Deciding for tomorrow, today

What makes governmental decisions about water infrastructure forward looking?

Wieke D. Pot

Propositions

belonging to the thesis, entitled

Deciding for tomorrow, today

What makes governmental decisions about water infrastructure forward looking?

1. Governing long-term problems means acting responsively in a responsible way. (this thesis)
2. Developing decision support tools is not sufficient for realizing forward-looking decisions. (this thesis)
3. Creating a strict division between agriculture and nature in the Netherlands cannot solve the nitrogen crisis.
4. Focusing on best value in asset management does not make government investments in infrastructure future-proof.
5. The university tenure track system delivers better social scientists when the system allows scientists to work up to 50% of their time outside of academia
6. People become less forward looking once they start to raise small children.

Wieke D. Pot

Wageningen, 19 March 2020

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Deciding for tomorrow, today

What makes governmental decisions about water infrastructure forward looking?

Thesis

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To you, my love

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CHAPTER

Introduction

1.1 The governance challenge of investing in end-of-lifetime water infrastructure

The seven combinations of locks and weirs on the Dutch Meuse river were built between 1918 and 1929 to make the river navigable and enable vessels to transport coal to the western parts of the country. In the past century, the number and size of vessels using the waterway have expanded and the nature of goods transported has similarly changed. This is impacting the functioning of the current locks and weirs. The locks and weirs are now approaching their end-of-lifetime, and this requires the Dutch government to make long-term investment decisions. Given the design lifetime of 100 years for locks and weirs, it is uncertain what type of infrastructure will be needed for the next century. A key question is whether the Meuse river and its locks and weirs can and will maintain their current functionalities, or whether these functionalities should change in response to, amongst other issues, climate change (probably increasing the frequency and intensity of both flooding and low river flows; see van Vliet & Zwolsman, 2008; Wind et al., 1999), economic change (impacting the type of goods transported), technological change (leading to, for example, larger vessels), and commitments by the Dutch government to reduce CO_2 emissions in response to national and international climate change agreements (leading to questions of whether the weirs could also be used to generate sustainable power) (Welberg et al., 2015). Considerations about these uncertain developments led the national water authority to consult a large number of parties in a co-creation process in 2015.[1] This process resulted in a diverse range of possible solutions for the locks and weirs as well as for changing the functionalities of the Meuse river, some of which are currently being further explored by the national water authority before it proposes specific investment decisions to the Dutch Ministry of Infrastructure and Water.

Another example of a long-term investment decision on water infrastructure that is likely to have immense consequences concerns the Maeslant storm surge barrier. This storm surge barrier is one of the Dutch Delta Works situated close to Rotterdam harbour. Recent insights about accelerated sea level rise (Pörtner et al., 2019) have caused the relevant authorities to realize that the storm surge barrier probably needs to be replaced 10 to 20 years earlier than its design lifetime (Haasnoot et al., 2018). It is currently expected that the decision process will start around 2030.

1 For more information, see: https://debouwcampus.nl/vraagstukken/vervangingsopgave-grip-op-de-maas

Furthermore, changing circumstances force consideration of different infrastructural solutions. An open storm surge barrier similar to the current Maeslant storm surge barrier will probably no longer be able to protect the Netherlands against floods and sea level rise in the future. Alternatives such as a sea lock have already been proposed and explored[2] but will have a major impact on Rotterdam harbour's economic prospects (Haasnoot, Diermanse, Kwadijk, De Winter, & Winter, 2019).

The examples of the Meuse locks and weirs and the Maeslant barrier illustrate the potential impact of long-term developments on infrastructure investment decisions. Changing circumstances such as climate change, technological developments, economic and demographic changes, and socio-political trends will shorten the design lifetimes of water infrastructures (OECD, 2014). In response to these developments, governments will need to consider alternative solutions, for example, adding energy production facilities and replacing an open storm surge barrier with a sea lock. Also, irrespectively of changing circumstances, an increasing number of water management structures are already approaching their end-of-lifetime due to technical ageing (Grigg, 2017; Hijdra et al., 2014; OECD, 2016). This will put decisions on end-of-lifetime infrastructure higher on the governmental agenda, in the Netherlands but also elsewhere. The long lifespan of infrastructure will require governmental decision makers to look into the far future to anticipate possible developments and to decide on solutions that can cope with changing circumstances over a long period of time. This will require, what I call, forward-looking decisions. Broadly considered, a forward-looking decision is a decision whereby governments anticipate possible future developments that could impact the long-term effectiveness of water infrastructure.

Making forward-looking decisions can be especially challenging for governments because of their short budget and election cycles, their accountability to current constituents, their responsibility to provide legal certainty, and their focus on short-term results (Bührs, 2012; Höglund et al., 2018). Governments that try to address long-term problems and invest in water infrastructure with a long lifespan are therefore faced with important temporal and substantive dilemmas, such as how to address long-term problems without losing legitimacy, how to impose costs on current constituents for the benefits of future constituents, and how to deal with conflicting goals and missions (Jacobs, 2011). Meanwhile, governments worldwide have committed themselves to international agreements that address long-term policy problems, for example, the 2015 Paris Agreement to combat climate change

2 Dutch second chamber, meeting year 2015–2016, 31 710, no. 48

as part of the United Nations Framework Convention on Climate Change (UNFCC). Implementing these agreements requires national and local governments to exploit investments in end-of-lifetime infrastructure to achieve specific long-term objectives (Hueskes et al., 2017; Pinz et al., 2018).

By answering the following general research question, this dissertation aims to assess, explain, and improve the extent to which governments make forward-looking decisions about their water infrastructure:

What makes governmental decisions about water infrastructure forward looking?

The next section introduces how governmental decision making can be understood and discusses the elements that characterize forward-looking decisions. In section 1.3, the specific research questions are formulated in relation to gaps in the literature. Section 1.4 presents the methodological approach, and section 1.5 provides the outline of this dissertation.

1.2 Understanding long-term decision making

This section introduces the decision-making lens that is used for understanding governmental decision-making processes and discusses the elements that characterize forward-looking decisions, based on a review of existing literature.

1.2.1 Understanding governmental decision-making processes

The term *forward looking* in regard to forward-looking decisions should not be mistaken for acting rationally (Dahlberg & Lindström, 1998). Decision making about long-term investments in infrastructure is anything but rational because of the many uncertainties, the plurality of actors, the large range of possible solutions, and the competing objectives involved. Under such ambiguous conditions, a rational choice or linear model will not adequately explain how governments arrive at decisions. This dissertation therefore starts from a combination of horizontal decision-making theories. More specifically, the dissertation integrates elements from the garbage can model (Cohen et al., 1972), the multiple streams framework (Kingdon, 1984, 2011) and recent developments of this framework (Howlett et al., 2015, 2016; Howlett, 2019), and the rounds model (Teisman, 2000).

Based on these theories, this dissertation argues that governmental decision making about infrastructure investments consists of relatively independent streams of politics, problems, solutions, and choice opportunities, and is characterized by multiple crucial decisions. The streams metaphor was introduced by Cohen, March, and Olsen in their garbage can model of organizational decision making (1972), and further developed by Kingdon (1984, 2011). Streams provide the conditions in which actors operate (Jones et al., 2016). Unlike the garbage can model, Kingdon's multiple streams framework does not focus on decision making but was developed to explain agenda-setting processes. Howlett and others (2015, 2016; 2018) therefore argue that it is not possible to apply the multiple streams framework to a decision-making process without re-introducing the choice opportunities stream – which they re-name the process stream – that was part of the original garbage can model. This choice opportunities stream consists of the pre-set opportunities for decision making within organizations and the formal rules, procedures, and norms relevant to examining options and making decisions. The other three streams of the multiple streams framework that are relevant for understanding governmental decision making consist of: a stream with competing problem definitions, a stream with alternative solutions, and a stream with political influences (such as the election cycle and political orientation of the executive branch) (Howlett et al., 2016).

In a multiple streams framework that is suitable to understand policy process phases beyond the agenda setting phase, Howlett et al. (2016) use the term *critical junctures* to demarcate these different phases (i.e. agenda setting, decision making, and implementation). Howlett et al. portray these phases as similar to the rounds in Teisman's (2000) rounds model. However, the rounds model argues that the decision-making process itself consists of several rounds of interactions between actors. The beginning and the end of each round are marked by crucial decisions. *Crucial decisions* can be identified on the basis of changes in the problem definitions or solution alternatives that become part of decisions, and changes in actors or interactions between actors (Klijn & Koppenjan, 2016). Crucial decisions also serve as important points of reference for interacting actors in later periods of the decision-making process (Teisman, 2000). Hence, the decision-making process consists of a sequence of decisions. These decisions can be made by multiple actors. The actors involved in decision-making processes can come from inside and outside government, and from different streams and different layers of government (Hill & Hupe, 2002; Klijn & Koppenjan, 2016). Actors can be individuals, organizational departments, and combinations of individuals from the same organization as well as from different organizations. In this dissertation, organizations should be understood as separate administrative entities.

The decision-making lens is further operationalized in Chapters 2 and 3 of this dissertation and serves as a starting point for the theory for forward-looking decision making introduced in Chapter 7.

1.2.2 Understanding the long term

Answering the main research question requires understanding not only the decision-making process, but also the concepts relating to a forward-looking decision on long-term infrastructure. Different strands of literature provide ways for governments to anticipate future developments with their investment decisions on long-term infrastructure. The next three sub-sections discuss the existing literature and the key concepts used to define a forward-looking decision in section 1.2.3 and to develop criteria and measurements in the empirical chapters of this dissertation.

Long-term problems

When governments make decisions about investments in infrastructure, they need to consider the long-term challenges or problems that could impact these investments. Sprinz (2009, p. 2) defines long-term policy problems as 'public policy issues that last at least one human generation, exhibit deep uncertainty exacerbated by the depth of time, and engender public goods aspects both at the stage of problem generation as well as at the response stage.' Long-term problems can be diverse, but many are based in the biophysical system and include adapting to global sea level rise, countering biodiversity loss, and moving away from fossil fuels towards low-carbon renewable energy to reduce greenhouse gas emissions (Foxon et al., 2009; Hovi et al., 2009). In the literature, long-term problems are also portrayed as grand challenges (Ferraro et al., 2015), meta problems (Seidl & Werle, 2018), and super wicked problems (Lazarus, 2008).

A core characteristic of long-term problems is their long-term time horizon, as these problems will last for a long time. In the literature, there is no generally accepted standard time horizon for addressing long-term problems, or consensus about the meaning of terms such as short term, long-term, or future generations (Bauer, 2018; Eshuis & van Buuren, 2014). Time horizons can differ per individual and the role individuals fulfil within organizations (Segrave et al., 2014). A long-term time horizon for policy advice is typically between 10 and 20 years (Bauer, 2018). The time horizon of politicians is likely to be shorter because they need to remain responsive to their current constituents and therefore do not look beyond their legislative period of a maximum of eight years. The limited time horizon of legislative periods has given rise to discussions about the myopic view within governments (Bonfiglioli & Gancia, 2013; Boston, 2017; Bührs, 2012). Because

long-term problems will last for generations or more, time horizons to address these problems need to cross the regular organizational cycles of elections, decision making, planning, and budgeting (Pörtner et al., 2019).

Long-term problems are also characterized by high levels of uncertainty about what the future will look like and about what actions to take to deal with the future (Foxon et al., 2009). As Underdal states: 'Uncertainty tends to increase the farther into the future we look' (2010, p. 387). Brugnach et al. (2008, p. 4) define uncertainty as 'the situation in which there is not a unique and complete understanding of the system to be managed'. In order to understand uncertainty, many scholars differentiate between types and levels of uncertainty (Dewulf & Biesbroek, 2018; Kwakkel et al., 2010; Zandvoort et al., 2018). Howlett et al. (2018) state that analysing the level of uncertainty can help to determine the required type of government response and hence to what extent a forward-looking decision is needed. To distinguish levels of uncertainty, Marchau et al. (2019) use four levels. At the first level, the future can still be predicted, whereas the deepest level of uncertainty refers to a situation in which many futures are plausible. To indicate the deepest level of uncertainty, scholars also speak of radical uncertainty (Ferraro et al., 2015), deep uncertainty (Kwakkel, Walker, et al., 2016), and unknown unknowns (Termeer & van den Brink, 2013). These situations require a greater extent of forward-lookingness of decisions.

Long-term solutions

Despite the uncertainties about changing future circumstances, water infrastructure needs to remain effective over a long period of time given its long design lifespan of up to 100 years (Herder & Wijnia, 2012). To ensure the effectiveness of infrastructure over the course of its lifespan, scholars in urban planning and engineering refer to related concepts such as resilience, robustness, and flexibility. The basic definition of resilience refers to the ability of systems to absorb change and disturbance so as to maintain the same functions (Holling, 1973). This definition of resilience has been broadened to combine social and ecological systems (Ferro-Azcona et al., 2019). The broadened definition includes the capacity to absorb shocks (absorptive capacity), the capacity to adjust responses to changing circumstances (adaptive capacity), and the capacity to create a new, less vulnerable system when changed conditions make the existing system untenable (transformative capacity) (Folke, 2016; Mao et al., 2017). Absorptive capacity is close to the meaning of static robustness, also referred to as robustness. Robustness means choosing solutions that can withstand shocks and remain functional under the full range of plausible futures. Adaptive capacity is close to the meaning of dynamic robustness, also referred to as flexibility. Flexibility means having a plan to change solutions over time or switch to another solution if conditions change (Maier et al., 2016; Walker et al., 2013). Robustness and flexibility can therefore be seen as two alternative paths to resilience of the social-ecological system (Dewulf & Termeer, 2015). Robustness and flexibility are useful concepts for designing engineered systems (Anderies et al., 2004; Spiller et al., 2015) and hence for designing infrastructure that can remain effective over long periods of time.

Besides choosing infrastructure that can remain effective over the course of its lifespan, decision makers need to plan their investment decisions carefully because of infrastructure's long lead time, i.e. the time it will take from the start of the decision-making process to the realization of a new infrastructure (Meuleman & in 't Veld, 2010). During this lead time, which can be up to 30 years for water infrastructure, changes in functional demands and new technologies are likely. This lead time also implies that infrastructure investments have a long time lag between costs and benefits: benefits will occur in the future, whereas resources need to be extracted in the short term (Underdal, 2010). Infrastructure investments are therefore what Jacobs (2011) calls policy investments: a policy choice that combines short-term resource extraction with long-run social benefits.

Future-oriented support for long-term investment decisions

To support investments in water infrastructure and choose robust and/or flexible solutions, governmental actors can develop and use ideas about what the future will look like. A future can be understood as everything that has not happened and that may or may never happen (Anderson, 2010). The future includes expectations, concerns, and hopes about what can happen (Hodgson, 2013). The future can be differentiated into probable, plausible, possible, and preferable or desirable futures (Bai et al., 2015; Bauer, 2018; Hicks & Holden, 2007). Probable futures are those futures that are deemed likely to happen; plausible futures are ranges of possible futures with specific assumptions; possible futures are those futures that 'can happen' and are therefore infinite; preferable futures are those futures that actors desire to happen. Future studies scholars have developed different types of tools to grasp these futures and support decisions. To analyse probable futures, probabilistic models and simpler cost-benefit analyses can be used (Ranger et al., 2013). To imagine plausible futures, scenario planning approaches can prove helpful (Healey & Hodgkinson, 2008). To explore possible futures, models for decision making under deep uncertainty are proposed (Marchau et al., 2019). Finally, to develop preferable or desirable futures, backcasting and envisioning processes have been developed (Neuvonen & Ache, 2017).

Desirable futures can also be formulated into long-term objectives. According to Meuleman and In 't Veld (2010, p. 260) long-term objectives are 'objectives concerning the future that must be reached by taking decisions today.' Objectives are therefore about the benefits of investment decisions: the outcomes that actors desire to achieve (Marchau et al., 2019). Long-term objectives can, for example, come from organizational strategic plans and visions and inter-organizational agreements, and will often need to be translated to the level of investment decisions. Well-known long-term objectives are the greenhouse gas emission reduction targets of the UNFCC Paris Agreement and the sustainable development goals of the United Nations. Long-term objectives can be formulated with and without a specific target year (for example, 'we will be climate neutral in 2050' versus 'our aim is to become climate neutral') (Hansson et al., 2016).

1.2.3 Forward-looking decisions

In this dissertation, I introduce the concept of a forward-looking decision and apply this to governments' long-term investments in water infrastructure. The literature presented in section 1.2.2 provides the main elements of a such a decision: a problem definition for which a long time horizon is used to anticipate long-term problems, an infrastructural solution that is flexible and/or robust, and a justification that supports the choice of specific solutions by imagining and formulating desirable futures or by exploring plausible and possible futures. These elements are used in Chapter 2 to present the criteria for a forward-looking decision.

Forward-looking decisions are not the opposite of short-term decisions. Short-term decisions are decisions with an immediate impact and can be important for addressing long-term problems when such decisions include long-term objectives (Meuleman & in 't Veld, 2010). Short-term decisions are often part of flexible strategies, as they can form a first step (such as more efficient water use) before more drastic measures are needed (such as severely increasing water levels in freshwater basins to cope with droughts) (Haasnoot et al., 2013). Forward-looking decisions are also not the same as long-term investment decisions: decisions that extract resources in the short term for long-term benefits (Jacobs, 2011). Rather, this dissertation focuses on the extent to which possible future developments are anticipated as part of long-term investment decisions. Therefore, this dissertation positions forward-looking decisions as the opposite of myopic decisions. Myopic decisions are decisions that do not take possible future developments into account but rather are focused on the current state of affairs (Nair & Howlett, 2017).

The next section introduces the research sub-questions, based on gaps in the existing literature.

1.3 Gaps in the literature and research sub-questions

This dissertation aims to assess, explain, and improve the extent to which governments make forward-looking decisions about their water infrastructure. To meet this overall aim, this section introduces the research sub-questions (RQs) that guide this research. These RQs focus on specific gaps in the literature.

1.3.1 RQ1: How can forward-looking decisions be conceptualized and measured?

As a first step necessary to assess, explain, and improve the extent to which governments make forward-looking decisions, the concept of a forward-looking decision needs to be further conceptualized. Existing literature tends to focus on one aspect of these decisions, such as the use of scenarios and forecasting to support decisions (Havas & Weber, 2017; Rickards, Wiseman, et al., 2014) or choosing robust or flexible solutions (Kwakkel, Walker, et al., 2016; Maier et al., 2016). Furthermore, the literature is often concerned with the long-term challenge of climate change (Dąbrowski, 2018; Lawrence et al., 2015; Lyles et al., 2018), whereas there are many more long-term challenges that governments need to consider to ensure the long-term effectiveness of infrastructure. This dissertation integrates the different strands of literature discussed in section 1.2.2 into one comprehensive concept with specific criteria for forward-looking decisions. To assess the presence as well as the extent of forward-lookingness, the dissertation provides several ways to measure this. These measurements can also be used by governments to prepare more forward-looking investment plans. This will contribute to improving the extent to which governments make forward-looking decisions about end-of-life-time water infrastructure.

1.3.2 RQ2: How forward looking are governmental investment decisions about water infrastructure?

By applying the concept and measurements of a forward-looking decision to different types of infrastructure, the second RQ focuses on assessing the extent to which governments anticipate the future. Existing literature discusses the extent to which governments are myopic (Bonfiglioli & Gancia, 2013) and capable of making long-term decisions (Jacobs, 2011). Long-term decisions, however, are not the same as forward-looking decisions (see section 1.2.3), and literature that addresses

myopia focuses mainly on proposing new institutions or institutional reforms that enable governments to address the needs of future generations (Boston, 2017; Bührs, 2012; Tonn, 2018). This literature acknowledges myopia but does not analyse it. RQ2 contributes to the empirical understanding of myopia and forward-lookingness within governmental organizations and the extent to which this can vary between organizations and over the course of decision-making processes.

1.3.3 RQ3: What conditions enable forward-looking decisions?

The third RQ focuses on the conditions that allow governments to make forward-looking decisions. This question requires the unravelling of governmental decision-making processes. Existing literature proposes valuable decision-making methods and approaches that support governments in making forward-looking decisions. Examples include the use of scenario building (Soetanto et al., 2011) and models to devise robust and adaptive strategies (Walker et al., 2013), but many of these methods rely on a rather rational and linear view of decision making (Wise et al., 2014) and neglect the institutional and political context of decision making (Bryson & Berry, 2010; Nilsson et al., 2011). Rational and linear decision-making models have mainly prescriptive power and do not reveal the ambiguous conditions in which governments operate. In contrast, the multiple streams framework is especially suited to explain decisions in situations of deep uncertainty and high ambiguity (March, 1991; Zahariadis, 2014). In order to reveal conditions enabling forward-looking decisions, this dissertation uses the multiple streams framework to include the political, institutional, and ambiguous decision-making context in which governments decide about long-term investments in water infrastructure.

1.3.4 RQ4: What mechanisms and strategies shape forward-looking decisions?

The fourth RQ focuses on understanding the strategies and mechanisms that directly shape forward-looking decisions. Knowledge about the factors causing forward-looking decisions is limited, because many scholars have treated the existing governmental context and decision-making processes as not sufficiently capable of addressing long-term problems. These scholars have therefore developed ideas about new institutions and governance frameworks (Bührs, 2012; Loorbach, 2010; Tonn, 2018), required institutional capacities (van den Brink et al., 2014), or required institutional reforms (Boston, 2017). These proposals focus on changing the conditions under which governments decide about long-term problems and solutions and therefore do not focus on existing practices. Literature that is concerned with analysing existing practices regarding long-term decision making tends to focus on specific long-term-oriented activities such as strategy development (Bryson et al., 2018; Hansen & Ferlie, 2016), scenario planning (Bowman, 2016; Rickards, Wiseman, et al., 2014), and vision making (Neuvonen & Ache, 2017; van der Voorn et al., 2015). However, these long-term-oriented activities are not the only organizational practices in which actors deal with long-term problems. Furthermore, these activities do not necessarily become part of governmental decision making (Rickards, Wiseman, et al., 2014; Volkery & Ribeiro, 2009). Therefore, this RQ focuses on current governmental decision-making processes, including actors' strategies to deal with long-term problems and invest in long-term infrastructure. This focus reveals the specific causal mechanisms and actor strategies that increase or decrease the forward-lookingness of investment decisions.

Figure 1.1 depicts the relationships between the four research sub-questions.

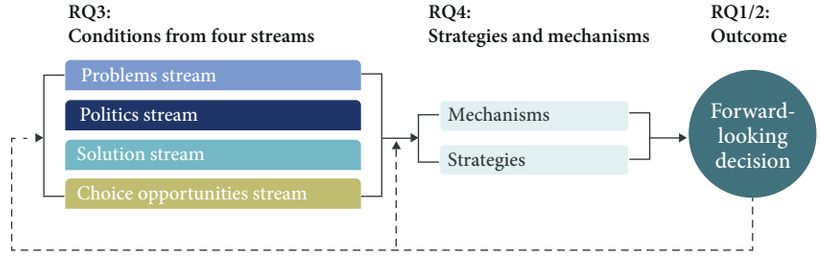

Figure 1.1. Relationship between research questions (RQs)

1.4 Research methodology

This section describes how this dissertation's research questions are answered. It discusses the ontological position, the multi-method research approach, case selection, and the methods for data collection and analysis.

1.4.1 Ontology and causality

As this dissertation focuses on the interplay between context (conditions) and the acts and interactions of actors (strategies) to explain the outcome of forward-looking decisions, it starts from a processual critical realist ontology (Fleetwood, 2015; Hay, 2005). A critical realist ontology accepts the existence of a material, social, artefactual, and ideational reality within which actors are situated and interpret their possible courses of action (Fleetwood, 2015; Verweij & Gerrits, 2013). In other words, there is a context, formed by the conditions, that actors interpret and to

which they respond in the form of strategies. The context is relatively difficult for actors to influence during decision-making processes, but their decisions reproduce or transform the context. Strategies influence the outcome of decision-making processes because they are part of mechanisms. Mechanisms are composed of entities that engage in activities, by themselves or in interaction with other entities (Beach & Rohlfing, 2018; Hedstrom & Ylikoski, 2010). In this dissertation, entities are the involved actors (individuals and organizations), and activities are the strategies that actors use in response to conditions and dilemmas. Causal mechanisms are the processes that link conditions to the outcome and that provide direct explanations for the occurrence of specific outcomes (Hay, 2005; Hedstrom & Swedberg, 1996).

