimte en Transport*, a national governmental multi-annual policy programme for large projects in infrastructure, spatial planning and transport
MARE	Managing adaptive responses to changing flood risk research
Interreg	Interreg BEGIN programme: Blue Green Infrastructures through Social Innovation
MLS	Multi-Layered Safety approach
PAA	Policy Arrangements Approach
SRID	Self-Reliant Island of Dordrecht

Translations of Dutch governmental bodies and regions

Dutch Delta	Hollandse Delta
Delta Programme	Deltaprogramma
Ministry of Infrastructure and Water Management	Ministerie van Infrastructuur en Waterstaat
Province	Provincie
Regional Water Authority	Waterschap
Safety Region	Veiligheidsregio
Municipality of Dordrecht	Gemeente Dordrecht
National Water Authority	Rijkswaterstaat
South Holland	Zuid-Holland

Translations of Dutch legislation

Delta Programme	Deltaprogramma
Deltabesluit	Delta Decisions
National Water Plan	Nationaal Waterplan
Water Act	Waterwet
Water Safety Plan	Waterveiligheidsplan, impactanalyse voor Dordrecht

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The author wants to thank several persons for their support in doing this research. First of all, the municipality of Dordrecht has been very helpful in being very open and cooperative from the start. It was no problem to attend LL meetings, discuss the research with public servants and plan the workshop in collaboration with the Municipality. Especially Rik Heinen, Ellen Kelder and Berry Gersonius were very helpful when commenting on the workshop design and results. Other people from the LL were also always friendly, helpful and interested, which contributed to a positive working environment.

At Utrecht University, several researchers that had expertise in backcasting were very open to help the author in finding his way in the backcasting method. Arjen Wardekker and Lucas Rutting were very helpful at the start of this research, when finding practical examples of a backcasting method and methods for a workshop were needed to start the design for Dordrecht.

In particular, I want to thank my supervisor Dries Hegger for his great and constructive feedback on any written work. His patience and flexibility when meetings on the thesis progress were rescheduled were very much appreciated and made the thesis struggle a bit more comfortable. Over the past months, his feedback kept the author on the right track and it was a large factor in the delivery of this master's thesis.

1 Introduction

Due to climate change, temperatures are rising. Future climate change is the subject of extensive scenario building on a global, national, and regional level (IPCC 2013). Every new scenario gives better insight in the drivers of climate change and scenarios become more detailed and accurate. Still, many uncertainties remain on the likeliness and magnitude of climate change impacts. This is especially true on a local level, as the impacts of extreme weather events are hard to predict. For river deltas, one of the effects is increased flood risk due to increased extreme precipitation events, higher peak river discharges and in some cases sea level rise (Runhaar et al. 2012b; Jongman, Ward, and Aerts 2012). Challenges on a local scale are intensified by the trend of urbanisation. The combination of increased threats from sea, precipitation and rivers and the increasing population and economic value of the urban areas, means the risk of flooding is increasing (Winsemius et al. 2016; Muis et al. 2015; Kundzewicz 2012).

Climate change is seen as one of the main challenges for the coming decades, needing mitigation and adaptation. In many fields this means that transitions are needed: to new forms of energy, different materials, other means of transport, other ways of building. On a regional level, changing weather conditions need a new approach, a transition. Heat and flood stress are prominent issues in Europe and the Netherlands (Runhaar et al. 2012a). New approaches to climate change on a local level often consist of adaptation to the changing conditions, as climate change mitigation is a topic on the national and global agenda. Much research exists on adaptation to climate change (de Bruijn et al. 2009). Adaptation to increased flood risks is subject of flood risk management literature, covering mitigation and adaption measures to flood risks, ranging from protection by dykes to crisis and disaster management (Driessen et al. 2018).

Facing these risks in urban water management is a challenge for the coming years and decades. The Netherlands has some large urban areas and low lying polders in its Rhine and Meuse delta that need attention because of the increasing threats (Bouwer, Bubeck, and Aerts 2010; Middelkoop 2008). The city of Dordrecht is situated on an island in the Dutch river Rhine and Meuse delta (Figure 2) and thus faces these flood risks.

1.1 Background on the case of the island of Dordrecht

The city of Dordrecht is situated on an island often referred to as the Island of Dordrecht. It is situated between branches of the Rhine and Meuse rivers. The area is largely surrounded by dykes, protecting the land from high river levels, but part of the city is built on and outside of the dykes. Since 2005, Dordrecht has increased its ambitions on water safety, and several researches on decreasing vulnerability to floods in the inner and outer dyke area were conducted (Leeuwen, Buuren, and Ellen 2018). The effort for water safety focused on the broadening for flood risk management strategies (FRMSs) for the island of Dordrecht, with a transition towards the concept of Multi-Layered Safety (MLS), transitioning from only defence by dykes towards the use of flood preparation and response, mitigation and adaptation FRMSs. Two researches were conducted in the context of a multi-annual policy programme focused on planning in the urban environment: MIRT (*Meerjarenprogramma Infrastructuur, Ruimte en Transport)*. This programme focused on exploring the opportunity for the city of Dordrecht to expand the current flood risk management, consisting of protection

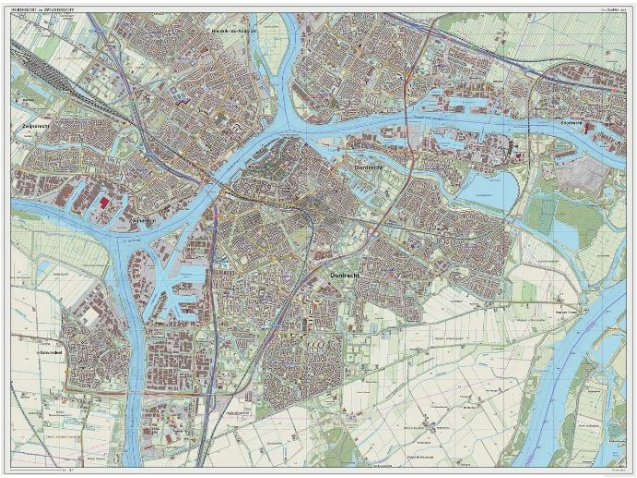

Figure 2. The Island of Dordrecht.

measures with dykes, with measures aimed at spatial adaptation, preparedness for floods and crisis management. A research and implementation agenda was presented by the research, including spatial measures to prepare for evacuation and emergency management in case of a flooding disaster (Waterschap Hollandse Delta et al. 2018, 18). The broadening for FRMSs for Dordrecht has been titled the 'Self-Reliant Island of Dordrecht' (SRID), as the goal is that people on the island can survive on their own or with their community if flood defences would fail.

With this in mind, in May of 2018 Dordrecht opened a 'Living Lab' (LL) on the subject of the SRID in terms of flood safety (B. Gersonius, personal communication, April 30, 2018). The LL brings together public actors from different governmental levels and private actors such as businesses, researchers and students. Its goal is the implementation of the FRMSs that resulted from the research by creating an action agenda for the coming years.

The transition from protective FRMSs towards a broader array of measures is a new phenomenon in the Netherlands, that has invested in and relied on protective flood defences for hundreds of years. Protective measures are highly institutionalised in the Netherlands, resulting in an entrenchedness: a transition to a broader set of FRMS requires significant effort. Dordrecht was a pilot for broadening FRMS in the Netherlands as part of the research into broadening FRMSs through MLS in the Dutch Delta Programme, a national policy programme for water safety and a secure freshwater supply in the Dutch delta. Some options for broadening FRMSs were not deemed viable, but other possibilities are still on the agenda (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken 2019 see Chapter 2 for details on the types of FRMSs). Although effort is already put in implementation of promising measures, the initiators of the concept of self-reliance at the municipality see the need for a long-term strategy (B. Gersonius, personal communication, May 22, 2018). Self-reliance is currently not clearly defined and therefore it is uncertain to what extent the planned measures contribute to a self-reliant island of Dordrecht; furthermore, the limited number of people involved with the self-reliance concept creates the possibility of blind spots (B. Gersonius, personal communication, May 22, 2018). The wish is to become self-reliant 15-30 years: by 2035-2050, and to define this in a clear pathway by 2020, the 600-year anniversary of a Dordrecht major flood (B. Gersonius, personal communication, April 30, 2018). This shows that the municipality of Dordrecht is looking to plan far ahead and needs to define the vision of self-reliance in order to work towards it. The municipality is specifically interested in a backcasting approach for their long-term planning efforts (B. Gersonius, personal communication, April 30, 2018).

1.2 Scientific knowledge gap: broadening of FRMS and backcasting on a Dutch local level

The efforts in Dordrecht are about broadening of FRMSs by flood risk governance arrangements (FRGAs). Recent literature on flood risk governance suggests that a combination of different FRMSs, such as protection, preparedness, spatial adaptation and crisis management, is effective in building flood resilience (Hegger, Driessen, and Bakker 2018). Research on FRGA on how to achieve this is a relatively new field, with several recent studies that compare different FRGAs in their efforts in implementing FRMSs. Case studies focusing specifically on efforts to transition from a strong focus on a single FRMS towards a broad range of FRMSs are not abundant. In the Netherlands, where protection FRMSs are institutionalised and entrenched: Dordrecht and Rotterdam are the only examples where these efforts are made. The research presented here has added a case of broadening of FRMSs in the Netherlands on a local level to the literature on flood risk governance.

A transition from a very institutionalised FRMS such as protective FRMSs in the Netherlands, takes effort and needs to be planned out. When planning for a long-term future, methods such as forecasting, visioning, scenarios and backcasting come into play (Millett 2006; Dreborg 1996). Backcasting has been used increasingly in the field of sustainability for the past decades

(Vergragt and Quist 2011). It has proven especially effective when an exiting trend needs to be broken, as is the case in Dordrecht with the use of FRMSs. Therefore, backcasting is used as a method of planning for the long-term future in this study. Elaboration on the use of backcasting and breaking trends is provided in Chapter 2. Backcasting is a normative form of forecasting that is suitable in a situation with multiple possible futures. It often includes a visioning step, followed by finding the actions and policies to reach this vision (van der Voorn, Pahl-Wostl, and Quist 2012). Backcasting as a method has been applied to cases of urban climate change adaptation planning (van der Voorn, Pahl-Wostl, and Quist 2012; Carlsson-Kanyama, Carlsen, and Dreborg 2013) and changing future mobility or energy use (Höjer, Gullberg, and Pettersson 2011; Neuvonen and Ache 2017). A study by Van der Voorn et al. (2017) specifically analyses vision and strategy development for climate change adaptation on the regional level of the Rhine-Meuse delta. The study shows that visioning and backcasting methodologies in the form of workshops yields results on a Dutch regional level in the form of follow-up activities and contribution to formal decision making (van der Voorn et al. 2017).

However, cases of flood risk governance on a local level have not been a specific focus of recent backcasting studies. This study addressed two knowledge gaps that followed from this observation. Firstly, it investigated whether long-term strategic planning, as is done by methods such as visioning and backcasting on a national or regional level, are also useful on a local level in flood risk governance with a specific focus on broadening FRMS. Secondly, it went into the specifics of the long-term planning methodology: what methods are most useful? Backcasting, scenarios and visioning are methods that can be used in a variety of ways, and this study explored what ways are successful on a local flood risk governance level.

1.3 Research Framework

Given the wish in Dordrecht to plan ahead for broadening FRMS and the scientific knowledge gaps in cases that address broadening of FRMS and long-term strategic planning on a local scale, the aim of this research was as follows.

The research objective is to offer the municipality of Dordrecht insights on how to approach long-term strategic planning for a transition towards broader use of flood risk management strategies to become a self-reliant island, and to get insights in the effectiveness of the backcasting approach in long-term strategic planning for flood risk management strategies on a local level, by designing and testing a backcasting approach for the flood risk governance arrangement on the island of Dordrecht.

The first part of this objective showed the practical aim of the study: to help the municipality of Dordrecht in current and future efforts to strive for the SRID with a broad range of FRMSs, with a focus to plan for the long-term future. The second part identified the scientific knowledge gap to address: adding a case of long-term strategic planning in flood risk management on a local level to the literature on flood risk management and governance, and to the literature on strategic planning and backcasting. The second part of the aim clarified how the research would offer these insights. A backcasting approach was designed and tested in a setting with several actors present. The relevant actors were referred to as the governance arrangement on the island of Dordrecht.

The research aim was translated into the following main research question: *What practices of a backcasting approach provide the municipality of Dordrecht with a suitable approach for realising a range of long-term flood risk management strategies towards becoming a self-reliant island, and what insights are gained from a case of flood risk governance for long-term flood risk management on a local level?*

The research was divided into the following sub questions:

1. What good practices from literature on long-term strategic planning for flood risk governance can be identified and how do they work?

2. What are important elements in a flood risk governance arrangement in the context of long-term planning found in literature on flood risk governance arrangements?
3. What does the flood risk governance arrangement in Dordrecht look like as characterised by the relevant elements found in question 2?
4. What practices are potentially useful in a long-term strategic planning design in the governance arrangement of Dordrecht based on good practices from literature (question 1) and the analysis of the flood risk governance arrangement in Dordrecht (questions 2 and 3)?
5. What are the results of a backcasting workshop in the municipality of Dordrecht and what can be learned from these results?

The research questions form the basis of the research framework. A graphical representation of the research framework is shown in Figure 3.

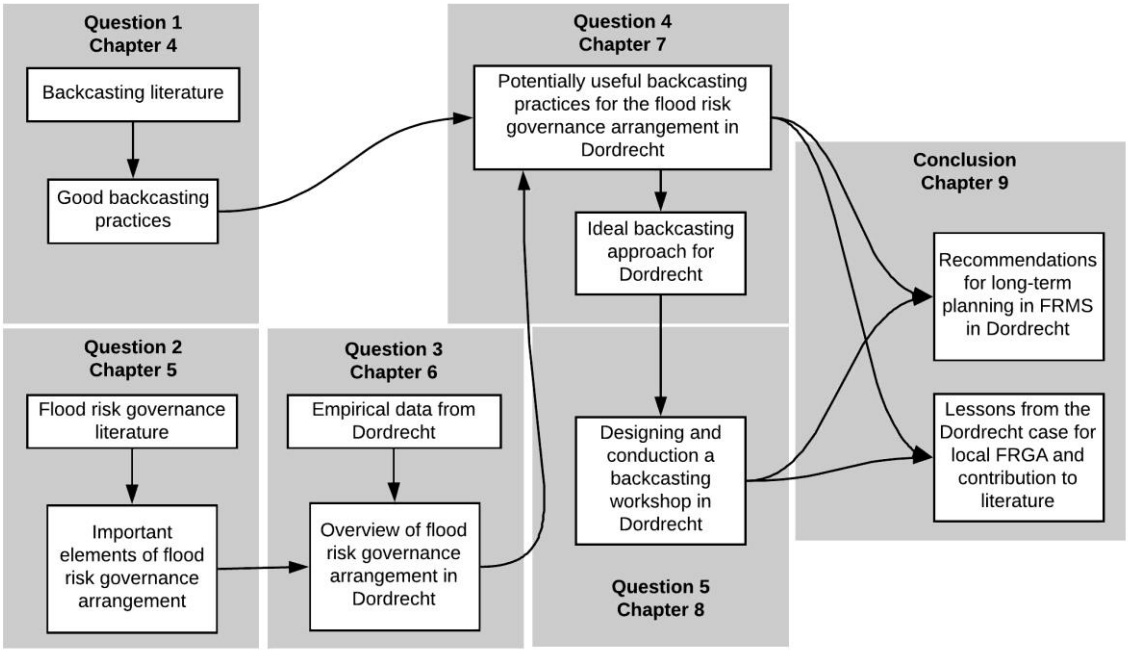

Figure 3. Graphical representation of the research framework.

As seen in Figure 3, the steps that were taken corresponded directly to the research questions. First, literature was consulted and analysed, to find practices that are used in long-term strategic planning, and practices that are found to be successful in literature were selected to create a set of good practices. This resulted in a range of practices including visioning, backcasting, and scenarios. Secondly, to be able to fit the good practices to the municipality of Dordrecht, literature on flood risk governance arrangements was used to find the elements of a such an arrangement that play an important role. This second step resulted in a list of elements or variables in a flood risk governance arrangement that can be used to characterise the arrangement found in Dordrecht, being the actors, discourses, rules, power and resources in the FRGA (Driessen et al. 2018).

After creating the theoretical basis, data was collected and analysed on the current FRGA on the island of Dordrecht, including actors' ideas on a strategy to achieve an SRID for the long-term. This empirical research step used the results from step two on the dimensions of a FRGA to operationalise them into interview questions. Step 3 resulted in an overview of the FRGA around the efforts in Dordrecht to broaden FRMSs and strive for a SRID. This empirical step allowed for fitting the good long-term

strategic planning practices from the theory in step 1 to the case of Dordrecht. This was done step 4. This fit of good practices to the situation of Dordrecht resulted in an overview of practices such as visioning and backcasting that were deemed potentially effective in the FRGA of Dordrecht. From this, a tentative backcasting approach for the municipality of Dordrecht was designed. In step 5, this design was made into a workshop that can be held in Dordrecht with the relevant parties form the FRGA. The results of this workshop provided feedback for the backcasting approach design, contributing insights into the practical issues around doing strategic planning, such as visioning and backcasting, in a local setting. Furthermore, it can provide Dordrecht with recommendations for the next steps to take in designing its strategy for becoming a self-reliant island.

In Chapter 2, the conceptual background of the research is described. Concepts such as flood risk management, transition theory, and long-term strategic planning in relation to backcasting, are explained for a good understanding of the analytical framework and the rest of the research. In Chapter 3, the methodology of the research is elaborated upon. Chapter 4 answers the first research question and finds good backcasting practices from literature. Chapter 5 answers the second research question by giving the analytical framework for analysing the FRGA in Dordrecht. This analysis is conducted in Chapter 6, showing the empirical results to answer the third research question. In Chapter 7, the results from Chapter 6 and Chapter 4 are used to create an ideal backcasting design for the FRGA in Dordrecht, answering the fourth research question. Finally, in Chapter 8, a backcasting workshop is designed and reported upon, to learn the practical constraints of the backcasting design as posed in research question five. The research concludes with a conclusion and discussion in Chapter 9.

2 Conceptual background

This section explains the concepts used in this research. In this order, the concepts of flood risk management strategies, transitions, flood risk governance arrangements, long-term strategic planning, visioning, backcasting, and scenarios are introduced and their role in the research is made clear. The chapter ends with a conceptual framework that shows the connection between concepts.

2.1 Flood risk management

This section sets out the field of flood risk management, starting with a description of the concept of flood risk management strategies, followed by the governance of flood risk management by flood risk governance arrangements.

Building resilience to floods is regarded in the literature on **flood risk management strategies** (FRMSs). FRMSs are ways to reduce flood risks, by reducing the chance of a flood happening or reducing the impacts of a flood if it happens. An extensive body of literature exists that covers the solutions used to reduce flood risks, and in the Netherlands a shift from protection towards deployment of a broader range of strategies is visible (Wardekker et al. 2010; de Bruijn et al. 2009; Runhaar et al. 2012b). FRMSs include a range of measures for protection, prevention, preparedness, emergency relief and recovery (van Herk et al. 2014), or prevention, defence, mitigation, preparation and response, and recovery (G. T. Raadgever, Booister, and Steenstra 2018b). Flood protection or defence refers to keeping the water from areas at risk by infrastructural flood defences, a widely used practice in the Netherlands using dykes. The concept of prevention is used in different ways among the literature. Whereas van Herk et al. (2014) include spatial adaptation to prevent building in vulnerable areas and mitigating flooding impacts by flood proofing, Raadgever, Booister, and Steenstra (2018b) and Driessen et al. (2018) use prevention only for the former and have a separate category for the latter: mitigation. The categories of preparation, emergency relief or response, and recovery are very similar, with preparation implying organisational preparation for a flooding event, such as warning systems and evacuation plans, emergency relief or response meaning the management of the flood when it happens, including evacuation and deployment of emergency services, and recovery focusing on the impacts of the flood, rebuilding and compensating. A concept used in the Netherlands to categorise FRMSs is the Multi-Layer Safety approach,[1] that uses the categories of prevention, spatial planning, and disaster management. This concept was used in the national water plan in the Netherlands and has been used in Dordrecht when addressing FRMSs (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken 2015; Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieubeheer and Voedselkwaliteit 2009; Hamer, de Jong Posthumus, and Ilic 2015). The categories differ from those used in literature: MLS prevention is similar to protection and defence from literature, MLS spatial planning is aimed at the prevention and mitigation from literature, and MLS disaster management is similar to preparation from literature. The different use of the concept of prevention can be confusing. See Table 1 for an overview of the categorisations of FRMSs in literature and in the Dutch MLS approach.

Table 1. Comparison between FRMS categorisations form literature and the Dutch MLS approach.

Raadgever, Booister, and Steenstra (2018b)	**Driessen et al. (2018)**	**Van Herk et al. (2014)**	**Dutch MLS approach**
Defence	Defence	Protection	Prevention
Prevention Mitigation	Prevention Mitigation	Prevention	Spatial Adaptation
Preparation and Response	Preparation	Preparedness Emergency Relief	Disaster Management

[1] Dutch: *meerlaagsveiligheid*.

Recovery	Recovery	Recovery

In this study, the categorisations from literature were used, meaning the FRMS of defence, prevention, mitigation, preparation, response, and recovery. If the research refers to MLS approach categories, this is explicitly stated. A categorisation including recovery was needed, because several interviewees addressed that FRMS. The more detailed distinction of the spatial adaptation and disaster management from MLS proved useful because spatial adaptation as a concept can be and is very broadly defined in the Dutch policy field, which proved to be confusing. A distinction of disaster management into preparation and response was used because the people working in this field addressed a 'cold' and 'hot' phase of crisis management, which can be referred to by these concepts.

In this case study, the aim of the municipality of Dordrecht for an SRID concerns the broadening of FRMSs from MLS prevention towards including all three MLS categories. This means a broadening from the FRMS of defence towards the inclusion of prevention, mitigation, preparation, response, and recovery.

Flood risk governance combines FRMSs with social science for a multidisciplinary perspective, including themes such as distributional effects, solidarity and citizen participation (Driessen et al. 2016). Embedding FRMSs in the social science context of governance is done in the literature on **flood risk governance arrangements** (FRGAs). Raadgever, Booister, and Steenstra (2018a) stress that the implementation, alignment and integration of FRMSs is a governance issue. Recent literature explains the dimensions of FRGAs in detail (G. T. Raadgever, Booister, and Steenstra 2018a; Driessen et al. 2016, 2018). According to Raadgever, Booister, and Steenstra (2018a), an FRGA has the dimensions of actors, discourses, rules, power and resources. For instance, in the Netherlands, responsibilities are such that municipalities have a responsibility in spatial planning rather than in flood defence or disaster management, as these are tasks of the national government and water safety regions respectively. The responsibilities and possibilities of Dordrecht and other actors in the FRGA in long-term flood risk management is therefore dependent on the governance arrangement and its characteristics. The actors involved in flood risk management in Dordrecht and the efforts for an SRID, are referred to as the SRID FRGA in this research.

The purpose of defining the SRID FRGA dimensions is twofold. Firstly, it is needed to design an approach for long-term strategic planning for the SRID FRGA, one of the aims of this study. Finding the arrangement of actors, their goals, policy programmes and financial power helps in understanding the arrangement in Dordrecht and enables the valuation of backcasting practise for the design of a backcasting approach for the FRGA of Dordrecht. Secondly, it is needed for finding out if the FRGA in Dordrecht is a suitable one for long term FRMS planning for flood crises. If the backcasting approach is to be copied to other cases or is found to be in particular successful or unsuccessful in the municipality of Dordrecht, the context of the FRGA helps to show the, in the words of Larrue, Hegger and Trémorin (2013), enabling and constraining factors of the FRGA on a backcasting approach for FRMS for flooding crises.

2.2 Transition theory

The movement of broadening the use of FRMS is seen as a transition from the institutionalised defence focused flood risk management in the Netherlands to the broader use of FRMSs. Transitions are a current theme in sustainability science and climate problems, and transition theory describes the characteristics of transitions and shows the elements that can be influenced to catalyse such a transition. To set the context of the transition, the theory on transitions is explained.

Transition theory models the transition of systems from one state to another, such as socio-technical systems (Geels and Schot 2007), socio-ecological systems (Folke et al. 2005), or water systems, with a human, physical and biological and biochemical component (Pahl-Wostl 2007). The systems typically consist of co-evolving parts. Water management has been in transition

since the 1970 in the Netherlands, from a technocratic style towards an adaptive and participatory style (Van Der Brugge, Rotmans, and Loorbach 2005). A broadening of FRMSs from only defence towards other forms of FRMSs can be seen as part of this: building flood defences with a certain norm based on water level calculations is a strictly technocratic approach to water safety. Considering mitigation and prevention by spatial adaptation and flood proof building, for example, in the light of climate change, is a more adaptive approach that considers area specific conditions and recognises that not every area can be well protected.

The transition from one stable system to another is dependent on the regime the system is embedded in. The regime refers to the arrangement of relationships, practices and rules that ensure the stability of a system (Stegmaier 2016). For the transition in FRMSs, the regime consists of current policy, governance, rules, science, and technology that define the current FRMS use in the Netherlands. A regime is embedded in a landscape, consisting of wider societal movements that exert pressure on the regime. The regime is fed by niches, that bring innovations to the regime. A transition of an existing regime is therefore dependent on the pressure of the landscape, and innovations in niches. For a FRMS transition, landscape developments can include climate change and changing socio-economic conditions (Pahl-Wostl 2007, 51), while niche developments can be the introduction of new FRMSs or new insights in water governance.