Causality is therefore real, as well as thick and complex. Causality is real because the effects of mechanisms and the strategies of actors can be observed (Gerrits & Verweij, 2013; Hay, 2005). Causality is thick, because the cause of forward-looking decisions lie not in the event that preceded it, but rather in a sequence of actions of interacting actors in response to their context (Fleetwood, 2015; Mayntz, 2004). Explanations are derived from a detailed description of the context in which actors operate, as well as from a causal history of the events that precede forward-looking decisions. Finally, causality is complex, because there are no mono-causal explanations for forward-looking decisions. Instead, forward-looking decisions are enabled by various combinations of conditions and can be produced by multiple different mechanisms (Gerrits & Verweij, 2013; Schneider & Wagemann, 2010a). Moreover, the outcomes that particular mechanisms produce will depend on the context (Falleti & Lynch, 2008).

1.4.2 Research design and methods

In light of the processual critical realist ontology, this dissertation adopts a multi-method research design that consists of a combination of qualitative research methods. The main rationale for using multiple methods is that they provides complementary answers to the question of what makes decisions forward looking (Beach & Rohlfing, 2018; Hendren et al., 2018): a multi-method research design reveals conditions, strategies, and mechanisms behind forward-looking decisions. Each research sub-question is answered by using a combination of methods. For RQ1 and RQ2, both of which focus on the outcome of a forward-looking decision, an in-depth case study was combined with cross-case analyses (Beach & Rohlfing, 2018). First, the in-depth case study was used to further develop the concept of, and criteria for, a forward-looking decision on the basis of an empirical case study, using process tracing. The criteria for a forward-looking decision were then tested

in a cross-case analysis using fuzzy set qualitative comparative analysis (fsQCA) and a comparative case study. These methods enabled the comparison of a total of 40 cases, i.e. investment decisions of different public sector organizations. Because the three methods required different operationalizations of forward-looking decisions, they provided different measurements for the outcome of interest.

For RQ3, which focuses on conditions, a combination of process tracing, fsQCA, and ethnography was used. The conditions are the organization's relatively fixed characteristics (for example, organizational analytical capacity) and the reality outside the organization, which is relatively difficult to influence (for example, extreme weather events). First, an in-depth case study on the basis of process tracing allowed exploration of the conditions that trigger mechanisms behind forward-looking decisions. Second, these findings were complemented with existing theory and tested in a cross-case analysis using fsQCA. With fsQCA, cases can be clustered according to their membership of the conditions and the outcome to find cross-case patterns (Beach & Rohlfing, 2018). The cross-case patterns were the combinations of conditions that enabled the outcome of forward-looking decisions (Schneider & Wagemann, 2012). Finally, ethnography is an interpretative research method that provides a deeper understanding of the context in which actors operate (Cappellaro, 2017). In relation to RQ3, ethnography provided a rich understanding of the conditions within which actors dealt with long-term problems and decided on infrastructural investments.

For the final RQ, RQ4, the dissertation focuses on developing deeper explanations in the form of mechanisms and strategies, using a combination of process tracing and ethnography. Process tracing can be defined as a within-case method that allows tracing of the processes, or mechanisms, that link the (combinations of) conditions with the outcome of interest (Beach & Rohlfing, 2018). This within-case method enables the analysis of multiple investment decisions within particular case studies. For RQ4, ethnography was employed to uncover the specific strategies of actors. A strategy is understood as a set of actions that display a certain pattern that can remain quite stable across time (Boswell et al., 2019). These strategies are responses to dilemmas: choices between seemingly paradoxical courses of action that can arise when actors deal with long-term problems and solutions (Hay, 2011). Strategies can also influence the outcome of decision-making processes, because they are part of mechanisms.

1.4.3 Cases

As part of the methodologies mentioned, different cases were used. Cases in this dissertation are the investment decisions of Dutch public sector organizations about end-of-lifetime water infrastructure, except for the ethnographic study where the case consisted of a public sector organization that was responsible for making investment decisions and dealing with long-term problems related to water (see Table 1.1). All decision-making processes analysed in this dissertation were recently finalized or are still ongoing. Recently finalized means less than five years before 2016–2019 (the data collection period for this dissertation). The scope of this dissertation is limited to public sector organizations in the Netherlands, the domain of water, and an institutional responsibility of organizations to invest in long-term water infrastructure. This scope ensures a sufficiently homogeneous empirical base.

Within this scope, diversity was sought to provide a complete picture and allow transferability of research findings to other organizations operating within the same context: the dissertation covers multiple public sector organizations (municipalities, national and regional water authorities, a province, and a ministry) in the Netherlands and different type of water infrastructure (urban water infrastructure and especially sewerage and drainage systems, a water pumping station, a sea lock also fulfilling the role of primary flood defence structure, and wastewater treatment plants). Several long-term problems are represented in the analysed cases, most prominently those of climate change adaptation, long-term sustainability objectives, energy transition, and economic growth.

To select cases, a clustered sampling of (municipal) cases was used for the cross-case analyses (see Supplementary Material B1 for the case selection protocol). Clustered sampling ensured a representative sample and a consistent dataset. For within-case analyses using process tracing and ethnography, purposeful sampling was used to select specific cases for exploratory use (Seawright & Gerring, 2008). More details on specific case selection criteria are provided in the empirical Chapters 2–6 of this dissertation.

1.4.4 Methods of data collection and data analysis

As part of the multi-method research design, the data collection strategy focused on collecting qualitative data such as interviews, primary documents, and observations. The conditions, mechanisms, and strategies (RQ3 and RQ4) were discovered on the basis of different data than the outcome (RQ1 and RQ2) (see Table 1.1 for an overview). The outcome of forward-looking decisions was measured on the basis

Table 1.1 Overview of research methods

Research methodology	Chapter	Case selection	Case(s)	Data collection	Data analysis
Process tracing	2, 5	Purposeful sampling	Sea lock *IJmuiden;* Water pumping station *Vissering*	Interviews; observations tender procedure; primary documents	Deductive and inductive coding Software: Atlas.ti
Qualitative comparative analysis	3	Clustered sampling	Municipal water management, especially urban drainage	Primary documents; existing questionnaires; telephonic interviews; media analysis	Deductive and inductive coding, calibration, necessity and sufficiency of conditions Software: R (packages QCA and set relations), Tosmana, Atlas.ti
Comparative case study	4	Clustered sampling	Municipal water management, especially urban drainage	Primary documents; telephonic interviews; expert workshop	Deductive and inductive coding; t-tests Software: Atlas.ti, Excel
Ethnography	6	Purposeful sampling	Regional water authority *Zuiderzeeland*	Participant observation; interviews; primary documents	Inductive coding; constant comparison Software: Evernote, Excel

of the formal decisions made by the political governing bodies of public sector organizations, whereby governing bodies allocated budget to invest in water infrastructure.

In line with the ontology and the methodologies, an abductive logic of data analysis was followed. An abductive logic represents a continual iteration between empirical data and existing theories, and between developed ideas and new insights. These iterations allow the researcher to get closer to one or more plausible explanations that can be tested in further research (Beach & Pedersen, 2016; Wolf & Baehler, 2018). Abduction includes both inductive and deductive methodological steps: for example, in fsQCA, the selection and operationalization of conditions requires prior theoretical knowledge (deduction), and empirical insights are used to adapt

initial operationalizations (induction) (Gerrits & Verweij, 2013; Schneider & Wagemann, 2010b). For ethnography and process tracing, the analysis started by providing a thick chronological and contextual narrative. A narrative enables arguing backwards from observed outcomes (decisions) to previous events and providing thick explanations in the form of mechanisms and strategies as emerging from specific contexts (Fleetwood, 2015). Identification of the mechanisms and strategies requires an iteration between theory and empirical findings.

The data collection and analysis methods are described in more detail in the relevant chapters.

1.5 Structure of the dissertation

To answer the main research question, five empirical studies are included in this dissertation, each described in a separate chapter. Table 1.2 shows how each empirical chapter relates to the different RQs. The first RQ is answered in Chapters 2 to 4. These chapters provide the criteria for forward-looking decisions and measurements to assess the extent of forward-lookingness of governmental decisions about water infrastructure.

The second RQ is addressed in Chapters 2 to 5, where the concept of a forward-looking decision and/or specific criteria for forward-looking decisions are applied to empirical cases of investment decisions about water infrastructure. These chapters therefore reveal the extent to which governments anticipate the future and try to achieve long-term objectives with their investment decisions, and the extent to which this varies across organizations and decisions.

The third RQ is addressed in Chapters 2, 3, and 6. These chapters provide the combinations of conditions that enable governments to make forward-looking decisions. Conditions are revealed through different research methods to gain a rich understanding of the context in which governments operate and work on investments in water infrastructure.

The fourth RQ is addressed in Chapters 2, 5, and 6, which include the mechanisms and strategies that have positive or negative consequences for the extent to which governmental decisions become forward looking. The mechanisms and strategies are the result of interactions between actors from the same organization and from different organizations. The chapters include, for example, interactions between the public and the private sector and between different governments. Chapter 6 also reveals core dilemmas that governments encounter when addressing long-term policy problems as part of their everyday practices.

Chapter 7 synthesizes the results of all previous chapters by answering the research questions and reflecting on the theoretical contributions. Further, this chapter presents a new theory about forward-looking decision making, outlining the main factors affecting forward-looking decisions. The chapter also reflects on the limitations of the research and provides avenues for future research. Finally, the chapter provides recommendations for governmental decision makers and water managers to enhance their capacity to make forward-looking decisions.

Table 1.2 Overview of dissertation

Chapter	Research Question	Method	Publication status
1. Introduction	-	-	-
2. What makes long-term investment decisions forward looking: A framework applied to the case of Amsterdam's new sea lock	RQs 1, 2, 3, 4 (outcome, conditions, mechanisms)	Process tracing	Published in: *Technological Forecasting and Social Change*
3. What makes decisions about urban water infrastructure forward looking? A fuzzy-set qualitative comparative analysis of investment decisions in 40 Dutch municipalities	RQs 1, 2, 3 (outcome, conditions)	fsQCA	Published in: *Land Use Policy*
4. Anticipating the future in urban water management: An assessment of municipal investment decisions	RQs 1, 2 (outcome)	Comparative case study	Published in: *Water Resources Management*
5. The governance challenge of implementing long-term sustainability objectives with present-day investment decisions	RQs 2, 4 (outcome, mechanisms)	Process tracing	Under review with international peer-reviewed journal
6. Governing long-term policy problems: Dilemmas and strategies at a Dutch water authority	RQs 3, 4 (conditions, dilemmas, strategies)	Ethnography	Accepted in revised form by *Public Management Review*
7. Conclusions and discussion	-	-	-

2

CHAPTER

What makes long-term investment decisions forward looking: A framework applied to the case of Amsterdam's new sea lock

ABSTRACT

Long-term investments challenge decision makers to look into the far future. Existing future studies often build upon a rational idea of decision making that does not help to explain why decision makers anticipate the future. In addition, existing studies do not provide a clear definition of what is considered as 'forward looking'. This chapter proposes a framework that can be used to evaluate and explain for what reasons and based on what criteria decision makers make forward-looking investment decisions. We apply this framework to a specific decision-making case about a Dutch sea lock, making use of interviews (n=16) and a content analysis of primary documents (n=430). We find that not all investment decisions are necessarily forward looking. Secondly, we conclude from our case that decisions became forward looking because administrators used scenarios, visions, and flexible solutions to build support, avoid political risks, and comply with formal rules. Scenario developers and urban planners could therefore involve administrators in early stages of the decision-making process to increase their awareness of the future towards which they are steering and provide them with alternative future paths. Furthermore, they could identify and use relevant institutional rules with forward-looking features to stimulate forward-looking decisions.

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2.1 Introduction

A current challenge in the developed parts of the world is that an increasing number of water management structures are approaching their end-of-lifetime consequent to technical aging or changing functional demands (Díaz et al., 2016; Grigg, 2017; Hijdra et al., 2014). This challenge of end-of-lifetime infrastructure puts long-term investment decisions on the agenda of many public sector organizations. The long infrastructure lifetime of up to 100 years may require decision makers to look into the far future to anticipate future challenges and to decide on technical solutions that can cope with deep uncertainty (Nair & Howlett, 2014). Various institutional barriers, including political myopia, can make it difficult for decision makers to make decisions that anticipate the future (Bonfiglioli & Gancia, 2013). Furthermore, decision makers are faced with large uncertainties when they need to invest in infrastructure that will remain for 100 years. Uncertainties can arise because new technical solutions will become available during the lifespan of an infrastructure, climate change will impact the effectiveness of infrastructure, and user demands may change severely.

A growing body of literature supports decision making under deep uncertainty by providing a range of scenario and decision support methods (see Haasnoot et al., 2013). Scenario planning and deep uncertainty approaches often assume a rational decision-making process in which a decision maker formulates long-term goals, explores as many alternatives as possible, weighs future consequences, and chooses the solution that can withstand long-term change (Kwakkel et al., 2010; Restemeyer et al., 2016; Wise et al., 2014). This dominant perspective of decision making as an orderly process is more prescriptive than descriptive, being more concerned with how alternative solutions and futures *should* be explored than with how specific solutions *are* chosen (Mintzberg et al., 1998, p. 3; Stone, 2002, p. 184). Such a perspective therefore does not help to elucidate the complex processes that cause decision makers to consider the future when deciding to invest in end-of-lifetime infrastructure. Furthermore, the literature does not provide a clear definition of a *forward-looking decision* or equates forward looking to the application of foresight and scenario methods (Havas & Weber, 2017; Iden et al., 2016). Without a clear definition of what constitutes a forward-looking decision, it is difficult to judge whether and how scenario methods influence public sector investment decisions (Rickards, Wiseman, et al., 2014; Volkery & Ribeiro, 2009).

This chapter aims to evaluate and explain for what reasons and based on what criteria decision makers make forward-looking investment decisions. The main question that guides this chapter is: *What makes long-term investment decisions forward looking?* In answering this question, we aim to make two theoretical contributions. First, we develop a decision-making framework to explain how decision processes evolve and why decisions become forward looking. Our framework provides an alternative to the burgeoning literature about scenario studies, strategic planning and deep uncertainty that has a more normative view on decision making and the role of future aspects therein. The decision-making framework that we develop builds on the Multiple Streams Framework (MSF) developed by Kingdon (2011) and advanced by Zahariadis (2014) and Howlett et al. (2015, 2016). The MSF is especially suited to explain decisions in situations of deep uncertainty and high ambiguity (March, 1991; Zahariadis, 2014). Our alternative framework is therefore particularly useful to explain how decision makers use scenarios, visions, strategies, and flexible solutions in practice and with that, produce forward-looking decisions. Second, we introduce a comprehensive definition of *forward looking*, to specify on the basis of what criteria an investment decision can be characterized as forward looking. The definition consists of three evaluative criteria: a problem definition that includes a long time horizon and future developments, a solution that is adaptive or robust to account for uncertainty, and a justification that relies on long-term goals or future scenarios. To illustrate the value of our framework and to provide explanations for why decisions become forward looking, we selected the case of the investment decisions in the *IJmuiden* sea lock in the Netherlands.

This chapter is structured as follows. Section 2.2 presents the MSF and defines the criteria for forward-looking decisions based on a review of different strands of literature. Section 2.3 describes the research approach and methods of data collection and analysis. Section 2.4 presents the case findings. Section 2.5 reflects on the key insights about forward-looking decisions gained from the application of our framework to our case and provides some directions for future research. We end this chapter with conclusions.

2.2 Conceptual framework for analysing and explaining forward-looking decisions

2.2.1 Framework to understand the process of forward-looking decision making

There are different frameworks to analyse decision making and each framework has its own assumptions about how decision making evolves. Scholars in the field of strategic planning, deep uncertainty, transition theory and forecasting tend to align to rational and linear notions of decision making: they tend to assume or prescribe a decision-making process that evolves according to successive stages and in which a single actor aims at finding the most optimal policy (Albrechts, 2004; Kemp & Loorbach, 2007; Kwakkel et al., 2010; Restemeyer et al., 2016; Wise et al., 2014). However, rational and linear models have mainly prescriptive power and are not well suited to explain complex decision making in situations of deep uncertainty and high ambiguity (March, 1991; Zahariadis, 2014). For the purpose of explaining decisions that consider uncertain future developments we need a different perspective to decision making than the rational view.

In this chapter we propose an alternative model to explain why decisions become forward looking. This model is based on a group of process-oriented decision theories that build on each other, namely the Garbage Can Model (Cohen et al., 1972), Kingdon's Multiple Streams Framework (Kingdon, 1984, 2011) including recent advancements by Howlett and colleagues (Howlett et al., 2015, 2016), and the Rounds Model (Teisman, 2000). This group of theories assumes that decision making evolves through more evolutionary and chaotic processes that are characterized by amongst others political conflicts, power struggles, and framing contests. The Garbage Can Model portrays the opportunity for a decision as a garbage can into which different problems and solutions are dumped by participants, and where a problem sticks to a solution from time to time (Cohen et al., 1972, p. 2). Kingdon (1984, 2011) modifies this Garbage Can theory to explain why certain problems receive the attention of policy makers and other problems do not. He uses *streams* to refer to the horizontal and parallel processes of (1) framing problems, (2) developing solution alternatives, and (3) politics. Each stream is characterized with its own specific participants and rules. Kingdon refers to the revised version of the Garbage Can Model as the Multiple Streams Framework (MSF). The metaphor of a stream has been further developed and used to understand decision making and describe the independent and parallel flow of solutions, problems, politics, and decision-making processes that develop and change over time (Howlett et al., 2015, 2016). When the streams come together at critical junctures, decisions can be made.

Several decisions, and therefore several rounds of decision making, may be needed before a final solution is chosen (Teisman, 2000). We will briefly explain the key concepts of the MSF that we will rely upon in this study.

The first stream that we distinguish is the *problem stream*. The problem stream consists of different problem definitions and these definitions can evolve over the course of the decision-making process (Stone, 2002, pp. 242–245). A situation is framed as a problem because certain actors feel something needs to be done to change that situation (Jones & Baumgartner, 2005; Kingdon, 2011). For example, some argue that an urban water system needs to be renewed to use new technologies, whereas others may argue that renewal is needed because urban water systems are unsustainable (de Graaf & van der Brugge, 2010).

The *solution stream* consists of the technical solutions developed by experts and highlighted by specific actors during decision making (Kingdon, 2011; Stone, 2002, pp. 246–247). Solutions for flooding, for example, can include strengthening dykes to prevent flooding or the creation of room for the river through land-use planning (Staveren & Tatenhove, 2016). Certain actors bring pet solutions to the decision-making process, in search of a suitable problem frame. The solution stream is typically dominated by technical experts and planners that are often strongly guided by their specific disciplinary practice and background (Lawrence et al., 2015).

The *political stream* consists of the political processes of party ideology, elections, coalition changes, and pressure from groups outside of government that cooperate on a certain topic (Kingdon, 2011). A new political administration may not want to increase taxes to renovate urban water systems. Without sufficient political will it is unlikely that investment decisions will be made (DeLeo, 2016; Volkery & Ribeiro, 2009).

The last stream that we distinguish is *the choice opportunity stream*, which consists of the occasions when organizations are expected to produce decisions. The choice opportunity stream includes the rules, procedures, and norms that guide decisions and that determine who is involved and on what basis solutions are examined (Cohen et al., 1972; Howlett et al., 2016, pp. 280–281). Examples are the annual budget cycle, delegations of authority, rules for cost benefit analyses to evaluate possible solutions, and information that needs to be sent to the parliament.

When these four streams meet at a certain juncture, decisions can be made (Howlett et al., 2016). The decision that emanates from the joining of the four streams does not necessarily have to be composed of content from all four streams. Also, any of the streams can be the main driver behind reaching a decision; for example, a new government can reframe the problem definition, or technological advancements can create new solutions (Howlett et al., 2015). Multiple decisions may be needed to invest in a new infrastructure. Therefore, following Teisman (2000), we portray the decision-making process in terms of rounds rather than phases. After each decision, the multiple streams start to flow independently until certain participants in the process connect the four streams to reach another decision about the same object. In the rounds model, decisions are then called *crucial decisions* because the decisions that are made change the circumstances in which future decisions will be made (see also Derbyshire, 2016, p. 3). This multi-faceted process is illustrated in Figure 2.1.

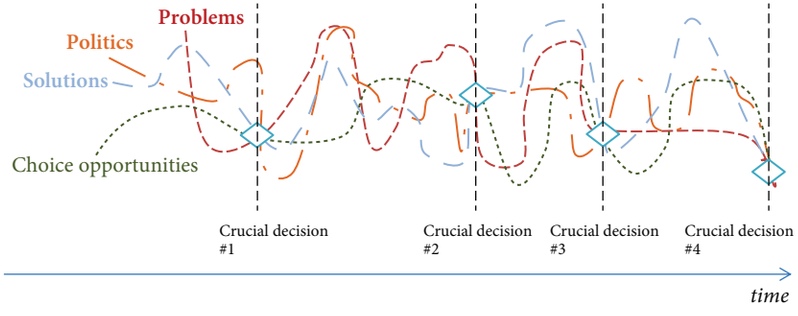

Figure 2.1. Multiple stream model of decision making modified from Howlett et al. (2016). Each thread represents one stream that evolves over time. The symbol refers to the crucial investment decisions made at critical junctures in the four streams.

2.2.2 Framework to analyse whether an infrastructure investment decision is forward looking

Arguably, investment decisions are specific types of crucial decisions, as they set the stage for later events in the different streams. Investment decisions are usually made in the political arena and have a specific problem definition, solution, and justification derived from the four streams. To understand whether investment decisions about end-of-lifetime infrastructure anticipate the future, we need a definition of what constitutes *forward looking*. This definition is currently lacking.

Several strands in the scholarly literature have looked at various aspects of forward-looking decisions, but what constitutes forward looking remains unspecified or narrowly defined, often referring only to foresight (e.g. Dahlberg & Lindström, 1998; Gavetti & Levinthal, 2000; Havas & Weber, 2017). A forward-looking decision is however not the same as a decision that relies on foresight, nor entails the opposite of backward looking (i.e. experience based) (Gavetti & Levinthal, 2000). Instead, we position forward-looking decisions as the opposite of myopic decisions, decisions that do not take into account long term future developments or consequences (Bonfiglioli & Gancia, 2013). To understand what forward looking as opposed to myopic means, we need to take into account a broad range of academic disciplines that aim to deal with 'the future' and with that develop a broader definition than currently exists. Also, this definition needs to be very specific to be useful for the analysis of infrastructure related investment decisions.

To conceptualize forward looking, we conducted a literature review in the fields of decision making under deep uncertainty, transition management, scenario planning, strategic management, and long-term policy making. Combining the key elements of these different strands of literature introduces an elaborate definition of a forward-looking investment decision that consists of three criteria: a problem definition that includes a long time horizon and future developments (Segrave et al., 2014), a solution that is robust or flexible to cope with uncertainty (Nair & Howlett, 2014), and a justification that relies on desired long-term goals (Jacobs, 2011; Meuleman & in 't Veld, 2010) or possible future scenarios (Rickards, Wiseman, et al., 2014). The criteria for forward-looking investment decisions are summarized in Table 2.1.

We briefly describe each of the forward-looking criteria for investment decisions about end-of-lifetime infrastructure.

First, the problem definition of a decision is forward looking when it includes anticipated *future developments or future needs*. To define a situation as a problem, actors in the streams may frame technical disturbances, user complaints, and indicators of change to strive for recognition of the end-of-lifetime of an infrastructure. However, only when the problem definition in the investment decision includes a reference to uncertain future developments do we consider the problem definition to be forward looking (Albrechts, 2004; Dominguez et al., 2011). Such future developments could potentially impact the core functionalities of the infrastructure but can also be highly unknown (Abbott, 2005; Termeer & van den Brink, 2013).

Table 2.1. Criteria for forward-looking investment decisions

Criterion	Elements	Description
1. Forward-looking problem	Future orientation and long time horizon	• The problem definition includes future challenges and/or future needs. • The time horizon of the problem definition is minimum 10 years.
2. Forward-looking solution	Robustness	• The solution remains functionally effective during its technical lifetime when tested against an extreme case scenario. • Pilots or experiments of one or more solutions were executed to test robustness.
	and/or flexibility	• The solution can be adapted to changed circumstances and insights during its lifetime, or supplemented by other measures to secure long-term effectiveness. • There is an agreement to establish a monitoring process to secure the effectiveness of the chosen solution. • There is an agreement to establish an iterative decision process for adaptation of the solution.
3. Forward-looking justification	Long-term goals/visions and/or future scenarios	• The decision is connected to future goals or a future vision. • The decision relies on multiple scenarios for one future development. • The decision relies on scenarios to understand multiple future developments.

Forward looking also means that decision makers adopt a *long-term time horizon* to understand and frame the problem (Segrave et al., 2014). What constitutes the 'long-term' can strongly differ per actor and depends on the problem at hand (Bressers & Deelstra, 2013; Wolf & Van Dooren, 2018). A infrastructural *solution* can have a lifetime of up to 100 years but that does not necessarily imply that decision makers will define the *problem* that a new infrastructure needs to solve in terms of 100 years. Maybe the infrastructure needs to solve an urgent water safety issue. The most important actor for investment decisions is the decision maker that usually resides at the highest organizational level. Decision makers at the highest organizational level typically are suspected of short-termism, myopia, or short sightedness, which means that they only pay attention to what is within their board terms of four to eight years (Bonfiglioli & Gancia, 2013; Boston, 2017; Nair & Howlett, 2017). Therefore, we argue that the *minimum* time horizon of a forward-looking decision problem should be 10 years (Boston, 2017; Meuleman & in 't Veld, 2010). A minimum of 10 years means that political decision makers are requested to look beyond the two political cycles during which they are allowed

to hold office in most Western democracies. This time horizon to understand long-term problems serves explicitly as a minimum since challenges such as climate change may require a much longer outlook.

Second, the chosen technical solution of a decision is forward looking when it aims to be robust, flexible, or both. *Robustness* refers to the capacity of a solution to remain functionally effective during its technical lifetime, even in extreme case scenarios (Ben-Haim et al., 2015; Halim et al., 2015). To assess the robustness of a decision, different future tests can be performed such as scenario analysis (Haasnoot & Middelkoop, 2012) and pilots (Loorbach, 2010; Nair & Howlett, 2016). *Flexibility* means that a chosen solution can be adapted to changed circumstances and insights to secure long-term effectiveness (Brugge & Roosjen, 2015; Dewulf & Termeer, 2015; Hargadon & Douglas, 2001). This implies that decision makers do not set up path dependencies that make adjustments difficult or expensive in the future. Actions that can be mentioned in decision(s) to ensure flexibility include actions to monitor future challenges and actions to make future decisions to adjust a chosen solution (Albrechts, 2004; Boyd et al., 2015; Haasnoot et al., 2013; Hill Clarvis et al., 2013). Ideally, solutions are both flexible and robust (Hargadon & Douglas, 2001).

Third, the justification for a decision is forward looking when the decision is based either on foresight methods to understand plausible futures or on future goals and visions to formulate desired futures. Forward-looking decisions may use scenarios to explore future trends or use specific intuitive scenario exercises to understand plausible futures (Halim et al., 2015; Hamarat et al., 2013; McKiernan, 2017). To be called forward looking, decisions – our review suggests – would need to rely on *multiple scenarios* to cover different plausible or imagined futures (Soetanto et al., 2011; Van't Klooster & Van Asselt, 2006). Furthermore, decisions should build on a combination of scenarios that includes a *range of future developments* such as economic and market developments, spatial-demographic futures, climate change, socio-political trends and possible technological developments (Haasnoot & Middelkoop, 2012; Mintzberg et al., 1998; OECD, 2014; Rowland & Spaniol, 2017). Forward-looking decisions can, however, also be based on *desired long-term goals and strategic visions* to establish desired change (Hansson et al., 2016; Meuleman & in 't Veld, 2010). To reach long-term goals, for example by aiming at a transition to renewable energy, visions may be developed by one or a combination of actors (Albrechts, 2004; Kemp & Loorbach, 2007; Mintzberg et al., 1998).

This framework to analyse forward-looking decisions can be used to analyse whether decisions are forward looking, i.e. decisions that meet all three forward-

looking criteria. It can also be used to assess the extent to which decisions are forward looking, i.e. the number of (sub)criteria that decisions meet. We will use this framework to evaluate decisions about infrastructure with a long lifespan, hence decisions that could be called 'long-term investment decisions'. This is because we expect that if anywhere, forward-looking decisions can be found in the field of infrastructure because of the long technical lifespan of infrastructure. But in theory, the framework could also be applied to short-term decisions. Decisions with a short decision lead time or short solution lead time can meet the criteria of a forward-looking decision whenever they aim to deal with long-term future developments (Meuleman & in 't Veld, 2010). An example of a short-term but forward-looking decision could be a decision to earmark an existing green area for water storage to be able to cope with extreme precipitation that may occur more often because of projected climate change.

2.3 Methods and case

We selected the case of the *IJmuiden* sea lock in the Netherlands to illustrate the value of our framework and to elucidate the processes that explain forward-looking investment decisions. The case was selected because the final crucial decision to realize the new sea lock was made recently (2016). The decision was preceded by a long history of events (1996–2016) and this enables a detailed reconstruction of the decision-making process and analysis of multiple crucial decisions. This chapter adopts a process-tracing approach to identify crucial investment decisions between 1996 and 2016, analyse the extent to which these decisions are forward looking, and find diagnostic evidence for how forward-looking decisions are made (Bennett & Checkel, 2015, pp. 7; 18).

2.3.1 Data collection

Data were collected from multiple sources to seek diverse evidence and cross-check causal inferences derived from process tracing (Bennett & Checkel, 2015, p. 28). Primary documents were collected through a systematic search of policy databases of the national parliament, Province of North-Holland, and the Municipality of Amsterdam by using three different search queries for the years 1996–2016 (see Supplementary material A, table A1). We excluded duplicates, audio files, and documents that only mentioned the *IJmuiden* sea lock as an example without providing any context. In addition, we conducted two rounds of interviews with key actors that were recorded and transcribed. For the interviews, a semi-structured interview guide was designed to cover pre-defined topics while being open to

other relevant information. Interviewees were identified through decision documents and snowball sampling. Interviewees were associated with the Municipality of Amsterdam and Port of Amsterdam (n=6), with the Province of North-Holland (n=3), and with the Ministry of Infrastructure and Environment and Rijkswaterstaat (RWS)[3] (n=7). Three of the interviewees were political administrators (see Supplementary material A, table A2). During the interviews, several recurring topics were discussed: the evolution of problem definitions, the impact of political processes and decision procedures, the way solutions were selected, actors' time horizon, and the role of visions and scenarios.

Interviews and primary documents were used to identify the crucial investment decisions. The documents that marked these crucial investment decisions were collected to analyse the extent to which these investment decisions are forward looking. The decisions in this study consist of the formally (i.e. politically) approved documents that formulate the decision to invest or not invest in the *IJmuiden* sea lock, as well as the underlying documents and reports to which these decisions refer. An overview of all decision documents can be found in Supplementary material A, table A3.

To improve our theoretical framework and validate the research findings presented in this chapter, we organized two symposia with scientists and practitioners working in the domain of water infrastructure. These symposia took place in April 2016 and May 2017.

2.3.2 Data analysis

We developed a rough storyline from the collection of primary documents and interviews. We inputted the transcriptions of interview records together with the collected primary documents into the qualitative data analysis programme Atlas.ti. We developed a code network to code the relevant paragraphs of parliamentary documents, ministerial speeches, and decision documents (see Supplementary material A, table A4 for an overview of codes).

To analyse the extent to which the investment decisions were forward looking, the coded decision documents were analysed in two rounds. First, we scored the coded paragraphs of the documents in terms of yes or no for the absence or presence of forward-looking criteria in each decision. Second, we described the forward-looking

3 Before 2010, the responsible ministry was called Ministry of Transport, Public Works, and Water Management. Rijkswaterstaat is the executive agency for Public Works and Water Management, part of the Ministry of Infrastructure and the Environment.

elements of each investment decision in words to account for their specific formulation and evolution.

To explain which processes led to the presence of forward-looking criteria in the investment decisions in our case, we first developed a detailed and chronological story line of the case events to reconstruct causal chains of events. Second, analysis of the interviews and primary documents enabled us to trace back the processes within streams that could explain the presence of each specific forward-looking criterion. Words in interviews that implicitly or explicitly referred to forward-looking criteria were used to find explanations for the presence of forward-looking criteria both during the interview and during transcript analysis. We iterated between empirical findings and theoretical concepts to identify causal mechanisms that explain how, in each stream, specific processes causally contributed to the forward-looking characteristics of the crucial investment decisions. This data analysis approach relates to what Beach and Pedersen (2016) call *theory-building process tracing*.

Table A1, Supplementary material, summarizes how we collected, analysed, and used the data in this study.

2.4 Results

We start the results section with a description of case events and crucial investment decisions. Second, we analyse the crucial investment decisions and show how forward looking they are. Last, we present the causal mechanisms that explain the forward-looking elements of these decisions.

2.4.1 Crucial investment decisions about IJmuiden sea lock

The *IJmuiden* lock in the Netherlands forms the access for vessels from the sea to the North Sea Canal area and the seaports of Amsterdam, Zaanstad, Beverwijk, and Velsen. The North Sea Canal was created between 1865 and 1876 to facilitate the growing number of vessels on the route from the sea to Amsterdam. The *IJmuiden* lock in fact consists of four locks, of which the North lock was the largest in the world until 1967 (Supplementary material A3; document #34, 35). The North lock – which can accommodate vessels 320 meters long, 45 meters wide, and 14 meters deep – dates from 1929. The four locks together can process up to 95 million metric tons of goods per year. The locks have three functionalities: providing access from the sea, protecting the Netherlands against the sea as a primary flood defense structure, and safeguarding water quality behind the locks (Supplementary material A3; document #23).

As a primary flood defense structure, the *IJmuiden* locks not only grant but also block access to the North Sea Canal area. In our case, the Province of North-Holland and the Municipality of Amsterdam argued that the locks are a bottleneck to reaching the North Sea Canal area and started lobbying for an additional large lock as far back as the 1960s (interviewees #5 and #15). From the early 1990s, the province and municipality emphasized that a growing number of large vessels were using the North lock, leading to capacity issues. The national government owns and maintains the *IJmuiden* locks and was at first not convinced of these capacity issues. The national government's attitude changed when a change in the problem stream and in the political stream successfully coincided: a new minister and parliament were receptive to the demonstrated growth in transshipment at the end of 2006. In 2009, the minister, province, and municipality agreed to invest in a new lock. In this agreement, the government invested the money that it otherwise would have paid at the end of the technical end-of-lifetime of the North lock in 2029.[4] From our analysis, we identified six crucial investment decisions. In the years 2002, 2009–10, 2012, and 2014–15, the crucial investment decisions consisted of a cluster of separate political decisions of the ministry, the province, and the municipality, and multiparty agreements. Table 2.2 provides a detailed chronological overview of events and crucial investment decisions.

2.4.2 Forward-looking decisions about IJmuiden sea lock

We analysed the crucial investment decisions identified in our case with the framework introduced in section 2.2. Table 2.3 synthesizes the extent to which the six crucial investment decisions are forward looking. Regarding the *problem definition*, our data suggest that the problem definition is forward looking in investment decisions 3 to 6. When we look at decision 3, the Ministerial decision states that 'with a favourable development of flows of goods […] it is expected that congestion will occur in the period 2010–2020' (Supplementary material A3: document #12). In decisions 4 to 6, the problem definition can be considered forward looking because, once the link to the technical end-of-lifetime of the North lock was established in 2008 (see Table 2.2), the decision documents after 2008 all include the problem frame of the anticipated need to replace the North lock in 2029 to secure the primary functionalities of this lock for the future (see, for example, the covenant, Supplementary material A3: document #15).

4 This is not money that the government reserved, but money the government was expecting to spend: in the Netherlands, the national government uses cash basis accounting, meaning that expenses are only reported in the year that cash payments occur. In terms of infrastructure investments, this means that the government raises money in the market just before it needs to spend it.

Table 2.2. Analysis of case events and decisions about *IJmuiden* sea lock

Rounds preceding crucial decisions	Summary of events
1. The province and municipality show willingness to invest at an early stage *1997–2002*	The project Quality of Sea Access North Sea Canal became part of a planning study programme of the Dutch Ministry of Transport, Public Works, and Water Management in 1998, with an estimated budget of 800 million to 1.3 billion Dutch Florins (approximately 500 to 790 million Euros). In this round, three alternative **solutions** were explored: a zero plus alternative with measures to improve access to the North Sea Canal; an additional and larger new lock; and an additional lock with the same parameters as the North lock. The alternative of a larger new lock was the one actively lobbied for by **politicians** from the Municipality of Amsterdam and the Province of North-Holland, although the **problem** that it should solve was contested. **Crucial investment decision 1:** In 2001, the municipality **decided** it was willing to co-finance a new lock; and the province reserved €34 million for a new lock; the money was realized from energy shares sold. Not all provincial **politicians** agreed to such a long-term reservation. The **Minister** decided to postpone a decision about the project after negative cost benefit analyses in April 2002.
2. More knowledge cannot support the desired solution *2003–2005*	Between 2002 and 2003, the province and municipality gathered more knowledge and financial investment alternatives to prepare for decision making. At the beginning of 2004, **Minister Peijs** asked the province and municipality to develop a regional vision for the North Sea Canal area and to explore alternative solutions instead of focusing solely on a new lock as part of the project, *IJmuiden* Approach. The Minister informed **parliament** that a decision about the project was postponed until completion of the continuing exploration of alternatives by the regional governments. **Solutions** explored in this period were an additional and larger new lock; a larger lock to replace one of the existing locks; an enlarged North lock; a semi-open flood defense; coastal expansion; and lightening of vessels from the sea. **Crucial investment decision 2:** On the basis of negative cost benefit analyses, **the Minister** concluded that there was not enough support for a large infrastructural investment in the lock complex and **decided to stop** the existing national government procedure. Instead, the minister offered to **invest in the alternative** of deepening the IJ gutter.

Table 2.2. Continued

Rounds preceding crucial decisions	Summary of events
3. Demonstrated growth and a resolution of parliament create an opportunity for change *2006–2007*	Between 2005 and 2007, the **lobby of provincial and municipal politicians** continued despite the negative decision of Minister Peijs. The lobby became successful when the province and the municipality found the previous member of the Amsterdam municipal council and then **Member of Parliament** (MP) Van Oudenallen prepared to file a resolution. Van Oudenallen asked for the exploration of **solutions** for access to the North Sea Canal to be restarted, because of demonstrated growth figures as well as expected future economic development of the ports behind the locks. The resolution was adopted in parliament and Minister Eurlings asked the Netherlands Bureau for Economic Policy Analysis (CPB) to analyse the growth trend. The CPB concluded that based on **continuous growth**, **congestion** might occur between the years 2010 and 2020 but that this growth was very uncertain. Because of the long lead-time of realizing a new infrastructure, the CPB recommended starting an exploration of alternatives. **Crucial investment decision 3:** On the basis of the CPB recommendation, Minister Eurlings decided to start exploring technical and financial solutions for the *IJmuiden* lock complex in September 2007.
4. The end-of-lifetime of the North lock is connected to the problem of allocating national budget *2007–2009*	During the 2007–2009 round, three alternative **solutions** were explored: 'maintain' the current locks; 'facilitate' by building a new lock; and 'selectivity' by decreasing the inflow of vessels. To open up possibilities for the ministry to invest in a solution, public officials linked new lock solutions to the **expected technical end-of-lifetime of the North lock** in 2029. The extension of the multi-annual plan for infrastructure (MIRT) by eight years created the possibility to plan infrastructure investments beyond 2020. The orientation study report was finalized in November 2008, and Minister Eurlings asked the CPB to provide a second opinion on the cost benefit analysis. The cost benefit analysis showed negative to almost neutral results except when the most optimistic macroeconomic scenario was applied to the solution of 'facilitate'. The CPB also concluded that the North lock could not be replaced at its current location when it reached its technical end-of-lifetime, because this would mean the lock would be out of order for minimum three years. This implied that building a new lock sometime in the future would necessitate maintaining the existing complex. This opened the opportunity to invest in a new lock despite the negative cost benefit analysis. The link to the end-of-lifetime of the North lock altered the **political discussion** from why to when and what. The province and the municipality wanted to realize a larger lock at an earlier stage than the foreseen end-of-technical lifetime of the North lock.

Table 2.2. Continued

Rounds preceding crucial decisions	Summary of events
	Crucial investment decision 4: As a result of this political negotiation, the province, the municipality, and the minister **signed a covenant in 2009** to build a larger new lock that would be financed with the replacement budget for the North lock and co-financing by the municipality and the province.
5. Political negotiations follow to find the feasible solution for the available budget *2010–2012*	The signing of the covenant marked the start of a round to explore whether a new sea lock was technically and financially feasible. During this round, **four lock widths** were explored: one with the same parameters as the North lock; and the others with a width of 60, 65, and 70 meters. In the MIRT plans of 2010 and 2011, the **problem** was defined as accessibility to the North Sea Canal area and expected congestion between 2010 and 2020. **MPs** discussed the need and lead-time of the new lock, and connected this need to a vision about the future. To ensure national government funding, involve governments emphasized that the lock was an existing asset that needed to be maintained for its functionalities of sea transport and water safety. **Minister Eurlings** connected the state's responsibility to the international position of the Port of Amsterdam. **Crucial investment decision 5:** At the end of 2012, parties decided on a 65-meter-wide lock and challenged the market to propose a 70-meter-wide lock that required the same budget. The lock was to have **rail doors**, because they fitted the design, were cheaper than other types, and were 'proven technology'. One of the novelties was that the lock was the first known wet infrastructure to be realized with a Design-Build-Finance-Maintain **tender contract**.
6. Politicians discuss and decide about financial agreements and environmental impacts *2012–2015*	The Municipality and the Port of Amsterdam found the *IJmuiden* lock system to be a **growing bottleneck especially due to the larger parameters of vessels, including cruise boats**. The province took the lead in the environmental assessment and spatial integration of the **new lock**. The governments in the North Sea Canal area co-developed a long-term vision to agree to facilitate future growth of the ports. **Politicians** became interested in the environmental consequences of the lock. Municipal politicians became aware of the need to transition to renewable energy resources. This desired transition was reflected in the resolutions that they filed when the final go-decision about the new lock was discussed. **Crucial investment decision 6:** At the end of 2014, the Ministry of Infrastructure and the Environment, the Province of North-Holland, and the Municipality of Amsterdam signed the final **financial agreement**. The building of the new lock started at the beginning of 2016.

Given our criteria, the solution in decisions 2 and 5 could be characterized as a flexible *forward-looking solution* because the decisions mention future additional solutions that can supplement the chosen solution at a later stage and take action to monitor the impact of the chosen solutions. With decision 2, the minister decided not to invest in a new lock and instead to invest in capacity management measures. The impact of these measures would be monitored. In the decision, the minister recognizes that 'in the long run a new sea lock will be needed' and states that she would discuss the development of transshipment with governments in the North Sea Canal area again in 2008 to 'determine which measures are needed' (Supplementary material A3: document #9). With decision 5, it was decided to build a new lock to replace the North lock. With the new lock, the *IJmuiden* lock system could facilitate growth of transshipment to 125 million metric tons per year. To grow beyond this point, the decision mentions the option of maintaining the North lock next to the new lock. One of the attachments of the decision is a roadmap that compares different scenarios with future decisions and interventions that could be made at certain points in time to enable future growth (Supplementary material A3: document #42, p. 14). Decision 5 also proposes a future decision about the future functionality of the North lock 'two years before realization of the new lock' (Supplementary material A3: document #28-29); and an action to monitor the technical end-of-lifetime of the North lock because the exact lifetime was uncertain (Supplementary material A3: documents #34–35). Last, the solution chosen with decision 6 meets one criterion of flexibility, as the decision mentions different monitoring agreements, of which one tracks the effectiveness of one of the primary functionalities of the new lock: a monitoring agreement focused on salt intrusion to safeguard the water quality functionality. However to be considered as a flexible solution, a decision needs to meet all three criteria for flexibility.

None of the crucial decisions meets the criterion of a robust solution. Although the 2014 solution passes the test of an extreme climate scenario, the solution does not pass the robustness test of high growth scenarios. In fact, according to a high growth scenario, the maximum capacity level of the *IJmuiden* lock system with the new lock will be reached around 2026; hence within 10 years of realization (Supplementary material A3: document #47, p. 25). No separate pilots or experiments were mentioned in the decisions to assess robustness. This may be because the Ministry of Infrastructure and the Environment and RWS have a strong focus on proven technology (interviewee #8).

Table 2.3. Evaluation of crucial investment decisions about *IJmuiden* sea lock based on forward-looking criteria.

Criterion	Description	Decision 1 2002	Decision 2 2005	Decision 3 2007	Decision 4 2009–10	Decision 5 2012	Decision 6 2014–15
1. Forward-looking Problem		**N**	**N**	Y	Y	Y	Y
	1.1 The problem definition includes future challenges and/or future needs.	N	Y	Y	Y	Y	Y
	1.2 The time horizon of the problem definition is minimum 10 years.	N	N	Y	Y	Y	Y
2. Forward-looking Solution		N	Y	N	N	Y	N
	2.1.1 ROB: The solution remains functionally effective during its technical lifetime when tested against an extreme case scenario.	N	N	N	N	N	N
	2.1.2 ROB: Pilots or experiments of one or more solutions were executed to test robustness.	N/E	N/E	N/E	N/E	N/E	N/E
	2.2.1 FLEX: The solution can be adapted to changed circumstances and insights during its lifetime, or supplemented by other measures to secure long-term effectiveness.	N	Y	N	N	Y	N
	2.2.2 FLEX: There is an agreement to establish a monitoring process to secure the effectiveness of the chosen solution.	N	Y	N	N	Y	Y
	2.2.3 FLEX: There is an agreement to establish an iterative decision process for adaptation of the solution.	N	Y	N	N	Y	N
3. Forward-looking Justification		Y	N	N	Y	Y	Y
	3.1 VIS: The decision is connected to long-term goals or a future vision.	Y	N	N	Y	Y	Y
	3.2.1 SCEN: The decision relies on multiple scenarios for one future development.	Y	N	Y	Y	Y	Y
	3.2.2 SCEN: The decision relies on scenarios to understand multiple future developments.	N	N	N	N	N	Y
Forward-looking decision		**N**	**N**	**N**	**N**	**Y**	**N**

Y means the criterion is met. N means the criterion is not met. N/E means that we could not find evidence for the presence or absence of this criterion. A forward-looking problem needs to include both a long time horizon and future challenges. A forward-looking solution can be either robust (meeting the criteria ROB 2.1.1 and ROB 2.1.2), flexible (meeting the criteria FLEX 2.2.1, FLEX 2.2.2, and FLEX 2.2.3), or both. A forward-looking justification can rely on long-term goals or visions (meeting criterion VIS 3.1.1) or on scenarios (meeting criteria SCEN 3.2.1 and SCEN 3.2.2), or on both.

Four out of the six decisions have *justifications* that can be considered forward looking. Decisions 1, 4, 5, and 6 discuss efforts to realize visions for regional economic and/or port development. For example, the municipal decision that is part of crucial decision 1 refers to the Port Vision 2001–2010, in which the expansion of the *IJmuiden* lock system is connected to transhipment growth (Supplementary material A3: document #5). For crucial decision 3, the most important justification came from a CPB report that analysed capacity issues at the locks. This report uses six macroeconomic scenarios, and the minister used the main conclusion to start exploring the possibilities of a new sea lock for *IJmuiden* (Supplementary material A3: documents #12, 14). Decision 6 relies not only on scenarios to understand macroeconomic futures but also on a scenario for climate change, i.e. scenario Veerman: 'the height of the *IJmuiden* locks needs to be 8.25 meters above sea level. This is based on a sea level rise of 1.20 meters to 2100 (scenario Veerman)' (Supplementary material A3: document #63).