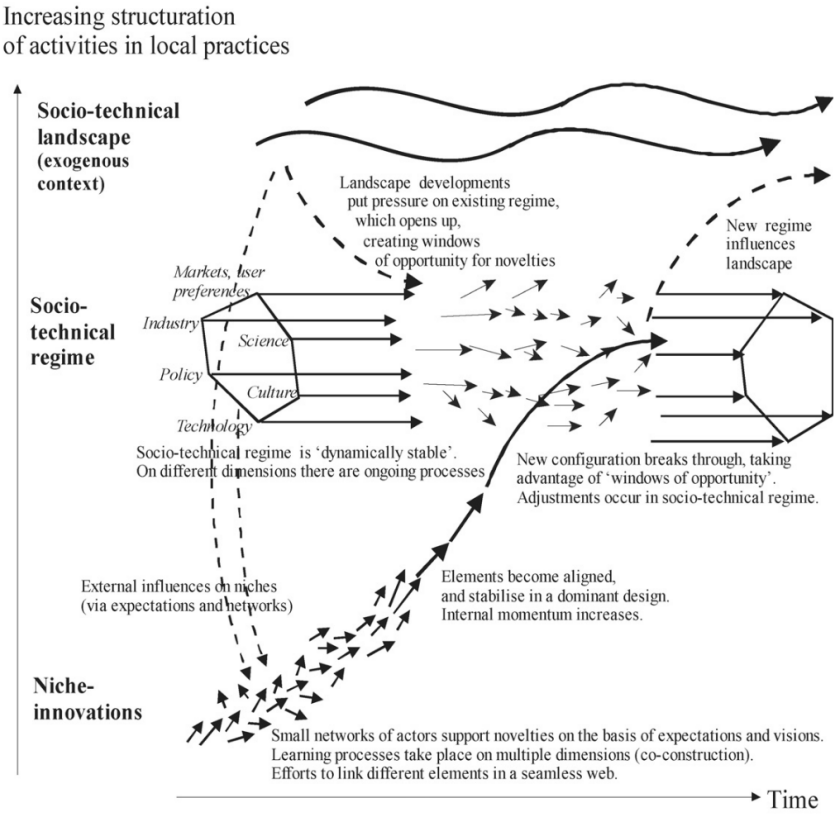

Figure 4. A system transition showing the landscape, regime and niche innovations, in this case from a socio-technical system. Adopted from Geels (2007).

Without making a full analysis of the transition in Dutch water safety management, it is useful for this research to see the broader context of a transition from technocratic water management with only defence FRMSs, towards adaptive water management using a broader range of FRMSs. The efforts in the municipality of Dordrecht to broaden their use of FRMSs can be seen as a niche innovation in water safety management in the Netherlands. The governance approach in the municipality of Dordrecht for broadening of FRMSs is an example for other municipalities in the Netherlands, and helps the Dutch government to define a national strategy in FRMS use in national water policy.

2.3 Long-term strategic planning

When planning for a long-term future, literature on methods such as forecasting, scenarios, visioning, and backcasting exists in several research fields (Millett 2006; Dreborg 1996). The classic way to plan for the future is by using forecasting. When forecasting, existing trends are extrapolated into the future, resulting in a prediction for the most likely future. Decision making is based on this likely future. This is a viable method in fields with stable trends that are little influenced by complexity or uncertainties. In the field of climate and sustainability, scenarios have offered a way to deal with more complex and uncertain futures. Instead of extrapolating an existing trend for a likely future, several plausible futures are predicted based on different future values of important variables that are to some extent uncertain for the future. For example, in climate, future temperature rise, future population, and future energy consumption are variables that can be predicted to some extent, but are uncertain to some degree. Taking the extremes of all three variables results in six combinations, that are six alternative plausible futures. This way of predicting the future, with several possibilities, has been used for predicting futures with climate change and enabling decision making based on different future outcomes. Important scenario based predictions are the UN IPCC climate reports and the KNMI climate reports in the Netherlands (IPCC 2013; van den Hurk et al. 2014).

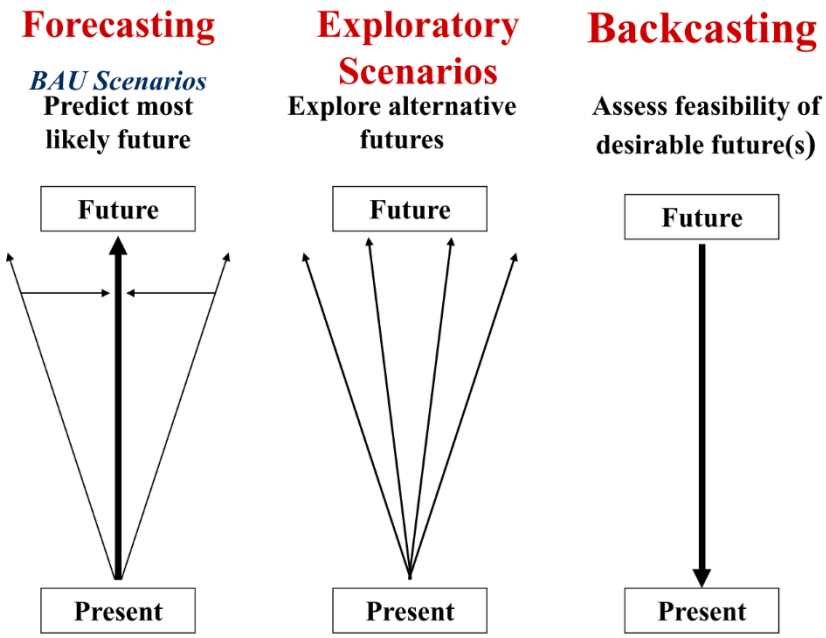

Figure 5. Graphical representation of the distinction between forecasting, scenarios, and backcasting. Adopted from Quist (2014). The visioning part of backcasting is in identifying a normative future.

Backcasting has been used increasingly in the field of sustainability for the past decades (Vergragt and Quist 2011). Dreborg (1996) argues that backcasting is an approach: it distinguishes itself by seeing the future as something that can be influenced and steered, rather than the future being deterministic. This articulates the normative nature of backcasting. Rather than creating images of the future based on extrapolations as in forecasting, or plausible futures as with scenarios, a vision of a desirable future is the starting point for policy strategies. This makes backcasting suitable for complex problems with different possible futures, that have a strong normative nature. The future is not only uncertain, and has several plausible versions, but we can make strategic choices to reach a desirable end state, a vision for the future. This makes backcasting suitable for situations that need a major change (Quist 2014) and it makes backcasting powerful in problems with a long time horizon, making strong alternatives possible (Dreborg 1996).

This makes backcasting useful in transitions, as a governance approach that may be able to incentivise and steer a transition towards a desirable future. This is why backcasting is used in several problem arenas that face transitions, such as transport

and urban climate adaptation. Furthermore, backcasting is deemed useful in flood risk governance (de Bruijn et al. 2008; Driessen et al. 2018) and several studies use backcasting in the context flood risk management (van der Voorn, Pahl-Wostl, and Quist 2012; van der Voorn et al. 2017; Carlsson-Kanyama, Carlsen, and Dreborg 2013; Neuvonen and Ache 2017). As Dordrecht is planning for the SRID and needs a transition in the use of FRMSs in the Netherlands, backcasting is a good approach to plan for this desirable future of an SRID with broad use of FRMSs and can help achieve this future and incentivise the FRMS transition. For the long-term strategic planning for the SRID, backcasting was therefore used as the preferred governance approach in this research. Backcasting is further elaborated upon in Chapter 4, and good practices from backcasting for long-term strategic planning in Dordrecht are identified there.

2.4 Conceptual model

The concepts just discussed and their relations to each other are shown in the conceptual model in Figure 6.

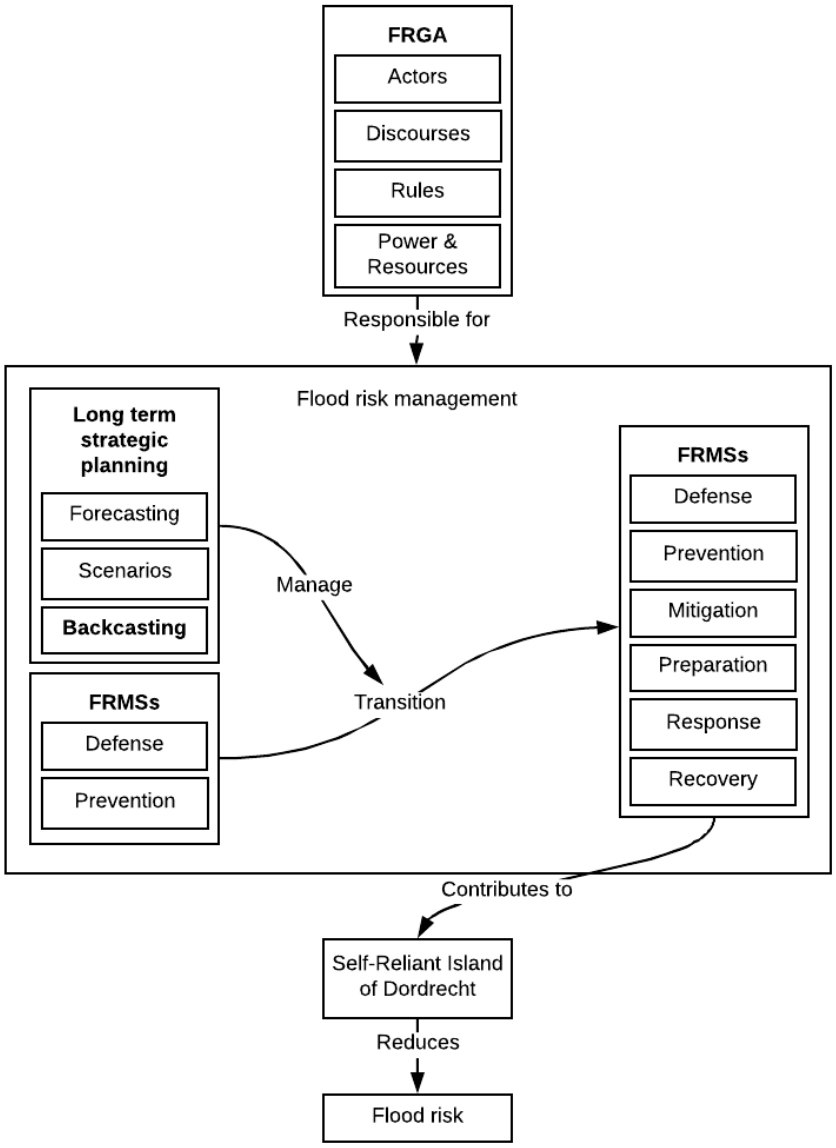

Figure 6. Conceptual model showing the concepts used in the conceptual framework and their relations.

This conceptual model shows how a FRGA is responsible for flood risk management. For a transition towards broader use of FRMS for the SRID, a transition is needed. The transition can be influenced, incentivised and steered by using long-term

strategic planning, and more specific backcasting. Broad use of FRMSs contributes to creating the SRID and reduces flood risk for Dordrecht.

This chapter has shown the place of the concepts that are central to this research, to support the relevance and to place the rest of the research into context. The next chapter shows the method used in this research.

3 Methodology

This chapter shows how the research was conducted. It starts with a general research strategy and elaborates on the methods for the different parts of the research in subsequent sections.

3.1 Nature of the research

This qualitative research followed a case study approach. It is a case of long-term planning by the flood risk governance arrangement for the island of Dordrecht. This case was chosen because the municipality and other actors have a long history in flood risk management, as shown in the introduction of this research. The FRGA in Dordrecht was therefore specifically chosen to test a long-term planning method. The Dordrecht case is unique and specifically chosen for that reason, making it an extreme and paradigmatic case.

The benefit of choosing such a case is that it provides an opportunity to create a backcasting design, as the actors that area active of flood risk governance are likely to cooperate. Furthermore, the empirical testing of a design through a workshop is possible. This increases chances of a successful study and an opportunity to get insights in backcasting for a flood risk governance arrangement that is functioning well. However, if it is unsuccessful, it is unlikely to work in less extreme cases, for instance in municipalities that first have to be mobilised for long-term planning or emergency management.

The research consists of a literature review on backcasting practices, an empirical part that investigates the FRGA in Dordrecht, a design part that designs an ideal backcasting design, and an empirical part that designs and conducts a workshop in the FRGA in Dordrecht. The methods used in these parts are elaborated upon in the next sections.

3.2 Backcasting literature review

Collection of materials

Materials used for the literature review consisted of scientific articles from peer reviewed journals. Both articles about backcasting in general, articles that summarised several case studies, and single case studies were found and used in this step of the research. The articles were found using search engines such as Google Scholar and Scopus. In addition to using search terms focussing on backcasting and visioning, an effort was made to find articles that are specifically suitable for the case of a municipal level flood risk governance, with search terms such as ‘local’ ‘flood’ and ‘flood risk’. Journals with high impact ratings and papers with a high number of citations were given priority, as were recent articles. Filtering on year was used to find more recent articles. In some cases, snowballing was applied by following references from a journal article to other journal articles, which helped to find the most important articles in a body of research.

Supportive material consisted of two interviews with researchers from Utrecht University that have expertise on backcasting research and workshops. These were found with a reference from the supervisor of the author. Interviews with experts in backcasting served as insights in the backcasting methodology, provided input for the organisation for the workshop, and provided suggestions to further literature. These interviews were not recorded, but notes were made during the conversation.

Data analysis

For finding the good practices from the literature, the author used tables in which elements of backcasting from different articles were listed, to identify practices that were used in most backcasting designs in literature. Furthermore, for different practices, or steps in the backcasting design, methods, elaborations and notes on successfulness by the author of the article were noted in tables. This led to an overview of practices from different articles and enabled the identification of practices that were used in

many cases, and of methods and practices that were deemed useful or proven by the author of a case, or proven to be useful by the research. The author of this research analysed this data and used the most common and successful practices to create an overview of good backcasting practices.

3.3 Empirical FRGA research

Collection of materials

The empirical research into the FRGA used an analytical framework from scientific literature. The literature containing the framework was found through the research network at Utrecht University and the supervisor of the author, Dries Hegger, that has expertise on this subject. Further literature on FRGAs was found using search engines such as Google Scholar and Scopus using search words such as 'flood risk governance', 'flood risk governance arrangements' and 'flood risk management strategies. Publication year was used as a filter when searching for articles.

The main materials for the empirical part consisted of interviews with members of the LL, to analyse the FRGA. Supporting materials consisted of documents on flood risk adaptation in Dordrecht, documents of the municipality of Dordrecht such as web pages, reports and policy documents, and attended meetings. The supporting documents were found by reference from interviewees. Attended meetings concern two meetings of the actors that participate in the LL SRID. After the first contact with the Municipality, that was established by the supervisor of the author based on previous contacts with the municipality of Dordrecht, the author was invited to sit in on the LL SRID meetings, make notes, and explain the purpose of the research and introduce the backcasting workshop that would be conducted later.

Nine interviews with FRGA actors were conducted. The aim was to interview at least one person from every organisation participating in the LL SRID[3]. The interviewees were contacted through the participation of the author in LL meetings, and invited by e-mail. Appointments were made by e-mail and the author visited most of the actors at their workplace to conduct interviews. The length of interviews was between one and 1.5 hours. A template of interview questions (in Dutch) can be found in Appendix A. Interviewees included two people from the Municipality of Dordrecht, two people of the Safety Region Zuid-Holland Zuid, and one person from the Province of Zuid-Holland, the Regional Water Authority Hollandse Delta, the National Water Authority, and the Environmental Service Zuid-Holland Zuid.

Interviews with policy officers from the municipality, and with the IHE researcher, partly served as helicopter interviews, due to the central and coordinating role of the Municipality in the FRGA. These served for getting more insight in the practices in Dordrecht and finding the next type of documents and interviewees to consider. The interviews were recorded.

The main source for policy documents were the interviews, where interviewees referred to relevant documents. This provided the researcher not only with a range of documents to look into, but also a filtered list, because the interviewees deemed these documents important. This was supported by using internet search engines for finding web pages of the municipality of Dordrecht, national water policy, and documents of the Delta Programme, and using a snowballing method by following links from those pages and reports.

Data analysis

The analysis of interviews was done by transcribing them. This was partly done by hand, and partly using speech to text transcribing software (Transcribe by Wreally). Using this software, the author dictates the interview to the software, while listening to the recording. The software converted the spoken text by the author to text. After review by the author this resulted in transcripts that were acceptable.

The transcripts were analysed in NVivo software. Before importing the transcripts into NVivo, all interviews were prepared by ordering all text spoken by interviewees into pre-set interview questions. When importing the interviews in NVivo, this meant that auto coding could be done on interview question level. The interviews were further coded into the FRGA dimensions, and more detailed codes that were part of one of the four FRGA dimensions. The discourses code was divided into discourses on the LL, the SRID, and FRMSs, as these were discourses that became apparent during the analysis. After coding, the author was able to review interview data relating to specific FRGA dimensions and put together an analysis of the FRGA.

Documents served as supportive data to the interviews. Documents were not coded, but specific parts that were referred to, or were needed for clarification on statements, were read and used in the FRGA analysis.

3.4 Ideal backcasting design

This part of the research concerned the design of an ideal backcasting approach. The materials consisted of the good backcasting practices and the empirical analysis of the FRGA in Dordrecht. The design was structured by using the backcasting steps from the results on good practices as the base for the ideal backcasting design. The steps were then adjusted to be fitting for the institutional environment of the FRGA in Dordrecht, leading to a tailor-made backcasting design.

3.5 Workshop design and organisation

The design of the workshop is discussed in Chapter 8, as this is part of the answer to the relevant research question.

Organisation

The workshop was planned for the afternoon of the 12th of September 2018 with a duration of three hours. The invitations were sent by using a web tool for making appointments (datumprikker.nl). The author of this study had prepared the workshop design beforehand and had discussed this with the facilitator or mediator of the day, the researcher from IHE that is also part of the FRGA. The mediator had provided input for the design and some practical choices for the design had been made with this advice. A choice was made, due to time constraints, to focus on visioning and backcasting, as these steps were seen as the basis of a backcasting approach; following steps would have less meaning without doing these steps.

The workshop had been planned out for the afternoon with the following schedule:

14:00 Soft start, shaking hands
14:15 Presentation with introduction to problem and the workshop
14:30 Visioning for the SRID in 2040
15:20 Break
15:30 Backcasting
16:40 Short term actions and comparison with action plan
16:55 Final words
17:00 End

The ultimate workshop was shorter than planned out, because some of the participants needed to leave shortly after four o'clock. This meant that the short-term action comparison was left out and the backcasting was shortened. The details are discussed in Chapter 8, as this is considered part of the answer to the relevant research question.

Collection of materials

Materials on the process of the workshop were collected by the author being present at the workshop, taking notes of what happened and making writing down findings shortly after the workshop finished. Furthermore, the process was discussed in an interview with the divergent thinker later.

Substantive materials, that give insight in the usefulness of the backcasting workshop for the FRGA, were collected by taking pictures of the visual representation on the wall and by recording the group discussions.

Analysis

The analysis of the process and success of the workshop was done by comparing the experiences from the workshop to the workshop design and the ideal backcasting design for the FRGA. The differences, barriers, or successes found are part of the analysis in Chapter 8.

Substantive results were analysed using NVivo. Pictures of the parts of the vision and steps to reach the vision were imported and coded. The codes used were MLS layers 1, 2 and 3, as well as the years 2040, 2030 and 2020. With all items coded to a year and a layer, pathways for each layer could be analysed, as well as all steps for 2020 or 2030, or the vision for 2040. Furthermore, elements of the vision were coupled to specific steps by creating tables to create an overview of connected steps and visions. The results for the research were used in the evaluation of the workshop in Chapter 8. The connected steps and visions, and a comparison of the workshop results with the LL action plan, can be found in Appendix B.

4 Theory: good backcasting practices

In Chapter 2 on the conceptual background, the backcasting approach was presented as a method that is suitable for long-term strategic planning in problems arenas facing a transition. This literature Chapter is focused at finding a good approach for long-term strategic planning for the transition towards broadening of FRMSs for the SRID FRGA. This section covers an elaboration on backcasting as a method for long-term strategic planning that conclude in a range of good backcasting practices from literature that have proven successful in different circumstances and can be used for a backcasting design for the SIRD FRGA. This answers the research question "What good practices from literature on long-term strategic planning for flood risk governance can be identified and how do they work?"

4.1 Emergence of backcasting

Backcasting has emerged from the notion that forecasting is not sufficient for all problems that try to plan strategically for the far future. Forecasting is based on the idea that the future can be determined by creating models, feed them with data and extrapolate trends to predict what the future will look like. Forecasting sees the future as a mirror of the past, which has large disadvantages when current trends are undesirable and dictating images of the future (Holmberg and Robert 2000, 293), and the most likely future is not always the most desirable one (Robinson 1990, 821). Furthermore, forecasting does not have a good record on doing good predictions, reflecting assumptions in the underlying models rather than a plausible future (Robinson 1990, 821). Therefore, as "discontinuities are likely to occur and should even be deliberately sought in some cases" (Dreborg 1996, 814), an approach assuming a predictable future is not always sufficient.

In the 1960s, Jantsch (1967) and Linstone (1969) wrote about exploratory and normative technological forecasting. Normative technological forecasting was a way to select the preferred future opportunity in a situation with more than one of such opportunities, a condition that "only 25 years ago (...) could not generally have been said to obtain", but "normative forecasting today is both possible and necessary" (Jantsch 1967, 26). This method meant that the possible opportunities were mapped by exploratory technology forecasts and matched with normative forecasts of what needed to be done to reach a desirable goal. Jantsch (1967) noted that adding the time perspective to this match is the most difficult part, as forecasts can change over time which would hurt the alignment of the forecasts. The exploratory technology forecasts are similar to what one could today call scenarios for technology development, whereas the normative forecasts are closer to the normative visioning and backcasting, which will be explained later.

Backcasting emerged in studies on energy futures as 'energy backcasting' and was made popular by Amory Lovins, who used the method of 'backwards-looking analysis' in several studies, starting in the 1970s (Robinson 1982, 1). The method was picked up as a method for companies to prepare for an uncertain future, including a sustainable one (Holmberg 1998). The concept of backcasting was developed as a method in policy analysis (Robinson 1982). Energy backcasting would start out by stating the policy goals and constraints for the future, such as type of energy, environmental impact, future standard of living, and costs of policy measures (Robinson 1982). Then the current energy consumption and production would be described, followed by outlining the future energy economy, mid-point dates between the desired system and the current system, and an energy supply and demand analysis (Robinson 1982). It becomes clear that there is a visioning element that sets a normative goal for the future and that from that mid-term goals are set, and energy supply and demand goals set the more specific policy goals.

Since the 1990s, backcasting was picked up as a method to plan for a sustainable future (Holmberg and Robert 2000; Alänge and Holmberg 2014; Robinson 1990). It was noted that backcasting is useful for complex or 'wicked' problems that need major change and where the current trends are part of the problem, which shows the departure form forecasting (Holmberg and Robert

2000). Backcasting has since been used in studies in several fields that need a transition to a sustainable system, such as transport (Åkerman and Höjer 2006; Barandier 2015), ecosystem services (Brunner, Huber, and Grêt-Regamey 2016), municipal climate change adaptation (Carlsson-Kanyama, Carlsen, and Dreborg 2013), and sustainable energy and low-carbon society (Giurco et al. 2011; Höjer, Gullberg, and Pettersson 2011; Neuvonen et al. 2014), on both national or regional and city level. Since the late 1990s, participatory backcasting, backcasting that involves not only the experts that conduct a backcasting study, but other participants that are involved with the issue addressed, gained popularity (Robinson et al. 2011; Wangel 2011). Backcasting has blended with industrial ecology and adaptive management (Quist 2014).

The usefulness of backcasting in transitions for sustainable futures and several more specific applications, also on a local level, suggest that it may be suitable for a transition towards a broader use of FRMSs for the SIRD, a transition that is set in motion and relevant because of changing climate. In the next section, the backcasting approach is elaborated on in more detail.

4.2 The definition and scope of backcasting

Dreborg (1996) has argued that backcasting is an approach rather than a method; the approach consists not only of a method, but also a philosophical view, a perspective, methods and techniques (Dreborg 1996, 819). According to Dreborg (1996, 821), backcasting is distinguishable from forecasting not primarily by its different method, but by its way of understanding: whereas forecasting is built on the belief of causality and determinacy, backcasting is interesting if teleology is accepted as a form of understanding. In essence, this means that one has to believe that normative choices make sense, rather than submitting oneself to the 'forces that be.' Whereas the discussion on determinacy and teleology is not one to include in this study, on a practical level, policy makers, especially those in sustainability sciences, would agree that determinacy is not a useful concept when designing policy with supposed impact, let alone a transition. The philosophical discussion of Dreborg (1996) is therefore an interesting one that explains the underpinnings of backcasting. The view on backcasting as an approach with different levels has merit and does explain the difference in perspective, approach and method between forecasting and backcasting, as shown in Table 2.

Table 2. Differences between forecasting and backcasting on different levels, adapted from Dreborg (1996).

	Forecasting	**Backcasting**
Perspective	Dominant trends	Societal problem needing solution
	Likely futures	Desirable futures
	How to adapt to trends	Human choice
		Strategic decisions
Approach	Extrapolate trends into the future	Define interesting futures
	Sensitivity analysis	Analyse consequences and conditions to reach futures
Method	Econometric models	Partial and conditional extrapolations highlighting polarities and technological limits

The approach as argued by Dreborg (1996) is visible in all approached and methods that use backcasting, but as early authors did not include very specific frameworks in their backcasting approaches and backcasting has been developing slowly over the past decades, no single backcasting approach is particularly dominant. Furthermore, backcasting approaches need to be tailor made to the case it is applied to (Soria-Lara and Banister 2018). Major approaches that recur in most backcasting literature are the ones from Robinson (1990), The Natural Step (TNS) (Holmberg 1998), and the one from the STD programme (Quist and Vergragt 2004). The TNS approach was developed with an application for firms in mind and does not get very specific. The approach of Robinson (1990) has a larger focus on describing targets, the current system, constraints and variables, before

constructing scenarios, whereas the STD approach includes creating a future vision early in the process, after problem orientations, followed by backcasting towards short term actions and implementation (Quist and Vergragt 2004). Quist and Vergragt (2006) show that there has been a move to involving stakeholders around the problem into a backcasting approach, where formerly backcasting was considered something to be done by researchers and experts, and they see a common methodology emerging among studies that use participatory backcasting that seems close to the STD methodology:

1. "Strategic problem orientation;
2. Construction of sustainable future visions or scenarios;
3. Backcasting;
4. Elaboration, analysis and defining follow-up and (action) agenda;
5. Embedding of results and generation follow-up and implementation" (Quist and Vergragt 2006).