Our results therefore show that, when our criteria are applied to analyse investment decisions, one crucial decision meets all criteria and can be considered as forward looking: decision 5 (see Table 2.3). First, this decision has a problem definition that includes future challenges and a long time horizon: the decisions refer to capacity restrictions of the current locks, the current and future growth of transshipment, the increasing parameters of vessels, and the technical end-of-lifetime of the North lock in 2029 (Supplementary material A3: documents #28–30, 35–35). Second, the municipal decision that is part of crucial decision 5 is based, amongst other things,

upon a long-term goal in the Port Vision: Amsterdam aims to increase transshipment to twice the current volume between 2005 and 2020 (Supplementary material A3: documents #34–35 pp. 7–8). Last, the decision proposes a solution that is flexible because it is anticipated that the new lock can be supplemented by another solution of maintaining the former lock to facilitate future growth (Supplementary material A3: documents #28, 34–35, 42).

2.4.3 Causal mechanisms behind forward-looking decisions

Now that we showed how to apply our criteria for a forward-looking decision to a specific case and analysed multiple investment decisions, we will look for explanations of why long-term investment decisions become forward looking. To do this we included all of the crucial decisions about the *IJmuiden* sea lock in our analysis and used our MSF lens to understand decision making. For each of the criteria that were present in these decisions, i.e. the criteria that scored a 'yes' in table 2.3, we identified explanations of why decisions became – partially – forward looking. We iterated between the empirical explanations that we retrieved and existing theoretical abstractions to identify the causal mechanisms. Mechanisms are the recurring, generalizable processes responsible for producing an observed outcome within interactive processes (Biesbroek et al., 2014). In this study, we consider mechanisms to be actors' responses within a certain context that result in forward-looking elements of investment decisions. Table 2.4 presents an overview of the three causal mechanisms that we found and that we discuss in more detail below.

Mechanism 1: Strategic reframing using forward-looking argumentation

First, we recognize the general theoretical mechanism of political manipulation of ambiguity through strategic reframing (Zahariadis, 2014). Politicians try to formulate interests that appeal to a larger audience and thereby increase support for pet solutions (Kingdon, 2011). To win support, they strategically use new information to influence the decision-making process. This mechanism of strategic reframing can alter the problem conception by highlighting certain arguments over others. If certain forward-looking arguments emerge from the problem or political stream and such arguments help to build support for a certain solution, the decision may also become forward looking.

In our case, decision makers did not aim for a forward-looking decision but used forward-looking arguments that helped to gain support for the preferred solution. We found that political administrators indeed *manipulated information from cost benefit analyses to invest in a pet solution*, a new lock, and that this led to a forward-

Table 2.4. Causal mechanisms of forward-looking decisions.

Mechanism	Empirical manifestations in the *IJmuiden* sea lock case	Forward-looking criterion and decision
Strategic reframing using forward-looking argumentation	Politicians used information from cost benefit analyses that rely on scenarios to strengthen the problem definition that supported their pet solution.	criterion 3.2.1 decision 3
	The Minister expressed a long-term goal in which he emphasized the national political stake in investing in a new sea lock.	criterion 3.1 decision 4
	Civil servants of the Ministry added the long-term time horizon and foreseen replacement challenge to the problem definition to allocate national budget.	criteria 1.1 and 1.2 decisions 4, 5, 6
Avoiding political risks by relying on visions, scenarios, and flexible solutions	The Minister proposed a flexible no regret alternative to compensate her decision to not invest in the pet solution.	criterion 2.2 decision 2
	RWS created a flexible pathway solution to solve a political disagreement by separating the optional long-term maintenance of the existing lock as an additional future measure.	criterion 2.2 decision 5
	The investing governments sought political alignment together by using visions to remove political bottlenecks before crucial decisions.	criterion 3.1 decisions 1, 4, 5
	Civil servants of the Municipality of Amsterdam used multiple scenarios to mitigate financial and political risks.	criterion 3.2.1 decision 6
Compliance with rules that have forward-looking features	Governments used acknowledged scenarios and standards for cost benefit analyses in response to existing regulation, and to positively impact decisions.	criterion 3.2.1 decisions 1, 3
	The Municipality of Amsterdam formulated a long-term goal that complied with the boundaries of growth according to the environmental assessment procedure.	criterion 3.1 decision 6
	RWS ensured that the technical design of the new lock complied with institutionalized standards including water safety standards that rely on climate scenarios.	criteria 2.2.2, 3.2.1, 3.2.2 decision 6

The first column presents the causal mechanisms that we found. These mechanisms are based on the combination of empirical evidence described in the second column with existing theoretical concepts. The third column links the decision and criterion numbers, referring back to Table 2.3.

looking problem definition in 2007. The cost benefit analyses themselves are quite forward looking: they use multiple scenarios and time horizons until 2040 to assess costs and benefits over time. On the basis of the 2007 cost benefit analysis, the CPB concluded that, in a situation of continuous growth, congestion might occur between the years 2010 and 2020 but that this growth was very uncertain (Supplementary material A3: document #14). The then minister responsible for infrastructure, Mr. Eurlings, used part of the CPB conclusion in his problem definition, which was stated in the decision: 'with a favourable development of inflow of goods in Amsterdam port it can be expected that congestion will occur in the period 2010–2020' (Supplementary material A3: document #12).

The minister himself connected the foreseen congestion issue to the position of the Port of Amsterdam as a 'port of international standing' (Port dinner speech 2008). We coded this as a forward-looking long-term aim. He adopted this long-term aim *to rescale the issue of investing in a new lock and justify the national level stake in investing in a new lock*.

Both the forward-looking problem definition and the future aim enabled the ministry to look for state funding to finance a new lock. *To allocate state funding,* the ministry connected the capacity issues of the lock to the expected technical end-of-lifetime of the North lock in 2029 (interviewee #5). The ministry had allocated funds to replace the North lock at the end-of-the-technical lifetime. This money was transferred to the new lock by linking the technical end-of-lifetime of the North lock to the problem definition of congestion. This added another forward-looking problem definition.

Our case demonstrates that strategic political administrators used forward-looking argumentation to reframe a problem definition such that it fitted and supported the pet solution: a new sea lock. This mechanism of strategic reframing impacted forward-lookingness when future-oriented information and arguments were adopted to reach the goal of finding support for a specific solution. Therefore, the presence of strategic leadership enabled the use of forward-looking arguments.

Mechanism 2: Avoiding political risks by relying on visions, scenarios, and flexible measures

Second, we found a mechanism of political risk avoidance behind forward-looking decisions. The general mechanism tells us that politicians are highly risk averse (Howlett, 2014). Because of this risk aversion, Jacobs (2011) argues that politicians will make long-term investment decisions only when they feel safe electorally. The

large body of literature on evidence-based decision making and knowledge in the policy process reveals the tendency of public sector organizations to fight uncertainty and risk by introducing more knowledge. Another strategy to be electorally safe is to build coalitions. By working together before crucial decisions need to be reached, politicians build shared commitment to facilitate desired outcomes (Swanson et al., 2010).

In our case, forward-looking solutions arose in an effort to avoid political risks. In decision 2, Minister Peijs proposed a flexible 'no regret measure' (interviewee #12) because cost benefit analyses did not support investing in a new sea lock (Supplementary material A3: document #9). The minister was risk averse in the sense that she did not want to defend a negative cost benefit analysis in parliament but also wanted to avoid political opposition from the regional governments. To avoid conflict, the minister proposed the alternative of deepening the IJ gutter *to compensate the province and municipality* for the decision not to invest in a new sea lock, saying 'I can give you this instead' (interviewee #7). In the decision, the minister proposes to re-evaluate her decision in 2008, conveniently after the next elections. The suggestion of a no regret alternative together with a specific proposal to re-evaluate the decision made the solution of decision 2 forward looking.

Before decision 5 was reached, actors did agree on the need for a new sea lock, but the national government, province, and municipality could not agree about what to do with the North lock once the new sea lock was realized (interviewees #5, #8). The conflict was settled, and the political risk therefore reduced, when RWS showed the municipality and the province that the decision about the North lock could be *separated from the decision as a future additional measure to enable political agreement*. RWS introduced a solution map that compares well with a simplified version of an adaptation pathways map (Haasnoot et al., 2013) to demonstrate how the decision about the future destination of the current lock could be an additional future measure for which decisions could be postponed until a later stage (interviewee #8).

Furthermore, decisions 1, 4, and 5 mentioned long-term visions that could also be explained by the mechanism of risk avoidance. First, the Municipality and the Port of Amsterdam developed a long-term Port Vision to inform the municipal council and to stipulate that a new sea lock was a precondition of future port development (interview #15; Supplementary material A3, document #66, 18, 19). The interviewees found the Amsterdam municipal council to be a highly uncertain actor in the case of the *IJmuiden* sea lock (interviewee #3, 4, 9). Therefore, the Port Vision was one of

the instruments whereby the Municipality and the Port of Amsterdam positively influenced internal political consent to *avoid internal politics becoming a bottleneck* for future multiparty decisions. Second, the municipalities and province in the North Sea Canal area developed a North Sea Canal Vision. This vision was emphasized by the national government to ensure that regional governments would facilitate the future growth of transshipment in the North Sea Canal area, before signing the final administrative agreement for the new sea lock in 2014 (interviewee #5). As one interviewee stated, the vision for the North Sea Canal area provided 'political comfort' about the new sea lock by reducing the risk of disapproval of future spatial and environmental permits that would be needed to facilitate this growth (interviewee #1). Therefore, we can conclude that these visions were used *to avoid the political risk of future political conflict* when crucial decisions needed to be made.

Finally, the risk avoidance mechanism explains why, in 2014, the Municipality of Amsterdam used a relatively large number of scenarios to understand future economic and market growth. The municipality found itself confronted with a different political situation with a new municipal council and a changed national mood consequent to the economic crisis. Because of this changed situation, the municipality was urged to negotiate a better deal, i.e. a specified investment sum, with the national government compared to 2009 (interviewee #1). The number of scenarios supported a second negotiation round in which the municipality aimed to *mitigate financial and thus political risks*, and thereby lower the threshold for political agreement within a new municipal council (interviewee #4).

Our case demonstrates that forward-looking decisions result from a mechanism in which actors seek to avoid political risks by co-developing visions, proposing flexible solutions, and applying scenarios. Negative cost benefit analyses, environmental impacts, and political dissent can constitute perceived political risks. In this mechanism, perceived political risk forms a condition for the application of forward-looking activities such as visions.

Mechanism 3: Compliance with rules that have forward-looking features

The last mechanism that we revealed is rule compliance; this triggers the forward-looking criteria of scenario usage, long-term objectives, and monitoring agreements. This mechanism relates to notions of rule-following in which actors are inclined to act in accordance to certain rules (Hodgson, 1997). As March (1991) argued, decision-making behaviour often involves finding the appropriate rules to follow.

The rule compliance mechanism was activated in different rounds in our case. In 2002, the national government decided to *apply official guidelines for cost benefit analyses* to guide investment decisions. These official – so-called OEI – guidelines also prescribed the use of scenarios. This application of official guidelines arose because the CPB questioned the way that a consultancy had executed the cost benefit analysis in an earlier decision round (Supplementary material A3, document #67). In 2007, the municipality and the province *used multiple well-established scenarios* to positively impact a decision by Minister Eurlings to restart the exploration of solutions for the lock. Only well established and therefore standard macro-economic scenarios were perceived as acceptable (interviewee #5).

In decision 5, the municipality formulated a future aim to grow transshipment to 125 million metric tons. This future aim confirmed the maximum growth allowed according to the environmental assessment procedure (Supplementary material A3, document #68). This *future aim therefore complied with the boundaries of growth according to institutionalized procedures*.

In 2014, the EU Water Framework Directive (WFD) and the Dutch Delta Freshwater Programme were applied to comply with water quality standards. The effort to monitor water quality was part of the WFD. The monitoring arrangement in decision 6 arose from concerns of the province and water boards about salt intrusion (interviewee #2). This monitoring agreement meets one of the flexibility criteria in our framework. Also in 2014, the height of the new lock needed to be determined. The prescribed height for primary flood defenses is derived from *existing water norms mentioned in the Dutch Water Law* (interviewee #8; Supplementary material A3, document #63). The norms include application of the most extreme climate change scenario of the Royal Netherlands Meteorological Institute (KNMI).

In our case, we can see that forward-looking decisions resulted from a mechanism to follow appropriate rules that possess certain forward-looking features. Such forward-looking features could include: monitoring arrangements, specific scenarios, and scoping conditions that trigger future aims. This mechanism was activated when the justification for specific investment decisions was prepared and when the design and (environmental) consequences of a chosen solution were detailed. Therefore, the context condition of this mechanism to lead to forward-lookingness is the presence and perceived appropriateness of rules that have forward-looking features.

2.5 Discussion

In this chapter we developed a framework to evaluate and explain for what reasons and based on what criteria decision makers make forward-looking investment decisions. Building on a combination of different theoretical strands our framework offers a rich analysis to assess whether, how, and why the long term plays a role in real-life investment decisions. Applying it to a specific case allows us to reflect on the value of the framework for the evaluation of investment decisions about end-of-lifetime infrastructure.

The application of our framework to a specific case provides three key insights about the value of our framework for decision makers, urban planners, and developers of decision support tools.

First and perhaps surprisingly, we find that huge investment decisions that involve up to hundreds of million euros are not necessarily forward looking. Just one investment decision in our case was forward looking and this decision still only met the minimum criteria. None of the decisions in our case met all sub criteria for a forward-looking decision: none of the decisions anticipated multiple future challenges, adopted a long time horizon, and proposed both a robust *and* a flexible solution, and was justified both with multiple scenarios for multiple future developments *and* with long-term visions. The forward-lookingness of decisions was more a side effect – an effect of which the involved actors were not even conscious – than an explicit aim of decision makers, despite the long time horizon involved in dealing with a sea lock with a lifespan of 100 years. Of course, we also need to add here that forward-lookingness is only one criterion to assess the quality of decisions and that the framework is not suited to answering, nor does it aim to answer, the question of whether a decision adequately and efficiently solves a problem. In conversation with decision makers and urban planners the framework could be helpful to reflect how their investment decision-making processes deal with the long term.

Second, with the application of the MSF to our case we revealed the causal processes behind forward-looking decisions. The causal mechanisms we found show that the forward-lookingness of decisions results strongly from political processes and institutionalized rules. This finding proves the importance of adopting non rational frameworks of decision making to understand the use of scenarios, visions, flexible and robust solutions in practice. Often, rational problem-oriented decision frameworks form the start in much of the literature on scenario planning and adaptive decision making. Here, forward-looking behaviour is equated with acting rationally (Dahlberg & Lindström, 1998; Keane & Wolpin, 2002). Our findings show, however, that, although the criteria for forward-looking investment decisions seem to fit well with a rational understanding of decision making, rational decision making alone does not help to explain forward-looking decisions. Our findings underline the importance of including the political and the institutional dimensions in studies that develop methods for decision making under deep uncertainty, such as adaptation pathway and scenario planning approaches (Brugge & Roosjen, 2015; Orach & Schlüter, 2016; Volkery & Ribeiro, 2009; Wise et al., 2014). The MSF can help to include the institutional and political dimension of decision making.

Third and last, our chapter contributes to the understanding of how scenarios and other types of decision support methods actually impact public sector organizations' investment decisions (Volkery & Ribeiro, 2009). Our case demonstrates that scenarios are important tools because political administrators rely heavily on cost benefit analyses that apply established scenarios to calculate returns. As Anderson (2010) states, calculation makes the future present and is a dominant mode of practice for governments to decide about futures; but, in a way, this reduces the potential of scenarios to a product that predicts rather than explores futures. Scenarios are also valuable to make sense of possible futures, thereby possibly stimulating our mechanism of political reframing (see, for example, Patel, 2016). However, when the problem is framed mainly to build support for the political pet solutions, there is little opportunity to gain a broad understanding of long-term problems through scenarios or visions. Another illustration of the limited use of future-oriented decision support methods is that, as we saw in our case, an adaptation pathway map can be used merely as an instrument to exit stagnated discussions and pave the way for political agreement (Haasnoot et al., 2013). Scenario developers and urban planners could start involving administrators to make them aware of the future towards which they are steering, provide them with alternative future paths, and help them to overcome myopic thinking. Furthermore, they could map the relevant institutional rules with forward-looking features so that those rules may be consciously applied to influence forward-lookingness.

While this framework has examined forward-looking decision making because it is often overlooked and has potential for investment consequences, the framework also enables that short-term needs will still be addressed (Burt et al., 2015). This is consistent with Goetz (2014) who stresses in the context of governments that it is vital for organizations to be both responsive and responsible, fostering attention to the needs of both current and future generations.

The development of our framework offers several avenues for answering new research questions. First, we used the framework to evaluate decisions about infrastructure with a long lifespan, but given the scope of our literature review, it has potential to be applied to decisions within other sectors such as healthcare, energy grids, and information technology. It would be valuable to see how our criteria, such as flexibility, are applied in a very different domain. See, for example, Hargadon and Douglas (2001) who discuss robustness and flexibility in the context of product innovation. Second, we used a process tracing-research design to analyse and compare multiple investment decisions within one case. The framework could also be applied to compare the investment decisions of multiple organizations within a sector and evaluate how organizations score compared to each other. Increasing the number of cases could also be valuable to find configurations of mechanisms or context conditions that enable forward-looking decisions. Third, it would be valuable to apply the framework to a different institutional context to better understand the generalizability of the causal mechanisms that we found.

2.6 Conclusions

This chapter aimed to answer the question of what makes long-term investment decisions forward looking.

We started this chapter with the assumption that decisions about infrastructure with a long lifespan may require decision makers to look into the far and uncertain future; but also that it may be difficult for political decision makers to do so because of various institutional barriers such as political myopia. We developed a framework to evaluate and explain for what reasons and based on what criteria decision makers make forward-looking investment decisions. We argue that forward-looking decisions are decisions that meet three criteria: a problem definition that includes a long time horizon and future developments; a solution that is robust or flexible to cope with uncertainty; and a justification that relies on desired long-term goals or possible future scenarios. Applying our forward-looking decision framework to the case of the *IJmuiden* sea lock, learns us that decision makers may not necessarily aim to anticipate the future with their long-term investment decisions and that therefore not all investment decisions are forward looking. Secondly, we revealed three causal mechanisms that drive forward-looking decisions: strategic reframing using forward-looking argumentation; avoiding political risks by relying on visions, scenarios, and flexible solutions; and compliance with rules that have forward-looking features. This shows that the decision makers in our case anticipated the future because it helped them to build support for their pet solution, to avoid political risks and because it was in compliance with rules to do so.

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3

CHAPTER

What makes decisions about urban water infrastructure forward looking? A fuzzy-set qualitative comparative analysis of investment decisions in 40 Dutch municipalities

ABSTRACT

Municipalities worldwide are confronted with the need to make long-term decisions about ageing water infrastructure in the face of unpredictable future developments. Previous studies on long-term decision making have proposed solutions targeted at the domain of either politics or planning. This study combines insights from the domains of policy, politics, and planning by using the Multiple Streams Framework to explain what enables municipalities to make forward-looking investment decisions. We combine the configurational MSF perspective with an explicitly configurational method namely fuzzy-set qualitative comparative analysis and apply this to 40 cases of Dutch municipalities. We conclude that enabling conditions differ for small versus medium-to-large municipalities. Furthermore, forward-looking investment decisions can be achieved regardless of the municipalities' organizational analytical capacity. In fact, and contrasting to the requirement of the MSF, not all streams necessarily have to be present for forward-looking decisions to occur. For medium-to-large municipalities, forward-looking investment decisions are stimulated by: (1) the presence of organizational analytical capacity, (2) transactional/networking political leadership in situations without focusing events, or (3) entrepreneurial/transformative political leadership in situations with focusing events. For small municipalities, forward-looking investment decisions are stimulated by networking/interpersonal political leadership combined with the occurrence of focusing events.

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3.1 Introduction

Municipalities worldwide are confronted with water-related crises and a portfolio of ageing urban water infrastructure (OECD, 2016). It is likely that the impact and frequency of crises will increase, and urban water infrastructure will age even more rapidly consequent to climate change, urbanization, and technological developments. Municipalities can no longer assume stationarity and predictability of future developments in their decisions to renew infrastructure (Hill Clarvis et al., 2013; Mazmanian et al., 2013). Instead, facing future challenges requires forward-looking investment decisions, in which governments adopt robust and flexible policies, and explicitly account for the future problems and developments that may impact these policies (Pot et al., 2018; Walker et al., 2013). Without forward-looking decisions, governments run the risk of disruptive surprises (Anderson, 2010) and policy failure (Nair & Howlett, 2017). To create resilient and sustainable built environments, municipalities will therefore need to anticipate a range of future challenges when they invest in their drainage, sewerage, and water storage infrastructure (Maier et al., 2016).

However, municipalities encounter barriers that make it difficult for them to anticipate the future. Frequently reported barriers include poor political leadership and weak political incentives to invest in the long term (Bonfiglioli & Gancia, 2013; Hovi et al., 2009), limited long-term strategic planning (Lienert et al., 2013), and institutional fragmentation (Van de Meene et al., 2011). To strengthen long-term governance, existing literature mainly focused on proposing new methods and institutions targeted at either political leaders (Bonfiglioli & Gancia, 2013; Boston, 2017; Goetz, 2014; Granjou et al., 2017) or the strategic planning arena (Abbott, 2005; Kwakkel, Walker, et al., 2016; Urich & Rauch, 2014). In the field of politics, Jacobs (2011) is one of the few that not only proposed but also tested political conditions necessary for long-term governance. But a configurational perspective that combines factors from politics, policy and planning to explain long-term governmental action is lacking. Therefore, we use the Multiple Streams Framework (MSF) in this study. The MSF has been designed as a configurational approach, in which multiple factors, or streams, in combination produce an outcome (Howlett et al., 2015; Kingdon, 2011). However, so far, no studies exist that combine the MSF with an explicitly configurational method, such as Qualitative Comparative Analysis (QCA) to understand which combinations of factors from the streams produce specific policy outcomes (Cairney & Jones, 2016; Jones et al., 2016; Ragin, 2008b). By combining the configurational perspective about decision making from the MSF with a configurational QCA research approach, this chapter aims to make

three contributions: (1) to strengthen insights about long-term governmental action by combining and testing enabling conditions from politics, policy, and planning; (2) to show how the MSF could be combined with a QCA research approach to explain specific policy outcomes; and (3) to provide explanations about how municipalities, both large and small, are enabled to make forward-looking investment decisions about their urban water infrastructure.

To meet these aims, we systematically compare 40 cases of municipal investment decisions in urban water infrastructure from 40 municipalities of different sizes. The QCA approach allows us to identify *configurational* explanations drawn from the MSF, i.e. *combinations* of conditions from the problem stream (focusing events), the political stream (leadership style of the elected politician), and the solution stream (organizational analytical capacity). We have formulated the following research question:

What combinations of focusing events, political leadership style, and organizational analytical capacity enable municipalities to make forward-looking investment decisions about their water infrastructure?

This chapter is further structured as follows. Section 3.2 presents the theoretical framework, in which we define the outcome of a forward-looking decision and identify conditions that may stimulate such decisions. Section 3.3 describes the data collection and analysis methods. Section 3.4 presents the combinations of conditions that were found to stimulate forward-looking decisions. The results are discussed in Section 3.5, including recommendations for municipal governments and avenues for future research. The chapter ends with a short conclusion section.

3.2 Theoretical framework

Following the Multiple Streams Framework (MSF) (Howlett et al., 2015; Kingdon, 1984), we consider decisions to be the result of non-linear processes in which streams of problems, politics, solutions, and choice opportunities meet. We extend the existing knowledge and use of the MSF by not focusing on when and how a decision emerges, but on why a specific type of decision results from the combination of streams, i.e. a forward-looking decision. We will first briefly introduce the outcome of a forward-looking decision before elaborating upon the conditions used in this study.