For this research, a backcasting approach is considered to have these elements, while only the third step of this approach carries the backcasting name. Case studies covering backcasting approaches always include some form of future projection, be it in the form of a vision as proposed in the above, or by creating (normative) future scenarios created with varying methodologies, with experts or a wide range of participants (Phdungsilp 2011; Quist and Vergragt 2006; Soria-Lara and Banister 2018).

Visioning is about "reaching consensus among stakeholders on what such a future that would be as much as ensuring the long-term commitment of stakeholders" (van der Voorn et al. 2017). Setting goals concerns the "rationalised pathways for making the vision become reality" (van der Voorn, Pahl-Wostl, and Quist 2012). The backcasting analysis is about "build[ing] bridges from the present to a desired future in a retrospective way" (van der Voorn, Pahl-Wostl, and Quist 2012). This includes the identification of policy actions that reach the set goals. Van der Voorn, Pahl-Wostl, and Quist (2012) also add problem orientation and evaluation and monitoring to the start and end of the methodology, but problem orientation seems clear in this case study, while monitoring is beyond the scope possible for this research.

Backcasting practices can differ in the number and type of participants, such as researchers, policy makers, or a group of actors in participatory backcasting (Sheppard et al. 2011; Robinson et al. 2011), which can influence the degree of social learning, participant buy-in and broadening of the scope (Robinson et al. 2011, 757). The detail and number of dimensions included in visions, the number of visions, and degree of participant agreement also differs among case studies. Furthermore, participants may decide that a pathway to reach a desired vision is not set but serves as a starting point for continuous reflection and reformulation. Detail and dimensions included in pathways and policy actions may also differ among backcasting studies. The time frame used for backcasting is often 50 years (Vergragt and Quist 2011). These differences between backcasting practices show that for each case the approach needs to be tailor made. In this research, good practices will be taken from cases studies that use backcasting for flood risk management or governance.

Participatory backcasting cases can have a focus on the end product, for instance a vision or scenario for a long-term future and a pathway to reach that scenario with a short term action agenda, or use the generation of a vision or scenario as guidance for fostering stakeholder participation, involvement, discussion and learning (Wangel 2011). As argued, the motive for using strategic planning and backcasting in particular is to incentivise a transition towards broadening of FRMSs in Dordrecht and the Rhine delta, so the use of backcasting here is goal-oriented. Stakeholder involvement and learning are important in reaching this goal and possibly learning from this case for the purpose of generalisation.

4.3 Good practices for a backcasting approach

The five common elements from a backcasting approach are used as a basis for discussing the details and methods used in existing backcasting studies. The overview uses literature that summarises backcasting methods and case studies.

4.3.1 Step 1: Strategic problem orientation

Strategic problem orientation is not part of all backcasting approaches and not much elaborated on. As Quist and Vergragt (2004) state in their elaboration on this step, it can be taken out if the normative assumptions are already set. That the step is not elaborately covered in a lot of literature does not mean it is not important: it sets the background for the backcasting study. This step includes exploring problem definitions and possible solutions, looking at current trends and identifying the unsustainability, and stakeholder mapping: how stakeholders perceive the problem and how that relates to their function, their interests and resources, and how they perceive solutions (Quist and Vergragt 2004). A backcasting approach including explorative scenarios was also designed, and such a step would fit in with finding current trends and setting scenarios, which corresponds with the authors notion that the explorative scenarios in that approach were created before the rest of the backcasting study (van Vliet and Kok 2015). Explorative scenarios map possible futures that help in the backcasting approach to create strategies and policies that are robust in different futures. These scenarios can also be created at a later stage, after the initial backcasting, in the 4th step (Lucas Rutting, personal communication, 7 August 2018), to test for robustness of the outcomes in a later stage. Exploratory scenarios need to be created by people that are knowledgeable about the problem, which is often done with participatory methods, and it can be done qualitatively and quantitatively (van Vliet and Kok 2015). In short, the practices from this step that are considered good practices for a backcasting design are:

1. Defining the problem, including current unwanted trends;
2. Generating exploratory scenarios with possible solutions;
3. Defining possible solutions;
4. Investigating the relation of the problem to the function of stakeholders;
5. Stakeholder mapping, including their problem and solution perceptions, interest, relations, and resources;

4.3.2 On participants

Stakeholder involvement is something that starts at the first step, but stakeholders can be added after a visioning step and before elaboration of the vision, if there is a need. Tools exist to include stakeholders in a policy process that can be used to find stakeholders for a backcasting approach (Quist and Vergragt 2006). Quist and Vergragt (2004) suggest including several societal groups: companies, research bodies, government bodies, public interest groups and the public. For different steps in the backcasting approach, different stakeholder groups can be used. Soria-Lara and Bannister (Soria-Lara and Banister 2018) used ‘visionary participants’ for their visioning step, consisting of participants from the public, policy makers, consultants and academics that were able to think ‘outside of the box’. For their backcasting step they used ‘instrumental participants’ that had knowledge about policy and policy interactions, such as policy makers and consultants. In step 4, where feasibility was tested, they used policy makers from different institutions on different governmental levels that were able to assess acceptability and feasibility of the policy. Furthermore, they note that in the visioning phase, it is important to have a larger and inclusive group when a vision has to reflect the common vision of the populace (Soria-Lara and Banister 2018). Other things to mind when involving participants is the heterogeneity and spatial distribution of the sample size, difference in age proved useful in several steps of the backcasting, and both decision makers and those affected by decisions need to be included (Soria-Lara and Banister 2018). The practices taken from this are that stakeholder involvement is done well when:

1. Participants companies, research bodies, government bodies, public interest groups and the public are considered;
2. Participants are chosen based on qualities suited to the step of the backcasting approach;
3. Number needs to be representative when needed for the backcasting step;
4. Minding heterogeneity, including spatial distribution, age, role in the policy process.

4.3.3 Step 2: Constructing future visions or scenarios

For the step of constructing **future visions or scenarios** there is a lot of variation possible. First of all, the time frame needs to be determined. Soria-Lara and Banister (2018) suggest that the long-term time frame for the vision should be at least 25-30 years from today and further in the future than the common planning time frames. Several studies use 50 years (Quist and Vergragt 2004), or a year that speaks to the imagination is chosen, such as 2050 (Phdungsilp 2011; van Vliet and Kok 2015). It is possible to create a single vision for the end point year, however the creation of several visions or normative scenarios is also used (Quist and Vergragt 2006; Soria-Lara and Banister 2018). Creating more visions can increase the chance that a successful one is among them and increase the robustness of outcomes (Soria-Lara and Banister 2018). Also van der Voorn et al. (2017) could not confirm the merit of a single shared vision by participants. They also suggest using existing visions as input in the visioning stage of the backcasting approach. It is deemed harmful to force participants into one scenario or vision, because that would defeat the use of a participatory process (Quist and Vergragt 2004). In the case that started out with explorative scenarios, only a single vision was created that set a goal to be met by all scenarios (van der Voorn, Pahl-Wostl, and Quist 2012; van Vliet and Kok 2015).

A vision is a future situation in which the current unwanted or unsustainable trend is broken, and there is a wanted or sustainable situation in place. A vision serves the purpose of guiding the interactions between actors in a later stage, and is particularly useful when the problem has no existing rules or institutions available (Quist and Vergragt 2004). The visioning step is defined by creativity and idea generation. Methods that are used here can include semi-structured interviews, Delphi method, or workshops. As noted, a wide range of participants is preferred in this step, especially when the vision has to reflect a large populace. Participants can find it hard to think this far ahead and difficulties may arise when participants agree when unconventional thinking is needed. Using 'wild cards' by introducing unlikely but very disrupting events can help incentivise creative thinking about the future (Soria-Lara and Banister 2018). Furthermore, they found that the scenario building needs to have an iterative process to ensure learning, which can be achieved by guaranteeing continuity in the line of reasoning, by making sure that in the case of several workshops, there is a core group that participates in all of them (Soria-Lara and Banister 2018).

An addition by van Vliet and Kok (2015) is identifying obstacles and opportunities to reach this vision, that can be used in the later backcasting stage. These can be identified by the participants and based on the formerly developed exploratory scenarios. They help to guide the later step of identifying policy actions. The good practices can be summarised as follows:

1. The end-point date is more than 25 year away and further away than common planning time spans;
2. Multiple visions by participants or prepared beforehand;
3. A large number of participants can help creativity;
4. Methods to foster creativity need to be used to avoid locked in thinking;
5. Maintain a level of continuity in the line of reasoning to foster learning by an iterative process;
6. Opportunities and barriers toward the visions help to guide later steps in the backcasting process.

4.3.4 Step 3: Backcasting

The third step, the backcasting step, is about filling the gap between the future visions and the current situation. This can be done more quickly by answering a guiding question "what are the needed changes to reach the future vision", or more elaborated or even in several steps (Quist and Vergragt 2004). This can take a number of forms and can be done with different levels of complexity. Van Vliet and Kok (2015) suggest that first milestones need to be identified between the end point vision and the current state, that can be seen as intermediate visions, that can be linked to the earlier created opportunities and barriers. After that, policies can be created to overcome obstacles, utilise opportunities, and reach milestones. Soria-Lara and Banister

(2018) used a different approach, where a large number of policies were generated by participants, that were clustered in two steps, first into 10 packages, which were in turn appointed to 3 different pathways. Quist and Vergragt (2004) suggest that the changes identified in this step can be categorised into technological, cultural, and structural or organisational changes.

As with the consideration of multiple visions, in this step there is a consideration on the creation of multiple pathways. Most studies use multiple pathways in the outcome of the backcasting approach, showing multiple ways to reach a future vision. Soria-Lara and Banister (2018) do this by creating three pathways in a bottom-up way, the are derived from the identified policies. Also van Vliet and Kok (2015) have multiple pathways in their backcasting results, called strategies, which are sequences of policy actions that are identified during the backcasting.

Methods suggested for this stage are face-to-face workshops and questionnaires, and the use of a timeline to make a pathway visible (Soria-Lara and Banister 2018; van Vliet and Kok 2015). Soria-Lara and Banister (2018) suggest that multi-temporal backcasting, using different end points in the process, is something that can be tried in the future, but they also note that adaptive and flexible frameworks can be complicated and have a risk of becoming vague, which is similar to the findings of van Vliet and Kok (2015) that the division between milestones and actions in this phase can become vague for participants. There is a fine line between making an elaborate pathway or timeline with detailed policy actions and making the exercise too complex for participants. Good practices from literature for the backcasting step are:

1. Backcasting needs to fill the gap between vision and current state with actions to reach the vision;
2. Earlier identified obstacles, opportunities, or uncertainties can help create policies;
3. A balance needs to be found in detail of the intermediate results and too much complexity for participants;
4. A result with multiple pathways or strategies makes for a more elaborate and flexible result;
5. Visual tools help create a timeline and pathway.

4.3.5 Step 4: Elaboration, analysis, defining follow-up agenda

The fourth step of the backcasting approach concerns the elaboration, analysis and defining follow-up and action agenda. This is the step that usually follows after backcasting is done and there are results from the approach, in the form of one or several vision endpoints, pathways towards the vision(s) containing more detailed actions or policies. In this step, these results can be elaborated on or analysed for use in practice, or there can be a feedback loop into other steps of the backcasting, with reconsiderations. This can take the form of more focused research into a specific vision or pathway, or a round of more focused stakeholder participation to elaborate or discuss a vision or pathway (Quist and Vergragt 2004). An assessment can include a focus on the environmental, social, and economic effects of the created pathways (Soria-Lara and Banister 2018). In this stage, it is also possible to create qualitative exploratory scenarios to test the robustness of the findings from the backcasting stage, if this hadn't been done as part of step one (Lucas Rutting, personal communication, August 7, 2018).

Furthermore, the feasibility, acceptability and barriers to implementation can be discussed in this stage, preferably by policy makers, with feasibility focusing on political and economic feasibility (Soria-Lara and Banister 2018). In the elaboration on the pathways, van Vliet and Kok (2015) identify robust policies that have been mentioned in all of the exploratory scenarios and thus would be successful in all possible futures. Another part of this step can be the identification of follow-up activities or agendas, that enable the implementation and realisation of the backcasting and elaboration step for the long term.

The method in this step is often in the form of workshops and discussions (Soria-Lara and Banister 2018; Quist and Vergragt 2004), while the latter authors also suggest a multi criteria analysis. Quist and Vergragt (2004) further mention that the effort in this step is very dependent on the time, capacity, and budget available for the backcasting approach. Therefore, this step is sometimes merged with the fifth step. The good practices to take for this fourth step are:

1. Identify if certain visions or pathways need elaboration or reconsideration;
2. Organise focused session with participants for parts that need elaboration;
3. Create qualitative exploratory scenarios to find robust policies;
4. For implementation, assess feasibility, acceptability and barriers with policy makers;
5. Create a follow-up agenda with the needed actions towards the vision.

4.3.6 Step 5: Embedding of results, generating follow up and implementation

The fifth step is the embedding of results and generation follow-up and implementation that follows after step four. This is where the results of the backcasting approach are used and policies get implemented. When these results are policies, these are made into an action agenda that contains direct follow-ups after the workshop, for the long term, that set things in motion for moving towards the vision; the vision still has the function of leitmotiv in these activities (Quist and Vergragt 2004). For policy implementation, the relevant societal groups have to give their contribution, and in this stage responsibilities for the implementation of certain short-term policies are awarded to certain actors, which can also be done by creating stakeholder co-operations for shared responsibility (Quist and Vergragt 2004).

The action agenda and responsibilities can be set by organising a workshop and the results can be in the form of policy proposals or recommendations. A different follow up is in the form of research, where a research agenda is established that starts the required research that was identified by the backcasting process (Quist and Vergragt 2004). The implementation phase is found to be more successful when the backcasting approach is more embedded in formal decision making processes (van Vliet and Kok 2015). The good practices to take from this are:

1. Create action agenda for the short term;
2. Create research agenda for the short term;
3. Define responsibilities and form of collaboration;
4. Embed results in formal decision-making processes.

4.3.7 On tools and methods

Finally, form the literature emerged notes on the methods to use during a backcasting approach, and what works best. The methods to use overall are, according to Quist and Vergragt (2004), participatory tools and methods, design tools, analytical tools and methods, process management and stakeholder tools and methods. These include stakeholder analysis, problem analysis, employee training, technology analysis, and visioning. Soria-Lara and Banister (2018) suggest group discussions, questionnaires, Delphi techniques, interviews, and ranking methods, Robinson (1990) adds impact analyses, methods for scenario construction, and system analysis and modelling, and Holmberg (1998) adds techniques for creativity. Most backcasting studies use a single method to make the backcasting process streamlined and structured for participants, but Soria-Lara and Banister (2018) see that using multiple methods is good for creative thinking and enriches the participative process. Other considerations they bring is that a combination of bottom-up and top-down approaches is valuable, because top-down approaches are useful to keep control, but bottom-up approaches create a ‘creative space’ with participants that feel more free to participate; for instance combinations of Delphi and questionnaires with face-to-face methods and in-depth interviews (Soria-Lara and Banister 2018). Discussion methods are very time intensive, but have a very low threshold for participation and are therefore useful for inviting participants to get involved (Soria-Lara and Banister 2018).

It is good to use an independent mediator that can act during discussions and workshops, because it makes the researcher an external observer. For this to work well, the mediator needs to have a background that relates to the topic, have experience in the public and private sector, and be a peacemaker that puts effort in creating a common language between participants (Soria-

Lara and Banister 2018). The mediator needs to agree on some rules with the researchers to create trust with the research team. Some good practices for the choice of methods are:

1. Choosing a combination of different methods, combining bottom-up and top-down ones;
2. Include methods that have a low threshold for participation;
3. Appoint an independent mediator fitted for the topic.

4.4 Chapter conclusion

An overview of the good practices that were identified per step are displayed in Table 3.

Table 3. Overview of good backcasting practices ordered by step in the backcasting approach.

Step 1	Define the problem including unwanted trends that need to be breached; Generate exploratory scenarios containing possible futures; Map the possible solutions; Investigate the relation of the problem to the function of stakeholders; Map stakeholders, including their problem and solution perceptions, interest, relations, and resources
Partici-pants	Companies, research bodies, government bodies, public interest groups and the public are considered; Participants are chosen based on qualities suited to the step of the backcasting approach; Number needs to be representative when needed for the backcasting step; Minding heterogeneity, including spatial distribution, age, role in the policy process.
Step 2	The end-point date is more than 25 year away and further away than common planning time spans; Multiple visions by participants or prepared beforehand; A large number of participants can help creativity; Methods to foster creativity need to be used to avoid locked in thinking; Maintain a level of continuity in the line of reasoning to foster learning by an iterative process; Opportunities and barriers toward the visions help to guide later steps in the backcasting process.
Step 3	Backcasting needs to fill the gap between vision and current state with actions to reach the vision; Earlier identified obstacles, opportunities, or uncertainties can help create policies; A balance needs to be found in detail of the intermediate results and too much complexity for participants; A result with multiple pathways or strategies makes for a more elaborate and flexible result; Visual tools help create a timeline or pathway.
Step 4	Identify if certain visions or pathways need elaboration or reconsideration; Organise focused session with participants for parts that need elaboration; Create qualitative exploratory scenarios to find robust policies; For implementation, assess feasibility, acceptability and barriers with policy makers; Create a follow-up agenda with the needed actions towards the vision.
Step 5	Create action agenda for the short term; Create research agenda for the short term; Define responsibilities and form of collaboration; Embed results in formal decision-making processes.
Methods	Choosing a combination of different methods, combining bottom-up and top-down ones; Include methods that have a low threshold for participation. Appoint an independent mediator fitted for the topic.

These good backcasting practices for a backcasting approach from literature answer the first research question “What are good backcasting practices from literature, and how do they work?”. It becomes clear that step one, that is mostly a preparatory phase of the approach, needs input in the form of some analysis of the stakeholders and their discourses, interests, and resources. Also, it needs to be clear what the backcasting approach is meant to deliver in this specific case, and what the current state is in the case, in order to design the backcasting approach tailor made to the case needs. Furthermore, the selection of steps and how elaborate they can be set up, is specific to the case, and to the time and resources available. This is done by investigating the FRGA arrangement in Dordrecht. The next section presents an analytical framework that guides the empirical research of the FRGA and shows what elements of a FRGA need to be considered.

5 Analytical Framework

The FRGA on the island of Dordrecht is transitioning to the use of FRMSs that work towards a self-reliant island of Dordrecht. This is done by a FRGA with different actors, that may have divergent responsibilities and discourses, resulting in the support for and implementation of different end goals for the SRID, different ideas or efforts for the implementation of FRMSs, or different resources to contribute to the SRID. These factors are important for a successful transition to broad FRMS use and therefore relevant in attempting to help the transition with a backcasting approach. As became evident from the listing of good backcasting practices, the problem, the actors that are involved, their interests, discourses, and resources, and perception of the problem and solutions, need to be mapped.

To be able to analyse the FRGA in Dordrecht, theory on FRGAs is set out in this section, answering the research question: "What are important elements in a flood risk governance arrangement in the context of long-term planning found in literature on flood risk governance arrangements?" The chapter finds the relevant elements of a FRGA that need to be considered in the empirical part of this research that maps out the FRGA in Dordrecht.

The chapter starts with explaining the concepts underlying a FRGA, by elaborating on the meaning of flood risk and governance. Then the analytical framework is presented.

5.1 FRMSs and governance

FRMSs are strategies used to reduce the risks of flooding. In this case study, the aim of self-reliance for the island of Dordrecht concerns the implementation of FRMSs that improve the preparedness of the island for floods. Improving preparedness starts from the preconception that a flood will happen at some point in time. When a flood happens, preparations need to be made that reduce the impact of the flood. These may include spatial measures such as building shelters and evacuation routes, raising awareness and knowledge among citizens, as well as designing emergency plans for evacuation. From the earlier categorisation of FRMSs this means the strategy for the SRID concerns preparedness, or preparation (van Herk et al. 2014; G. T. Raadgever, Booister, and Steenstra 2018b), while measures are implemented in layer 2 and 3 of the MLS approach (Hamer, de Jong Posthumus, and Ilic 2015).

Governance is a concept used to describe how governments govern society. They "exercise collective control and influence over the societies for which they have been given responsibility" (Peters 2001, 1). Making policy is not a task performed by a government alone, but it is "formulated and implemented in dynamic contexts where multiple actors interact at multiple levels" (Driessen et al. 2012). Driessen et al. (2012) define different modes of governance, where the state, market and civil society have varying roles and relations, ranging from a central authoritative government in a mode of centralised governance, a state with several sub-national governments and higher stakeholder involvement in a mode of decentralised governance, and more participatory modes with increasing roles for the private sector and civil society: public-private governance, interactive governance and self-governance (145-48). Governance can exist in a multitude of arrangements, but they have in common that policy is made together by several actors, sometimes on different governmental levels and sometimes with the inclusion of private and civil stakeholders.

This is no different for flood risk management, as according to Raadgever, Booister, and Steenstra (2018a), "The implementation of flood risk management strategies, as well as their mutual alignment or integration, is more and more considered a governance issue." (101) Whereas studies have focused mainly on the application and effectiveness of FRMSs in the past, more recently the governance of flood risk management has gained more attention, shown by recent studies that address this matter (Hegger et al. 2014; Driessen et al. 2016; Fournier et al. 2016; Gersonius et al. 2016; Driessen et al. 2018). The choice and

implementation of FRMSs is done by a multitude of actors on different governmental levels and may also include private stakeholders and civil society. For flood risk management, the modes of governance, or the arrangement of actors governing its implementation, can be analysed in detail by describing them in FRGA. The concept of FRGA will be elaborated upon in more detail in the next section.

5.2 Flood risk governance arrangements

Raadgever, Booister and Steenstra (2018a) state that "a proper embedding of strategies in flood risk governance arrangements is essential for their successful implementation." (101) To define FRGA arrangements, definitions of governance arrangements are explored, followed by the definition used for this research.

In trying to define governance arrangements (GA), several definitions can be found in governance literature. Governance arrangements were defined by Arts, Leroy, and van Tatenhove (2000) as "the temporary stabilisation of the content and organisation of a policy domain," (54) giving GA the characteristic of a stable situation and the dimensions of content and organisation. Maassen (2003) defines governance arrangements as "the set of institutions which governments are using to govern society" (31), while referring to the aforementioned shift from central, national governance arrangements towards multi-level arrangements, similar to the distinctions made in the modes of centralised and decentralised governance (Driessen et al. 2012). This shows a focus on actors in a policy domain. Termeer et al. (2011) define a governance arrangement as the collection "of rules, processes, and instruments that structure the interactions between public and/or private entities" (161) in a certain policy arena. Summarising these definitions, common dimensions of a GA are actors, interactions, rules, processes, and instruments. Some literature using the concept of governance arrangements does not define it, using the word 'arrangement' to point out a certain form or mode of governance. In this case the authors are either implicitly relying on prior knowledge and common theories on governance to define the dimensions of an arrangement or using it to describe the specific situation in their case study or policy field. Referring to the former, theories that could be used from the field of governance research include among others institutionalism, advocacy coalition, actor networks, power or political ecology.

In this research, a GA is studied in the field of flood risk management: a FRGA. The STAR-FLOOD project conducted a large study on flood risk management, covering the use of different FRMSs and the governance of flood risk management (Driessen et al. 2018). The study defines governance arrangements for the field of flood risk management and gives an analytical framework to analyse and evaluate, and transform them, based on the framework of policy arrangements approach of Arts, Leroy, and van Tatenhove (2006). They elaborate on the requirements for FRGAs, evaluating current flood risk governance in six countries and creating a handbook with recommendations for policy makers (Driessen et al. 2018). The operationalisation of FRGAs in this study will use that of the STAR-FLOOD project and its supporting studies (Driessen et al. 2018; Hegger et al. 2014; Larrue, Hegger, and Trémorin 2013; Arts, Leroy, and van Tatenhove 2006; Hegger et al. 2013). The STAR-FLOOD project created the framework specifically to analyse governance arrangements dealing with floods and flood management strategies, which makes it suitable as an analytical framework in this research.

For the STAR-FLOOD project, Hegger et al. (2013) define GAs as "the constellation resulting from a dynamic interplay between actors and actor coalitions" (5) in a policy field, "their dominant discourses; formal and informal rules of the game; and the power and resource base of the actors involved." (5) This shows a focus on actors, their interplay and formed coalitions solidified in a constellation at some point in time, discourses, rules, power, and resources. This is compatible with the dimensions found in other literature: actors, interactions, rules, processes, and instruments: processes can be seen as informal rules and instruments can be covered by power and resources. Furthermore, Hegger et al. (2013) define GAs for flood risk management by defining the policy field as all fields relevant for flood risk management.

In line with the STAR-FLOOD project (Driessen et al. 2018), in this study, FRGAs are understood as governance arrangements that implement FRMSs, and the dimensions from the project definition are the dimensions used in this research. The definition tailored for this research is as follows: a *flood risk governance arrangement is the constellation resulting form a dynamic interplay between actors and coalitions involved in the implementation of flood risk management strategies and characterised by their discourses, formal and informal rules, power, and resource base.* This definition includes the dimensions of governance arrangements found in literature and focuses on the implementation of FRMSs. The definition from Hegger et al. (2013) was furthermore slightly changed to highlight the dimensions that define the actors and coalitions in the constellation that makes up the governance arrangement.

It follows from this definition that the main dimensions of a FRGA are actors, discourses, rules, and power and resources. In general, for successful implementation of FRMSs, these dimensions need to be present in a FRGA (G. T. Raadgever, Booister, and Steenstra 2018a, 101). The elaboration of these dimensions will be addressed in the next section.

5.3 Dimensions of a flood risk governance arrangement

Larrue, Hegger, and Trémorin (2013) and Hegger et al. (2014) The dimensions of the FRGA – actors, discourses, rules, and power and resources – are based on the policy arrangements approach (PAA) as formerly developed by Arts, Leroy, and van Tatenhove (2000, 2006) and used by the STAR-FLOOD project for analysing FRGA (Larrue, Hegger, and Trémorin 2013; G. T. Raadgever, Booister, and Steenstra 2018a; Hegger et al. 2014). Based on these sources, the dimensions can be defined as follows.