3.2.1 Outcome: forward-looking investment decisions

In the literature, forward-looking decisions are often equated with decisions that build on foresight (Dahlberg & Lindström, 1998; Gavetti & Levinthal, 2000). Foresight then refers to the exploration of futures, culminating in the formation of scenarios or joint visions (Amanatidou, 2017; Havas & Weber, 2017). In his book *Governing for the long term*, Jacobs looks at long-term investment decisions, defined as decisions that extract resources in the short term to invest in long-term benefits (2011, p. 17). In the present study, however, we want to assess whether long-term investment decisions actually take future challenges into account. Therefore, following Pot et al. (2018) we conceptualize a forward-looking decision as a decision that consists of three elements:

1) A forward-looking problem definition, i.e. a problem definition with a long time horizon and referring to possible future developments (Sprinz, 2009);
2) A forward-looking solution, i.e. solutions that are flexible and/or robust so as to remain effective under changing future circumstances (Dewulf & Termeer, 2015);
3) A forward-looking justification, i.e. a justification that relies on desirable, possible, or plausible future states of the world through scenarios, long-term goals, and/or visions (Maier et al., 2016; Meuleman & in 't Veld, 2010; Voß et al., 2009).

3.2.2 Conditions enabling forward-looking decisions

From the three streams that are part of the MSF, which we combine with a review of literature about considerations of the long-term in governance and policy processes, we derive three conditions that stimulate forward-looking decisions. (1) From the problem stream: the attention to long-term problems as a result of focusing events (Jones & Baumgartner, 2005); (2) from the political stream: political commitment to allocate resources to long-term problems (Jacobs, 2011); and (3) from the solution stream: organizational analytical capacity to address long-term problems adequately (Lodge & Wegrich, 2014). The original Garbage Can Model upon which the MSF is build, as well as applications of MSF to decision making processes, also added a *choice opportunity stream* (Cohen et al., 1972; Howlett et al., 2015). This stream is composed of the institutionalized processes that guide decisions (e.g. who participates, which legal requirements need to be met with decisions, and when budgets can be allocated). Because we compare cases that are embedded in the same national-institutional context and are therefore faced with the same formal rules and decision making procedures, we did not derive a separate condition from this choice opportunity stream.

Problem stream: focusing events

Kingdon (1984, 2011) developed the concept of a focusing event in his work on agenda setting, arguing that a focusing event (e.g. a crisis) is needed to direct the attention of governmental officials to important problems. Policy studies evidenced that exogenous events are an important contributor to policy action (Jones & Baumgartner, 2005). The importance of a focusing event also applies to '...long-term problems that have not yet fully emerged' (Jacobs, 2011, p. 48), because the events provide the government with the necessary electoral leeway to invest scarce resources in long-term problems. Disturbing events happening today can be strongly linked to long-term issues. When this condition is applied to the context of urban water management more specifically, there is also evidence that focusing events, in the form of floods or storm events, triggered revisions of existing policies in urban environments (Ahmed et al., 2015; Mazmanian et al., 2013). Ahmed et al. (2015) found that extreme events triggered a revision of flood-risk management policies in Bangladesh. One shock is not always enough to trigger a response, though. Mazmanian et al. (2013) note, in their study about climate change adaptation in the built environment, that multiple shocks may be needed to address long-term problems. Sequences of weather events, such as heavy showers leading to local floods, can for example raise the political attention paid to the long-term issue of climate change. In the context of this study, we thus expect the occurrence of multiple extreme weather events to facilitate forward-looking decisions.

Political stream: leadership style of the elected politician

Political leadership is the ability to make authoritative decisions that mobilize public resources to achieve public goals (Torfing & Ansell, 2016). Political leaders that are democratically elected usually hold office for a period of four to maximum eight years. Election results often bring a new administration to power. The election cycle, in terms of its election results and changes of administration, is an important element of the political stream (Howlett et al., 2016; Kingdon, 2011). This cycle can increase accountability but also introduce a short-term bias, whereby politicians fail to explore the bounds and range of uncertain future developments when making decisions (Nair & Howlett, 2017). Indeed, research shows that politicians are more likely to invest in short-term policies than policies with future returns (Bonfiglioli & Gancia, 2013). For forward-looking decisions, therefore, there needs to be political will to extract short-term resources for long-term returns (Howlett et al., 2015; Jacobs, 2011). Importantly, this willingness depends at least in part on the leadership style of the elected politician who is responsible for investment decisions about urban water infrastructure. Many scholars have in fact argued that specific political leadership styles are needed for anticipatory action, including transforma-

tional leadership (Folke et al., 2005), entrepreneurial leadership (Schneider & Teske, 1992; not to be entangled with Kingdon's concept of a policy entrepreneur), and collaborative leadership (Torfing & Ansell, 2016). Taking into account the political time perspective as part of political and administrative leadership styles, Ricard, Klijn, Lewis, and Ysa (2017) distinguish five public sector leadership styles: transactional, interpersonal, network governance, entrepreneurial, and transformational leadership. Basically, transactional leadership is authoritative and rule-following; interpersonal leadership is oriented towards cooperation and relationship-building within organisations; network governance leadership also focuses on cooperation but adds involving the external environment; entrepreneurial leadership focuses on initiating change through strategic action and the mobilization of resources and the willingness to accept risks; and transformational leadership builds on charisma and visions to inspire change. According to Ricard et al. (2017), the network governance, entrepreneurial and transformational leadership style are characterized by a long-term perspective, whereas the transactional style is characterized by a short-term perspective. Based on these characteristics, we expect that politicians with a transformational or entrepreneurial leadership style are most likely to contribute to forward-looking decisions.

Solution stream: organizational analytical capacity

Policy capacity broadly refers to the skills and resources necessary for policy making (Wu et al., 2015). Organizational analytical capacity is a form of policy capacity, consisting of human resources, financial resources, and knowledge resources (Craft et al., 2013). Organizational analytical capacity focuses on medium to long-term problem solving (Parrado, 2014) by the solution stream, the stream in which policy experts develop technical solutions and prepare political decisions (Howlett et al., 2015). The ability to address the long term thus depends on the available organizational analytical capacity needed for understanding future uncertainties (Boston, 2017). Organizational analytical capacities are needed for activities such as identifying future developments, implementing and benefiting from decision-support tools, monitoring the effectiveness of implemented solutions, and making appropriate use of knowledge to gain new insights and ideas (Campos et al., 2017; Head, 2014; Nair & Howlett, 2014; Parrado, 2014). It can therefore be expected that relatively high levels of organizational analytical capacity within the solution stream will stimulate forward-looking decisions.

In line with the configurational idea behind the MSF, this study seeks to understand what combinations of focusing events, political leadership style, and organizational analytical capacity enable municipalities to make forward-looking investment

decisions about their water infrastructure. We outline the methodological approach in the next section.

3.3 Data and methods

3.3.1 Sample

This chapter compares the investment decisions of 40 Dutch municipalities (out of 388 municipalities in total). To ensure representativeness and sufficient variation, we used a stratified sample (Rihoux & Ragin, 2009). This allowed us to include municipalities of different sizes (based on number of inhabitants) and from different regions of the Netherlands (based on soil type). Before sampling, we excluded municipalities with low/no information availability, with a structurally bad financial situation, and that were merged after 2010. The financial situation and municipal merger criteria were used to ensure homogeneity, i.e. to make cases comparable in terms of background characteristics (Rihoux & Ragin, 2009). Figure 3.1 shows the locations of the sampled municipalities included in this study. Supplementary Material B1 presents further details of our case selection protocol.

3.3.2 Data collection

This study combined multiple data sources: primary documents, media coverage (2012–2017), existing survey results from the Dutch urban sewerage and drainage foundation *Rioned*, and telephone interviews with the responsible water manager of all 40 municipalities. The interviews were held in September 2017 and were recorded.

For the outcome *forward-looking investment decisions about water infrastructure*, we collected the 40 municipal decisions that enacted the Municipal Sewerage and Drainage Plans (MDPs). The MDPs cover the investments in urban water infrastructure in the upcoming (usually 5) years. All Dutch municipalities are legally obliged to have a valid MDP according to the Dutch Environmental Management Act. The guidelines from the Dutch urban sewerage and drainage foundation's (Stichting RIONED, 2017) dictate the structure and the content of the MDPs, which makes for a consistent and comparable dataset. Each municipality's current MDP was collected together with the council decision, edicts, and appendices.

For the condition *focusing events*, we performed a systematic search in the online database LexisNexis, using the same search term throughout and only changing the municipal region. For each municipality, we collected media articles in the

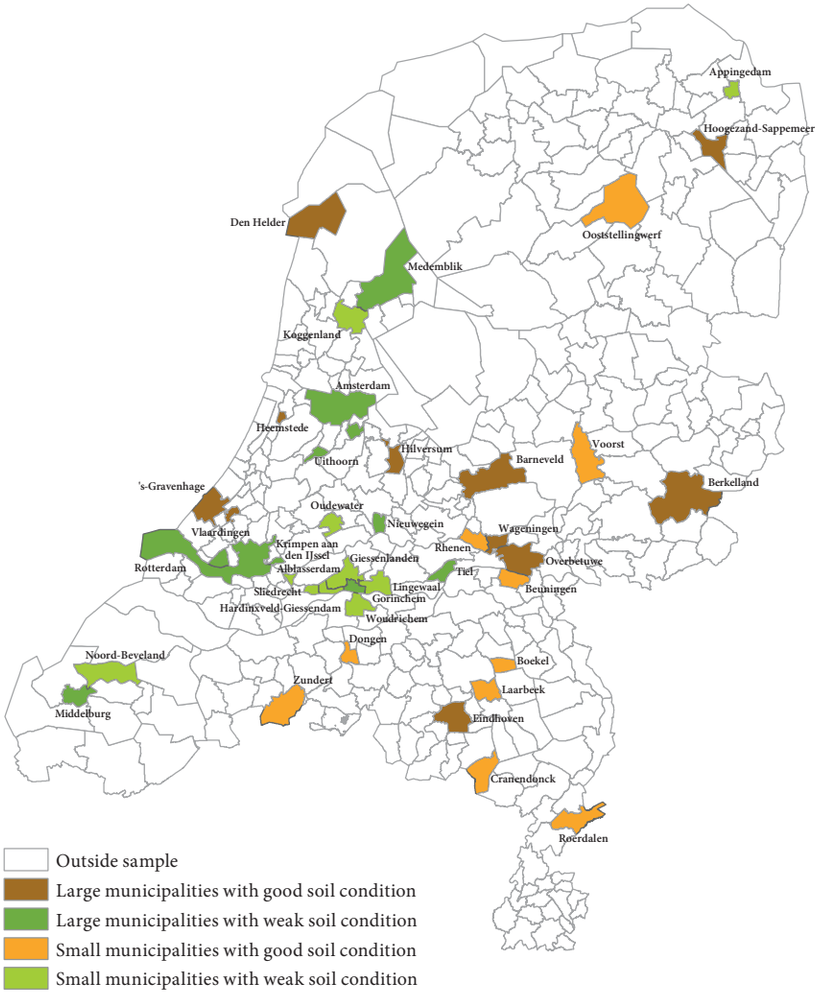

Figure 3.1. Sampled municipalities and their location in the Netherlands

specific regional newspaper about rainfall and flooding within the municipal area in the five years before the start of the MDP. We counted the number of events as well as the number of articles about one event, the latter as a proxy to measure impact.

For the condition *political leadership style*, we used telephone interviews with a standardized closed question about leadership. We asked the water manager of each municipality to choose one of Ricard et al.'s (2017) five styles of leadership to describe the leadership style of the alderman responsible for the MDP decision. In the three cases where the respondents did not pick a specific style, we asked them to describe their alderman and we chose a style matching that description. After the interviews, the chosen style and description were shared with the interviewees for validation.

For the condition *organizational analytical capacity*, we collected data about financial, human, and knowledge resources within the department responsible for urban sewerage & drainage management, i.e. the solution stream. For financial and human resources, the *Rioned* foundation's municipal benchmark for urban water management was used (Stichting RIONED, 2010, 2013, 2016). To measure knowledge resources, the interviewees were asked two standardized open questions and one closed question. The open questions asked each municipal water manager to describe what their department knew about their water management system and the impact of long-term developments such as climate change, as well as how their department acquired the knowledge. The closed question asked interviewees to grade the level of knowledge at the time of the MDP decision on a scale from 1 to 10. The responses to these three interview questions were transcribed and subsequently compared, within as well as between the interviews, to arrive at an overall score representing departmental knowledge resources.

To ensure familiarity with the cases and avoid incorrect interpretation of the data (Rihoux & Ragin, 2009), we used the 40 interviews also as member-checks. We sent a summary of collected data on each municipality's outcome and conditions to the relevant respondent before and after each interview. We discussed these summaries during the interviews.

3.3.3 Data analysis

We used Atlas.ti to code the MDPs based on a codebook for each of our forward-looking criteria (see Table 3.1 for measurement, operationalization, and calibration).

For the analysis, we used the fsQCA method, following the protocol in Schneider and Wagemann (2010b, 2012). fsQCA is a systematic comparative method in which conditions and the outcome are conceived as sets, and cases can have degrees of membership in these sets, ranging from 0 to 1. Set theory focuses therefore on set relations instead of correlations, and such relations can be intersected (i.e. conditions

Table 3.1. Measurement, operationalization, and calibration of the conditions

Condition/ Outcome	Label	Measurement	Calibration		No. of cases
Forward-looking decision	FWL	Coding of current Municipal Sewerage and Drainage Plan with Atlas.ti 7.5. Applying three criteria for a forward-looking decision: 1) Forward-looking problem definition: problem definition employs a long-term time horizon of minimum 10 years and mentions at least two future developments. 2) Forward-looking solution: decision invests in flexible and/or robust solutions. Flexible when the decision invests in at least two or three types of flexible measures to release capacity: underground measures, above ground measures, and social measures (Cettner et al., 2014; Deng et al., 2013; Orach & Schlüter, 2016; Urich & Rauch, 2014). Robust when the underground and above ground water management system are stress-tested (Walker et al., 2013). 3) Forward-looking justification: decision relies on visions and/or scenarios. Visions when the justification relies on formulated future goals or a future vision (Meuleman & in 't Veld, 2010; Voß et al., 2009). Scenarios when multiple future scenarios are used for one development or one future scenario for multiple developments (Maier et al., 2016).	0	0/3 criteria for a forward-looking decision is met	2
			0.33	1/3 criteria for a forward-looking decision is met	12
			0.67	2/3 criteria for a forward-looking decision are met	11
			1.00	3/3 criteria for a forward-looking decision are met	15
Political leadership style	LEAD	Structured interview question about leadership style of responsible alderman in interview with municipal water manager. All interviewees were surveyed with the same question in which they had to select one of the five different leadership styles.	0	Interpersonal/Transactional	11
			0.33	Network governance (Networking)	17
			0.67	Entrepreneurial	6
			1.00	Transformational	6
Focusing events	EVE	Media analysis with LexisNexis®. Because most MDPs are written for a period of five years, we looked for focusing events in the form of nuisance-causing rainfall events covered by the regional newspaper in the five years before the MDP decision. Literature does not give a specific guidance in terms of number and severity. Therefore, we based the calibration on our data. We registered the number of events as well as the number of articles about one single event. Cases of ≥ 2 articles about one event were coded as high impact and this was verified with the content of the article and the interviewee.	0	0 or 1 low impact (l.i.) event	18
			0.33	2 low impact (l.i.) events	6
			0.67	1 high impact (h.i.) event / 3 or more low impact (l.o.) events	5
			1.00	3 or more events of which at least one with high impact (h.i.)	11
Organizational analytical capacity	CAP	Presence of financial, human, and knowledge resources in the solution stream. The solution stream is the policy department responsible for urban sewerage and drainage management. We first checked whether each of the resources was present (minimum score of 0.67, see below) and then scored cases according to the presence of 0, 1, 2, or 3 of these capacity resources.	0	0/3 capacity resources is present	5
			0.33	1/3 capacity resources is present	15
			0.67	2/3 capacity resources is present	14
			1.00	3/3 capacity resources is present	6
		Sub-indicator of **financial resources**: sum of investments in year of MDP decision divided by length in kilometres of sewerage system as registered in urban water management surveys of Rioned Foundation (2010, 2013, 2016). We used a categorization by Rioned foundation (see Stichting RIONED, 2013 p. 102, Figure D3.4) in combination with variation within our data to arrive at the thresholds for calibration in *R*.	0	< 3,000 Euros / km	9
			0.33	3,000 – <5,000 Euros / km	11
			0.67	5,000 – <10,000 Euros / km	13
			1.00	≥ 10,000 Euros / km	7

Table 3.1. Continued

Condition/ Outcome	Label	Measurement	Calibration		No. of cases
		Sub-indicator of **human resources**: fte internal service incl. contracted fte, divided by length of sewerage system in 100 kilometres, as registered in Rioned Foundation surveys in year before MDP decision (Stichting RIONED, 2010, 2013, 2016). The QCA programme Tosmana (Cronqvist, 2017) was used to find appropriate thresholds through a simple cluster analysis: 0.96; 1.57; 2.17.	0	< 0.96 fte / 100 km	7
			0.33	0.96 – <1.57 fte /100 km	15
			0.67	1.57 – <2.21 fte /100 km	12
			1.00	≥ 2.21 fte /100 km	6
		Sub-indicator of **knowledge resources**: we asked the interviewees three questions: 1. What was the level of knowledge about climate change and flooding in the year of the MDP decision?; 2. How does the department update its knowledge about future developments such as climate change?; and 3. How would you grade the level of knowledge about forward-looking themes in the year of the MDP decision and in the current year, from 0 to 10? For calibration, we used this grade but combined it with the qualitative interviewees' answers to understand what a grade of '7' reveals and whether it can be understood as high or low. Also, we compared between interviews to look at the variation between the grades and variation in qualitative answers to adjust grades if necessary as well as to define thresholds for calibration in *R*. Climate change was used as long-term theme because the analysis of MDPs revealed that climate change is the first long-term development to be considered by municipalities (93% of the analysed MDPs mentioned climate change).	0	Grade of 0 - ≤ 6	13
			0.33	Grade of > 6 – <7	11
			0.67	Grade of 7 – <7.5	6
			1.00	Grade of ≥ 7.5	11
Contextual: Size	SIZE	Registered number of inhabitants in Rioned Foundation surveys. We used the number closest to the MDP decision date (Stichting RIONED, 2010, 2013, 2016). The size categories of the Dutch Bureau of Statistics (CBS) were used in combination with the variation in our data to define thresholds for calibration.	0	0 – 19,999	10
			0.33	20,000 – 29,999	13
			0.67	30,000 – 99,999	13
			1.00	≥100,000	4

in combination produce the outcome, indicated by the * sign in Boolean terms) or unified (i.e. multiple and different combinations of conditions can produce the outcome, indicated by the + sign in Boolean terms). QCA studies the necessity and sufficiency of (combinations of) conditions for the outcome of interest (Gerrits & Verweij, 2018; Ragin, 2008b; Schneider & Wagemann, 2012). A condition is necessary if the outcome cannot be achieved without it. In terms of set theory, the condition is a superset of the outcome. A condition is sufficient if, whenever we observe the condition, the outcome is also present. In terms of set theory, the condition is a subset of the outcome (Schneider & Wagemann, 2012).

Case comparison leads to the identification of configurations (i.e. combinations of conditions) that are sufficient for (i.e. that explain) the forward-looking investment decision. The fsQCA in this study includes the three theoretical conditions and the additional context condition *size*. This allowed us to distinguish explanatory configurations for small and medium-to-large municipalities separately, and thus allowed us to provide recommendations for small and medium-to-large municipalities, respectively.

To determine the cases' membership in the conditions and the outcome, we used the fsQCA four-value calibration scheme (Ragin, 2008b). Calibration is the process of assigning set-membership scores to cases (Schneider & Wagemann, 2012). The advantage of four-value fsQCA over other calibration schemes is that it allows the retention of a certain level of raw data detail (compared to dichotomous calibration), and at the same time does not create false precision (which may increasingly occur with calibration schemes with more than four values, especially when the data are qualitative) (Gerrits & Verweij, 2018). Also theoretically, a four-value scheme fits well with the operationalisation of our conditions. In the four-value scheme, cases can have membership scores of 0 (full non-member), of 0.33 (more non-member than member), of 0.67 (more member than non-member), and 1 (full member). The raw and calibrated scores covering the four conditions and the outcome, as well as the raw data matrix, are presented in Supplementary Materials B2 and B3.

Table 3.1 shows how the cases are distributed over the membership scores for the outcome and each condition (see last column of Table 3.1). Approximately two-thirds of the cases (n=26) are a member of the outcome (score of 0.67 or higher); about a quarter of the municipalities (n=12) have an alderman characterized with a long-term political leadership style; a third of the cases (n=16) experienced high impact or multiple severe weather events; and half of the municipalities (n=20) have high organizational analytical capacity. Furthermore, our sample represents 23 small municipalities and 17 medium-to-large municipalities. The cases are therefore nicely spread in terms of membership of the conditions and outcome.

For our QCA analysis, we used the QCA package, version 3.4, in *R* (Dusa, 2019). As a standard of good practice within QCA, we first conducted an analysis of necessity (Schneider & Wagemann, 2010b, 2012). Second, based on the calibrated data matrix, the truth table was created. The truth table lists all the logically possible combinations of conditions, in our case 16 (i.e. 2^4). Table 3.2 presents the truth table, showing how the 40 cases are distributed over the logically possible configurations. It displays the 16 logically possible configurations, along with the empirical evidence (i.e. the cases) for each configuration. Second, the truth table was minimized, leading to the identification of minimal configurations that explain the outcome. Truth table minimization involves the pairwise comparison of configurations that agree on the outcome and differ in only one of their conditions, thus eliminating the condition in which two configurations differ.

Table 3.2. Truth table

Row no.	Conditions				Outcome	Consistency		Case	
	Political leadership	Focusing events	Organizational analytical capacity	Size	Forward-looking decision	Raw	PRI	N	Cases
8	0	1	1	1	1	1	1	5	Amsterdam, Berkelland, Den Haag, Overbetuwe, Rotterdam
2	0	0	0	1	1	1	1	4	Barneveld, Hoogezand-Sappemeer, Medemblik, Vlaardingen
5	0	1	0	0	1	1	1	1	Voorst
12	1	0	1	1	1	1	1	1	Wageningen
14	1	1	0	1	1	1	1	1	Gorinchem
16	1	1	1	1	1	1	1	1	Eindhoven
7	0	1	1	0	1	0.940	0.873	4	Cranendonck, Krimpen aan den IJssel, Lingewaal, Rhenen
4	0	0	1	1	1	0.936	0.872	2	Nieuwegein, Tiel
15	1	1	1	0	0	0.907	0.744	1	Beuningen
6	0	1	0	1	0	0.879	0.773	3	Den Helder, Hilversum, Middelburg
9	1	0	0	0	0	0.868	0.726	5	Boekel, Koggenland, Ooststellingwerf, Oudewater, Roerdalen
11	1	0	1	0	0	0.855	0.622	3	Hardinxveld-Giessendam, Heemstede, Woudrichem
3	0	0	1	0	0	0.824	0.634	3	Dongen, Giessenlanden, Zundert

Table 3.2. Continued

Row no.	Conditions				Outcome	Consistency		Case	
	Political leadership	Focusing events	Organizational analytical capacity	Size	Forward-looking decision	Raw	PRI	N	Cases
1	0	0	0	0	0	0.819	0.685	6	Alblasserdam, Appingedam, Laarbeek, Noord-Beveland, Sliedrecht, Uithoorn
10	1	0	0	1	?	n/a	n/a	0	
13	1	1	0	0	?	n/a	n/a	0	

To minimize the truth table and exclude inconsistent truth table rows, QCA standards recommend the use of a consistency threshold of 0.8 as a rule of thumb. But this rule of thumb should not be applied mechanically (Schneider & Wagemann, 2010b, 2012). In fact, it is not strict enough for our results since all our truth table rows with empirical evidence (i.e. cases) have a consistency score higher than 0.8. Therefore, to decide upon the consistency cut-off point, we also took into account gaps in the proportional reduction in inconsistency (PRI) measure and examined each truth table row manually to detect contradictory cases. PRI measures the extent to which a configuration is sufficient for the outcome and not also simultaneously for the non-outcome (Ragin, 2009; Schneider & Wagemann, 2012). Below the consistency score of 0.936, we can observe quite a sharp drop in PRI with 0.1 point (see Table 3.2). This drop in consistency is an important signal for determining the consistency cut-off value (Gerrits & Verweij, 2018). Finally, we checked the truth table rows manually. Below a consistency level of 0.936 and PRI of 0.872, over 50% of the cases contradicted the outcome. On the basis of this examination, we set the outcome of truth table rows to 1 if the consistency was higher than 0.935.