- The **actors** in a FRGA concern both actors and coalitions that take responsibility in the implementation of FRMSs. These may include governments, governmental organisations and private organisations, such as the Municipality of Dordrecht, the Safety Region and Water Authorities. The FRGA may also include one or more policy entrepreneurs.
- All actors have their **discourses**, in the form of views, narratives, thinking, discussions, and policies. In these discourses, the norms, values, problem definitions and approaches to a solution are expressed.
- **Rules** of the game, formal and informal, that structure actor interactions and structure the policy field by formal procedures of decision making and implementation.
- The division of **power** and **resources** that the actors rely upon. The mobilisation and deployment of available resources yields power. The concept of influence stands for the ability to determine policy outcome in a certain way. Resources may include finances, knowledge, political and interaction skills.

There is an interplay between the dimensions. Discourses, rules, and power and resources are all connected to certain actors in the FRGA. A change in one of the dimensions is likely to cause a stir in the FRGA and influence other dimensions as well. The FRGA can be seen as a stable, but fragile and temporary, equilibrium of the four dimensions. This is depicted in

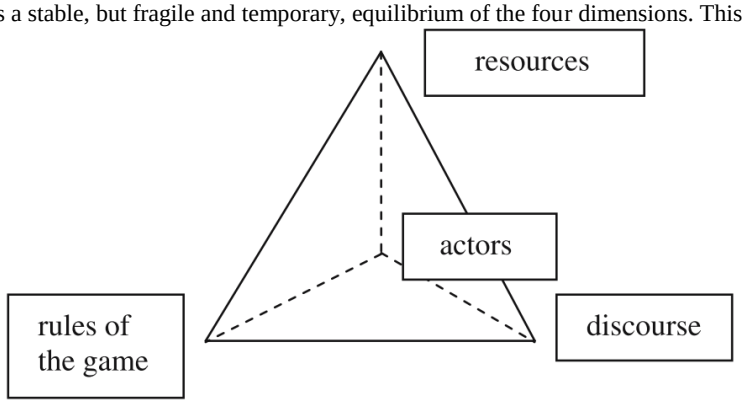

Figure 7. Schematic representation of a FRGA, with the four dimensions in a certain equilibrium. Figure taken from Arts, Leroy, and van Tatenhove (2006).

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The dimensions are further operationalised into sub-dimensions in the original PAA and in the STAR-FLOOD project. The PAA and STAR-FLOOD project furthermore extend their research to explaining dynamics of FRGA by identifying drivers of stability or change in FRGA. Although the purpose of this research, designing a backcasting approach for the island of Dordrecht has to do with change and transition, analysing or bringing about stability or change in the FRGA in Dordrecht is beyond the purpose of this study. This part of the theory on FRGAs is therefore not covered. This study uses the four dimensions of the PAA as an analytical framework to map the FRGA in Dordrecht: the dimensions of actors, discourses, rules, and resources are operationalised into specific elements, that are used in the empirical research.

5.4 Operationalisation of FRGA

The FRGA dimensions from the PAA need further operationalisation to be able to use them in interviews and document analysis. The STAR-FLOOD research, using the PAA, defines sub-dimensions for the four main dimensions as summarised in Table 4 (Larrue, Hegger, and Trémorin 2013).

Table 4. Dimensions and sub-dimensions of a FRGA, taken from Larrue, Hegger, and Trémorin (2013).

Actors	**Discourses**	**Rules**	**Power and resources**
-Public actors -Private actors -Coalitions and oppositions (*advocacy coalitions and partnerships*) -Interaction patterns -International river basin organisations	-Relevant and dominant scientific paradigms and uncertainties -Policy programmes -Policy objectives -Policy concepts -Historical metaphors/narratives *-Policy and legal values and principles*	-Legislation (including *jurisprudence/case law) on flooding, water management, spatial planning, property rights etc.* *-Constitutional, procedural and substantive norms* -Legal instruments -Legal traditions -Integration of rules *-Policy and legal principles*	-Legal authority including the right to regulate property (regulation, compensation and expropriation) -Financial power -Knowledge -Informal political networks -Interaction skills

To address the dimensions and sub-dimensions of the FRGA in Dordrecht, questions that address the dimensions of FRGA as are designed and supportive documents are analysed. In accordance with the categories of Larrue, Hegger, and Trémorin (2013), the questions focus on the characteristics as shown in Table 5. Per dimension, several questions are proposed that address the sub-dimensions and together the overall dimensions of the FRGA. An overview of the questions used can be found in Appendix A.

Table 5. Focus of the interview questions, based on FRGA dimensions of Larrue, Hegger, and Trémorin (2013).

Actors	**Discourses**	**Rules**	**Power and Resources**
Purpose of the organisation	Motivation for contributing to SRID	Role of legislation in activities	Legislative instruments of the organisation
Role of interviewee in organisation	Perceived goal of FRMS in Dordrecht	Role of legislation in contribution to SRID	Budget and its defining factors
Contribution to SRID	Preference for FRMS to implement	Role of specific water legislation	Means of the organisation in SRID
Activities of interviewee	Interpretation of SRID	Role of national legislation	Experience of organisation in projects similar to SRID
Collaboration with other organisations	Perceived progress towards SRID	Legislative instruments at the disposal of the organisation	Knowledge of organisation in water management, FRMS, long term planning
Communication with other(s) (organisations)	Perceived need and feasibility of SRID	Perceived constraining legislation	Relevant network of the organisation
	Long-term vision for Dordrecht		

The analytical framework presented in this chapter, with the operationalisation of FRGAs into the dimensions of actors, discourses, rules and resources, is used in the next chapter that analyses the FRGA in Dordrecht. The operationalisation presented in this chapter was used to design research questions and analyse data and transcripts.

6 Empirical Results: the FRGA for the SRID

This chapter goes into the third research question: "What does the flood risk governance arrangement in Dordrecht look like as characterised by the relevant elements found in question 2?" The characteristics of the governance arrangement were needed to map the institutional setting to enable the design of a backcasting approach that suits the transition to a SRID. The mapping of the FRGA is one of the foundations on which choices are made for the backcasting design. The characteristics of the FRGA are deemed important in designing a backcasting approach, for the characteristics of the FRGA are among the main factors to base the design of a backcasting workshop on. This focuses on the discourses of the actors involved on the long-term flood risk management and the topic of SRID, on the power relations between actors and how they see the FRGA, the resources the actors bring to the FRGA, and the formal and informal rules that organise the actors in the FRGA and the SRID. These characteristics of the FRGA show who are important, how communication takes place, who determines the goal and direction of the project, how the goal of the SRID is seen and how the long-term future is perceived and how the FRGA works or wants to work. Communication, relations, and power distribution are important in determining the form of a backcasting approach: in certain constellations a group visioning and backcasting may be likely successful, while in others smaller groups or interviews by an independent backcaster may be more successful. Ideas about the SRID and long-term planning determine what elements of backcasting are useful: short term or long-term thinking, the inclusion of visioning, scenarios and uncertainties are determined by how actors view the problem, in what stage they are and how they (are able to) think about the future.

This chapters starts with a sketch of the background, with focus on the history of actions and the state of affairs in the current situation. In the subsequent section follows an investigation of the four dimensions of a FRGA by the PAA as presented in Chapter 5 on the analytical framework for FRGAs. The results are presented in the second part of this chapter, ordered by the four FRGA categories. First a more general background of the FRGA is given that came forward from the data but was not exclusively attached to one of the FRGA dimensions.

6.1 The background of the FRGA

This chapter shows the background of the SRID FRGA by elaborating on the nature of the problem and the solutions that are available, concurrent with the history that the FRGA has in addressing this problem and the choices that were made in the past. This sketch of the history was done with material form interviews and supporting documents. It evolves into the current situation of the FRGA. Based on the current situation, the goal of using the backcasting approach for long-term strategic planning is explained.

6.1.1 History of the SRID

The efforts in Dordrecht to put more effort in floods started in Dordrecht in 2005. After hurricane Katrina in the United States, people at the municipality became aware that such a major flooding event could happen in Dordrecht and efforts should be made to prepare for such an eventuality (Municipality 2, 2018). This was something that was not done in the Netherlands, as the Netherlands has had a focus on the defence FRMS ever since the major flooding in 1953. For Dordrecht, 2005 was also the start of looking at the MLS approach, an effort to combine multiple FRMSs in the Netherlands. This resulted in the MLS approach being mentioned as a future strategy in the national water plans (Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieubeheer and Voedselkwaliteit 2009). The aim was to start several pilots for starting this MLS approach, and Dordrecht wanted to be such a pilot. Dordrecht had been looking first at the area outside the dyke ring and how people could survive there in case of a flood, because small floods occur there regularly, but now the area inside dykes also became a point

of focus, which was the start of looking at self-reliance in case of floods (Municipality 2, 2018). Two researches were conducted: first the Urban Flood Management trajectory on the area outside of dykes, followed by the Interreg project Managing Adaptive Responses to Changing Flood Risk (MARE). This research project was in the time that Dordrecht was a pilot area and the results of the projects were input for the national policy programme for water safety in the Dutch river deltas, the Delta Programme, that Dordrecht participated in. The research projects and participation in national water programmes made for mutual learning and information exchange and resulted in the ideas for the SRID: "we developed that with a lot of different partners (...) and there were a lot of partners from the Delta Programme that were looking over our shoulder" (Municipality 2, 2018). At the end of the pilot for the Delta Programme, there was no definitive end result. Dordrecht participated in a national programme for large infrastructural projects, MIRT, to continue the efforts and come to a result. The first MIRT project resulted in the estimation that an SRID would be a good option in Dordrecht, including a 'smart combination' of flood defences with primary, outer dyke flood defences supplemented with secondary flood defences (Waterschap Hollandse Delta et al. 2018). However the second MIRT research, that was aimed at elaborating the plans and prepare for implementation, resulted in the verdict that the 'smart combination' was not a viable option, because the needed development in the secondary flood defences was too costly compared to continuing to invest in the primary flood defences (Waterschap Hollandse Delta et al. 2018). Furthermore, primary flood defences are currently above the national requirement in Dordrecht (Leeuwen, Buuren, and Ellen 2018). Therefore, Dordrecht has abandoned the smart combination, but secondary flood defences may still have a role in flood risk mitigation instead of defence. The SRID is was deemed a viable strategy, with a broader use of FRMSs including defence with dykes, mitigation with secondary flood defences, and preparation and response in preparing organisations for a flooding event and evacuation planning. The last MIRT research concluded with an implementation agenda of several of specific actions for the coming years to make the SRID become reality.

6.1.2 Current situation

The municipality is still taking the initiative in wanting to implement the broader use of FRMSs for the SRID. Following on the MIRT-research, the efforts on implementing the proposed measures needs to continue, and Dordrecht wants to keep the partners that worked on the MIRT research involved. Also, there is a realisation that for a lot of these measures, research is needed. Therefore, Dordrecht has started a Living Lab (LL) for the SRID, in which different governmental partners, researchers, and the public can come together and work on implementation. It is a way of working, but also has a physical location in the city of Dordrecht, an open space on the ground floor of an office building that will be demolished in the near future to make way for a new Municipal administrative office building. At the start of this study, the partners that were included in the research[2], renewed their efforts in creating a plan of action as a follow up of the aforementioned implementation agenda. This plan of action will contain the selected measures, a time-line and the actors involved in the measures, as to benefit from matching projects to ongoing projects at other partners and create an efficient implementation pathway (B. Gersonius and E. Kelder, team meeting self-reliant island, May 22, 2018). The action plan is meant to cover the next two years and secure the continuation of efforts made by the FRGA in broadening FRMSs.

This chapter continues by elaborating on the SRID FRGA for use in step 1 of the backcasting approach, and to find out what good practices can be used in a backcasting approach for the SRID FRGA.

[2] The current participants include the municipality of Dordrecht, national water management authority *Rijkswaterstaat*, the provincial government *Provincie Zuid-Holland*, the regional crisis management authority *Veiligheidsregio Zuid-Holland Zuid*, the regional water board *Waterschap Hollandse Delta*, and the regional environmental executive agency *Omgevingsdienst Zuid-Holland Zuid*.

6.2 The four dimensions of the FRGA for the SRID

The PAA with the four dimensions of a FRGA: actors, discourses, rules, and power and resources, is used to determine these characteristics of the FRGA. Actors are discussed to show the context of the FRGA and they serve to put the discussion on discourses, rules, and power and resources into the FRGA context. The operationalisation of the FRGA by the PAA is recalled in Table 6.

Table 6. The operationalisation of the FRGA by the PAA, as presented earlier in the analytical framework.

Actors	**Discourses**	**Rules**	**Power and Resources**
Purpose of the organisation	Motivation for contributing to SRID	Role of legislation in activities	Legislative instruments of the organisation
Role of interviewee in organisation	Perceived goal of FRMS in Dordrecht	Role of legislation in contribution to SRID	Budget and its defining factors
Contribution to SRID	Preference for FRMS to implement	Role of specific water legislation	Means of the organisation in SRID
Activities of interviewee	Interpretation of SRID	Role of national legislation	Experience of organisation in projects similar to SRID
Collaboration with other organisations	Perceived progress towards SRID	Legislative instruments at the disposal of the organisation	Knowledge of organisation in water management, FRMS, long term planning
Communication with other(s) (organisations)	Perceived need and feasibility of SRID	Perceived constraining legislation	Relevant network of the organisation
	Long-term vision for Dordrecht		

6.2.1 Actors

This section describes the actors, their role in the problem and the SRID, and the collaboration and communication between actors. The operationalisation of this part is shown in Table 7. The actors that are discussed are the Municipality of Dordrecht, IHE Institute for water education, national water management authority *Rijkswaterstaat*, the provincial government *Provincie Zuid-Holland*, the regional crisis management authority *Veiligheidsregio Zuid-Holland Zuid*, the regional water board *Waterschap Hollandse Delta*, and the regional environmental executive agency *Omgevingsdienst Zuid-Holland Zuid*.

Table 7. The operationalisation of the actor dimension of the FRGA.

Actors
Purpose of the organisation
Role of interviewee in organisation
Contribution to SRID
Activities of interviewee
Collaboration with other organisations
Communication with other(s) (organisations)

Municipality of Dordrecht

The most important actor in the SRID FRGA is the Municipality of Dordrecht. A municipality in the Netherlands is the third and last layer of government, after the national and provincial governments. The municipality of Dordrecht geographically covers the complete island of Dordrecht, with the city of Dordrecht situated in the northwest of the island. As described in the history in the SRID in the first section of this chapter, the municipality has been the initiator in the broadening of FRGA in Dordrecht and has been continuing to do so during the researches that followed and the current stage of implementation in the LL. The municipality of has one person with a job description as policy advisor on water, that is fully dedicated to water safety and climate adaptation. According to Researcher 1 (2018) this is a unique situation in the Netherlands. Another person from the municipality with the function of task manager is working on climate adaptation on a more general level, including another LL on spatial adaptation in the city of Dordrecht and setting up a general adaptation strategy.

The relation of the municipality to the problem is based on the safety of citizens: “We are responsible for the health of the inhabitants and how they can happily live here, (...) for the safety of our citizens” (Municipality 1, 2018). Until 2005, Dordrecht was seen as “the drain pipe of the Netherlands: if something goes wrong, it’s the worst here” (Municipality 2, 2018). Furthermore, the municipality knows it is a frontrunner in the transition towards broad use of FRMSs in the SRID, and wants to be known as such, as is stressed by both people from the municipality: “Dordrecht, water city, city in the delta” (Municipality 1, 2018). The municipality is the driving force behind the LL SRID because they see themselves in the perfect position for that: they are involved with almost all subjects, directly or indirectly, and they can keep the overview (Municipality 1, 2018).

Within the organisation of the municipality there is contact with a project manager with a focus on climate adaptation, with expertise on actual projects can be done in a climate proof way. There is contact with Researcher 1 from IHE Institute of Water Education, that is also part time working at the municipality. Furthermore, there is regular contact with people from crisis management. The role of Municipality 1 is more focused on risk management, while other people within the municipality have a focus on crisis management. These other people are not included in the LL SRID directly. On the project of the SRID, the Municipality has had close collaboration with the regional water authority in the past, they were the main partner to discuss the ‘smart combination’ of flood defences by primary and secondary defences.

Province of Zuid-Holland

The Province of Zuid-Holland (South Holland) is in the second governmental layer of provinces. The province covers approximately 3400 square kilometres and has 3.6 million inhabitants as of 2015 (Wikipedia n.d.). The province covers the Rhine estuary in the city of Rotterdam, making it an important actor in governing the Rhine delta and estuary. The contact involved with the LL SRID is a policy maker on water safety. The province has been involved for a long time, which followed from its responsibility for the legal requirements for the regional water system and flood defences, those along smaller waters such as canals. This also covers the secondary flood defences in Dordrecht that may have a role in compartmentalisation of the island (Province 1, 2018). The Province has the legal power and the Regional Water Authority as an executive governmental organisation is responsible for regular checks of the flood defences.

Another task related to the SRID problem is the creation of maps showing flood danger and risk maps, a task that follows from the EU Floods Directive (FD, 2007/60/EC). The danger maps show the water depth and water arrival time in areas in the Netherlands, which is used in the risk maps, that take into consideration things like population density and economic value of an area, and evacuation possibilities, to calculate a risk (Ministerie van Infrastructuur en Milieu et al. n.d.; Province 1, 2018). The contact from the province has a technical background and involved with the risk maps in both a substantive as well as governance level.

The province wants to be involved because it wants to provide a “safe and attractive place to live, that is also economically attractive for businesses” (Province 1, 2018).

Regional Water Authority Hollandse Delta

The Regional Water Authority of Hollandse Delta (Dutch Delta) is a governmental executive organisation concerned with water management in the Netherlands. These water authorities are the oldest still existing governmental unit in the Netherlands, of which the first was established in the year 1255 (Unie van Waterschappen n.d.). The regional water authorities are responsible for water management in the Netherlands, covering managing freshwater supply and water safety. This regional water authority is geographically responsible for the Rhine delta from Dordrecht to the estuary, covering the southern South Holland Region. The person participating in the LL SRID is strategic advisor on all of the water authority responsibilities and has expertise in both physical water management and the political and administrative side. The activities of the contact are a wide range of water related projects, with regular contact with the Ministry of Infrastructure and Water Management and the Ministry

of Agriculture, Nature and Food Quality, and with provinces and municipalities on a transregional level; the individual contact with the Municipality of Dordrecht is unique (Regional Water Authority 1, 2018).

The Regional Water Authority has been involved with the SRID project for a long time, as it was the driving force behind the MIRT researches into the SRID, together with the municipality of Dordrecht (Regional Water Authority 1, 2018). There is also partnership within the Safety Region on the management of calamities; this is also where the regional water authority meets the municipalities. The involvement of the regional water authority is motivated from a responsibility for the regional water defences: "the regional water authority is directly involved because it is about flood defences that may or may not fail" (Regional Water Authority 1, 2018). Further motivation to participate in the project comes from the wish to meet other partners and align responsibilities, not only working on their own separate subjects: "knowledge sharing, informing, showing what the boundary conditions [for the SRID] are: (...) what the minimum of a safety requirement for a flood defence is that cannot be tampered with" (Regional Water Authority 1, 2018). And vice versa is it important to know what the interests of the municipality are. The cooperation is about sharing knowledge both ways and working towards the SRID (Regional Water Authority, 2018).

National Water Authority

The National Water Authority is the governmental organisation that is responsible for water management on a national level, as well as national infrastructure management. It is responsible for the legal requirements of primary flood defences, such as dykes that protect against rivers and the sea. The National Water Authority's current involvement is relatively short, for 1.5 years. The contact is responsible for large scale evacuations and events and usually has contact with the Safety Regions, the Police and the Ministry of Defence, who all play a role in evacuations. There is also contact with Regional Water Authorities are a regular contact. There is little direct contact with municipalities; the Safety Regions are the most important network organisations where partners like municipalities are encountered (National Water Authority, 2018).

Involvement with the SRID LL was initiated when the regional crisis coordinator saw that the SRID project in Dordrecht could have implications that are interesting on a national level, and the current contact got involved. The interest of the National Water Authority is the impact that the project can have for crisis management and evacuation on a national scale. The SRID project is therefore seen as a pilot with a focus on response FRMSs, such as evacuation in case of a flood. Involvement is therefore partly to keep an eye on the progress made and lessons that can be learned. The National Water Authority sees it as its tasks in the SRID project to add expertise and facilitate certain aspects of the SRID: "we can manage a lot of things in traffic flows and evacuation, (...) and not only moving, but also taking care of where people can go and what they can expect" (National Water Authority, 2018).

Safety Region Zuid-Holland Zuid

The Safety Region Zuid-Holland Zuid (Southern South Holland) is the Safety Region that contains the Municipality of Dordrecht. Safety Regions are a relatively new governmental body in the Netherlands, established in 2010. The Safety Regions are an extension of local government, and the board of the organisations consists of the mayors of the municipalities that are in its geographical area (Ministerie van Veiligheid en Justitie n.d.). It is tasked with the coordination of emergency preparation response, a task formerly appointed to the fire brigade. "The primary concerns of the Safety Regions are fire brigade service and hazardous substances and some healthcare service, but also other crises following from foreseeable risks are a task of the Safety Region to manage" (Safety Region 2, 2018). Two people from the Safety Region have been involved with the LL SRID. One of them is a programme manager on the topic of crisis management, on all types of crises. The main activities of this person consist of calculating the risks of different crisis types and weigh them relatively to each other in making a risk profile for regions. This person looks from a higher, regional level at the SRID and wants to add expertise on crisis management. The

involvement of the Safety Region has been since the MIRT researches and is based on sharing expertise: "when something goes wrong, we are the ones who are responsible for managing it, so the Safety Region needs to be involved with that [the SRID] and needs to share expertise" (Safety Region 2, 2018).

A second contact from the Safety Region is active in the SRID project. This is a policy advisor on the preparation for disasters and crises. He has a specific focus on the cooperation between partners in case of a crisis is organised. His tasks therefore have the focus of network management, coordination of national crisis management, keeping operations prepared, and some substantive work (Safety Region 1, 2018). This person is involved because the Municipality took the initiative for the project that the activities of the Safety Region relate to, and it is seen by the contact as a good platform to discuss the subject of crisis management for floods. The Safety Region sees itself as a network organisation around the subject of crisis preparation and response, that has an obligation to contribute to a project like this.

Research institutes

Another participant in the LL and therefore the FRGA, is a researcher from the IHE Institute for Water Education, that has been cooperating with the municipality for a long time. This institute in Delft offers master's degree education on the topic of water management to international students. The contact has expertise on water management and water safety. This contact was also responsible for the reporting on the MIRT researches. The involvement began through involvement of the institute in researches, such as the aforementioned MARE and Interreg researches for water safety in the Municipality of Dordrecht. At the time of this research this contact is working for the municipality part time, and the role in the LL SRID in the implementation phase is not yet clear. This contact was the facilitator of the backcasting workshop that was conducted as part of this study, because of expertise with workshops and water management in general. Municipality 2 (2018) mentions that other research partners in the past have been the Delft University, Utrecht University, Erasmus University from Rotterdam and Wageningen University.

Also, other research institutes have been part of the SRID researches in the past. Particular collaboration has occurred with HKV, a water research institute, that has done an several researches for Dordrecht: an impact analysis on water safety on the island of Dordrecht, an assessment of strategies for the SRID, and a research into public support for vertical evacuation in Dordrecht (Kolen and Zethof 2016; Waterschap Hollandse Delta et al. 2018; Terpstra and Vreugdenhil 2015). These have been important sources for the MIRT-research and report that was discussed earlier this chapter (Waterschap Hollandse Delta et al. 2018). The HKV institute does research commissioned by the Municipality, Safety Region, or Province and as such adds expertise and scientific support for the MIRT researches for broadening FRMSs.

Environmental Service Zuid-Holland Zuid

A recent addition in the past months to the LL is the Environmental Service Zuid-Holland Zuid (Southern South Holland). The Environmental Service organisations are executive governmental organisations for the municipalities and provinces and they act on permits, control, and enforcement on environmental issues. In practice, this means the Environmental Service is aware of industry or companies in a region that may have environmental impacts because of their activities. This knowledge made them see possible threats in case of a flood: "If you are trying to evacuate people from their homes, the last thing you need is a propane tank from a nearby industrial complex floating through the city streets" (Environmental Service 1, 2018). They want to make the other actors aware of these threats and make sure these are taken care of when deploying FRMSs for the SRID and can contribute by making industries aware of the threats their activities may pose in a flooding event.

Delta Programme

The actors just described collaborate explicitly on the SRID, but the Delta Programme as collaborative arrangement is also relevant. The Dutch delta is subject of a policy programme on the national level, the Delta Programme. The Delta Programme

produces progress reports every year, with the most recent one released in 2018 (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken 2019). The programme uses a research base including plausible scenarios for the Dutch river delta for 2050 and 2100 including drivers such as sea level rise, increased precipitation, river discharge, and social-economic growth (Wolters et al. 2018). The Delta Programme includes a decision on water safety for the Dutch delta, including a new way to set safety requirements of dykes for areas in the river delta. These decisions have been signed by Provinces, Municipalities, Regional Water Authorities and the Minister. Furthermore, implementation is specified in 'preferred strategies' that are developed by regional actors: the Province, Municipalities, Regional Water Authorities, Safety Regions, the national government and the private sector (Deltacommissaris n.d.). The interviewees from the Municipality of Dordrecht interviewed for this research take part in the directional and programme meetings respectively of the Delta Programme Rijnmond-Drechtsteden region. This collaboration in the scope of the Delta Programme is supportive for the function of Dordrecht as pilot for FRMSs and is an example of the Municipality as an organisation that strives for water safety and creating networks to continue the frontrunner efforts.

Summary of main actor findings

The main findings from this section that lists the actors, their purpose, their role in and contribution to the SRID, and collaborations, is displayed in Table 8.

Table 8. Overview of actors, their role in the SRID and main partners in the listing of actors in the FRGA

Actors	**Purpose of actor (organisation) in relation to SRID**	**Role in SRID**	**Collaboration and communication**
Municipality	Ensuring safety of citizens Being an example for the rest of the Netherlands People working on water risk and crisis management	Initiator and driving force of the LL SRID Being a pilot for Delta Programme Striving specifically for FRMS broadening	Internal alignment between water safety people Intense collaboration with Regional Water Authority in the past Hiring and contact with research institutes
Province	Making policy on water safety and secondary flood defences requirements Ensuring safety and economic value of the area Creating flood risk and safety maps	Dordrecht is geographic part of Province Expertise and legislative relevance	Collaboration with Regional Water Authority as executive agency on secondary flood defences
Regional Water Authority	Executive body on secondary flood defences and water safety	Regional Water Authority has Dordrecht in its geographical region Lending and gaining knowledge	Close partner of Municipality in SRID efforts
National Water Authority	Water management on a national level, primary flood defences Currently focus on crisis management	Monitoring Dordrecht as a pilot of managing water crises	Regular communication with Ministry of Infrastructure and Water Management, Safety Regions and Regional Water Authority
Safety Region	Calculating and comparing risks in the area Coordination of emergency preparation and response Being a network organisation on the subject between other relevant actors	Discuss water crisis management with all relevant actors Add expertise on crisis management	Municipalities are the partners because they constitute the Safety Region Contact with all other governmental actors
Research Institutes	Seeing broadening of FRMSs further developed Doing commissioned researches	Add expertise and research on technicalities and feasibility	Hired by Municipality, Province, Safety Regions and Regional Water Authority

Environmental Service	Permits and enforcement of environmental regulations	Identifying environmental threats by industries	Contact with Safety Region
Delta Programme	Water safety and availability of freshwater in Dutch delta	In need of pilots to develop FRMSs further Governmental partners needed to develop policies for the region	All governmental partners in the region are involved

6.2.2 Discourses

This section describes the discourses of that exist in the SRID FRGA. The operationalisation of the discourses dimension of the FRGA is displayed in Table 9. The discourses are presented in three categories: 1) discourses on the LL SRID, its goal, why it is important to participate in the LL and discourses on the cooperation that takes place, 2) discourses on the SRID, why it is needed, what an SRID means and how it can be achieved, 3) discourses that are related to the use of FRMSs to use. Attention is given to the actors that support certain discourses.

Table 9. Operationalisation of the Discourses dimension of a FRGA.

Discourses
Motivation for contributing to SRID
Perceived goal of FRMS in Dordrecht
Preference for FRMS to implement
Interpretation of SRID
Perceived progress towards SRID
Perceived need and feasibility of SRID
Long-term vision for Dordrecht

Discourses on the LL SRID

The Living Lab for the Self-Reliant Island of Dordrecht is perceived by some of the actors to be the simple continuation of the efforts for the SRID that have been going on since 2005. The research projects of MARE and the Interreg project, and later the MIRT researches, all were investigations by a group of partners into the possibilities of a SRID and broadening FRMSs. The LL is seen a as a continuation of the cooperation, with the LL being a new name for the efforts that were going on for some time. According to Researcher 1 (2018), after the MIRT researcher, when the 'smart combination' was not feasible, a new MIRT research was impossible and a new format for the project had to be found. There already was a LL on spatial adaption in Dordrecht, so another LL on the SRID was a good option. This is supported by the Municipality, saying that "it's not about the LL, it's about the collaboration" and "all partners, including the politically responsible aldermen, wanted to continue that" (Municipality 1, 2018).

Municipality 2 (2018) adds that the LL also means that students and researchers have role, and that citizens can come by and share expertise or opinions as well, and that having a lot of contacts to find funding is one of the characteristics of the LL. "A living lab is about discovering together, and spreading that knowledge" (Municipality 2, 2018). Students and interns do research and also publish that sometimes together with a consultancy firm. Participation with citizens was more common in the earlier stages of the programme, starting from 2000. People from the city were contacted and acted as water ambassadors, took part in spatial planning in the city. This helped solve conflicts with citizens, who became very dedicated in participating in projects. This citizen group is not active anymore, and now the municipality knows a few citizens that sometimes want to come, but there is no active group or pool of citizens (Municipality 2, 2018).

Some partners note that the arrangement of the LL is not completely clear to them: "It would be good if they have something to present themselves in a simple way, (...) not only for citizens, but also for organisations" (National Water Authority 1, 2018). According to the Regional Water Authority, this is one of the characteristics of a LL: "in the first place it is a place to meet" (Regional Water Authority, 2018).

The LL SRID has a focus on implementation of the results from the MIRT research: "The results from the MIRT research was a water safety plan with a follow-up agenda and we are making that more concrete for implementation in an action plan"

(Municipality 2, 2018). Also the Province sees working towards the SRID as the main goal of the LL, as well as using the gathered knowledge and experience elsewhere. Furthermore, for this implementation and how that has to work, a lot of knowledge still has to be gathered: "It has not been done in the Netherlands, so there is not a template lying around somewhere on how to realise a shelter" (Municipality 2, 2018). Also the National Water Authority one sees it as a "space to do research and experiment" (National Water Authority 1, 2018). Another goal of the LL is to gather knowledge that can be used more general in the Netherlands (Province 1, 2018; National Water Authority 1, 2018).

The formal existence of the living lab is that of an informal working group. However, there is now a formal improvement by the directors within the municipality for a programme of two years, with an evaluation by directors and the politically responsible aldermen after one year. The directors agreed on the action plan of the LL for the coming two years; the action plan is an internal document written by the Municipality on behalf of all partners that contains agreements on commitments from the involved partners of several meetings a week and elaborates on the different identified policies that need to be researched or start implementation and the responsible actor. In essence, it contains what the LL is for the coming years: the aforementioned group of actors working towards the SRID, defined by some FRMS measures, that will be elaborated on later.

There is freedom for innovation at the LL: the Municipality is the initiator and main driving force, but has a lot of freedom because water safety is not one of the formal tasks of a municipality in the Netherlands, while the Municipality has significant human resource committed to it in the form of two policy makers committed to climate adaptation and water safety. This makes for a lot of freedom in the LL (Researcher 1, 2018). This freedom gives room for more free thinking, but the disadvantage is that there is no budget and projects need to be funded by a partner; however, there are endless connections and a lot of exchanges, so you can achieve a lot with a small group (Municipality 1, 2018).

The LL is considered by some to be suitable to plan for the long term, however a lot of the partners did not have a clear view on that when asked. The Regional Water Authority (2018) sees the LL as a good way to look far ahead, with 10 years as the shortest term, but towards 2100 is also a possibility. "For the Living Lab it makes sense to look this far ahead on some subjects, for instance sea level rise: what scenarios do we consider" (Regional Water Authority, 2018). This considers a role of the LL to plan for a much more distant future than acknowledged by other actors and includes considering different future climate scenarios in that planning process.

Discourses on the SRID

When asked if and when the SRID was needed, there were some deviances in responses. Actors like the Municipality, the Regional Water Authority, and the Safety Region, agreed that this was something that was very needed, because Dordrecht is a place that is in larger danger than most areas. However, it was heard that Dordrecht is not the area in the Netherlands in most danger, and that due to the increased safety requirements of flood defences towards 2050, Dordrecht will be in less danger in 2050 than it is now (Province 1, 2018). However, many arguments are given in favour of the necessity of an SIRD, such as the low evacuation rate off the island of 20% (Researcher 1, 2018), the group risk for Dordrecht that was identified (Regional Water Authority 1, 2018), the increased threats due to climate change (Municipality 1, 2018). The actors that see less urgent need for a SRID, couple that with the discourse on a project that does not implement large measures, but does some small things that take little effort anyway, such as informing citizens what to do in case of a flood (Province 1, 2018). This way, with little effort, a fall-back system when something goes wrong can be created.

All actors think the SRID is achievable, and most talk about relatively short periods of time. When asked if Dordrecht is self-reliant already, the Municipality stresses that to some degree, this is already the case. The SRID has, due to its long history in Dordrecht, had some attention before by expositions and questionnaires (Municipality 1, 2018). Most actors see the need to develop this self-reliance further in the coming year and think this is possible. It is hard to get an opinion on the long term, as

actors tend to think a few years ahead when thinking about the SRID. The Municipality sees a time frame of four years: “In four years we need to be able to say that we are self-reliant; or as self-reliant as we can be” (Municipality 1, 2018).

All partners have a rather clear idea of the definition of a SRID, as this was discussed before and also put in the concept document for the action plan by the Municipality at the time of the interviews. All partners mention the principle of vertical evacuation as the main feature of the SRID. Furthermore, when there is time, horizontal evacuation will take place, and there is an aim for shelters and a communication strategy (Researcher 1, 2018). Multiple actors also stress that the efforts for the SRID mean that there is smart thinking about different FRMSs and how to use them next to each other: “The use of FRMS in different MLS layers is what makes the project so interesting” (Safety Region 2, 2018). The main FRMS that actors think contribute to the SRID are mitigation, preparation and response. Mitigation in the form of shelters that people can use to evacuate towards, and people being able to use the top floor of their house for vertical evacuation. People need to be able to survive in these places for two hours up until a week. This means preparation is needed in the form of heating and food, and power is also mentioned by several actors. Some actors think houses need to be equipped to have electricity in case of a flood, but not all think this is feasible. Other preparation methods consist of governmental organisations, emergency services, and healthcare services with vulnerable people are prepared for a flooding emergency. One of the major measures to reach this is deemed communication towards the inhabitants.

Discourses on FRMS

The MIRT research identified a range of FRMSs that have been put into more concrete actions in the recent action plan. The list of actions from this plan is displayed in

Table 10. The LL ordered the measures into prevention, spatial adaptation, evacuation and communication, parallel to the MLS approach layers. This means that the prevention measures fall under the definition in this study of defence. Spatial adaptation consists a list of mitigation measures, and two preparation measures (mooring sites and vital and vulnerable). Evacuation and communication are a mix of preparation and response measures, and also an investigation into the recovery possibilities. It is visible that the aim is to go for a broad range of FRMSs, of which many have been identified, with some in an implementation phase and others needing further research. This discrepancy between measures is notable in an action plan and it becomes obvious that no time frame is attached to the measures. While in the interviews most actors thought that the SRID efforts can be completed in 2-10 years, this does not become obvious from the action plan and is not something people mentioned during the interviews.

Noted in the interview was that a delta dyke, a very strong dyke at the upstream side of the island of Dordrecht still the best option from a purely safety point of view (Municipality 2, 2018). It is now a stronger dyke than required by legal norms, and the Municipality now wants to keep the extra strength, even if the norms increase in the future.

The effort for broadening FRMSs is seen by the Municipality as a unique one in the Netherlands: “At the Delta programme preparation and response were not an issue that was discussed, and we tried to push that. Now we developed a strategy on our own and are the first municipality in the Netherlands to start with implementation” (Municipality 2, 2018).

Table 10. List of actions in different FRMS categories for the LL SRID, adapted from the internally used action plan of the LL.

Subject	*Description*	*Involved partners*
Prevention Strategy		
Voorstraat street	Assessment of the procedure of closing flood defence at Voorstraat	Regional Water Authority
Extra strong dyke	Assuring extra strong dyke at the Kop van het Land location	Regional Water Authority
Regional flood defences	Preservation requirements, new developments on legal requirements – trees on the Zeedijk dyke	Regional Water Authority and Province
Spatial adaptation strategy		
Adaptation strategy outside the dykes	Develop strategy for outside the dykes, offer perspective to citizens	Municipality
Risk profiles	Engage in risk dialogue on the basis of risk profile functions	Municipality and Environmental Service
Plan of requirements for shelter locations	Develop plan of requirements for shelter locations	Municipality, Environmental Service, Safety Region, Province
Mooring sites	Investigate possibilities for mooring sites as part of the Saving Man and Animal project of WAVE2020	Safety Region
Vital and vulnerable	Research into the effects of power failure to healthcare and dependent people living at home	Municipality, Safety Region
Evacuation strategy		
Evacuation routes	Research into Reverse Lanes – Action perspectives evacuation	National Water Authority, Safety Region
Scale up decision making	Elaborate results of the set of blocks on flood casualties from the MIRT result with the water management centre	Province, Safety Region
Flooding scenarios and chances	Update flood risk maps, advise on impact analyses, prepare to assess conditional flooding chance	Province, Regional Water Authority, Safety Region
Recovery	Explore possibilities, couple to strategic agenda of safety council; Continuity in society.	Municipality
Practice and training	Train governors and advisors on the new strategy	Safety Region
Communication strategy		
Risk communication	Advance self-reliance	Municipality of Dordrecht, Safety Region, Regional Water Board
Crisis communication	Elaborate water safety plan	Safety Region

6.2.3 Rules

This section goes into the rules dimension of the FRGA. It goes into the role of legislation in the SRID project and shows the legal instruments that actors in the FRGA have at their disposal. Finally, some legal constraints that were perceived by the interviewed actors are presented.

Table 11. The operationalisation of the rules dimension of a FRGA.

Rules
Role of legislation in activities
Role of legislation in contribution to SRID
Role of specific water legislation
Role of national legislation
Legislative instruments at the disposal of the organisation
Perceived constraining legislation

As was discussed prior, the work form of the LL SRID is not bound by legislation. By creating the action plan for the coming two years, the partners committed effort to the LL SRID in the form of an agreement rather than an obligation to participate in the project. Also, the initiation of the project for the SRID was not directly motivated by law, however Municipality 1 (2018) mentioned that the obligation of the Municipality to ensure the safety of its citizens was reason to look further into water safety at the time. The lack of legislation on other FRMSs such as preparation for evacuation or shelter locations, gives the LL room to think freely about these subjects and dedicate time as they see fit, but also means that it is harder to find the necessary resources to work on achieving the SRID and the specific measures need time, because there are not existing examples in the Netherlands (Researcher 1, 2018). Since September 2018, the LL has the approval of the directors of the organisations involved in the LL, giving the LL some status as to the efforts of the actors involved, for the next two years.

As said, some actors pointed at the fact that they are responsible for legislation on flood defence an that therefore then felt the obligation to participate in the project. However, the Regional Water Authority also mentioned that there strictly is no obligation to participate, firstly because everyone has been appointed separate tasks in the water system, and secondly because a specialised governmental organisation like the Regional Water Authority should not interfere with the tasks appointed to a general governmental organisation at a lower level, such as the Municipality (Regional Water Authority 1, 2018). However, it is important to know each other's interests in these matters, share knowledge both ways, and gain something on a higher level. Because the SRID project touches upon their responsible fields of expertise, they feel the obligation to participate. This is why most of the organisations participate in the SRID.

Perceived barriers include the funding of projects: "the Delta Fund only wants to fund what is the most cost effective one" (Municipality 1, 2018). This may hamper using multiple FRMSs, as only one can be the most cost-effective option. Furthermore, secondary or regional flood defences now only have a preservation requirement, while a numeral norm requirement would help in using them in flood defences (Province 1, 2018).

An important piece of legislation in the project for the SRID has been, and still is, the legal requirement for flood defences. In the Netherlands, the legislation for dyke requirements changed in 2017 (Rijksoverheid n.d.; Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken 2014). Every Dutch person should have a chance of 1:100.000 per year that he or she dies because of a flood. The former requirements were based on a dyke breach, while the new norms are based on the chance of casualties. The Regional and National Water Boards have until 2050 to get the dykes up to the 1:100.000 requirement. Still the Delta Decision that presented these changes, states that only in very specific cases a deviation from defence FRMSs is possible, in the form of a cost efficient smart combination with other FRMSs (Ministerie van Infrastructuur en Milieu and Ministerie van Economische Zaken 2014). According to the interviewee form the Regional Water Authority it is a possibility to propose this to get funding for another FRMS instead of a primary dyke, which would be new, but not unthinkable if a solid proposal with a group of actors is made. Currently, the legislation is a barrier to broadening FRMSs, and a shift is not yet visible on a national level. In the case of the SRID, this explains the effort by the municipality to do something extra for the city of Dordrecht by making efforts to add other FRMSs to the primary defences. This is one of the reasons Dordrecht can play an important role in finding out how well the requirement can be met with other ways to decrease the chance for casualties in case of a flood, such as facilitating vertical evacuation with shelters.

6.2.4 Power and Resources

This section describes the power and resources of the actors involved in the SRID FRGA.

For the project of the SRID, the lack of resources that are directly linked to the project was already touched upon. This can be explained by the lack of legal status of other FRMSs than defence in the Netherlands and the own efforts of several governmental bodies to work on this project outside of the usual activities. This means that resources have to be found elsewhere, and subsidies or other projects that the SRID project can couple to are continuously sought.

The **Municipality** has the most resources dedicated to the project, with two people working on it part time. Furthermore, the Municipality was the initiator of the project, and the project is somewhat looked up to by other actors as a pilot that they can learn from. The Municipality is also in charge when it comes to inviting other organisations to the LL. Also, the Municipality reports meetings and was the main writer of the action plan, that is the main document of agreement between the partners. Furthermore, the Municipality has been working with other partners in the Delta Programme for a long time, with other governmental bodies and research institutes, giving them a strong resource base in terms of network and expertise. These factors make the Municipality a very powerful actor in the FRGA, with the ability to steer the project to a large extent: what things are worked on most, who is involved, what projects are possible to implement, is all up to the Municipality.

As for the resources other actors contribute, this is much less. Most other organisations contribute one person with very little to no formal time dedicated to the project. The actors commit 8 days of work to the project per year, as agreed upon by the actin plan (Municipality document, 2018). do however have other ways to have influence on the project. The **National Water Authority** and **Province** have legislative power; however, the National Water Authority has little intention of contributing to the SRID project: it focuses on some separate projects and wants to keep an eye on the SRID project to see if it can be used on a national scale. The Province is also on a higher governmental level and not too attached to the SRID project, but has a lot of relevant knowledge to share as the province deals with legislation on regional defences and has expertise on flood risks for specific areas.

The **Safety Region** has two people involved, but they admit that very little time is spent on the SRID project (Safety Region 1, 2018). They see themselves as a network organisation, with connections to all partners that have something to do with crisis management. Furthermore, they have much knowledge and expertise available, especially on the topics of preparation and response measures. This makes them relatively powerful.

The **Regional Water Authority** has a lot of expertise on flood defences and has a contact in the living lab that has much knowledge and expertise on the administrative and legislative processes around water safety on a level higher than the municipality. They have been working with the Municipality for a long time and therefore are relatively invested in the project. Legally the Regional Water Authority is dependent on the Province, as it has specific executive tasks. The Regional Water Authority is therefore moderately powerful in the project.

The **Environmental Service** is relatively new to the project and has expertise on a small portion of the topic of water safety. The contact is very dedicated and wants to contribute to the project. But still this actor has relatively little power.

The **IHE Institute of Water Education** has a very good relationship with the municipality as the contact is also hired as a freelancer to work on the project. The contact has a history with the project and relevant expertise. As the first external expert, this means a moderate amount of power to determine the direction of the project.

An overview of the actors and their power is shown in Table 12.

Table 12. Overview of the Power and Resources dimension of the FRGA.

Actors	Time	Financial	Legal Instruments	Knowledge	Network
Municipality	Two persons on water safety and spatial adaptation	-	Spatial planning Communication to citizens and private sector	Expertise with SRID, FRMSs and research results over the years	Large network from LL, Delta Programme, earlier researches
Province	LL participant	-	Secondary flood defences legislation	Water risk maps	Standard network
Regional Water Authority	LL participant	-	-	Insights in possibilities with defence standards and long experience in SRID efforts	Close to Municipality, standard network on SRID
National Water Authority	LL participant	-	No SRID relevant instruments found	Expertise on large scale crisis management	Large network on crisis management on national-regional level
Safety Region	2 part time LL participants	-	-	Large expertise on risks and crisis management	Large network on crisis management on regional-local level
Research Institutes	1 LL participant	-	-	Expertise on water management	Network in research world connected with several governmental bodies
Environmental Service	LL participant	-	Permitting firms	Knowledge on environmental crises related to private businesses	Network with firms and several governmental bodies
Delta Programme	-	-	Delta Decisions and 'preferred strategies' implementation	Expertise on water safety and other water related problems	Large networking group

6.3 Chapter conclusion

The research question answered in this chapter is "What does the flood risk governance arrangement in Dordrecht look like as characterised by the relevant elements found in question 2?" The relevant elements from question two are the actors, discourses, rules, power and resources of a FRGA. These four dimensions form the institutional background of the backcasting exercise. In answer to the research question, the four dimensions of the FRGA are summarised below.

Actors

It becomes clear from the listing of actors that the Municipality, Province, Regional Water Authority and Safety Region are most invested in the SRID from the reasoning of citizen safety, or their direct role in water safety, whereas the National Water Authority and Delta Programme are interested in the SRID as a pilot. Most actors see their role as supportive of the efforts of the Municipality, with a focus on sharing knowledge, both giving and receiving. The municipality is the main problem owner and has the clearest vision in wanting to broaden FRMSs for safety and being a pilot and an example to the rest of the Netherlands. In communication and collaboration, the Municipality, Safety Region and Delta Programme are real network organisations on the SRID, crisis management and water management respectively. The partners connect through these arrangements.

Discourses

Distinction was made between discourses on the LL, the SRID and FRMSs. As for discourses on the LL, it is seen as a logical continuation of efforts to strive for an island of Dordrecht that is better protected against flood risks, following from several earlier conducted researches and pilot programme as part of the Delta Programme. The LL is perceived by most to be a working group and a physical place with room for participation by external experts and citizens. There is a lot of freedom of thinking in

the living lab because of its minor embedding in policy programmes, but this hurts the available resources. There The focus of the LL is research into and actual implementation of FRMSs that have been identified in earlier researches. A long-term view for the LL is mostly absent; some see the need to plan towards 2100 for water safety.

About the SRID, most actors see it as obvious that it is needed, given the low evacuation rate possible in Dordrecht. Some stress that other areas are in more danger and that the dyke requirements for 2050 will mean defences will make the island safer towards 2050 anyway. They see small efforts and measures for an SRID as an easy to achieve fall-back for the eventuality that something goes wrong. All actors think that the SRID can be achieved with current identified measures to a satisfactory level, with further improvements on the long term. The SRID vision is shared among actors; it consists of mitigation, preparation and response FRMSs with vertical evacuation being the main strategy, followed by horizontal evacuation in the subsequent days or week. Recovery is sometimes mentioned as well.

On FRMSs, the action plan resulting from the MIRT researches is leading, with measures identified in all MLS layers, which translate to defence, mitigation, preparation, response and recovery measures, showing the aim for a broad range of FRMSs. Actors are assigned to each FRMS; however, no end date is identified, other than that the current LL project is evaluated after 2 years.

Rules

Legislation plays a small role in the LL and SRID, as the projects are initiated by the motivation of the Municipality to do something extra for the safety of its citizens, and commit resources to that without requiring specific results. This is good for exploring new areas, but a lack of financial resources is encountered and designing and implementing a new measure takes a lot of time and effort. Other actors also indicate that strictly they do not have to participate in the project, but they see benefits in knowledge sharing and building expertise. With the LL action plan approved by directors of the participating actors, a small commitment of these actors is agreed upon. National legislation can make for a barrier in the broadening of FRMSs, as only the most cost efficient FRMSs are funded and secondary defences have no numeral standards, promoting entrenched defence technologies in the Netherlands. Some actors see small opportunities to propose other FRMSs to get an area up to safety standards, but as of now this is not yet possible.

Power and resources

There is a lack of financial resources dedicated to the SRID project. Funds are found by trying to link specific implementation measures to other projects that do have funding. As to time, the municipality has the most invested in the SRID project by far, with two people working on water safety and spatial adaptation, while the other actors have a LL participant committed to eight days of work on the project. The Municipality and province are those with legislative power in their respective fields. Absent from the actor groups is the Ministry of Infrastructure and Water Management, with legislative power on primary flood defences and dyke standards. Knowledge exists in the group on water management, water safety and crisis management, with expertise spread among actors. Especially the Municipality and Safety Region seem to have strong network relevant to the SRID project, with the Delta Programme a place where all meet. Overall, the municipality is dominant in the direction of the project, but it needs others to achieve an SRID.

7 Design of an ideal backcasting approach for the SRID FRGA

This chapter presents a backcasting approach for the FRGA for the SRID, which answers the research sub-question: "What practices are potentially useful in a long-term strategic planning design in the governance arrangement of Dordrecht based on good practices from literature (question 1) and the analysis of the flood risk governance arrangement in Dordrecht (questions 2 and 3)?" As the question shows, the results from the other chapters were used as input for the backcasting design. The good practices from Chapter 4 served as the basis for a backcasting approach, and the empirical results from Chapter 6 served to create a tailor-made approach for the FRGA for the SRID. The good practices were used as a guideline through this chapter, from backcasting step one to five, discussing for every step the use of the good practices in the tailor-made backcasting approach. The result of this chapter is an 'ideal' backcasting approach for the SRID FRGA. The ideal approach was used for the backcasting workshop with the FRGA in Dordrecht that is presented and evaluated in Chapter 8.

The chapter starts with a notion on the function of a backcasting approach for the SRID FRGA based on the results of the empirical chapter on the FRGA. The subsequent section goes through the five steps of the good backcasting practices as presented in Chapter 4.

7.1 The goal of backcasting for the SRID FRGA

The sketch of the history in the development of plans on the SRID and the results it has yielded so far, show that the transition towards broader use of FRMSs in Dordrecht has already been set in motion. One of the merits of a backcasting approach is to break free from entrenched practices to start a transition. As for the Netherlands primary flood defences are still the dominant and entrenched FRMS, for Dordrecht thinking about FRMSs has already moved on, and implementation is starting. Still, backcasting may be useful: firstly, not all participants in the LL have the same view on the SRID, as the concept has always been very much the idea of the municipality, to which others contributed. The goal of joint implementation would benefit from all partners working towards the same goal and having the same 'leitmotiv' in the implementation phase. Secondly, in the implementation of the SRID partners are needed that are not involved yet actively, such as businesses and citizens. The governmental partners would benefit from a clear future vision to communicate to other actors in a later stage, when they are involved in the implementation of measures, or when they are involved in a backcasting session with the citizens and businesses. Furthermore, if a vision is clearly defined by a backcasting approach among the LL partners, this may have implications for the short-term implementation agenda and for the mid to long term research and implementation agenda. Another important goal of backcasting can be to test the robustness of measures, as discussed in Chapter 4 on the good backcasting practices. This can be done by creating exploratory scenarios, that test measures in different possible futures. This can be an improvement on a future vision, the steps towards it, and the short-term implementation agenda.