After the inclusion threshold was then set, the QCA standard analysis procedure was applied to retrieve the solution formula (Ragin, 2008b; Schneider & Wagemann, 2012, p. 175). The conservative, intermediate, and parsimonious solution formulas are presented in Supplementary Material B4. We followed a conservative approach.

This means that we did not use as 'counterfactual cases' the truth table rows with a consistency score below the set threshold or that were devoid of any cases. A case frequency threshold of 1 is recommended for QCA analyses that include a limited number of cases (Marx & Dusa, 2011; Ragin, 2008a). The results of the truth table minimization and the conservative solution term are presented in the next section.

3.4 Results

3.4.1 Necessary conditions

Table 3.3 presents the result of the analysis of necessary conditions for the outcome of a forward-looking decision. According to QCA standards, conditions should only be considered necessary if their consistency scores are 0.9 or higher (Rihoux & Ragin, 2009). As can be seen from Table 3.3, none of the conditions meets this standard. This indicates that neither focusing events, nor long-term political leadership, or organizational analytical capacity are necessary conditions for forward-looking investment decisions about urban water infrastructure.

Table 3.3. Analysis of necessary conditions for forward-looking investment decisions

Condition	Consistency	Coverage
~Long-term oriented political leadership	0.709	0.766
Organizational analytical capacity	0.632	0.818
Size	0.607	0.940
~Organizational analytical capacity	0.594	0.795
~Size	0.594	0.680
~Focusing event	0.594	0.661
Focusing event	0.493	0.795
Long-term oriented political leadership	0.466	0.786

Note: tilde sign (~) indicates negated condition

3.4.2 Sufficient configurations of conditions

We found four minimized configurations that enable municipalities to make forward-looking investment decisions (Table 3.4). The consistency of the solution formula was 0.946. This means that the empirical evidence supports the claim that these configurations are indeed sufficient for the outcome. The coverage was 0.671,

meaning that about 67% of the cases that possess the outcome are explained by the solution formula. The results indicate that no single condition or configuration is sufficient for forward-looking decisions. Instead, conditions are INUS conditions: they are in themselves insufficient but form a necessary part of an unnecessary but sufficient configuration (Schneider & Wagemann, 2012).

Configuration 1 shows that medium-to-large municipalities with a high organizational analytical capacity can successfully make forward-looking decisions. In this configuration, the forward-looking investment decision about urban water infrastructure was reached regardless of the leadership style of the responsible alderman and regardless of the presence or absence of extreme weather events. This configuration applies to nine cases.

Configuration 2 shows that, additionally, medium-to-large municipalities can achieve forward-looking investment decisions with an alderman with a transactional or networking style, combined with the absence of high impact weather events, and independent of organizational analytical capacity. Note that the *Nieuwegein* case is a contradiction, as it does not have the outcome of a forward-looking decision. However, with a membership score of 0.33 on the outcome, Nieuwegein's MDP did have some forward-looking features. Furthermore, the other five cases clearly support the configuration being sufficient for the outcome.

Configuration 3 shows that medium-to-large municipalities can make forward-looking investment decisions about their urban water infrastructure with an alderman with a long-term oriented leadership style (i.e. transformative/entrepreneurial leadership style, when the municipality is faced with extreme weather events. This is independent of organizational analytical capacity. This configuration applies to two cases.

Configuration 4 shows that small municipalities are able to make forward-looking investment decisions about their urban water infrastructure with an alderman with an interpersonal/networking leadership style when the municipality is faced with extreme weather events. In this configuration, the forward-looking decision is reached regardless of organizational analytical capacity. Note that *Lingewaal* is a contradiction, as it does not have the outcome of a forward-looking decision. However, with a membership score of 0.33 on the outcome, Lingewaal's MDP did have some forward-looking features. Furthermore, the other four cases do support the sufficiency of the configuration.

Table 3.4. Configurations that enable municipalities to make forward-looking investment decisions

Condition	1	2	3	4
Size	●	●	●	ø
Focusing event		ø	●	●
Long-term oriented political leadership		ø	●	ø
Organizational analytical capacity	●			
Cases	Nieuwegein, Tiel; Amsterdam, Berkelland, Den Haag, Overbetuwe, Rotterdam; Wageningen; Eindhoven	Barneveld, Hoogezand-Sappemeer, Medemblik, Vlaardingen; Nieuwegein, Tiel	Gorinchem; Eindhoven	Voorst; Cranendonck, Krimpen aan den IJssel, Lingewaal, Rhenen
Consistency	0.972	0.956	1	0.912
PRI	0.958	0.927	1	0.818
Raw coverage	0.454	0.278	0.214	0.265
Unique coverage	0.140	0.064	0.013	0.089
Solution consistency		0.946		
Solution coverage		0.671		

Note: ● = present causal condition; ø = absent causal condition. In configuration 2, the ø for long-term oriented political leadership indicates that the aldermen of these municipalities are perceived as either transactional or networking. In configuration 4, the ø, the ø for political leadership indicates that the aldermen of these municipalities are perceived as either interpersonal or networking. No circle indicates that the condition is irrelevant for explaining a forward-looking decision. Raw coverage reflects how many cases are explained by a certain configuration of conditions. Unique coverage reflects the extent to which the presence of the outcome is uniquely explained with a specific configuration. PRI refers to the Proportional Reduction in Inconsistency.

3.5 Discussion

In this section, we discuss the role of the individual conditions in relation to our theoretical expectations so as to strengthen ideas about long-term governmental action, the first aim of this study. Second, and in line with our second aim, we discuss the implications of our results for the MSF. Lastly, we discuss the configurations (Table 3.4) in relation to one another, to provide recommendations for policy practice, which relates to our third aim.

3.5.1 Contributions to ideas about long-term governance

If we look at the individual conditions, we find that in contrast to the promotion of anticipatory (Boyd et al., 2015) and responsible (Goetz, 2014) governance to deal with long-term problems, forward-looking decisions can also occur when anticipatory action is taken *in response* to *focusing events*. This suggests that municipalities benefit from a responsive government mode in which focusing events are embraced to solve both pressing and long-term problems. Therefore, more attention could be given to preparing governments to not only handle but also *use* surprises adequately in order to address the long term (Anderson, 2010; Rickards, Ison, et al., 2014).

For the condition *leadership style*, we conclude that different leadership styles can contribute to a forward-looking decision and that such decisions do not rely only or necessarily on one specific style. This may call for an adjustment of the leadership characteristic 'long-term perspective' within Ricard et al.'s (2017) framework. Specifically, our analysis adds that the political leadership style that enables forward-looking investment decisions depends on the size of the municipality and the occurrence of extreme weather events. Cooperation-oriented styles, such as interpersonal and networking governance, are also promising for forward-looking decisions. Leaders with these styles may contribute to forward-looking decisions, because they tend to increase the diversity of perspectives needed to make decisions in a context of increasing external complexity and uncertainty (Duit et al., 2010; Koppenjan & Klijn, 2004).

Thirdly, we find that *organizational analytical capacity* plays a role in only one of the four configurations found (Table 3.4). Of course, the combination of being a relatively large municipality with a high analytical capacity is highly consistent with the occurrence of a forward-looking investment decision (Configuration 1). Capacity is important for the development, application, and monitoring of foresight methodologies and decision-support methods to deal with the uncertain future

(Dominguez et al., 2011; Frijns et al., 2013; Nair & Howlett, 2017; Ranger et al., 2013; Tapinos & Pyper, 2018). However, according to Configurations 2 to 4 representing a total of 13 municipalities, forward-looking investment decisions can be achieved regardless of the municipalities' organizational analytical capacity. This offers a hopeful prospect, as municipalities may not be able to increase their capacity levels easily.

Finally, if we look at the importance of *size*, we see that three configurations involve medium-to-large municipalities (≥ 30,000 inhabitants). From this, we may conclude that size matters, although small-sized municipalities are also able to make forward-looking decisions, as reflected in Configuration 4. In the literature, several authors argue that organizational size is important for national and especially local governments to address societal problems (Schwartz, 1998, in Pattyn & Brans, 2015; Termeer et al., 2010), and our results support that claim. However, many existing studies suffer from a research bias regarding size, as often only large cities are included (e.g. Carter et al., 2018; Meene et al., 2011; OECD, 2016; Schuch et al., 2017). We addressed this gap, having included small municipalities and explicating configurations that explain forward-looking investment decisions differently for small and medium-to-large municipalities.

3.5.2 Implications for the multiple streams framework

As a point of departure, we use the MSF to argue that decisions are a result of a combination of factors from the arenas of politics, solutions, and problems. Furthermore, we use the MSF not to explain when and how a decision emerges, but why a specific type of decision, i.e. a forward-looking decision, results from the combination of these arenas, or streams. To operationalize these streams, we used literature from the field of long-term governance and planning, showing how the streams can be defined more specifically than often is done (Jones et al., 2016). We do emphasize that our operationalization is particularly useful for research applications on long-term governance, and less so for applications to processes of agenda setting or decision making in general.

By using QCA and comparing a total of 40 cases of Dutch municipalities, we catered to the critique of Cairney and Jones (2016) that the MSF is often applied to isolated cases only. To the best of our knowledge, our study is the first time the MSF was used in combination with QCA. This combination contributed to the specific operationalization of MSF concepts as discussed above.

Furthermore, our QCA analysis results in four configurations of Table 3.4 that show that it is not necessarily the case that all three conditions of the streams are present when a forward-looking decision occurs. This could imply that, in the specific case of forward-looking decisions, the requirement that all streams need to come together for policy decisions needs to be relaxed. This corroborates a research finding that is also mentioned by Rawat and Morris in their review of MSF studies (2016). We especially find that organizational analytical capacity is present in one of four configurations and therefore not necessary for forward-looking decisions, and also that minimized *Configuration 2* (i.e. SIZE*eve*lead) suggests that the size of the municipality explains forward-looking decisions when no political pressure emerges from focusing events or when there is no long-term oriented leadership style, and regardless of organizational analytical capacity. Therefore, it would be interesting to perform an in-depth case study to find conditions that also contribute as part of the three MSF streams or maybe even in additional streams such as the programme and process stream that Howlett et al. (2015, 2016) add. Furthermore, there are three configurations that presented a combination of the absence/presence of focusing events that emerge from the problem stream with specific political leadership styles. The specific mechanism, or coupling logic, at play – whether leadership follows event (consequential coupling) or vice versa (political coupling) (Blum, 2017) – should be investigated by adopting an in-depth process-tracing research approach (Schneider & Rohlfing, 2013) .

3.5.3 Implications for policy practice

By bringing the configurations (Table 3.4) in relation to one another, we can derive the following recommendations for municipalities that need to invest in the future of their urban water infrastructure:

1. Comparison of *Configurations 1 and 3* suggests that medium-to-large municipalities benefit from organizational analytical capacity but that a possible lack thereof may be compensated by an alderman with an entrepreneurial or transformative leadership style in a situation with focusing events. Medium-to-large municipalities that have a transformative or entrepreneurial alderman, could use that strength in particular when focusing events occur to mobilize resources to also address long-term problems. Focusing events can create 'windows of opportunity' (Kingdon, 2011) for forward-looking investments. Such windows can only be exploited when political leaders are willing to connect severe weather events to future challenges and are willing to invest in forward-looking solutions. As it is possible that the administration will change after new election, it is important to realize the political leadership style may change as well. This does not necessarily have to be a problem, because different leadership styles can contribute to forward-looking decisions in different situations, as long as political leaders are trained to be adaptive in terms of their leadership style. In other words, this requires situational political leadership in that 'certain contexts require certain kinds of leadership' (Morrell & Hartley, 2006, p. 491). This fits well with the idea of forward-looking decisions, since future challenges are currently unknown and demand not only flexibility in terms of solutions as illustrated above, but also in terms of leadership.
2. Medium-to-large municipalities with high organizational analytical capacity are clearly able to keep long-term non-urgent problems on the agenda of decision makers, as indicated by both our results (*configuration 1*) and existing studies (Mintrom & Luetjens, 2017; Regonini, 2017). Forward-looking decisions could therefore benefit from depoliticization towards more technocratic arenas, or urban partnerships in the case of stable situations (Marshall & Cowell, 2016; Taylor & Harman, 2016). Municipalities that have a strong organizational analytical capacity could use that strength to develop solutions that can cope with future challenges by being flexible and/or robust (Green, 2017; Mintrom & Luetjens, 2017). An example is the creation of multifunctional urban green spaces for water storage to deal with intense rainfall in the future such as is done with the 'sponge city' concept (Chan et al., 2018; Dai et al., 2018). Furthermore, to maintain a strong anticipatory capacity and deal with the unexpected it is important that water managers in the solution stream not only focus on resources to invest in robust and/or flexible solutions; but also on resources to invest in their own adaptive capacities (Plummer et al., 2018). Examples are the capacity to develop scenarios and to model alternative response strategies (Urich & Rauch, 2014), as well as to develop issue framing skills to create support for decisions (Aldunce et al., 2016).
3. Small municipalities benefit from interpersonal or networking leadership when they are faced with multiple or severe rainfall events (*configuration 4).* According to Ricard et al. (2017), both leadership styles can be viewed as cooperation-oriented. This finding suggests that small municipalities are enabled to make forward-looking decisions because they involve others. Small municipalities should therefore use their relationship building capacities when unexpected events occur, not only to respond rapidly to the event but also to address related long-term problems. Municipalities could especially benefit from their participation in inter-organizational networks, which can increase the organizational and anticipatory capacity of municipalities by sharing knowledge, developing joint visions, participating in pilots, and lobbying for regulation (Boyd et al., 2015; Kellogg & Samanta, 2018).

3.6 Conclusion

We set out to identify the conditions that enable municipalities to make forward-looking investment decisions about their urban water infrastructure. To identify specific conditions that potentially contribute to forward-looking decisions, this chapter combines the MSF with literature from long-term governance and applied the configurational method of QCA. Our research reveals that medium-to-large (≥ 30,000 inhabitants) municipalities seem to have the advantage regarding forward-looking decisions (74% of the cases covered by the configurations in Table 3.4 are medium-to-large municipalities). We also find that forward-looking decisions do not necessarily emerge from a specific combination of all three conditions, this finding is in contrast to the MSF assumption that all streams need to combine for policy outcomes to occur. For medium-to-large municipalities, we found three combinations of conditions: (1) forward-looking investment decisions are stimulated by the presence of organizational analytical capacity; (2) forward-looking investment decisions are enabled by transactional/networking political leadership in situations without focusing events (i.e. extreme weather events) and; (3) forward-looking investment decisions are enabled by entrepreneurial/transformative political leadership combined with the occurrence of focusing events. For small municipalities, we found one configuration: forward-looking investment decisions are stimulated by networking/interpersonal political leadership combined with the occurrence of focusing events. For small municipalities, therefore, focusing events are important to address uncertain future developments. We also conclude that organizational analytical capacity is not necessary for municipalities to make forward-looking investment decisions.

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4

CHAPTER

Anticipating the future in urban water management: An assessment of municipal investment decisions

ABSTRACT

Municipalities are confronted with future uncertainties when they need to make decisions about their ageing water infrastructure. Previous work that addressed future challenges of urban water management focused mainly on climate change. This chapter develops a comprehensive index for forward-looking decisions about urban water management, to assess the extent to which, and how, Dutch municipalities anticipate the future with their investment decisions on urban water infrastructure. Results are based on a systematic comparison of investment decisions of 40 Dutch municipalities (about 10% of the population). Findings show that: (1) the extent to which municipalities anticipate the future differs largely; (2) only half of the municipalities adopt a long time perspective; (3) there are no commonly applied robustness tests; (4) flexibility is not explicitly adopted; rather, different flexible measures are applied; and (5) a minority of municipalities develop strategic visions or scenarios for urban water management to support decisions. These results highlight important areas of attention for municipalities worldwide. First, the need to invest in ageing water infrastructure can be seized as an opportunity to establish futureproof urban water management. Furthermore, climate change should be integrated with other future uncertainties into water management decisions. Third, transboundary cooperation could potentially increase municipalities' capacity to address uncertain futures and enhance learning. And last, increasing the use of scenario analysis and envisioning could help municipalities to prepare for the future. The index provided can be used for *ex ante* development and *ex post* assessment of investment decisions, to increase municipalities' preparedness for the future.

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4.1 Introduction

Municipalities play a key role in reliable water supply and water sanitation services. However, the costs of water resources management are increasing due to future developments such as ageing populations, urban and agricultural pollution, economic trends, and climate change. These future developments will also increase the impact of water-related crises in developed and developing countries (OECD, 2016) and shorten functional lifetimes of water infrastructure; but ageing infrastructure is already an investment challenge for governments worldwide (Grigg, 2017; Hijdra et al., 2014; Selvakumar et al., 2015). Ageing infrastructure provides an opportunity as well as a challenge to consider often highly uncertain future developments when crucial and large financial decisions need to be made (Urich & Rauch, 2014). It is therefore important to ascertain the extent to which municipalities are preparing for the future with their current investments in water infrastructure.

An interesting country to look at to assess future anticipation in water resources management is the Netherlands. As a low-lying delta region, the Netherlands not only faces many water-related challenges, but also has a strong reputation as a forward-looking pioneer country in water management (OECD, 2014). However, literature that discusses future anticipation in Dutch and other regions of the world, often focuses solely on anticipating climate change (Dąbrowski, 2018; Lawrence et al., 2015; Lyles et al., 2018), whereas there are many more future developments that governments will need to consider to prepare for the future and avoid disinvestment or even disruption (Herman et al., 2015).

Therefore, this chapter asks to what extent and how, Dutch municipalities anticipate the future (understood as a range of future developments) with their current investment decisions about urban water infrastructure. In answering this question, this chapter aims to make two contributions to existing literature. First, this chapter proposes a novel and comprehensive index of forward-looking investment decisions that can be used for *ex ante* and *ex post* evaluation of investment decisions in critical infrastructure by municipalities worldwide. The index builds on Pot et al.'s (2018) concept of a forward-looking decision, and combines technical as well as sociological aspects of future anticipation. Second, this index is then applied to systematically compare urban water infrastructure investment decisions made by a clustered sample of 40 Dutch municipalities (about 10% of the population). Results of this study reveal areas of improvement for future anticipation in investment decisions about water infrastructure, by showing differences among municipalities located in a frontrunner country in water management.

Section 4.2 introduces the conceptualisation and operationalisation of forward-looking investment decisions. Section 4.3 describes the data collection and analysis methods. Section 4.4 presents the results of a systematic case comparison of Dutch investment decisions about urban water management, followed by a discussion and a conclusion in sections 4.5 and 4.6.

4.2 Forward-looking investment decisions on urban water infrastructure

Anticipation means explicitly preparing for something (Anderson, 2010; Granjou et al., 2017). Anticipation in the context of urban water management refers to preparing for a range of future developments, such as climate change and population growth, that can impact urban water systems (Van de Meene et al., 2011). The level of anticipation can be measured by analysing municipalities' investment decisions (Gersonius et al., 2013), understood here as governments' decisions to allocate financial resources to the realization and renewal of urban water infrastructure. To measure the extent to which, and how, municipalities anticipate the future, this study builds on Pot et al.'s (2018) conceptual framework of forward-looking investment decisions. The concept of a forward-looking investment decision consists of a problem criterion (what future developments are recognized?); a solution criterion (can proposed solutions remain effective under future circumstances?); and a justification criterion (do decisions rely on probable, possible, or preferable future images?). The subsections below discuss the meaning and operationalisation of each of these criteria for urban water management.

4.2.1 Long-term problems considered

First, the problem definition of an investment decision is forward looking when it includes future developments and adopts a time horizon of 10 years minimum to discuss these challenges. *Future developments* can, for example, be climate change, economic and demographic trends, socio-political trends, and technological developments (OECD, 2014). Such developments can potentially impact the core functionalities of water infrastructure and can be highly unknown (Abbott, 2005). Long term also implies that the decision takes on a *long-term time horizon* to understand the problem (Segrave et al., 2014). The technical lifetime of water infrastructure is typically long, 100 years or more. However, the functional lifetime of infrastructure can be shortened severely if investment decisions do not consider the far future to foresee any possible developments that may actually impact the effectiveness of the infrastructure during its lifetime (Herder & Wijnia, 2012).

Therefore, as a minimum, the time horizon within investment decisions should be 10 years to encompass future developments (Meuleman & in 't Veld, 2010).

Operationalisation of a forward-looking problem definition

To measure *forward-looking problem definition*, each future development mentioned in the investment decision is counted, and the number of future developments is multiplied by the presence or absence (1 or 0) of a long-term time horizon. This leads to the following formula: TOTAL#DEV * PRESENCE TH. If no long-term time horizon is mentioned in the investment decision, the forward-looking problem definition scores 0.

4.2.2 Robust or flexible solutions

Second, the chosen water management solution is forward looking when it aims to be robust, flexible, or both. *Robust solutions* are solutions that perform satisfactorily across a large range of plausible futures (Walker et al., 2013). In the specific case of wastewater treatment systems, Spiller et al. (2015) argue that robust systems need to remain functional for 25 years under changing conditions such as changing water demand. To assess whether water management systems will remain functionally effective over a long period of time, both the underground and the aboveground system need to be stress-tested. In the literature, various robustness stress-tests are proposed, including scenario analysis (Fletcher et al., 2017), extreme shower simulations (Urich & Rauch, 2014), and climate change impact assessments (Zhou et al., 2012).

Solutions can also be *flexible* to cope with future developments. Flexibility implies that decisions about a water infrastructural solution leave options open for corrective or supplementary future measures after the solution has been implemented (Spiller et al., 2015). Flexibility includes piped solutions, aboveground solutions, and social measures. An important and flexible piped solution is to decouple rain and wastewater streams to free up space for changing precipitation patterns (Urich & Rauch, 2014). However, to anticipate changing precipitation and other future uncertainties, underground solutions will not suffice. Several authors in the field of sustainable urban water management argue that flexible aboveground measures and blue-green infrastructure are increasingly important for municipalities (Carter et al., 2018; Cettner et al., 2014; Porse, 2013). Last, to support the transition from inflexible sewerage and drainage systems to more flexible urban water management systems, Buurman and Padawangi (2018) stress the importance of including a social dimension, an important element of which is raising awareness and influencing behaviour.

To ensure flexibility, it is also important to monitor the effectiveness of the water management system (Kwakkel, Haasnoot, et al., 2016). Flexibility then means that water managers adjust their social and infrastructural solutions in line with new information about changing circumstances and system performance (Brugge & Roosjen, 2015). This often requires new (forward-looking) decisions.

Operationalisation of a forward-looking solution

To measure robustness, municipalities could earn a point for the application of I) underground and II) aboveground stress-tests that go beyond the standard precipitation patterns used for the system's design parameters. This leads to the formula: DRAINTEST + SYSTEMTEST, in which DRAINTEST refers to testing the urban drainage system itself and SYSTEMTEST refers to aboveground stress-tests.

To measure flexibility, municipalities could earn a point for investments in I) underground flexibility (i.e. decoupling of drainage systems), II) aboveground flexibility (e.g. water storage in parks), and III) social flexibility (e.g. public awareness raising campaigns). Furthermore, when a municipality uses monitoring information to adjust the system or future plans, it could receive an extra point for monitoring. This leads to the formula: DECOUPLING+ABOVE+SOCIAL(+MON).

4.2.3 Probable, possible, or preferable futures to support investments

Third, the justification of an investment decision is forward looking when the decision relies on multiple scenarios, or on future goals or visions. *Scenarios* are used to intuitively sense possible futures as well as to explore uncertain future developments (Amer et al., 2013; Maier et al., 2016). According to both the intuitive and the exploratory scenario tradition, multiple scenarios will need to be used to grasp uncertain futures. Forward-looking decisions can also be based on *long-term goals* and *strategic visions* to identify the preferred future (Fryd et al., 2012). Governments may formulate long-term goals to reach specific future states (Bai et al., 2015; Meuleman & in 't Veld, 2010). A well-developed vision can be a starting point to establish anticipatory action, and visions in decisions can serve as an important justification for measures that are argued to be needed (Haasnoot et al., 2013; van der Voorn et al., 2015).