The goal of a backcasting approach for the municipality, based on the current state of affairs in working towards a SIRD by the FRGA as collaborating in the LL, consists of the following points:

- Discuss and align future visions among LL partners;
- Identify steps to reach a shared future vision on long and short term;
- Compare the resulting steps and policies with the existing action plan and complement the action plan;
- Test the robustness of steps, measures and the action plan by testing them in the context of several possible futures.

The steps of the ideal backcasting approach are discussed in the next section.

7.2 Step 1: Strategic problem orientation

In step one of the good practices, the problem needed to be defined, the relation of the problem to the stakeholders explained, and the stakeholders with their problem and solution perceptions, interests, relations, and resources mapped. This is recalled in Table 13.

Table 13. The good practices for step one of a backcasting approach as recalled from Chapter 4.

Step 1	Define the problem including unwanted trends that need to be breached;
	Generate exploratory scenarios containing possible futures;
	Map the possible solutions;
	Investigate the relation of the problem to the function of stakeholders;
	Map stakeholders, including their problem and solution perceptions, interest, relations, and resources.

Problem and unwanted trends

The problem and unwanted trends are clear within the SRID FRGA. The problem was defined by actors as the safety of the citizens of Dordrecht that is in danger because of the high impacts a flood can have in the area. Only 20% of the citizens can be evacuated, making Dordrecht qualify as having a group risk for floods. The trend in the Netherlands is to focus only on flood defences as FRMS, and this has been the case in Dordrecht. This means that nothing is done to reduce the risk of casualties in case a flood does occur, when flood defences fail. The urgency actors attach to the problem differs, as some stress that flood defences are at a high level and will be increased up to 2050. However, all actors agree that the problem exists and breaking the trend has merits.

Exploratory scenarios

From the research into the FRGA it became clear that actors do not mention possible futures in their discourses explicitly when the SRID is discussed. They can however be seen in the background of the SRID activities as the Delta Programme does use scenarios for 2050 and 2100 are part of the background of the activities. Climate change and socio-economic growth are part of the scenarios used in the Delta Programme, which is part of the background of the SRID project. The impact analysis for the island of Dordrecht, showing water safety threats to the island, does not include future scenarios.

No exploratory scenarios for the long-term future of the island of Dordrecht were found. For the next step of creating a vision for the island, this is not a problem, as most actors already have a vision. However, to test the robustness of a vision and measures taken in the backcasting step, exploratory scenarios can be very useful. This research does not create exploratory scenarios, but suggests that the SRID is tested for robustness by creating exploratory scenarios, with the scenarios from the Delta Programme and the impact analysis of the Water Safety Plan as starting point (Wolters et al. 2018; Kolen and Zethof 2016).

Map possible solutions

The possibilities as to ensuring safety for citizens and breaking the trend of focus on one FRMS, is using multiple FRMSs from different categories, such as prevention, mitigation, preparation, response and recovery on top of defence FRMSs. This goal is clear among all actors. There are different possibilities in which FRMSs to use, which has been discussed in the SRID project over the past year in several researches with the result of a list of FRMSs in a current plan of action. The mapping of possible solutions is therefore considered to be done extensively over the past years and is not a focus of a backcasting approach at this time.

Relation between problem and stakeholders

The stakeholders have different roles to play in solving the problem. There are three main functions identifiable: the Municipality has to care for its citizens, and therefore cares about the water safety in Dordrecht. Other actors support Dordrecht in these efforts because they too see that Dordrecht has a problem with a focus on only defence FRMSs and they see a role for themselves if they are called upon. This is often based on knowledge and expertise sharing between stakeholders to bring the field of water safety in the Netherlands further. Also some actors on higher governmental levels see Dordrecht as a pilot for the rest of the Netherlands. The function of the Regional Water Authority and the Province is in water management, which relates to the problem through floods that they have responsibility and expertise on. The same goes for the Safety Region and the National Water Authority on crisis management. The IHE contact has expertise in both these fields. The Environmental Service sees a role in crisis management for itself, for it has expertise on hazardous activities of industries that are affected by floods. The actors investigated see the problem for Dordrecht and feel motivated to help, share knowledge and expertise, and use the results of Dordrecht as a pilot.

The mapping of stakeholders

The stakeholders have been mapped in Chapter 6 extensively to investigate the institutional setting of the backcasting approach. The results from Chapter 6 are used in designing this ideal backcasting approach. For details on the mapping of stakeholders, Chapter 6 can be consulted.

7.3 On participants

This section concerns the participants that need to be included in a backcasting design for the SRID FRGA. The good practices on including participants are shown in Table 14.

Table 14. The good practices for participant selection in a backcasting approach as found in Chapter 4.

Participants	Companies, research bodies, government bodies, public interest groups and the public are considered;
	Participants are chosen based on qualities suited to the step of the backcasting approach;
	Number needs to be representative when needed for the backcasting step;
	Minding heterogeneity, including spatial distribution, age, role in the policy process.

As for the types of participants to involve, the SRID FRGA already includes research bodies and relevant governmental bodies. Public interest groups, companies and the public are only sparsely involved. Actors form the FRGA have mentioned that citizens were more closely involved in the past, but that this has reduced in the past years. As some of the FRGAs discussed require action from citizens and communication towards citizens is one of the major actions in the FRGA action plan, involving citizens is crucial and should be done when actions for FRMSs in Dordrecht are elaborated in the fourth step. This can be done by inviting citizens or public interest groups. The same goes for companies in the region, and their buildings may play a role in evacuation and their activities. Therefore, involving companies in the elaboration phase is deemed useful. Inviting citizens and companies for creativity in step two and three is suggested by the good backcasting practices, however due to the current situation of the FRGA, with an already existing vision and backcasting done to some extent, it is deemed unlikely that adding societal groups to this process is fruitful: the existing actors in the FRGA have advanced ideas on the vision and steps to take and are unlikely to accept changes by societal groups as they feel owner of the solutions.

Considering the steps of the backcasting approach, the current actors of the FRGA, research bodies and the Municipality, Regional Water Authority, Province and Safety Region are considered to be best to include in all steps of a backcasting approach, as they have expertise and a long history on the project. For the visioning step, these governmental actors and the

involved research institutes are deemed the best actors to involve. For the elaboration phase, citizens and companies can be very useful to include to create support for the identified actions and measures and help working on feasibility. In this phase the Environmental Service and National Water Authority are also useful to include for connection with higher governmental levels, elaboration and feasibility of ideas, and working on a follow-up agenda. In the last step on the implementation, all actors will have a role that is determined in that step.

Having a representative number for governmental organisations and research bodies can be ensured by asking if two persons from each organisation can be present. For the Safety Region and Municipality, that already have two people involved, it showed that this adds more relevant expertise: from the Safety Region an expert on risks and one on crises is involved, representing the preparation and response in FRMSs. For citizens and companies, two persons of an interest group can be invited, or a small group of citizens can be selected. As for minding heterogeneity, citizens that participate can be randomly selected, or a citizen from different neighbourhoods can be selected.

7.4 Step 2: Constructing future visions or scenarios

This section gives the ideal design for the second step of the backcasting approach: constructing future visions or scenarios. The good backcasting practices for this step from Chapter 4 are recalled in Table 15.

Table 15. The good practices for step 2 of a backcasting approach as found in Chapter 4.

Step 2	The end-point date is more than 25 year away and further away than common planning time spans;
	Multiple visions by participants or prepared beforehand;
	A large number of participants can help creativity;
	Methods to foster creativity need to be used to avoid locked in thinking;
	Maintain a level of continuity in the line of reasoning to foster learning by an iterative process;
	Opportunities and barriers toward the visions help to guide later steps in the backcasting process.

The end-point date for the visioning step is suggested to be further away than common planning time spans. The common planning time span can be considered from the point of view of the Municipality. The typical planning time span is the time the Municipal council and aldermen are appointed, which is four years. However, against the background of the Delta Programme, that plans for 2050, the planning time span can be interpreted as around 30-40 years, as the Delta Programme started years ago. For the Municipality looking further than four years can be considered looking further than usually. The good practices suggest choosing an end-point at least 25 years ahead, which in this case is 2043. Considering the Delta Programme, 2050 is a good end-point to use for the visioning step in this backcasting approach, as it is more than 25 years ahead and aligns the efforts with the Delta Programme.

The good practices suggest creating multiple visions or scenarios for the chosen end-point of 2050. The choice to strive for an SRID by broadening the used FRMSs, is a vision for the future of Dordrecht. This means the FRGA already has a vision for Dordrecht. As noted before however, the Municipality has the with to discuss the vision to make sure all involved in the FRGA have the same vision. Furthermore, form the FRGA analysis it became clear that the long-term future is not mentioned when speaking about the SRID, as most actors see it as a project for the coming years. This means that visioning in the backcasting approach can serve two purposes: aligning visions for the SRID that already exist among actors and creating a vision for the longer term. The ideal backcasting approach therefore wants the actors to come up with visions for 2050 for an SRID with broad use of FRMSs and these visions are ideally aligned into one shared vision. The participants are also encouraged to identify at least two opportunities and barriers to reach the vision.

The good practices suggest using a large number of participants to foster creativity in the visioning. Creativity can further be encouraged by interviewing participants first, then having the different groups first discuss in their own separate groups or sessions, before merging the groups and discussing the results from the separate groups. A line of reasoning is maintained by focusing on visions for self-reliance of citizens to survive a flooding event and by having the separate groups discuss visions for the same end-point and focus on FRMS to reach an SRID; also the visions are further discussed in the aggregated groups.

7.5 Step 3: Backcasting

This section gives the ideal design for the third step of the backcasting approach: backcasting. The good backcasting practices for this step from Chapter 4 are recalled in Table 16.

Table 16. The good practices for step 3 of a backcasting approach as found in Chapter 4.

Step 3	Backcasting needs to fill the gap between vision and current state with actions to reach the vision;
	Earlier identified obstacles, opportunities, or uncertainties can help create policies;
	A balance needs to be found in detail of the intermediate results and too much complexity for participants;
	A result with multiple pathways or strategies makes for a more elaborate and flexible result;
	Visual tools help create a timeline or pathway.

The backcasting step fills the gap between the current situation and the vision in 2050. As described earlier, the four central governmental organisations and research bodies take part in this step. There needs to be a balance between complexity and the level of detail that is attempted in this step. For the FRGA, with a lot of expertise on existing measures and a lot of possible FRMS already identified, the level of detail can be such that a distinction can be made between intermediate goals on the long, medium and short term, and specific policy measures to achieve these goals on the long, medium and short term. The obstacles and opportunities of step two serve as inspiration for the intermediate goals and measures, on top of the vision in 2050. The elements are put on a timeline that shows the vision in 2050. Specific room for multiple pathways is created by drawing three lines on the timeline from the start.

The methods of this step include interviews beforehand in which participants are asked how they would want to reach the future vision for the SRID in 2050. This is followed by face-to-face discussion session and the use of a visual timeline with a focus on the vision backwards to the current situation. During this session, participants are encouraged to discuss first in smaller groups and then discuss with the whole groups, to generate more creativity before sharing the ideas with the whole group.

To ensure the backwards thinking, first long-term intermediate goals are identified for 2040, then for 2030 and for 2020. These intermediate goals help in assessing the place of policies on the timeline. After this, policies are identified to reach the goals ant these are put on the timeline where they should be implemented. The existence and structuring of pathways is let to the participants and analysed afterwards: participants can suggest that different policy pathways can be distinguished and in the analysis of results it can become clear that the policies are part of different pathways towards the vision.

7.6 Step 4: Elaboration, analysis, defining follow-up agenda

This section gives the ideal design for the fourth step of the backcasting approach: elaboration, analysis and defining a follow-up agenda. The good backcasting practices for this step from Chapter 4 are recalled

Table 17.

Table 17. The good practices for step 4 of a backcasting approach as found in Chapter 4.

Step 4	Identify if certain visions or pathways need elaboration or reconsideration;
	Organise focused session with participants for parts that need elaboration;
	Create qualitative exploratory scenarios to find robust policies;
	For implementation, assess feasibility, acceptability and barriers with policy makers;
	Create a follow-up agenda with the needed actions towards the vision.

Between the backcasting step and this step, the results of the backcasting step need to be mapped and the pathways towards the vision need to be identified. This analysis can be done by a researcher or one of the participants, such as the dominant actor, the Municipality. It can become clear that the vision or certain policies or pathways need elaboration. These elements are discussed in a subsequent session, or meetings with the relevant participants, to get the needed clarification.

This is also the step to introduce exploratory scenarios as suggested by the good practices. This can be done by an expert that creates exploratory scenarios based on the scenarios from the Delta Programme and impact analysis for the Water Safety Plan of Dordrecht, or a session can be held in which participants with expertise, from the governmental organisations and research bodies of the FRGA, create qualitative scenarios. The result of either of these methods is commonly a set of four scenarios. The pathways from the backcasting session can be tested against these scenarios, separating robust pathways and policies from those that do not hold in certain scenarios. This use of exploratory scenarios in the backcasting approach helps to generate more robust results.

The assessment of feasibility, acceptability and barriers is suggested by the good practices by having policy makers assess these. As policy makers are important in the whole backcasting approach, the approach for the SRID FRGA is to include citizen and company representatives at this point, to get their opinion in the identified policies and to make a start in including them in the follow-up and implementation. Participation by these actors is stimulated by lowering the threshold through using interviews beforehand on their ideas, that they can than share in one on one discussions with policy makers.

The result is a follow-up agenda with robust and feasible policy pathways and individual policies to reach the SRID in 2050. This follow-up agenda is to be compared to the MIRT-research results, as a follow-up agenda was included with these results. Differences and similarities need to be discussed and an aggregate follow-up agenda created.

7.7 Step 5: Embedding of results, generating follow-up and implementation

This section gives the ideal design for the fifth step of the backcasting approach: embedding of results and generating follow-up and implementation. The good backcasting practices for this step from Chapter 4 are recalled in Table 18.

Table 18. The good practices for step 5 of a backcasting approach as found in Chapter 4.

Step 5	Create action agenda for the short term;
	Create research agenda for the short term;
	Define responsibilities and form of collaboration;
	Embed results in formal decision making processes.

Step five is concerned with translating the results from step four to actions for the short term, to start working towards the vision in 2050. The pathways and policies were already identified for the long, mid, and short term, meaning that the short term actions can be used in the short term action agenda.

From the analysis of the FRGA, it became clear that an action agenda was made for the LL SRID, including policies and a research agenda for the short term, responsibilities of the FRGA actors and that in September 2018 the LL and its activities were acknowledged by the directors of the participating actors, institutionalising the LL efforts for the SRID. The LL actors have been using these exact good practices.

In this situation, therefore, from the outcomes of step 4, the short-term policies and research agenda are identified and compared to the existing action plan and research agenda, to find discrepancies and supplement the existing agenda.

7.8 On tools and methods

This section concerns the tools and methods to be used in a backcasting design for the SRID FRGA. The good practices on tools and methods are shown in Table 19.

Table 19. The good practices for method selection in a backcasting approach as found in Chapter 4.

Methods
Choosing a combination of different methods, combining bottom-up and top-down ones;
Include methods that have a low threshold for participation.
Appoint an independent mediator fitted for the topic.

In the description the methods used were described and an effort was made to include bottom-up approaches when creativity was needed. As the FRGA actors have a long history with thinking together about the SRID, they are eager to participate. Citizens and companies are stimulated by lowering the threshold through interviews to share their ideas and one on one discussions with policy makers, to minimize the effects of an intimidating environment of a group discussion.

An independent mediator for all the group sessions is appointed to lead discussions, encourage participation, ensure inclusiveness of all actors and ensure continuity between sessions.

7.9 Chapter conclusion

The research question answered in this chapter was: “What practices are potentially useful in a long-term strategic planning design in the governance arrangement of Dordrecht based on good practices from literature (question 1) and the analysis of the flood risk governance arrangement in Dordrecht (questions 2 and 3)?” From the FRGA it became clear that efforts have been made on creating a vision, identifying FRMSs and creating an action agenda. The backcasting exercise therefore has the function of discussing the vision and policies with actors, ensure that there is alignment between visions of actors, test robustness of the identified FRMSs and policies, and compare the results of backcasting with the existing action plan.

The backcasting design for the SRID FRGA can be summarised as follows.

Step 1: Strategic problem orientation

The problem, unwanted trends, and possible solutions are clear among stakeholders: the problem evolves around the safety of the citizens of Dordrecht in face of flood threats that may increase due to climate change, and the solution is to use a wider range of FRMSs. Actors see themselves responsible for the citizens of Dordrecht, see a role in sharing knowledge and expertise, or want to see results from Dordrecht as a pilot in the Netherlands. Exploratory scenarios can be used later in a backcasting design to test the robustness of vision and actions, and can be based on scenarios from the Delta Programme and impact analysis of the Water Safety Plan for Dordrecht.

Participants

The Municipality, Safety Region, Regional Water Authority and Province should be included in all backcasting steps. The National Water Authority and Environmental Service are deemed most useful in the elaboration and implementation steps. Citizens and companies should be involved. They can help in creating support for and feasibility of the measures in the elaboration step. Two individuals from each entity present help the representativeness of the actor and citizens should be selected at random or from each neighbourhood.

Step 2: Construction future visions

The SRID already is a vision, but a long-term vision is still absent and visions among the partners need to be discussed and aligned. Participants are interviewed, discuss in their own group and later with all participants, visions they create for the SRID in the year 2050 and at least two opportunities and barriers they identified to reach this vision. Creativity is important and encouraged by the bottom-up approach of interviews, having smaller sessions and inviting groups of citizen and company representatives.

Step 3: Backcasting

The four main actors form the FRGA and research bodies are interviewed, then discuss in small groups and with the whole group intermediate goals and policies for 2040, 2030 and 2020. These are put on a timeline and may result in different pathways towards the vision in 2050. Specific attention is given to working backwards from 2050 in the visualisation and session process.

Step 4: Elaboration, analysis, defining follow-up agenda

The results of the backcasting steps are processed and pathways identified. Elements that need clarification or elaboration are discussed in sessions or meetings with relevant actors. Exploratory scenarios are created by either researchers or qualitative exploratory scenarios are created in a session by expert participants, resulting in robust pathways and policies. Feasibility and acceptability is assessed by including citizens and companies. The result is a follow-up agenda with robust and feasible pathways and policies towards the SRID in 2050.

Step 5: Embedding of results, generating follow-up and implementation

The short-term actions and research agenda are taken from step 4 and assigned to responsible organisations. This is compared to the existing action and research agenda used by the FRGA. This leads to an updated action and research agenda with the results of the backcasting approach incorporated in the already existing activities.

Tools and methods

Bottom-up interviews and one on one discussions are complemented with group sessions. An independent mediator is used for all the group sessions to lead discussions, encourage participation, ensure inclusiveness of all actors and ensure continuity between sessions.

Table 20. The ideal backasting design for the SRID FRGA.

Step in backcasting approach	Ideal design for the SRID FRGA
Goal	Discuss and align future visions
	Identify steps to reach a shared future vision on long and short term;
	Compare the resulting steps and policies with the existing action plan and complement the action plan;
	Test the robustness of steps, measures and the action plan by testing them in the context of several possible futures.
Step 1	Problem definition and unwanted trend known, so no focus on identifying those
	Concern is for safety of citizens, knowledge sharing and learning from SRID pilot
	Exploratory scenarios not to be used here, but later in testing robustness
Participants	Use existing FRGA members, with a focus on Municipality, Safety Region, Regional Water Authority and Province
	Add citizens and companies in elaboration stage to generate support, make them problem owners and start with communication
Step 2	Create and align ideal visions for the SRID in 2050
	Interviews, smaller groups and group discussion
Step 3	Interviews, smaller groups and group discussion
	Intermediate goals and policies for 2040, 2030 and 2020 working backwards
	Use of timeline for visualisation
	Pathways become clear during or after the session
Step 4	Elaborate or clarify pathways when needed in expert analysis or meetings with relevant actors
	Creation of exploratory scenarios by researchers or experts to test robustness of pathways and policies
	Test feasibility and support with citizens and companies
	Compare robust pathways and scenarios to previous research results
Step 5	Create short term action agenda including responsible organisations
	Compare to existing action agenda to incorporate additions
Methods	Bottom-up methods used for creativity
	Mediator used for discussions, participation, inclusiveness and continuity

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8 Empirical results: backcasting workshop

The last chapter resulted in an ideal backcasting approach for the SRID FRGA. As part of this research, the ideal approach was tested in a real-world situation, with the SRID FRGA. The corresponding research question was: "What are the results of a workshop on long-term strategic planning in the municipality of Dordrecht and what can be learned from these results?" As shows, the ideal design was fitted into a design for one workshop with people from the SRID FRGA. The design of the workshop is shown in the first section of this chapter. The second section is a report of the workshop and shows the substantive results of the workshop. The third and last section goes into the lessons that can be learned from the workshop in relation to the ideal backcasting design in Chapter 7.

8.1 Workshop design

The ideal backcasting design suggests several sessions and the inclusion of citizens and companies as extra actor groups in the backcasting. Furthermore, the design covers all five steps from the good backcasting practices, covering the creation of visions, backcasting policy measures and pathways, elaborating exploratory scenarios and comparing the results to the existing SRID efforts in the FRGA.

Using the design in a single workshop makes for certain restrictions. The goal of the design was to keep close to the goals of the ideal backcasting design, as recalled in Table 21.

Table 21. The goal as defined in the ideal backcasting design for the SRID FRGA.

Goal	Discuss and align future visions
	Identify steps to reach a shared future vision on long and short term;
	Compare the resulting steps and policies with the existing action plan and complement the action plan;
	Test the robustness of steps, measures and the action plan by testing them in the context of several possible futures.

The steps as used in the good practices and ideal backcasting design were used in the elaboration on the workshop design as presented in this chapter, as well as an explanation on the actors that were involved and the employed methods. Step two, three, and five had been planned to be the most important ones in the workshop. This is reviewed later in this this chapter. In the following part of this section, the steps of the ideal backcasting design are recalled and their use in the backcasting workshop design is elaborated upon.

8.1.1 Step 1: Strategic problem orientation

The ideal backcasting design for step 1 is recalled in Table 22.

Table 22. Step one from the ideal backcasting design for the SRID FRGA.

Step 1	Problem definition and unwanted trend known, so no focus on identifying those
	Concern is for safety of citizens, knowledge sharing and learning from SRID pilot
	Exploratory scenarios not to be used here, but later in testing robustness

The ideal backcasting design did not have a focus on step one, as the problem definition and unwanted trend are known and agreed upon in the FRGA, and exploratory scenarios can therefore be better used in a later stage. The workshop design therefore did also not include a first step. In the workshop design, the problem definition, historical efforts for an SRID and goal of the

workshop were presented by the author of this research and the mediator to introduce the participants to the workshop and the following steps of the workshop.

8.1.2 On participants

The ideal design on the inclusion of participants is recalled in Table 23.

Table 23. The ideal backcasting design for the SRID FRGA on the inclusion of participants.

Participants	Use existing FRGA members, with a focus on Municipality, Safety Region, Regional Water Authority and Province
	Add citizens and companies in elaboration stage to generate support, make them problem owners and start with communication

As part of the workshop design, all the existing LL members were invited for the workshop. All members were invited to bring an extra person from their organisation to the workshop, to improve the representation from their organisation and have more participants during the visioning and backcasting, which can improve creativity. Also, three researchers from the university of the author were invited that do research in water policy and backcasting to increase expertise and the number of participants. Furthermore, an expert external to the FRGA, further called 'divergent thinker', was invited to specifically incentivise creativity by giving feedback on other participants with divergent opinions.

To structure thinking and lower the threshold for participants, the workshop design included a suggestion for multiple pathways and parts of a vision that were taken from the FRGA interviews. Based on responses from FRGA actors in the interviews, a distinction could be made between a vision and measures affecting citizens and businesses, organisations, and spatial adaptation. These categories in the workshop design were aimed at inspiring participants when needed and provide some structure and continuity through all steps of the workshop.

An effort was made to include citizens. These efforts met with several problems; first of all, there are no active contacts with citizens at the moment, and contact with companies on flood risks is also absent. This meant that extra effort should have been made to invite citizens. The author suggested finding citizens from a neighbourhood centre, or inviting other citizens, but this met with hesitance from the Municipality, that did not see role for citizens in the current stage of the SRID project and preferred to include citizens later, when actual implementation of specific measures would be discussed. One trusted citizen that visited the Municipality more often was ultimately invited.

8.1.3 Step 2: Constructing future visions or scenarios

The ideal design for step 2 is recalled in Table 24.

Table 24. Step two of the ideal backcasting design for the SRID FRGA.

Step 2	Create and align ideal visions for the SRID in 2050
	Interviews, smaller groups and group discussion

In the design of the workshop, the end-point date of 2040 has been chosen, as actors from the FRGA considered 2050 or later too far away to speak to the imagination of the FRGA actors. Step two was aimed at discussing and aligning visions. Therefore, the step in the workshop design consisted of three parts. First the participants were asked to write down their ideal vision for the SRID in 2040 individually first, on small papers. These written down visions were then to be discussed in small groups of a few participants, to provide feedback to each other and refine the writings when needed. In third phase, participants would

discuss the written down visions with the whole group, and when something has the agreement of the group, the paper was to be put on the wall to create a shared vision on the SRID. In the workshop design, creativity during this step was to be incentivised by a divergent thinker that was to provide comments on the discussed visions, and 5-10 minutes at the end of the step two were reserved for the divergent thinker to give opinions and provide feedback on the session.

The notion from the ideal backcasting design to also invite participants to write down barriers, opportunities and uncertainties in reaching the vision, were not included in the workshop design as to not add too much complexity in a single workshop.

The ideal backcasting design includes interviews as well. As part of the FRGA interviews for the empirical mapping of the FRGA, questions were asked on the SRID vision. These were discussed in the empirical FRGA chapter and used for creating the ideal backcasting design. One of the findings was that visions are somewhat aligned and that the SRID vision is clear for most actors. The FRGA interviewees seemed to focus on Therefore, this step of creating visions in the workshop design was aimed at creativity to find if new parts of an SRID vision could be found to add to or complement the existing visions, and to make sure all actors can align their visions and support a shared agreed upon vision.

8.1.4 Step 3: Backcasting

The ideal design for step 3 is recalled in Table 25.

Table 25. The backcasting step from the ideal backcasting design for the SRID FRGA.

Step 3	Interviews, smaller groups and group discussion
	Intermediate goals and policies for 2040, 2030 and 2020 working backwards
	Use of timeline for visualisation
	Pathways become clear during or after the session

In this step, the backcasting design required participants to think about intermediate goals and steps to reach the vision that was created for the SRID in 2040 in step two of the workshop. As suggested by the ideal backcasting design, years between the end-point and present were chosen in the workshop design to give direction, with the end-point serving as long term, 2030 as intermediate term and 2020 as short term. Figure 8. Design of the backcasting step for the workshop. shows the backcasting process as designed for the workshop as it was to be presented to participants.

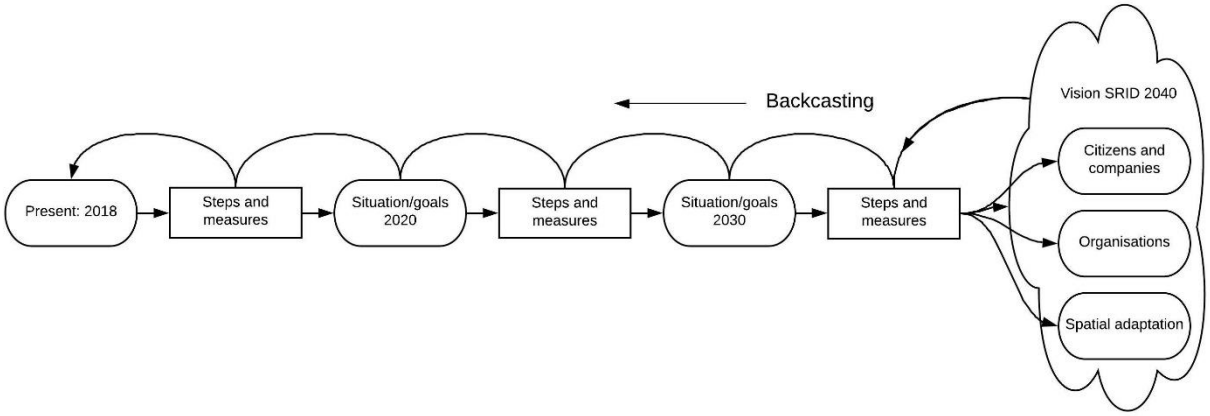

Figure 8. Design of the backcasting step for the workshop.

The workshop design invited participants to set intermediate goals that make for desirable situations in 2030 and 2020, and identify steps that are needed to reach these goals and the end-point vision of 2040. Furthermore, the workshop design asked participants to think of specific policy measures that would accomplish the steps.

The workshop design specified that the specific visions from step two could be used as input for this step three: when a vision for 2040 was identified that reliant people can go to shelters to survive a flood, for 2030 a goal can be that shelters have been assigned to existing buildings or newly built, but not yet operational, and a goal for 2020 can be that there is approval for a shelter policy plan. This way, the workshop design aimed at thinking from the end-goal vision back into intermediate goals. The corresponding steps to the example could be building a shelter, with accompanying policy measures such as doing tenders for a shelter or aligning building regulations to enable shelters in buildings. This way, participants would be inspired to create pathways towards the end-point vision.

The workshop design consisted of two parts for the backcasting step: 1) a session for the intermediate goals and 2) a session for the steps and measures. During both parts, discussion would first take place in small groups, followed by a discussion with the whole group. Again, the participants would be invited to write their creations down on small papers, that could be used in the large group discussion. Goals, steps and policies would be written on differently coloured pieces of paper.

In the large group discussions, the writings from the smaller groups would be discussed and put on a timeline on the wall. The workshop design intended a timeline on the wall of the room, with a vision for 2040 on the right side divided into the afore-mentioned three categories of 1) citizens and companies, 2) organisations and 3) spatial adaptation, and three lines going to the left to the present time, that serve as timelines from the present situation towards the three parts of the vision. The intermediate goals, steps, and measures were to be put on the timelines, so pathways towards the vision would become visible on the timeline on the wall.

Similar to the visioning step, the workshop design made time for the divergent thinker at the end of this step to reflect on the process and results of the backcasting step.

8.1.5 Step 4: Elaboration, analysis, defining follow-up agenda

The ideal design for step 4 is recalled in Table 26

Table 26. The ideal backcasting design of the fourth step for the SRID FRGA.

Step 4	Elaborate or clarify pathways when needed in expert analysis or meetings with relevant actors
	Creation of exploratory scenarios by researchers or experts to test robustness of pathways and policies
	Test feasibility and support with citizens and companies
	Compare robust pathways and scenarios to previous research results

This step concerns elaboration of the second and third steps of the design, that is typically done in follow-up meetings or sessions. This is not possible during one workshop and therefore was not included in the workshop design. The creation of exploratory scenarios was considered for the workshop design, as the testing of robustness of the found policies was deemed very valuable, given the amount of measures already identified by the FRGA. However, the second and third step could not be omitted to make more time for this, and three hours was not deemed enough to include the creation of qualitative exploratory scenarios with workshop participants.

The same is true for a feasibility test with citizens and companies present: time constraints are such that this was left out, and as mentioned earlier, inviting citizens was not something that all actors received with enthusiasm in this phase of the project. This part was therefore omitted in the workshop design. Robust pathways are therefore not a planned result of the workshop and a comparison with earlier findings not a possible activity.

8.1.6 Step 5: Embedding of results, generating follow-up and implementation

The ideal design for step 5 is recalled in Table 27

Table 27. The implementation step from the ideal backcasting design for the SRID FRGA.

Step 5	Create short term action agenda including responsible organisations
	Compare to existing action agenda to incorporate additions

Step five from the ideal backcasting design was included in the workshop design: the results from the backcasting timeline in step three would include short term steps and policies towards the end-point vision. These would be the intermediate goals for 2020, the identified steps to reach those goals and the specific policies that need to be implemented to take those steps.

These results were to be compared to the action plan document of the LL SRID, to identify differences and determine if there had been oversights in the action plan. The participant would be invited to discuss the relevance of the differences, if the action plan needs revision or if the workshop results are to be used in another way.

8.1.7 On tools and methods

The notions on methods from the ideal backcasting design are recalled in Table 28.

Table 28. The method requirements of the ideal backcasting design for the SRID FRGA.

Methods	Bottom-up methods used for creativity
	Mediator used for discussions, participation, inclusiveness and continuity

Bottom-up methods were included in the workshop design by inviting participants to think individually during the visioning step, and work from smaller groups towards the large group discussion, with the findings from the smaller groups as input. The design included a mediator for discussions and process control.

8.1.8 Summary of the workshop design

The workshop design was focussed on step two, three and five of the backcasting design, as is summarized in

Table 29.

Table 29. The design of the backcasting workshop for the SRID FRGA.

Step in backcasting workshop	Workshop activities
Goal	Discuss and align future visions
	Identify steps to reach a shared future vision on long and short term
	Compare the resulting steps and policies with the existing action plan and complement the action plan
Participants	Inviting all FRGA actors from the LL
	Inviting one trusted citizen
	Inviting a divergent thinker
Step 2	Create and align ideal visions for the SRID in 2040
	Work individually, in small groups, and with whole group
	Write on small papers and put these on the wall
Step 3	Smaller groups and group discussion
	Intermediate goals, steps and policies for 2030 and 2020 working backwards
	Write on small papers and put these on a timeline
	Result are pathways
Step 5	Take 2020 goals, steps and policies
	Compare to existing action agenda to incorporate additions
Methods	Bottom-up methods by working first individually, then in small groups, then in whole group
	Mediator used for discussions, participation, inclusiveness and continuity
	Visual timeline on the wall with three pathways

8.2 Lessons from the workshop for a backcasting approach

This section contains lessons from organising the backcasting workshop for the SRID FRGA. This section uses the workshop design as guidelines to review how the design worked out in reality and identify successes and difficulties.

8.2.1 General

In general, it became apparent that the intended participants, being mostly civil servants of governmental organisations, are busy people and can barely spare the time for a whole afternoon to participate in the workshop. Planning a date that most of them could be present was successful, but the available time was adjusted. The author of this research had the wish for a whole afternoon. At first, a time of four hours seemed available from 13:00 to 17:00, but this was later adjusted, starting an hour later, to be able to add a meeting of the LL SRID in the first hour. On the day itself, it became apparent that several participants could not stay until 17:00 and the workshop ended around 16:15. This means that the workshop had a duration of about two hours in practice.

This tight time limit posed several difficulties in the schedule for the workshop. The reflections by the divergent thinker were cancelled, the fifth step of the workshop design was cancelled, and the third step, the backcasting, was significantly shortened. More details are given in the respective sections.

During the introduction of the workshop, the idea of three categories or pathways to structure the creation of visions and backcasting, were shortly discussed, and participants soon opted to use other categories. The categories of the MLS approach were suggested: 1) protection, 2) spatial adaptation and 3) crisis management. The author and the mediator agreed with changing the categories from the design to these three categories. These categories are important in the discourses of the FRGA actors and therefore a logical choice. The author did not choose these categories in the design because they are different from the

FRMS categories used in the research and because protection or defence measures are not a main focus of the efforts for an SRID. The choice by the participants to use these categories, shows the discourse of thinking about the different layers in FRMSs in the terminology used in the Netherlands and by the Delta Programme.

8.2.2 Participants

The workshop design invited the FRGA actors that worked together in the LL, a trusted citizen and a divergent thinker. A divergent thinker was found that was a researcher and expert on water policy. The trusted citizen was not available at the time of the workshop.

From the FRGA actors, both persons from the Municipality, and one person from the Regional Water Authority, Province, Safety Region, and Environmental Service were present, as well as the person from IHE, that was also the mediator. The National Water Authority could not be present. The invitation to all actors to invite an extra person from their organisations was received but yielded no result. This means that the number of participants was eight, including the mediator and divergent thinker, and excluding the author of this research. The four central actors from the FRGA were represented during the workshop, which is positive. The divergent thinker was an active participant in discussions and triggered reactions regularly.

Figure 9. The participants of the workshop discussing the vision for the SRID in 2040.

There were a few issues identified on the subject of participants of the workshop. First of all, the number of participants was more limited than planned, which meant that the boost to creativity that a lot of actors would incur, was imitated. Furthermore, working in smaller groups meant that two groups of effectively three people were formed, because the mediator and divergent thinker had an independent role. This made the small group discussions still effective, but less diverse.

Second of all, organisations were represented by a maximum of one participant, with exception of the Municipality, that was considered a dominant actor in the FRGA. This meant that also during the workshop the Municipality was dominant, and diversity was not optimal. Furthermore, the participants were the 'usual suspects' of the FRGA organisations, meaning that creativity and finding new ideas was not stimulated as much. This last issue was also present because no other organisations were present at the workshop, such as the citizens and companies suggested by the ideal backcasting design.

The cause for the more limited presence of FRGA actors than planned for can be found in the fact that the SRID project is not a major activity for most of the FRGA organisations, that already make an investment by having one person work for some

time on the project. The absence of citizens and companies was caused by the reluctance of some of the FRGA actors to include them at this stage and the effort that the author would have to have made to find these, for which there was little time.

8.2.3 Step 2: Constructing future visions or scenarios

This step of the backcasting workshop turned out as planned for the most part. It was clear for the participants, after the introduction, what was expected of them. The participants worked for about five minutes individually on their ideas for the SRID for 2040 and wrote their ideas down on small papers immediately. It turned out that oftentimes, multiple ideas about the vision were written down on a single paper. This was not how the design was intended, but evidently this was not emphasized in the explanation of this step.

Table 30. The backcasting workshop plan for step 2 on visioning.

Step 2	Create and align ideal visions for the SRID in 2040
	Work individually, in small groups, and with whole group
	Write on small papers and put these on the wall

The discussions took place in two groups of three actors. The two people from the municipality were not in the same group, promoting discussion on different ideas. The mediator visited both small groups shortly to see how they were doing and promote discussion. In one group it was visible that people discussed the ideas and sometimes added or changed something on their paper, while in the other group people were mostly explaining what they had written down to the others without engaging too much in discussion.

After some discussion, the large group discussion took place. The mediator asked the participants for their pieces of paper and read them out loud, asking for opinions of others, or explanation or elaboration on what was written down. This led to some interesting discussions and elaborations on some ideas. Most of the time, the ideas for the vision were quickly agreed upon as they were considered ideas that were shared by the group already. The deviant thinker added side notes here and there to invoke more discussion, especially on matters that most participants saw as natural, or a given. This worked well in a number of occasions, but sometimes lead to the whole group explaining to the deviant thinker, that was naturally less experienced with the subject matter than the FRGA actors, what a certain text was about. This made obvious that the group worked together on the subject of the SRID a lot, and could point to them being too invested in the subject matter to come up with new creative ideas. This can be countered by having more diverse and external participants.

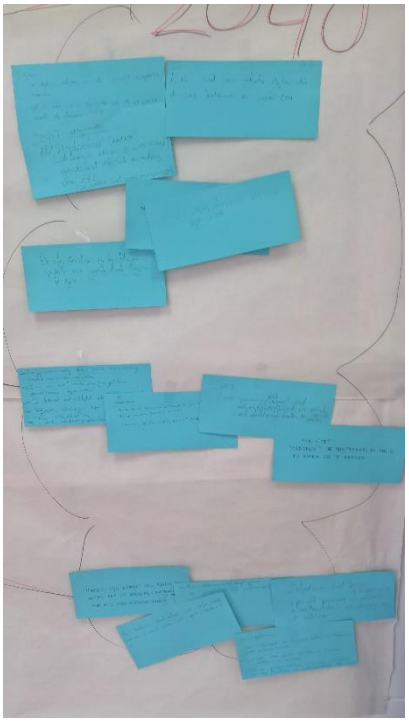

Figure 10. A cloud of writings forming a shared vision during the workshop.

The mediator then put the pieces of paper on the right side of the timeline, where the vision was constructed. This resulted in a cloud of small papers that together formed the vision for the SRID in 2040. The fact that some pieces of paper contained more than one idea, reduced the impact of visualising the parts of the vision somewhat, as individual parts became less distinguishable. The result is shown in Figure 10. For the contents of the vision, see the Appendix B.

8.2.4 Step 3: Backcasting

The backcasting step had to be done in less time than anticipated, and therefore there was no time to split it in two parts focussing on the intermediary goals first and later on the steps and policies. Furthermore, the distinction between goals, steps, and policies turned out to be confusing to participants. These factors lead to the decision to simplify the backcasting step. There would be only one part, in which steps to reach the vision would be identified for 2030 and 2020.

Table 31. The backcasting step from the workshop design.

Step 3	Smaller groups and group discussion
	Intermediate goals, steps and policies for 2030 and 2020 working backwards
	Write on small papers and put these on a timeline
	Result are pathways

Participants were asked to identify these steps first in smaller groups and write them down again. Using only the concept of steps made it easier for participants to come up with ideas. This shows that it may be advisable to not introduce several concepts at once, but start with steps and later introduce intermediate goals or specific policies, once the steps have been identified. The steps were then discussed in the whole group in the same way as the vision was: the mediator read the writings out loud, they were discussed and put on the timeline.

Most discussion took place on the placement in time: if the step was to be taken in the short or longer term. Sometimes there was small discussion on the pathway that the step belonged to. In one case time placement was not possible because the participants agreed that it was a continued effort; this posed difficulties with visual representation on the timeline. Discussions on the substance of the step were present, but less common. This showed that most steps also were already known; only a few new ideas were opted. The role of the divergent thinker was similar to the role in the visioning step.

One issue was that participants found it hard to think backwards from the vision, which became visible due to the fact that participants had written down a step to reach a vision, and only then thought about placement on the timeline. This means the resulting ‘pathway’ from the present to the end-point consists of one step and is therefore hardly a pathway, but rather one action to reach a desired effect. The timeline component of the exercise is lost. Furthermore, participants did not always explicitly couple their step to a specific part of the vision, also hurting the creation of pathways.

This issue might be partly solved by specifically instructing participants to choose a vision element to couple the step to. Furthermore, it may help to force participants to create a step for 2030 first, before moving on to 2020. This may force participants to think about the state of affairs in 2030 and consider what is needed to move from 2030 to the vision in 2040. This will make sure the timeline element is considered and helps to produce a pathway as result of the backcasting step.

Figure 11. The visual result of the backcasting step of the workshop.

The result of this step showed steps that were put on the timeline as agreed upon in the large group discussion. Pathways were not visually identifiable, but there was distinction between the short, mid and long-term steps. See Figure 11 for the resulting visual representation of the backcasting step.

Pathways were not explicitly identified during the workshop. Some steps in 2020 were linked to later steps or parts of the vision, but this was not further discussed during the workshop. Identifying the linkages was done by the author after the workshop, for the contents of this analysis see Appendix B. This analysis showed linkages between steps on the short term and mid term to parts of the vision, but also that some parts of the vision, in all three layers, were not supported by steps. This could be avoided by going through the whole vision in the group discussion, to make sure the whole vision is referred to in steps.

8.2.5 Step 5: Embedding of results, generating follow-up and implementation

After the backcasting step, there was no time to do step five by identifying the short-term steps and comparting them to the action plan. However, the Municipality saw a role for this step in the follow-up of this workshop: the author of the research would report on the results and also look into the comparison with the action plan. The municipality intents to use these results in an update of the plan of action. The report on the substantive results and comparison to the plan of action can be found in Appendix B.

Step 5	Take 2020 goals, steps and policies Compare to existing action agenda to incorporate additions

8.2.6 On methods

In both step two and three the bottom-up character of the move from individual working towards the large groups was used and deemed successful in including all actors, they all had something to contribute. However, two other goals of the methods used, stimulating creativity and promoting consistency between steps, were less successful.

Creativity was a main challenge during the workshop, as all of the participants have been working on the project for a long time, came up with a vision and policies before, and find it hard to think of something outside of that. As said, extra participants would have helped. However, no other specific methods for promoting creativity among participants was found for the ideal

backcasting design. From the workshop became clear that these are needed. For further backcasting efforts, it is advisable to look specifically into tools for promoting creativity.

Continuity was also an issue. As argued before, the steps did not always specifically connect to the vision and a pathway with multiple steps was not always reached. This should be made clearer to participants by being more explicit on using the vision as starting point and by splitting the session into separate parts for the long, mid and short term, to force backwards thinking. Time was an issue during the workshop for the latter, however. In future efforts, these small things need to be specified in the design of a workshop or other session, and these rules should be communicated to the participants clearly.

8.3 Chapter conclusion

The research question for this chapter was: "What are the results of a workshop on long-term strategic planning in the municipality of Dordrecht and what can be learned from these results?" The workshop was designed on the basis of the ideal backcasting design. Due to time constraints, a choice was made for a focus on step two, three and five of the ideal design. The workshop design was able to use the practices from the ideal backcasting design to a large extent.

During the workshop it showed that the workshop design could not be fully executed, and several issues became clear. The lessons from these issues answer the research question and are summarised below.

The choice for MLS as a guideline for the pathways in the workshop by participants, shows their focus on broadening FRMSs, but also shows that it is hard for them to look at the issue with a new view. This became evident during several other steps as well. The workshop had less participants than planned in the design. The lack of diversity and people external to the FRGA or LL work group, lead to creativity being a major issue. Most elements of the vision and steps were not new and many of them are part of the action plan of the LL. That only one person of all organisations except the Municipality was present, made for diversity problems. The divergent thinker contributed to creativity and diversity, but was sometimes overpowered by the other participants.

Working with civil servants on a project that is not in embedded in regular duties, creates issues in planning. Due to people being busy, the time for the workshop was limited and changing schedules made it hard to follow the workshop design. This leads to several issues, including degradation of steps taken in the workshop, leading to less valuable results. The backcasting step was shortened in time, which lead to less care for backwards thinking.

Several process issues that seem small had a large impact. Participants wrote down multiple parts of a vision or multiple steps on one piece of paper; participants did not always connect steps to specific parts of the vision; participants did not always work back from the vision to create a pathway. These issues seem interrelated and have a major cause in not being clear about the process. Extra effort needs to be made, especially when time is short, to make participants do these things, by communicating them very clear. This can be done by the mediator.

In the ideal backcasting design, complexity during the backcasting step was a warning, and this turned out to be true during the workshop. Introducing intermediate goals, steps, and policies or measures all at once lead to confusion. It is advisable to start with one of these and add others later if needed and possible.

Overall, it seems that the goals of the workshop of aligning a vision and creating steps towards the vision was partially successful. As discussed, the results are a vision and steps, but there is a lack of added value to the existing action plan document. This can be solved by either putting more effort in creativity of participants by increasing their number and using tools to stimulate creativity, or by moving towards a focus on the robustness on the already existing action plan by creating exploratory scenarios, as suggested in the ideal backcasting design.

9 Conclusion and Discussion

This chapter consists of a conclusion that answers the questions that are central to this research and discusses the outcomes, their relevance, their limitations and the limitations of the research in general, opportunities and recommendations following from this research, and suggestions for further research.

9.1 Conclusion

This research had a focus on answering the main research question: "*What practices of a backcasting approach provide the municipality of Dordrecht with a suitable approach for realising a range of long-term flood risk management strategies towards becoming a self-reliant island, and what insights are gained from a case of flood risk governance for long-term flood risk management on a local level?"*

The first part of the research question is aimed at finding a suitable backcasting approach for the Municipality of Dordrecht that help to realise broad use of FRMSs for the SRID in the long-term. A choice in this research was made to focus on backcasting as a method from future studies, because backcasting is suitable to use when planning for the long term and when breaking with dominant trends, which suits the problem of Dordrecht: making the island flood proof is, in the light of climate change, a challenge for the long term, and there is a need to break with the dominant trend of using FRMSs from only the defence category in the Netherlands towards a broader use of FRMS.

A suitable approach for long-term planning of FRMS in Dordrecht

In the literature study of Chapter 4, good practices were identified that have been applied in other cases for long term planning in climate related problems and on the municipal level. This resulted in a list of five backcasting steps and good practices on the methods to use and participants to include. The steps include good practices in a problem orientation step, a visioning step, a backcasting step, an elaboration step, and an implementation step. The good practices were tailor made to the Dordrecht case in Chapter 7 using the FRGA mapping from Chapter 6. This resulted in an ideal backcasting approach for planning long term in FRMSs in Dordrecht answering the first part of the research question.

The goal of this backcasting approach is to discuss and align visions for the long-term future of the SRID, identify steps to reach the vision for the short and long term to fill gaps in the already existing FRMSs from the action plan, and test the robustness of the steps and policy measures for reaching the SRID on the long term.

Given the goals of the backcasting approach a focus was put on the visioning, backcasting, elaboration and implementation steps of in the ideal backcasting design from Dordrecht. Given the lessons from the backcasting workshop, Dordrecht has a choice between two types of backcasting approaches for further efforts in long-term FRMSs planning. The first option is to focus on creativity and actor inclusiveness, including multiple participants from the involved governmental organisations, broaden the number of involved actors to more research bodies and include actors from different governmental levels, such as people from the Delta Programme, public servants from municipalities dealing with the same threats, and the Ministry of Infrastructure and Water Management. Furthermore, citizens and companies need to be included. A focus for this approach would be on the visioning and backcasting aspects. The creative power would help in really thinking outside of already existing patterns, identify new visions for the far future and ways to get there. This goes beyond the current efforts of thinking mainly about the SRID for the next few years and did not work with the actors that were involved in the backcasting workshop.

A second option for a follow-up backcasting design is to view the visioning and backcasting steps as completed, as the project has been working for the past ten years to arrive at the current action plan for broader FRMS use in a process that unintentionally

followed some of the methods used in backcasting: a vision of an SRID was created and measures were identified by researches in the past that work towards the SRID. Furthermore, the workshop results show similarities to a large extent in the identified policies and the policies that are already laid out in the LL action plan. In this second option, the focus is on working towards implementation, which connects better to the current activities in the LL SRID. The elaboration and implementation step receive focus in such a design. In the elaboration step, the recommendations from the ideal backcasting design are relevant, including the involvement of citizens and companies to work on the feasibility and support for the FRMSs. An important step that needs most attention in the elaboration phase is the creation of exploratory scenarios. The Delta Programme includes scenarios for 2050 and the Water Safety Plan impact analysis for Dordrecht calculates risks specific for Dordrecht. To test the FRMSs identified, scenarios for the impacts of climate change and socio-economic drivers in 2050 for the island of Dordrecht specifically, should be used. This can be done by issuing a research, or it can be done in a less elaborate way by inviting the governmental FRGA actors, the authors of the Water Safety Plan and experts from the Delta Programme to discuss the drivers and uncertainties for the Dordrecht area for 2050 and come to a set of qualitative exploratory scenarios. These can be used to test the current strategies, from both the long history of the SRID and the current action plan, and the results from the backcasting workshop as part of this research, for robustness towards 2050 and can ensure that a robust SRID for 2050 is realised.

Insights for long-term flood risk governance on a local level

The second part of the research question asked what this case means for long-term flood risk governance on a local level in general. As has been established, Dordrecht is a unique case in the Netherlands. No other local governments have made such efforts to broaden their FRMS use as the Municipality of Dordrecht. Dordrecht has been a pilot for the effort of the Delta Programme to start looking into broader FRMS use. The Municipality of Dordrecht is therefore being watched by national actors such as the National Water Authority and is mentioned every year in the Delta Programme reports with a progress report on the SRID developments. This does give Dordrecht a unique position to carry over its findings to other municipalities in the Netherlands in the river delta. Municipalities such as Alblasserwaard and Vijfheerenlanden in the polder Alblasserwaard-Vijfheerenlanden, a polder with higher flood risks than Dordrecht, are making effort to reduce their risk, giving an opportunity for knowledge sharing for all municipalities involved.