Operationalisation of a forward-looking justification

To measure scenarios, I) the total number of scenarios (TOTAL#SCEN) and II) the future developments that are part of these scenarios (TOTAL#SCENDEV) are counted. This leads to the formula: TOTAL#SCEN * TOTAL#SCENDEV. Scenarios that municipalities use to support financial decisions regarding urban drainage tax

are excluded, because these scenarios are not focused on understanding external developments.

To measure visions and long-term goals, different weights are used. Visions formulated as an integral part of the investment decision are assigned the heaviest weight, as these are specifically focused on the current investment decision on urban water management (compared with previously developed more generic visions) and present a holistic view on the future water management system (compared with future goals). The presence of future goals within decisions is weighted more heavily than reference to visions previously developed, because such goals are specifically formulated for the investment decision. Therefore: I) previously developed visions mentioned in the decision are weighted 0.5 (e.g. a water management plan); II) the formulation of long-term goals within the decision is weighted 1 (e.g. a goal to establish a climate-robust water management system); III) the formulation of a specific strategic vision within the decision is weighted 2 (e.g. a vision of future urban water management). This leads to the formula: (VISEX * 0.5) + (GOALS * 1) + (VISDEV * 2).

4.3 Methods

This section briefly describes the data collection and analysis steps, after an introduction to the Dutch context.

4.3.1 The Dutch context and choice of investment decisions

The entities responsible for Dutch water management are prescribed in the Dutch Water Act of 2009. Water management tasks are divided over the different levels of government. The national government is responsible for national water policy and for the operation and maintenance of the main water system by the National Water Authority (*Rijkswaterstaat*). Municipalities are responsible for local spatial planning, sewerage collection and wastewater transport, urban drainage (groundwater and rainwater), and storm water collection (OECD, 2014). The local sewerage tax is used to finance investments in local water infrastructure. To justify the rate of this tax, all municipalities are required to have a valid Municipal Sewerage and Drainage Plan (MDP) according to the Dutch Environmental Management Act (1979). In this plan, municipalities have to describe the wastewater, storm water, and groundwater management measures in which they will invest in the upcoming period. The Dutch urban water management and sewerage foundation (*Stichting Rioned*) provides guidelines for the structure and content of these plans. These plans

are therefore a consistent data source for a comparison of municipal investment decisions on water infrastructure.

4.3.2 Sample

A clustered sampling method was used to sample 40 municipalities out of the population of 388 Dutch municipalities in 2017. First, to ensure complete and comparable data (Ford & Berrang-Ford, 2016), municipalities were excluded: (1) that were merged after 2010; (2) that needed additional payments from the Province between 2013 and 2016 and were therefore not financially independent, and (3) for which a large amount of information was missing about the municipality's characteristics and its water management systems in four Rioned surveys.

Additionally, to ensure a varied and representative sample, municipalities were selected on the basis of size (i.e. number of inhabitants) and soil type (i.e. soil factor). Soil factor refers to the weighted average share of different soil types (i.e. sand, clay, clay-peat, peat) within a municipality (Stichting RIONED, 2013). Soil type can be a relevant difference between municipalities when investments in urban water infrastructure are being compared, because soil type impacts the structural deterioration of underground water infrastructure (Micevski et al., 2002).

4.3.3 Operationalising forward-looking investment decisions

The following formulae are used to assess the extent to which investment decisions on urban water management are forward looking:

- Forward-looking problem definition:
  (TOTAL#DEV * PRESENCE TH) +
- Forward-looking solutions:
  (DRAINTEST+SYSTEMTEST) + (DECOUPLING+ABOVE+SOCIAL + (MON)) +
- Forward-looking justification:
  (TOTAL#SCEN * TOTAL#SCENDEV) + ((VISEX * 0.5) + (GOALS * 1) + (VISDEV * 2))

4.3.4 Data collection

The results of this study rely on an expert workshop, an analysis of municipal investment decisions, and 40 interviews with municipal water managers.

In July 2017, an expert workshop was organized in which three urban water managers, three academic urban water management experts, and one representative of the Dutch urban sewerage and drainage foundation participated. This workshop was used to discuss MDPs as a primary data source and to further conceptualize and discuss forward-looking decisions in the context of urban water management.

The collected investment decisions on urban water management consisted of the currently valid MDPs, municipal council decisions, council edicts, amendments, and MDP appendices (177 documents in total). Documents were collected through internet searching, accessing council databases, and – in eight cases – contacting the municipal registrar. Only one municipality had no valid MDP in place and was swapped with a municipality on a clustered sample backup list.

In September 2017, interviews were held with the municipal water manager of all 40 municipalities. All interviews were recorded. The interviews were used to (1) verify the coding of the MDPs and (2) gain additional insights into each municipality's way of working to prepare for the future, including, for example, the use of monitoring information.

4.3.5 Data analysis

All MDPs and their appendices and decision documents were uploaded in the programme Atlas.ti. Within Atlas.ti, a high-level codebook was used with codes based on the operationalisations described in section 4.2. During the coding process when codes for the presence of forward-looking criteria were assigned, codes were also added inductively, mainly to code the specific solutions, robustness tests, future developments, and monitoring activities mentioned in the MDPs. At the end of the coding process, applied codes were double-checked, codes referring to the same thing were merged, and codes were compared across different MDPs to improve reliability and consistency.

The interviews were used as a member-check for the MDP analysis. Before each interview, the MDP analysis was shared with the interviewee. After each interview, the MDP analysis and the interviewee's transcribed comments were shared again. This resulted in factsheets for each municipality that were compared across municipalities to rank the municipalities according to their forward-looking score, discover similarities and differences between municipalities, and to sum the presence of forward-looking aspects across MDPs.

4.3.6 Limitations of the methodological approach

Although the MDPs form a consistent and comparable data source as argued in section 4.3.1, there are some limitations. The MDPs are obligatory investment plans that cover a period of four to six years. As a result, the implemented solutions can differ from the solutions mentioned in these plans. New insights, negotiations, politics, and events during the MDP period may have led to different implementation decisions (van Riel et al., 2016). In addition, some forward-looking solutions may

have been executed without explication or reference in the MDP. To avoid important omissions, the MDP coding was verified and complemented with interviews. Third, the MDPs' start- and end-date were not the same for all municipalities. During the interviews, some municipalities noted that they were preparing a new MDP. In those cases, the version valid until at least the end of 2017 was used. The results focus on the presence and absence of forward-looking aspects within investment decisions of the overall sample, instead of assessing individual municipal capacities.

4.4 Results

This section describes the study's main findings by applying the forward-looking decision criteria presented in section 4.2. Section 4.4.1 first compares the overall scores on all forward-looking criteria between municipalities.

4.4.1 Extent to which municipalities anticipate the future differs largely

Only 12 of the 40 MDPs analysed met all criteria for a forward-looking decision and included a forward-looking problem definition, solution, and justification. The average forward-looking score for the solution criterion is highest: 3.4; compared to 1.65 for problem definition and 1.99 for justification (see Figure 4.1).

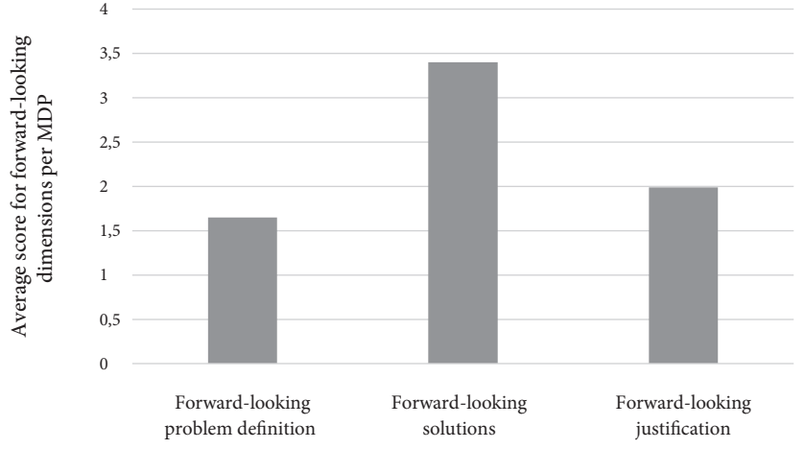

Figure 4.1. Calculated average of the forward-looking problem definition, solution, and justification per municipal sewerage and drainage plan (MDP)

MDPs' level of forward-lookingness varied, with scores from 1 to 15.5. The highest possible score of a forward-looking decision is dependent on the number of future developments mentioned and could therefore potentially be higher than 15.5. Table 4.1 presents the index score that shows the extent of forward-lookingness of the current MDPs of 40 municipalities in the Netherlands.

Eindhoven scored highest by mentioning future developments of climate change, recovery of resources from waste, new technology for decentralized sanitation; by applying robustness tests with extreme shower simulations and two-dimensional simulation models; by including a combination of aboveground, underground, and social flexibility measures; by using monitoring to adapt; and by relying on a combination of climate change scenarios, a municipal water management vision, and a long-term national water vision, and on future goals for storm water, water quality, and climate change. The municipalities with the lowest score of 1, *Alblasserdam* and *Giessenlanden*, on the other hand, applied only decoupling of waste- and storm water; and *Giessenlanden's* MDP did not include any future developments. In the interview, *Giessenlanden* explained that it did not face acute problems with its water management system after peak rains in 2014 and that ongoing cost reduction efforts did not leave room for anticipating measures.

The four largest municipalities sampled, *Amsterdam, Den Haag*, *Eindhoven*, and *Rotterdam*, each with more than 220,000 inhabitants, comprise the top four in Table 4.1. The bottom of Table 4.1 on the other hand represents mainly relatively small municipalities, with the exception of *Den Helder* and *Middelburg*. A simple t-test confirmed that the average forward-looking score is higher for larger municipalities than for small municipalities ($n = 40$; $t = -3.29$; $p = 0.002$). *Middelburg*, as a large municipality with a low score of 2, noted in the interview that its MDP was 'outdated' and that it was preparing a new and broader MDP that would cover both underground and aboveground water management solutions. Newer MDPs could potentially meet more forward-looking criteria. Table 4.1 indeed shows that the nine highest-ranking municipalities all have MDPs that date from 2015 or later. The 10 lowest-ranking municipalities have MDPs from 2010, 2012, 2013, to 2015, with the exception of *Zundert* with an MDP from 2016. In the interview, *Zundert* explained that it consulted the larger neighbouring municipality of *Breda* for knowledge about future developments.

To verify the influence of soil type, the other sampling criterion with size, municipalities with a sandy soil were compared with municipalities with a non-sandy soil type. T-test values ($n = 40$, $t = 1.40$; $p = 0.05$) showed no meaningful

Table 4.1. Assessment of current municipal sewerage and drainage plans based on forward-looking criteria

Rank	Municipality	Forward-looking score	MDP start-date	Size (inhabitants)	Soil factor
1	Eindhoven	15.5	2015	223898	1
2	Amsterdam	15	2016	790110	1.32
3	Rotterdam	15	2016	616260	1.32
4	Den Haag	14	2016	514861	1.02
5	Barneveld	12.5	2016	53521	1
6	Heemstede	12.5	2017	26242	1
7	Dongen	11.5	2016	25395	1
8	Hilversum	11.5	2015	87175	1
9	Roerdalen	10.5	2017	20699	1
10	Uithoorn	9.5	2013	28307	1.35
11	Berkelland	8.5	2013	44911	1
12	Koggenland	8.5	2014	22345	1.24
13	Gorinchem	8	2016	35206	1.4
14	Hoogezand-Sappemeer	8	2013	34778	1
15	Krimpen aan den IJssel	7.5	2013	28692	1.43
16	Medemblik	7.5	2017	43117	1.26
17	Vlaardingen	7.5	2013	71042	1.39
18	Appingedam	6.5	2013	12053	1.31
19	Boekel	6.5	2017	10119	1
20	Overbetuwe	6.5	2013	46269	1.01
21	Cranendonck	6.5	2016	20542	1
22	Rhenen	6	2015	19253	1
23	Ooststellingwerf	5.5	2015	25652	1
24	Woudrichem	5.5	2010	14442	1.2
25	Hardinxveld-Giessendam	5	2011	17654	1.43
26	Nieuwegein	5	2014	60720	1.13
27	Tiel	5	2015	41527	1.14
28	Voorst	5	2015	23908	1
29	Laarbeek	4.5	2013	21608	1
30	Lingewaal	4	2012	10895	1.28
31	Noord-Beveland	4	2015	7416	1.1
32	Wageningen	4	2010	37049	1
33	Zundert	3.5	2016	21363	1
34	Beuningen	3	2013	25433	1.01
35	Oudewater	3	2012	9850	1.48
36	Sliedrecht	3	2012	24232	1.43
37	Den Helder	2.5	2013	57065	1.09
38	Middelburg	2	2014	47768	1.12
39	Alblasserdam	1	2015	19467	1.37
40	Giessenlanden	1	2015	14508	1.37

difference between the forward-looking scores of the 21 municipalities with a sandy soil (average score 7.9) compared with those with a non-sandy soil (6.2).

4.4.2 Long-term problems considered: only half of the municipalities adopt a long time perspective

The most frequently reported future development within MDPs is climate change: 93% of the municipalities referred to climate change explicitly. Interviewees stated that awareness of climate change, its impacts, and local response options developed only gradually over the years. The *Den Helder* respondent, for example, observed a mildly increasing awareness of climate change within the municipality but also perceived climate change as a 'fashionable trend'. Some municipalities that did not address climate change argued in interviews that there was no urgency to act: they had not experienced any severe flooding or water nuisance issues (*Berkelland*, *Giessenlanden*).

To discuss climate change, five municipalities referred to the Dutch Delta programme or to climate scenarios of the Dutch Weather Institute (*KNMI*) and adopted the climate scenarios' 2050 time horizon. Half of the municipalities did not adopt any long time horizon to discuss future developments and to look beyond the MDP's time horizon. Besides climate change, future developments mentioned include spatial developments (55%), recovery of resources from wastewater (48%), sometimes also referred to as circular economy, and new technology (45%) (see Table 4.2). Recovery of resources from wastewater was included only in problem definitions or justifications, without translation to specific forward-looking solutions. Regarding spatial developments, municipalities often do not account for spatial developments until such developments are almost fixed with the inclusion of spatial projects in a spatial planning vision (expert workshop).

4.4.3 Robust solutions: no commonly applied robustness tests

Municipalities used different robustness tests for their underground and aboveground water management systems (see Table 4.2). To test the capacity of the underground system, 38% used standardized showers based on actual rainfall patterns recommended by the Dutch urban water management and sewerage foundation. A quarter of the municipalities used the most severe standardized shower of 35.7 millimetres rain in 60 minutes to test the aboveground system. Other severe shower tests used consisted, for example, of 35.7 millimetres plus an additional 10% (*Giessenlanden*), 60 millimetres (10% of the municipalities), or 100 millimetres (10% of the municipalities). About a third of the municipalities (30%) applied more comprehensive stress-tests of the aboveground water management system that included multiple theoretical

Table 4.2. Presence of forward-looking characteristics in municipal sewerage and drainage plans

Long-term problems considered	Count	%
Climate change (mainly water nuisance and precipitation)	37	93%
Spatial developments	22	55%
Recovery of resources from wastewater (sometimes referred to as circular economy)	19	48%
New technology (mainly related to new sanitation solutions)	18	45%
Demography (i.e. urbanisation, population decline)	7	18%
Increase of grey over green areas	6	15%
Legislation (mainly referring to new Dutch Environmental Planning Act to be adopted by 2021)	6	15%
Other sustainability topics (e.g. energy reduction)	4	10%
Hazards (e.g. explosions with dangerous goods, crisis management)	2	5%
Soil degradation	1	3%
Economy (i.e. national economic development, need for sustainable investments)	1	3%
Robustness or flexible solutions		
Robustness		
Stress-test with ≥ 2 theoretical and past showers	12	30%
35.7mm stress-test developed by *Rioned* foundation	10	25%
Stress-test with Dutch / Belgian extreme rainfall event	4	10 %
60mm stress-test	4	10%
100mm stress-test	4	10%
3D simulation	3	8%
2D simulation	3	8%
Flexibility		
Decoupling of storm water and wastewater streams	40	100%
Awareness raising (social)	25	63%
Use and creation of green for storage	14	35%
Streets as water storage and street profile adjustments	11	28%
Aboveground measures and aboveground storage (not specified)	14	35%
Stimulate private measures (social)	11	28%
Water infiltration storage	9	23%
Adjusting building standards	8	20%
Compensate private measures (social) (e.g. decoupling and green roof subsidies)	7	18%
Use and creation of surface water for storage	6	15%
Improvement of water flow with spatial planning	5	13%

Table 4.2. Continued

Long-term problems considered	Count	%
Water permeable streets	1	3%
Water storage compensation	1	3%
Reserving space for water within foreseen spatial developments	1	3%
Justification with probable, possible, or preferable futures		
Reference to other visions	20	50%
Future goal: climate change	16	40%
Climate change scenarios Dutch Weather Institute	15	38%
Future goal: water nuisance	11	28%
Vision developed for MDP	8	20%
Future goal: sustainability (e.g. future generations, People – Planet – Profit, purchasing of materials)	8	20%
Future goal: decoupling	5	13%
Future goal: recovery of resources from waste water	5	13%
Future goal: energy reduction	5	13%
Future goal: water quality (mainly compliance with EU Water Framework Directive in 2027)	5	13%
Technical solution scenarios	2	5%
Future goal: environmental pollution	1	3%

and/or past showers, and 8% uses two or three dimensional simulations Another third (33%) of the municipalities expressed the intention, in MDPs or during the interviews, to perform a stress-test. During the expert workshop, new standards to test the system were advocated because of already experienced and projected unpredictable weather, but there was no consensus or strong scientific basis for choosing one extreme shower over the other.

4.4.4 Flexible solutions: flexibility was applied although not explicitly adopted

Only four MDPs included the word flexibility in relation to water management solutions, either connected to the measure of decoupling (*Middelburg*, *Noord-Beveland*) or expressing a general ambition to move towards more flexible systems to be able to incorporate adjustments based on changing insights (*Amsterdam*, *Eindhoven*). With or without reference to flexibility, all municipalities applied decoupling of wastewater and storm water flows. *Dongen* framed decoupling as an important 'climate measure'. Three quarters (78%) of the MDPs included above-ground measures. These measures covered a range of different solutions, such as:

adjusting streets and green spaces to create additional water storage, creating water infiltration storage, and adjusting building standards (see Table 4.2). According to the interviews, municipalities still face barriers to taking aboveground measures. For example, it is difficult for municipalities to reserve space for water at potentially suitable storage locations before new spatial plans are drawn up (*Barneveld*). Also, according to *Oudewater*, its weak soil is a barrier to aboveground water infiltration storage. The respondent of *Den Helder* pointed towards a lack of priority for economic reasons and a backlog in data management.

To support aboveground solutions, a large majority of the municipalities (63%) invested in the social measure of awareness raising. *Rotterdam* and *Amsterdam* also proactively stimulated private partners and citizens to apply water management measures such as green roofs. Expert workshop participants perceived it as risky to rely on privately owned green infrastructure as part of the urban water management system, because this infrastructure can be prone to change: a new house owner may again pave his entire garden despite the government subsidising the previous house owner to create a rain garden. Paving gardens reduces a city's porosity (Fryd et al., 2012).

To be able to adjust measures to changing insights, only six municipalities used monitoring of system data, such as overflows, precipitation, citizen complaints, pumping stations, or infiltration basins. The remaining 85% of the municipalities were still in the process of collecting or analysing data. From the interviews, it emerged that municipalities rely strongly on their own knowledge of the system and actual experience with flooding rather than on structural system signals, something that van Riel et al. (2016) also showed. The expert workshop also called for more attention on learned adaptation, by monitoring information.

4.4.5 Justification with probable, possible or preferable futures: uncommon to develop visions or scenarios for urban water management

None of the municipalities developed scenarios to justify measures in their MDPs. This was confirmed by the expert workshop. Table 4.2 shows that 38% of the municipalities refer to *KNMI's* existing national climate scenarios; but often municipalities treated these scenarios as one, summarising the main points from the four *KNMI* scenarios (e.g. *Krimpen aan den IJssel*, *Koggenland*, *Barneveld*). In the expert workshop, one participant said that referring to *KNMI* scenarios provides a 'false security' about the future, because national scenarios cannot account for local system specifics and unknowns. Paradoxically, water managers start to recognize uncertainties such as climate change or population growth when these

uncertainties are no longer uncertain but real, through for example extreme rain events or plans for a new city quarter (expert workshop).

Only 20% of the municipalities specifically developed visions for the MDP. For spatial developments such as a new city quarter, water managers relied on the local spatial planning vision (*Structuurvisie*), but the future in this vision is not an uncertainty but a 'future truth' according to the expert workshop. Also, municipalities referred to visions from a decade earlier such as water management plans of 2006 and 2007 (*Vlaardingen*, *Den Helder*, *Krimpen aan den IJssel*). Lastly, a large majority of the municipalities (70%) formulated long-term goals in their MDPs, most often related to climate change (40%) or water nuisance (28%) (see Table 4.2). Five (13%) municipalities formulated a specific long-term goal of decoupling storm and wastewater flows (e.g. to decouple 10% of the existing combined waste- and storm water systems in 20 years' time, *Barneveld*).

4.5 Discussion

This chapter presents the first attempt to build a forward-looking index for the field of water management. The operationalized framework and index of forward-looking decisions developed in this study can increase the future-awareness of municipalities in two ways. First, the framework can assist with the development of forward-looking investment plans (i.e. *ex ante* application of the framework). Second, the framework can be used to assess investment decisions (i.e. *ex post* application of the framework) as shown in this study.

Applying the forward-looking decision framework to municipal investment decisions provides urban water managers and municipal decision makers with a number of key insights.

First, and *overall*, an important finding is that anticipating the future is clearly not self-evident for Dutch municipalities. This is surprising for two reasons: first, because the Netherlands is often portrayed as a leader in water governance and climate change adaptation (Kamperman & Biesbroek, 2017; Kwakkel, Walker, et al., 2016; OECD, 2014); second, and more importantly, because the long lifetimes and lead-in times of implementing new infrastructure are not necessarily translated into forward-looking decisions (Gersonius et al., 2013; Herder & Wijnia, 2012; Meuleman & in 't Veld, 2010). The low incidence of forward-looking aspects within many Dutch municipalities' investment decisions raises doubts about whether the water management systems built today will be effective over a long period of time (Gregersen & Arnbjerg-Nielsen, 2012). Ageing water infrastructure provides an opportunity that municipalities should seize to invest in the future of urban water management.

Second, this study's results show that there are still considerable gaps in the *future developments* that municipalities address and the possible developments that can impact their critical infrastructures. Municipalities anticipated climate change mainly with their investment decisions on urban water infrastructure, and climate change was mainly interpreted as water nuisance. Anticipating climate change impacts, however, also calls for attention on urban heat islands, drought, and flood risks (Forzieri et al., 2018; Koop et al., 2017). Furthermore, other important future uncertainties possibly impact urban water infrastructure, for example, ageing, growing or shrinking populations, soil degradation, and environmental pollution (Ferguson et al., 2013). Municipalities worldwide will need to integrate climate change with potential future uncertainties into a water management modelling-and-decision framework to ensure sustainable living environments and avoid major disruptions (Díaz et al., 2016; Fletcher et al., 2017).

Third, ensuring *flexibility* and *robustness* to respond to future uncertainties will require not only flexible measures and robustness tests but also learning to adjust (Koop et al., 2017). Municipalities in this study often treated climate change scenarios as one, or they applied only one precipitation scenario in a robustness test. This is more a predict-then-act approach than an accommodation of change (Gersonius et al., 2013). Very few municipalities monitored the performance of their water management system to make incremental adjustments as advocated by real options (Urich & Rauch, 2014), adaptive management (Pearson et al., 2009), and sustainable urban water management (Fryd et al., 2012). Monitoring and evaluation of decisions are key for anticipation. If capacity to do so is a problem, reported by the OECD to be the 'Achilles' heel for sub-national governments' (OECD 2016, p. 12), it may be a good idea to strengthen or establish multi-level networks. Transboundary cooperation could stimulate learning and adaptive action (Hill Clarvis et al., 2013).