As the Dordrecht case shows from past studies and the current research, broadening FRMS is not easy to do in the Netherlands, as a focus on defence FRMSs using dykes along rivers in an entrenched strategy. The history of the SRID showed that using secondary flood defences is not accepted by the Dutch flood defence institutions, as keeping focus on the already used strategy is economically more efficient. Dordrecht has shown that investing time and effort over the past years was needed to find other FRMSs that are potentially useful in a low-lying Dutch delta area. This shows that a local actor that is driven to reduce flood risk for its population is able to achieve this in an environment that is institutionally focused on other strategies. In these efforts, the idea of an SRID has always been the red line. The strength of using a vision was therefore proven to be effective in setting a goal in broadening FRMSs fore reducing flood risks in the Netherlands, and having such a vision is a recommendation for other local governments. Backcasting with a focus on creativity in municipalities that have to build such a vision from the ground up, can be an effective method. The notions on participants and methods to foster creativity apply to such a case.

The success of Dordrecht can further be explained by the use of networks. It became apparent during this research that the Dordrecht local case may be unique, but that it is embedded in multiple networks, such as the Delta Programme and the network of municipalities of the Safety Region. This has helped Dordrecht to gain knowledge and expertise that was needed, from research bodies, as well as water and crisis managers from governmental organisations. The knowledge and expertise became apparent during this research as a vital source for the creation of a vision and FRMSs to reach the SRID vision. Furthermore, funding has been found in the past, and is planned to be found in the future, by coupling the FRMSs to other existing projects.

Therefore, it is advisable for local governments that are trying to break a trend in their policies, use these networks for the needed knowledge, expertise and funding.

When such networks are present and used, backcasting was found to be a successful approach in making an effort to reach the vision of the local government. The ideal backcasting approach in this research invites networks with a lot of knowledge and expertise to be creative in finding policies to reach a shared goal for the region. A backcasting approach can therefore be a good way to broaden FRMSs or find new policies in general, if the local government has the knowledge and expertise gathered around the issue.

Some barriers for local government in long-term planning for flood risk governance were also identified. Being a pilot and a frontrunner can be a strength in the opportunity to be creative and be an example to other areas. However, the most limiting factor found in this study was the lack of financial resources. Many FRMSs are planned in the action plan by the FRGA, for many of them, finding the financial resources to implement them is an ongoing challenge.

This relates to the found good practice in a backcasting approach, that advises to institutionalise the results of a backcasting approach. In the case of Dordrecht, there is embeddedness in some networks, as described earlier, but the broadening of FRMSs is not embedded in the institutional environment of flood risk management in the Netherlands. Flood risks are still based on defence systems, and not on other FRMSs that have been implemented. This is a barrier, and it is advised that the FRGA SRID strives for finding an opening on the national level to promote the use of broad FRMSs in flood risk calculations in the Netherlands. This can help other local governments in the Netherlands to follow the example of Dordrecht.

This provides opportunities to catalyse the transfer of knowledge gained in Dordrecht to other regions. Embedding of the findings in Dordrecht, the strength of using multiple categories of FRMSs and using a vision for the region to reach this, can be used in the Delta Programme as a guideline for other regions in the Dutch river deltas. Local governments in the Netherlands are recommended to make use of these network organisations to find the knowledge they need to broaden FRMSs to reduce flood risk in their region.

9.2 Discussion

This section discusses strong and weak points of the research, including limitations. Furthermore, it goes into the implications of this research for theory on FRGAs and backcasting.

This research is a case study with a practical element in the form of a backcasting workshop. Testing the findings of an ideal backcasting approach is a good way to verify and improve the findings of an otherwise theoretical practices. This makes the final results more valid, as they have been tested in a real-world case. This strong point of the research also had its limitations, however. The full use of the visioning and backcasting steps could not be tested, due to limited creativity and a limited number of participants. It was concluded that extra effort should be made to find more participants and methods that foster creativity, but the conclusion is also ambiguous in that it suggests the municipality to either redo the backcasting and visioning properly, or move on to elaboration of the already existing results. The practical test of the workshop has lost some of its value, in that it did not live up to its full potential.

The fact that the case of Dordrecht was an extreme case in the sense that it already puts a lot of effort into the broadening of FRMSs, gives interesting insights into the use of backcasting and in lessons for other local governments: if a backcasting design would fail in Dordrecht, it would be unlikely to succeed elsewhere. However, as it turned out, it seemed Dordrecht had unintentionally already done backcasting over the last ten years, by creating a vision of the SRID and finding FRMSs in different categories to reach that vision. This became increasingly apparent during the research, but the author did not decide to cancel

the visioning and backcasting parts of the ideal backcasting approach or workshop. This could have been done to yield more interesting results in testing the robustness of the FRMSs, but the focus of the research would then have shifted to exploratory scenarios and elaboration and implementation of FRMSs. The author chose to keep a focus on a full backcasting approach, as the initial goal of the research was to find out if that is a good method for broadening FRMSs. This may have led to less fruitful results in bringing the SRID closer for Dordrecht, but has produced insights in the use of backcasting for broadening FRMSs.

The research aimed to add a case of backcasting to the existing body of literature on backcasting. Most literature on backcasting, including cases, does not get very specific on the methods used in sessions. The addition of a workshop in this research and a specific elaboration on the methods used and how they worked out therefore adds insights that the body of literature on backcasting may be lacking. Furthermore, backcasting practices from the backcasting literature were used in a new case, and therefore tested and their validity confirmed, increasing their reliability. The addition of an extreme case, where a lot of efforts in a transition were already made, showed that backcasting by creating a vision and working on FRMSs to reach that, is an effective way to work on a transition, as it was found that the Municipality already did that over the past years quite successfully. Backcasting is proven to be in such an advanced case, a method to create consensus and fill gaps in the vision and backcasting step, and to provide the tools for elaboration and implementation.

A specific part of backcasting literature focuses on adding exploratory scenarios to backcasting. Although this was not used in the practical part of this research, the use of exploratory scenarios in a backcasting design in an advanced case is deemed promising. It can help to test the robustness of found policies. It would be interesting to see Dordrecht apply this method in the future, to see if the application lives up to its promise.

Literature on FRGAs was used to map the institutional environment in which a backcasting design was made. The categories of FRGAs proved useful as a guideline and lead to a form of stakeholder analysis in this research. It is therefore possible that other forms of stakeholder analyses would also be fitting to find the needed input when creating a backcasting design for a case. Furthermore, an effort was made to couple the four FRGA dimensions more directly to the creation of a backcasting design, to show in which steps or good practices the FRGA dimensions would be used. This proved difficult, and the FRGA analysis was ultimately used as a more general sketch of the institutional environment. If the theory on FRGA and its four dimensions is to be used in further backcasting designs, an effort should be made to create a framework that incorporates the mapping of the FRGA more directly into the creation of a backcasting approach.

Lastly, Dordrecht is not the only local government that is dealing with existing and increasing flood risks in the Netherlands. For example, the area of Alblasserwaard-Vijfheerenlanden is an area with a very high flood risk. Most areas in the Netherlands are less advanced in broadening FRMSs. It would be interesting for future research to create a backcasting design for another local government or FRGA that still has to create a vision and is not sure yet about the steps to take or the FRMSs to implement. The results of this research suggest that a backcasting approach can be effective for such cases, and it would be very interesting to find out if that is indeed the case.

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Appendix A: Interview template

Version date: 23-7-2018

The following interview questions were the template used for interviews with the municipality of Dordrecht and an external expert employed by the municipality of Dordrecht. The questions are in Dutch.

Questions

Achtergrond

1. Kun je iets over jezelf vertellen?
2. Wat voor werkzaamheden doet je bij de [organisatie]?
3. Hoe ben je betrokken geraakt bij het living lab ZrE van Dordrecht?

Project ZrE van Dordrecht

4. Wat is het doel/wat is de inhoud van het project ZrE van Dordrecht volgens jou?
5. Wat zijn je mogelijkheden en beperkingen binnen het ZrE van Dordrecht?
6. Hoe denk je dat het ZrE van Dordrecht bereikt kan worden?

Lange termijn planning en backcasting

- Korte uitleg geven van backcasting.
7. Hoe zie je backcasting voor het ZrE van Dordrecht? Hoe zou dit moeten worden vormgegeven?
8. Wat is je eigen uitgangspunt in een backcasting workshop? Wat is je visie voor het zelfredzaam eiland van Dordrecht en hoe kunnen we dit bereiken?

Slot

9. Heb je zelf nog iets gemist in dit interview, of een vraag, of opmerking?
10. Weet je wie ik verder nog zou kunnen benaderen voor informatie over dit onderwerp?
11. Heb je specifieke tips voor literatuur die je in het bijzonder aanraadt?

Checklist and follow-ups

Vraag 1: Kun je iets over jezelf vertellen?

- Taakomschrijving, afdeling, werkgroep(en)
- Achtergrond (opleiding, loopbaan, interesses)
- Wat is je ervaringen met watermanagement?
- Wat zijn je ervaringen met crisismanagement?
- Wat zijn je ervaringen met projecten die plannen voor een lange termijn?

Vraag 2: Wat voor werkzaamheden doe je bij de [organisatie]?

- Eigen activiteiten: vraagstukken, projecten
- Met welke andere personen en organisaties werk je samen?
- In wat voor relatie vindt deze samenwerking plaats en hoe vindt de communicatie plaats?

Vraag 3: Hoe ben je betrokken geraakt bij het living lab ZrE van Dordrecht?

- Hoe betrokken geraakt bij living lab ZrE van Dordrecht?
- Vanuit welke expertise betrokken?
- Waarom wil je bijdragen?
- Speelt wetgeving een rol bij het feit dat de [organisatie] bijdraagt?
- Wat is het living lab en wat doet het?
- Met welke organisaties werk je samen binnen het living lab?
- Wat voor communicatiekanalen worden gebruikt in de samenwerking met andere organisaties?
- Welke opdrachten heb je binnen living lab?
- Welke rol en taken heb je binnen living lab?
- Wat zijn je opdrachten binnen ZrE?

Vraag 4: Wat is het doel/wat is de inhoud van het project ZrE van Dordrecht volgens jou?

- Wat betekent 'living lab' voor jou?
- Is het project ZrE geïnitieerd door wetgeving? Wat is de aanleiding van het project?
- Wat is het doel van het project?
- Wat is je definitie van ZrE van Dordrecht?
- Is een ZrE van Dordrecht nodig? Waarom?
- Is een ZrE van Dordrecht haalbaar?
- Hoe zie je de huidige staat van het ZrE van Dordrecht?

Vraag 5: Hoe kun je zelf bijdragen aan ZrE van Dordrecht?

- Welke instrumenten heb je zelf tot je beschikking in het project ZrE van Dordrecht?
- Welke middelen heb je binnen het ZrE van Dordrecht? Bepaalde budgetten..
- Welke andere manieren heb je om het ZrE van Dordrecht te sturen?
- Welke andere manieren heb je om het ZrE van Dordrecht een succes te maken?
- Welke andere organisaties heb je contact mee over het project ZrE van Dordrecht?
- Is er wetgeving die je als beperkend of stimulerend ervaart?
- Is er specifieke wetgeving die van grote invloed is op het realiseren van het ZrE van Dordrecht?
- Welke nationale wetgeving speelt een rol binnen het project ZrE van Dordrecht?

Vraag 6: Hoe denk je dat een ZrE van Dordrecht bereikt kan worden?

- Hoe kan ZrE van Dordrecht worden bereikt? Wanneer?
- Hoe denk je dat er moet worden toegewerkt naar dit doel?
- Welke maatregelen zijn gewenst om het doel te bereiken?
- Dragen de huidige maatregelen bij? Zijn ze voldoende?
- Zijn er mogelijkheden/middelen om een ZrE van dordrecht te bereiken in die tijd?
- Welke partijen moeten bijdragen aan een ZrE van Dordrecht?
- Welke rol zouden deze partijen moeten spelen? Wat verwacht je van anderen?

- Wat voor samenwerkingsvorm is ideaal? Wat voor methode om naar het doel toe te werken?
- Wie is verantwoordelijk voor het einddoel?
- Wie is verantwoordelijk voor onderdelen en maatregelen?

Vraag 7: Hoe zie je backcasting voor het ZrE van Dordrecht? Hoe zou dit moeten worden vormgegeven?

- Denk je dat het mogelijk is om gezamenlijk een visie voor het ZrE van Dordrecht te definiëren?
- Hoe zie je (een workshop voor) backcasting voor het ZrE van Dordrecht voor je?
- Welke onderdelen moeten volgens jou niet missen in de workshop?
- Hoe zou het werken aan een visie er volgens jou uit moeten zien?
- Is het belangrijk om mensen buiten de werkgroep te betrekken, professionals of burgers?
- Op welke termijn moet worden gedacht?
- Is het belangrijk dat de partijen samen tot één visie komen?
- Is het belangrijk dat er visueel gewerkt wordt?
- Hoe concreet zie je het tijdspad naar de visie graag?
- Is het belangrijk de verantwoordelijkheden voor de verschillende maatregelen vast te leggen?
- Is het belangrijk om de resultaten te verankeren? Hoe?

Vraag 8: Wat is je eigen uitgangspunt in een backcasting workshop? Wat is je visie voor het zelfredzaam eiland van Dordrecht en hoe kunnen we dit bereiken?

- Wat is je eigen visie voor het ZrE van Dordrecht?
- Welke beleidsmaatregelen denk je dat er een rol spelen in het bereiken van een ZrE van Dordrecht?
- Wat voor tijdspad zie je voor je voor het ZrE van Dordrecht?
- Welke partijen zie je als verantwoordelijk in het bereiken van de doelen?
- Hoe zie je het resultaat van de workshop, of een uitgebreidere bakcasting, het liefst gebruikt worden in de komende jaren?

Appendix B: Workshop results

This appendix shows the results of the backcasting workshops by linking policies on different time scales to parts of the vision. Furthermore, a comparison with the action plan of the LL was made. Some parts are in Dutch.

Pathways and policies

Layer 1

In laag één blijkt in de workshop vooral aandacht te zijn voor een visie voor bescherming van de stad. De primaire en secundaire waterkeringen moeten voldoen aan de normen. Aanvullend wil men extra sterkte behouden en het extra versterken van de dijken in de gaten houden, vanwege het hoge risico in Dordrecht. Aanvullend wordt waarde gehecht aan de verbindende functie van keringen binnen Dordrecht.

Het borgen van het behoud van de extra sterke kering in Dordrecht wordt genoemd als één van de taken op de korte termijn, vóór 2020.

Layer 2

Enkele zaken in laag 2 kwamen enkel bij het vormen van een visie voor 2040 ter sprake, maar werden niet opgevolgd met concrete stappen op de korte of middellange termijn.

1. Dordrecht is een aantrekkelijke plaats om te wonen;
2. Dordrecht is voorbereid op een groter aantal kleine overstromingen;
3. Infrastructuur is dusdanig ingericht dat schade door overstromingen minimaal is.

De eerste kan worden gezien als een brede visie voor 2040 die geen concrete actie behoeft, maar een rol moet spelen bij alle ontwikkelingen op dit gebied: een aantrekkelijk Dordrecht moet altijd in het achterhoofd worden gehouden. Het thema van kleine overstromingen keerde niet specifiek terug in concrete stappen, evenals de inrichting van infrastructuur.

2040	Houses are structurally able to cope well with floods.
2030	Half of the homes is flood proof.
2020	Requirements are formulated for flood proof construction on top of the *Bouwbesluit*. Maintenance and improvement programmes comply. New projects are required to consider flooding damage and recovery.

Houses suit the need of vertical evacuation in the building.
First homes or neighbourhood is ready for self-reliance.
Requirements are formulated for vertical evacuation facilitation in homes. Maintainance and improvement programmes comply. New projects are required to consider limiting flooding casualties.

Businesses have made risk assessments of their activities that are hazardous in case of a flood.
Assess the position of hazardous activities of businesses in the Omgevingswet (BKL). Increase demands on industrial installations in relation to floods and the environment in the Omgevingswet (BKL).

Shelters are available for vertical evacuation on a neighbourhood or city level.
Implementation of the Shelter Strategy. Shelters for reliant people.
Start vision on "*Shelter Staat."* Indicate the shelters for each neighbourhood.

The tail of the island has been developed as a 'large shelter'.
Implementation of the Shelter Strategy.
Start vision on "*Shelter Staat."*

Buildings have an energy supply that works or keeps working during and after a flooding event. The energy transition provides opportunities for energy supply during and after a flooding event.
Use the energy transition to create a more robust energy system during and after flooding.
Requirements are formulated for buildings that include considerations on electricity and energy in case of flooding. Use the energy transition to create a more robust energy system during and after flooding.

A bridge to the south can handle heavy storms.
Provide requirements for the bridge.

Two mooring sites have been established on safe locations.
Suitable mooring sites have been established.
Start research into suitable mooring sites.

First secondary flood defence has been made suitable for use in self-reliance.
Make a plan for the use of secondary flood defences for self-reliance. Awareness campaign promoting secundary flood defenses.

Layer 3: communication

Enkele zaken in laag 3 met betrekking tot communicatie kwamen enkel bij het vormen van een visie voor 2040 ter sprake, maar werden niet opgevolgd met concrete stappen op de korte of middellange termijn.

1. Er is geen onnodige onrust onder burgers met betrekking tot overstromingen;
2. Wijken zijn zelfredzame gemeenschappen.

Het eerste punt is een onderdeel om altijd in het achterhoofd te houden. Wel geeft het een belangirjke afweging aan in de communicatie naar burgers en bedrijven. Er moet een balans worden gevonden tussen waarschuwen voor een overstroming en het voorkomen van onrust. Dit onderdeel zou op de agenda kunnen komen als een onderzoek dat samen met een communicatie-

expert zou kunnen worden uitgevoerd. Het tweede punt kan worden gezien als een breed doel van het zelfredzaam eiland en is zodoende tijdens de workshop niet geconcretiseerd.

Citizens are aware of flood risks.
Large safety demonstration with citizens. Set up risk communication programme including yearly communication and special events (flood anniversary). Determine preferred level of 'preparedness.'

Organisations are aware of flood risks.
Start with risk communication.

Citizens know what to do in case of a flood.
First mooring site is used in a drill with citizens.
Start with self-reliance communication.

Layer 3: evacuation

Enkele zaken in laag 3 met betrekking tot evacuatie kwamen enkel bij het vormen van een visie voor 2040 ter sprake, maar werden niet opgevolgd met concrete stappen op de korte of middellange termijn.

1. Regelmatige oefeningen;

Deze visie voor 2040 werd niet gespecificeerd of naar voren getrokken, maar oefeningen komen wel terug voor het behalen van enkele andere onderdelen van de visie.

Organisations are prepared for floods.
Start with healthcare organisations to make a water safety protocol.

Emergency services are prepared for floods.
Large safety demonstration with citizens.

Neighbourhood guard in place.
First neighbourhood guard in place.

Technical modifications are available to facilitate course of action of citizens.

Self-driving cars are able to evacuate.

Evacuation routes are prepared and known in neighbourhoods.
Evacuation embedded in traffic and transport planning. Main evacuation route marked. Self-driving cars are able to evacuate.
Research into evacuation behaviour. Embed evacuation in traffic and transport planning. Main evacuation route marked.

Comparison with LL Action Plan

Layer 1

Voorstraat	Beoordeling Sluitingsprocedure vloedschotten volgens kader van WBI	WSHD
Extra sterke dijk	Borging van extra sterkte bij Kop v.h. Land	WSHD
Regionale Keringen	Behoudsnorm, nieuwe ontwikkelingen op gebied van normeringen - bomen Zeedijk	WSHD & PZH

De genoemde punten in de workshop zijn allemaal zichtbaar in het Plan van Aanpak. Een toevoeging van de workhop is dat de borging van de sterke dijk op de korte termijn moet gebeuren.

Layer 2

Adaptatie strategie Buitendijks	Ontwikkelen strategie voor buitendijks, bieden perspectief aan bewoners	Gemeente Dordrecht
Risico profielen	Risicodialoog aangaan op basis van risico profiel functies	Gemeente Dordrecht & OZHZ
PvE schuillocaties	Ontwikkelen PvE voor schuillocaties	Gemeente Dordrecht & OZHZ & VRZHZ & PZH
Aanlandingsplekken	Onderzoeken mogelijkheden voor aan-landingsplekken binnen project Redden Mens en Dier van WAVE2020	VRZHZ
Vitaal en kwetsbaar	Onderzoek naar effecten stroomuitval op gezondheidszorg, thuiswonende minderzelfredzame	Gemeente Dordrecht & VRZHZ

De workshop biedt enkele toevoegingen op het Plan van Aanpak:

- Met het oog op huizen en wijken die overstromingen goed kunnen weerstaan en waar verticale evacuatie en zelfredzaamheid mogelijk is, is het zaak om op de korte termijn eisen te stellen aan nieuw te bouwen woningen en onderhouds- en verbeterprogramma's. De eisen hiervoor moeten op korte termijn worden onderzocht en gesteld.
- Voor het waarborgen van energie in de vorm van elektriciteit na een overstroming in gebouwen, is het zaak om op korte termijn eisen te formuleren die hier betrekking op hebben en hierbij een energietransitie als kans te gebruiken.

- Voor het realiseren van een brug naar het zuiden die zware stormen kan verduren is het zaak op korte termijn eisen te formuleren voor deze brug.
- Aangezien er een rol wordt gezien voor secundaire keringen in zelfredzaamheid, is het zaak om op korte termijn een plan voor worden gemaakt.

Layer 3: communication

Risico communicatie	Bevorderen van zelfredzaamheid	Gemeente Dordrecht & VRZHZ & WSHD
Crisis communicatie	Uitwerking waterveiligheidsplan	VRZHZ

In aanvulling op de acties in het Plan van Aanpak geven de resultaten van de workshop enkele suggesties. In het kader van risicocommunicatie naar burgers is het zaak op korte termijn:

- een grote veiligheidsdemonstratie te organiseren,
- een risicocommunicatieprogramma op te zetten waarbij jaarlijks wordt gecommuniceerd en speciale gebeurtenissen als jubilea worden benut,
- het gewenste zelfredzaamheidsniveau vast te stellen,
- te beginnen met communicatie over zelfredzaamheid.

Dit zijn specificaties van de risicocommunicatie zoals die in het Plan van Aanpak staat.

Layer 3: evacuation

Evacuatie routes	Onderzoek Reverse Laning – Handeling-sperspectieven evacuatie	RWS & VRZHZ
Opschalen besluitvorming	Uitwerken resultaten "blokkendoos" uit MIRT onderzoek met watermanagement centrum	PZH & VRZHZ
Overstromingsscenario's & kansen	Actualisatie ROR kaarten, advisering t.b.v. impactanalyses, voorbereiden inschatten conditionele overstromingskans	PZH & WSHD & VRZHZ
Herstel	Verkennen mogelijkheden, koppelen met strategische agenda van veiligheidsberaad; Continuïteit van de samenleving	Gemeente Dordrecht
Oefening en training	Training van bestuurders en adviseurs gegeven nieuwe strategie.	VRZHZ

De workshop geeft enkele aanvullingen op de punten in het Plan van Aanpak:

- Voor het bewerkstelligen van evacuatieroutes is het op korte termijn zaak onderzoek te starten naar evacuatiegedrag, evacuatie in verkeers- en transportplannen op te nemen en de hoofdevacuatieroutes te markeren. Verder kan op de korte termijn worden onderzocht of zelfrijdende auto’s een protocol voor evacuatie kunnen ondersteunen.
- Voor het voorbereiden van organisaties op evacuaties is het op korte termijn zaak dat zij veiligheidsprotocollen ontwikkelen.
- Voor het voorbereiden van hulpdiensten is het op korte termijn zaak dat er oefeningen worden georganiseerd.
- Voor het voorbereiden van burgers op evacuaties is het zaak dat op korte termijn een eerste wijkleger wordt georganiseerd.

Recommended additions to Action Plan

Een belangrijke afweging die geen concrete stappen heeft in de communicatie naar burgers en bedrijven, is de balans die moet worden gevonden tussen waarschuwen voor een overstroming en het voorkomen van onrust. Dit is een advies voor het onderdeel in het Plan van Aanpak van risicocommunicatie ter bevordering van zelfredzaamheid.

- Een punt opnemen dat eisen stelt aan nieuw te bouwen woningen en onderhouds- en verbeterprogramma's voor het waarborgen van huizen die overstromingen overleven en overlevingskans en verticale evacuatie van mensen te bevorderen.
- In het PvE voor shelters aandacht schenken aan het stellen van eisen aan een elektriciteitsvoorziening en de kans van een energietransitie hierin te benutten.
- Een punt toevoegen voor het formuleren van eisen voor een brug naar het zuiden die zware stormen kan verduren.
- Een punt toevoegen voor het maken van een plan voor de rol van secundaire keringen in zelfredzaamheid.
- In de risicocommunicatie uit het Plan van Aanpak op korte termijn stappen te maken in het vaststellen van het gewenste zelfredzaamheidsniveau, te starten met communicatie over deze zelfredzaamheid door hier een programma voor op te stellen met periodieke communicatie en gebruik van speciale gelegenheden zoals jubilea, en een veiligheidsdemonstratie te organiseren.
- In de plannen voor evacuatieroutes in het Plan van Aanpak toe te voegen of te specificeren dat er aandacht is voor het onderzoeken van evacuatiegedrag, het opnemen van evacuatie in verkeers- en transportplannen en het aangeven van hoofdevacuatieroutes. Het onderzoeken van evacuatie door zelfrijdende auto's kan worden toegevoegd.
- Het voorbereiden van organisaties kan als punt worden toegevoegd met het doel dat op korte termijn veiligheidsprotocollen door deze organisaties worden opgesteld.
- Het voorbereiden van hulpdiensten kan worden toegevoegd met oefeningen op de korte termijn.
- Het voorbereiden van burgers op een evacuatie kan worden toegevoegd met als concrete actie op de korte termijn het organiseren van het eerste wijkleger.