Last, to strengthen governance capacity for forward-looking decisions, potential lies in the use of *scenarios* and visions; this was found to be limited in this study. Scenario analysis within strategic planning can help to identify different strategic options needed to confront future uncertainties (Dominguez et al., 2011). Cettner et al. (2014) show how visions can help to reframe dominant views and establish

innovative ideas for sustainable urban water management. Scenario analysis and envisioning, preferably in participatory processes, can increase the diversity of future perspectives, help to identify blind spots and alternative strategies, and stimulate learning (Head, 2014; Tschakert et al., 2016). Although time intensive, scenario analysis and envisioning can therefore be important tools for municipalities to prepare for the future and improve investment decisions.

The index of forward-looking decisions is novel and therefore not perfect yet. This study has its limitations and offers several avenues for future research. First, this study was based on assessing investment plans of municipalities located in one frontrunner country in water management. To discover how less advanced, and potentially more vulnerable, countries prepare for the future, the index can also be used to compare municipalities from different countries. Second, this study provided a snapshot analysis of currently valid investment plans, but with the index it will be possible to track progress over time (Lesnikowski et al., 2016). It is recommended to repeat this study to compare multiple investment decisions by the same governments to stimulate learning. Third and last, this study was mainly descriptive to enable the harvesting of all aspects of forward-looking decisions. An explanatory study could test the specific factors that impact decision making, such as participatory processes, multi-level networks, and leadership, to enable municipalities to successfully anticipate the future.

4.6 Conclusion

Municipalities are confronted with future uncertainties when they need to make decisions about their ageing water infrastructure. This chapter systematically compared 40 Dutch municipalities' investment decisions on urban water infrastructure to assess the extent to which, and how, municipalities anticipate the future with their current investment decisions on water infrastructure.

This chapter developed an index for forward-looking decisions on urban water management that can be used for *ex ante* development and *ex post* assessment of investment decisions on urban water infrastructure, to increase municipalities' level of preparedness for the future. The results of applying the index to a sample of Dutch municipalities showed that, despite the long lifetime of water infrastructure and the respected reputation of Dutch water management, the extent to which municipalities anticipate the future differs largely. Larger municipalities were found to be more forward looking than smaller ones. The results also provide an

overview of relevant future developments, robustness tests, and flexible strategies that municipalities worldwide could consider to anticipate the future. This study showed that Dutch municipalities most often anticipated climate change and only half of the municipalities adopted a long time perspective to discuss future developments. To ensure the long-term effectiveness of urban water management solutions, municipalities used different robustness tests with often limited scope. Flexibility is not yet a concept that is fully embraced, although municipalities did invest in different flexible measures such as decoupling, water storage in parks, and social awareness campaigns. What is also striking is that less than a quarter of municipalities developed strategic visions or scenarios to better grasp uncertainties before investing in urban water management. Using envisioning or scenario analysis before making investment decisions on new and ageing water infrastructure can potentially help municipalities worldwide to acknowledge a range of future uncertainties and formulate different strategic options to cope with these.

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5

CHAPTER

The governance challenge of implementing long-term sustainability objectives with present-day investment decisions

ABSTRACT

Grand sustainability challenges and international sustainability agreements require national and local governments to further incorporate sustainability as part of their present-day investments in infrastructure. Existing literature about sustainable public procurement focuses on the procurement process and/or its design; and there still is a black box between the barriers or conditions for sustainable public procurement and sustainability outcomes. Therefore, this chapter combines a governance lens with a process-tracing approach to explain why it is difficult for governments to reach sustainability objectives with their present-day investment decisions. The results derive from a longitudinal case study of the investment process in a Dutch water pumping station and are based on primary documents, interviews, and observations of the tender procedure between 2017 and 2019. The research reveals that risk avoidance, goal satisfaction, and budget compliance interfere with the implementation of national and international sustainability objectives at a local level. There is need for more attention on learning as part of procurement procedures, scale flexibility to realize sustainability objectives efficiently and effectively, and prioritization of conflicting long-term objectives to avoid implementation gaps.

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5.1 Introduction

To combat grand sustainability challenges, such as climate change and clean energy, most countries worldwide have committed themselves to international agreements such as the United Nations Sustainable Development Goals (SDGs) and the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCC) of 2015. Implementing these agreements requires national and local governments to invest substantial resources and further incorporate sustainability as part of their present-day procurement and investment decisions (Hueskes et al., 2017; Pinz et al., 2018). Infrastructure investment decisions provide an important opportunity for incorporating sustainability as those decisions require substantive resources and a long-term time horizon given the long lifespan of infrastructure. The United Nations has recognized explicitly that achieving sustainability will not be possible without public–private partnerships (PPP) because of the required resources, expertise, and implementation capacity (Marx, 2019). Prior research has also positioned procurement as an important policy tool that could help governments to reach societally desired outcomes (Brammer & Walker, 2011; Grandia & Meehan, 2017).

However, the extent to which PPPs contribute to the accomplishment of sustainability-related objectives is uncertain (Pinz et al., 2018). Tensions can arise between the private sector's shorter-term commercial interests and government's long-term sustainability objectives (Koppenjan & Enserink, 2009); and PPP arrangements are not always the most cost-efficient or effective way to achieve objectives (Marx, 2019). Furthermore, besides this tension between the public and the private sector, tensions within government, such as between politics and civil servants may contribute negatively to achieving sustainability objectives. Election cycles and legally binding core tasks, for example, incentivize governments to pay attention to short-term needs at the possible expense of long-term sustainability objectives (Bonfiglioli & Gancia, 2013; Jacobs, 2011).

This chapter aims to explain why it is difficult for governments to achieve long-term sustainability objectives with their present-day investments in infrastructure. Although existing literature has discussed barriers to sustainable public procurement (Brammer & Walker, 2011; Cheng et al., 2018; Günther & Scheibe, 2006), two gaps remain. First, the literature focuses on the procurement process and/or its design, such as contracts or specific tender procedures (Koppenjan, 2014; Uttam & Le Lann Roos, 2015) or on the procurer (Grandia, 2015, 2016) and not on the entire governmental process of decision making about infrastructure investments.

Second, there still is a black box between the barriers or conditions for sustainable public procurement and sustainability outcomes; including how sustainability changes over the course of the decision-making and implementation process (Grandia, 2016; Pinz et al., 2018).

This chapter contributes to addressing the first gap by adopting an interactive governance lens to understand decision making and implementation, looking at interactions within and between organizations, and consequently does not focus solely on the PPP process. The chapter portrays governance as a multi-level, multi-actor, and multi-phase process through which governments try to reach desired outcomes (Klijn & Koppenjan, 2016; Tukker & Butter, 2007). To address the second gap, this chapter adopts a longitudinal process-tracing research design (Beach & Pedersen, 2016) to reveal both changing sustainability objectives over time and the causal processes that explain these changes. Process tracing is used to investigate a case of an investment decision process about a critical water infrastructure with which government, in the form of a regional water authority, aimed to contribute to long-term sustainability objectives laid down in a national climate change agreement. Showing how a national climate change agreement is implemented at the local level potentially provides lessons for future implementations of international sustainability agreements such as the SDGs.

The chapter proceeds as follows. Section 5.2 introduces the concept of sustainability objectives and the governance lens in more detail. Section 5.3 elaborates upon the methods used in this study. Section 5.4 presents the case results in the form of a chronological narrative and the causal mechanisms involved. Section 5.5 links the results to previous literature and highlights key findings. The chapter ends with a short conclusion.

5.2 Theoretical background

This section introduces the outcome of this study – long-term sustainability objectives – and the governance lens to understand the implementation process.

5.2.1 Understanding the outcome: long-term sustainability objectives as part of infrastructure investment decisions

Three interrelated concepts – investment decisions, forward-looking decisions, and long-term sustainability objectives – guide the analysis of changing sustainability objectives.

When governments invest in critical infrastructure, they make a decision to extract resources in the short-term for the creation of goods with long-term value. Therefore, such a decision is a long-term investment decision, or policy investment as Jacobs (2011) calls it. Long-term investment decisions, however, are not necessarily forward-looking decisions, meaning that decisions explicitly anticipate future challenges through a long time horizon to understand future challenges, the adoption of flexible and/or robust solutions, and a forward-looking justification in the form of scenarios, long-term objectives, or visions (Pot et al., 2018). This research does not assess whether decisions are fully forward looking but focuses on one element of this particular concept: that of long-term objectives and organizations' desire to achieve specific long-term objectives with present-day infrastructure investments.

Long-term objectives are 'objectives concerning the future that must be reached by taking decisions today' (Meuleman & in 't Veld, 2010). Such objectives can be formulated with a specific long-term time horizon, for example, 'we need to become energy neutral by 2050', but can also have indefinite time horizons, for example, 'we aim to become a frontrunner in sustainability'. Long-term sustainability objectives are those objectives explicitly targeted at sustainability (Pinz et al., 2018). Sustainability in its most broadly accepted definition refers to satisfying the needs of the present generation without compromising the ability of future generations to fulfil their needs (Brundtland, 1987). Therefore, in essence, sustainability objectives are always long-term oriented. Sustainability encompasses three aspects, also sometimes referred to as Triple Bottom Line or Triple P (Armenia et al., 2019): economic sustainability, ecological or environmental sustainability, and social sustainability (Pinz et al., 2018).

Because sustainability is an ambiguous concept (Hueskes et al., 2017), an inductive approach is adopted to explore how sustainability objectives changed over the course of time in this case (see section 5.3).

5.2.2 Understanding the process: top-down and bottom-up implementation of long-term objectives

This section builds on literature in the field of implementation, governance, and public sector procurement. In the implementation literature, a key divide is that between top-down and bottom-up implementation. The top-down strand creates a distinction between policy formation and policy implementation and focuses on the achievement of policy goals laid down in an official policy document (Pressman & Wildavsky, 1973). The bottom-up school, on the other hand, focuses more on the

discretion and action of bureaucrats that establish policies through, amongst other things, their interpretation of policy goals, their use of their networks, and their use of rules (Lipsky, 1980). Network governance is one of the theoretical approaches that synthesize elements of this top-down/bottom-up debate (Cairney, 2009; Hill & Hupe, 2002). This chapter incorporates elements from both sides. From the top-down perspective, a decision is understood as a formal decision that stipulates the long-term objectives to be achieved. The objectives themselves can – and are likely to – come from a higher level of government; and these objectives will then need to be translated into organizational visions and regional or local strategic plans – something a formal law such as a climate act can even prescribe (e.g. the newly adopted Dutch climate act of 2019 prescribes that the national government write a climate vision). These formal decisions, however, should be seen as the – intermediate – result of the previous interactive process. This is where this study departs from the top-down perspective and uses the network and interactive governance lens to understand the implementation – or governance – process leading to the making of specific decisions. Moving beyond the hierarchy-network-market trichotomy (Lupova-Henry & Dotti, 2019), this chapter focuses on the dynamic governance process that produces decisions and influences outcomes. This governance process consists of multiple and interacting governmental layers and levels, actors and objectives, and decisions and stages.

These different interactions are now briefly elaborated. First, there are multiple layers and levels. Multiple *layers* refers to the involved formal political-administrative institutions. Interacting layers, for example, means that national level policies need to be implemented at local level. Interacting *levels* refers to the levels of analysis: whether the decision-making and implementation process is visible at the individual, the organizational, or the inter-organizational level (Hill & Hupe, 2002).

Second, there are multiple actors and objectives. During processes of implementation and decision making, the multiple *actors* involved impact the decisions made. Actors can be individuals, groups, organizations, and groups of organizations (Klijn & Koppenjan, 2016). Involved actors are autonomous and can therefore have different, sometimes conflicting, *objectives*. For example, the private sector's short-term interest in profit and return on investment may conflict with the government's long-term objectives and responsibilities (Koppenjan & Enserink, 2009). To achieve desired objectives, actors need one another's resources and are therefore interdependent. This interdependence forms the basis of their interaction (Klijn & Koppenjan, 2016). In the infrastructure domain, the government is

dependent on the private sector to realize its objectives and for the renovation or realization of infrastructure. In this domain therefore, it is important to include inter-organizational arrangements, and especially PPPs, in the implementation process (Marx, 2019; O'Toole, Jr., 2014). Increasingly, with new types of tender arrangements being developed, private sector involvement is not limited to project execution but is also part of the public sector decision-making process. For example, the government may consult private sector parties, be active in processes of co-creation, and may try out new tender procedures that allow for more interaction with the private sector before final tender, such as the competitive dialogue (CD) procedure (Hoezen et al., 2012; Uttam & Le Lann Roos, 2015).

Third, there are multiple *decisions* and *stages*. From the bottom-up perspective on implementation, decision making should not be seen separately from implementation, as actors continuously produce mutually impactful decisions. Furthermore, a decision is not solely the decision of the political body, the organization, or one single actor (Scharpf, 1997; Williams et al., 2017). Rather, the decision is influenced and prepared by bureaucrats such as project managers, purchasers, policy advisors, and directors. This multiple decision and stages idea is also key to the rounds model of decision making (Klijn & Koppenjan, 2016; Teisman, 2000): this model conceptualizes series of interactions between actors as rounds. This rounds model is also of value to cover the *different stages* of a procurement process. During rounds, actors interpret rules and select strategies based on their understanding of the problem. The beginning and the end of a round are marked by *crucial decisions*. These crucial decisions can be identified from a change in the composition of actors, in the content (problem definitions, solutions, and so on), and/or in the interaction process. This chapter focuses on change in content in terms of changing long-term (sustainability) objectives.

5.3 Method

5.3.1 Process tracing

This study adopts a theory-building process tracing approach that elucidates why it is difficult for governments to reach long-term sustainability objectives with their present-day investment in infrastructure. Process tracing (PT) is especially suitable for understanding the influence of dynamic and interactive processes on a specific outcome (Beach & Pedersen, 2016). Theory-building PT traces back the outcome occurring at a specific juncture to the initial conditions and aims to unpack the black box between X and Y (Mayntz, 2004). It does so by reconstructing a historical

chain of events to unravel a plausible mechanism or set of mechanisms that explain what happened (Goertz, 2017). Mechanisms refer to the causal processes between a condition or set of conditions and the outcome of interest. Mechanisms consist of a series of parts, and these parts are composed of entities engaging in activities (Beach & Pedersen, 2016). The entities (actors) are the individuals or organizations with their belief systems and experiences. The activities are the entities' strategies and acts that produce change (Biesbroek et al., 2014). In order to answer the research question, this chapter focuses on the combination of actors' strategies and acts that cause long-term sustainability objectives to become disconnected from infrastructure investment decisions. Therefore, the need to invest in an infrastructure is the condition and long-term sustainability objectives are the outcome. Within-case variation provides different values for the outcome of interest (Seawright & Gerring, 2008). Figure 5.1 shows the relationship between mechanisms and their components, the starting condition, and the outcome.

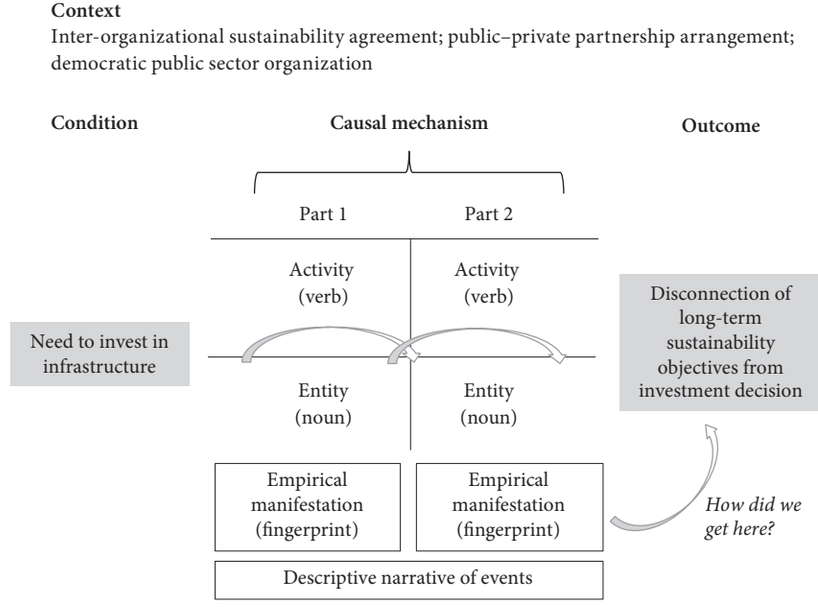

Figure 5.1. Relationship between mechanisms and their components, conditions, context, and outcome (adapted from Beach & Pederson, 2016)

5.3.2 Case selection and scope conditions

The following case selection criteria were used:

- Presence of contextual factors: inter-organizational agreements that include sustainability objectives, a PPP arrangement, and a public sector organization with democratically elected governing bodies.
- Additional efforts to anticipate the future with the infrastructure investment: specific sustainability objectives that became connected to an infrastructure investment (see Dupuis & Biesbroek, 2013).
- Accessibility: accessibility seems a pragmatic criterion but is especially important because many tender procedures are protected with specific confidentiality agreements. The researcher needs to be trusted by the organization to gain access to information about public–private interactions during the tender procedure.

On the basis of these criteria, the case of the *Vissering* water pumping station (PS-V), owned by the Dutch regional water authority Zuiderzeeland (RWA-Z), was selected. RWA-Z aimed to renovate PS-V in the years between 2017 and 2020 and had formulated the ambition to realize the 'world's most sustainable water pumping station' in its 2017 decision about its future. Furthermore, RWA-Z granted access to all documents relevant to both the PS-V renovation project and the tendering procedure; and it allowed access to specific meetings during the process. A limitation is that it was not possible to directly observe the conversations between market parties and government during the dialogue phase of the CD procedure because of confidentiality agreements. However, accessing all internal meetings and documents as well as interviewing one market party during the process allowed the researcher to mitigate data gaps.

5.3.3 Data collection

A longitudinal approach to data collection was adopted to trace back to the origin of the investment process. Data collected consisted of primary documents, observations, and interviews (see Supplementary Material C).

Observations of CD procedural phases took place during the period September 2018 to April 2019. The CD procedure structures the PPP process according to different phases: pre-launch, short-listing phase, dialogue, and selection (Uttam & Le Lann Roos, 2015). The observed events consisted of: market consultation day (pre-launch phase), dialogue team meetings (dialogue phase), assessment day, meetings between the dialogue team and the executive directors and line manager, executive assembly meeting with tender decision (selection phase), and an evaluation with market parties.

While the CD procedure progressed, conversational and informational interviews (n=19) were held with members of the project team, the dialogue team, the steering group, and one market party. Planned informational interviews and observations of the dialogue and assessment team were recorded.

To not only include the CD part of the process but open up the entire decision-making and implementation process, documents were collected (n≥180), including all RWA-Z multi-annual budgets between 2001 and 2018, all RWA-Z rolling forecasts and investment plans between 2010 and 2018, all decision documents about PS-V, all tender and contract documents about PS-V, all minutes and project team presentations of the PS-V project during the different CD phases, and relevant organizational long-term plans and related decisions.

Finally, by means of a member check, written results were shared with three key involved RWA-Z actors. and the results were presented to seven involved RWA-Z actors in September 2019. The results were acknowledged and confirmed.

5.3.4 Data analysis

The collected data were entered in the Atlas.ti programme for coding purposes and analysed according to the following steps. First, to analyse the process, a chronological narrative of events and decisions was developed (Beach & Pedersen, 2016; Klijn & Koppenjan, 2016). The narrative described what happened when, with what content, and with whom to reveal the entire decision-making process. Codes were developed inductively mainly for how PS-V was discussed in the data (e.g. 'renovation of the pumping installation', 'reliability and availability', 'heat and power plant'). Coding continued until the narrative was saturated and no new data emerged. Second, to analyse the outcome, the crucial decisions were identified, based on changing substantive content about PS-V (Teisman, 2000). The decisions used were those laid down in writing, publicly available documents that also informed the political-administrative bodies. To capture the formulation of long-term sustainability objectives in the crucial decisions, data were coded inductively with codes using the organization's exact words, such as 'fish passage', 'social relevance', 'energy self-sufficiency', and 'CO_2 reduction target'. Third, on the basis of the chronological narrative, a flowchart was developed to connect events, actions, and consequences. In this step, the guiding question 'How did we get here?' was used to match variance of the outcome with the events during the process (Beach & Pedersen, 2016). Fourth and last, the different chains of events were further analysed to find empirical manifestations (*fingerprints*) of the causal mechanisms that could explain the variance of sustainability objectives over time.

In this step, the activities of actors that produced change were sought out. Also, each of these parts needed to be a necessary part of the full explanation: without it, the mechanisms would not occur. Counter-factual reasoning was used to verify this: if something had not occurred, how would the outcome have changed? Furthermore, for all parts, findings were triangulated and checked to see whether other sources indeed confirmed their presence. Findings were then compared with existing theory.

5.4 Results

5.4.1 Historical background and chronology of events

Dutch regional water authorities (RWAs) are *functional democracies* and as such have predetermined tasks that are limited to water management, have specific taxation powers and earmarked revenue, and have their own democratically elected governing bodies (Mostert, 2017). RWA governing bodies consist of a general assembly (GA), an executive assembly (EA), and a chairperson. The RWA-Z geographical area is almost completely below sea level; between four to six metres on average (tender document shortlisting phase 2018, RWA-Z). Every day, even on dry days, RWA-Z needs to use its pumping stations to pump water from the polders to the open water (water management plan 2016–2021). This means that about two-thirds of its total energy consumption is used for pumping and one-third for wastewater treatment (rolling forecast 2012–2015). Almost all energy is purchased instead of produced and, to compensate for purchased energy, RWA-Z buys guarantees of origin (GOs) of European thermal energy (tender document shortlisting phase 2018; GA proposal energy and pumping stations 2015).

RWA-Z owns seven pumping stations in total. PS-V is one of the three pumping stations that manage the water level in the northern area of RWA-Z. PS-V, built in 1942, contains three pumps powered by two gas engines and one diesel engine. In the past decades, the gas engines had reliability issues and consequently relatively high maintenance costs (LCC calculation document 2012). In 2000, the PS-V building was registered as a national monument by the national government (source: Dutch national monument registration).

Table 5.1 summarizes the descriptive narrative of the efforts to renovate PS-V and make it more sustainable, based on national climate agreement objectives.

Table 5.1. Summary of empirical narrative and crucial decisions

Round	Summary empirical narrative and crucial decisions
1. Need to renovate PS-V **2008–2013**	In 2010, RWA-Z renewed its water drainage plan for the years 2011–2020 and postponed the PS-V 'renovation of the pumping installation' and its budget of €9.5m from 2011 to 2017 based on a cost-benefit analysis (rolling forecast 2011–2014; water pumping plan 2011–2020). In 2012–2013, RWA-Z translated the following national climate change agreement objectives into an 'energy strategy': - 30% energy efficiency in 2020 (in the energy strategy, RWA-Z expected to reach only 5% for the pumping task) - 40% energy production/self-sufficiency in 2020 (RWA-Z adjusted this to 35–45% in 2030 because of the high energy consumption for the pumping task) - 30% CO_2 emissions reduction in 2020 - climate neutral water management in 2050 (National climate agreement 2010–2020; GA proposal Energy Strategy 2013). **Crucial decision 1:** 2010: Water pumping plan 2011–2020: long-term sustainability objectives are not (yet) explicitly connected to the renovation of PS-V.
2. Need to make PS-V sustainable **2015–2016**	In 2015, the Energy and Pumping stations project formulated the ambition to 'make the energy consumption of drainage more sustainable' and to become 'leading in energy-efficient polder drainage' (rolling forecast 2016–2019). The project team, also responsible for a 'masterplan sustainable energy', expected PS-V to contribute 4–5% to energy-efficiency and CO_2 reduction targets by using electric engines, and 3% to energy self-sufficiency by producing thermal energy. By connecting energy self-sufficiency, CO_2 reduction, and the 'design principle of sustainability' to the PS-V renovation, the masterplan project team argued that PS-V 'could become the most energy-efficient large surface water pumping station of [RWA-Z] and possibly of the Netherlands or Europe' (masterplan sustainable energy). At the beginning of 2017, the assembly agreed to free up budget for the renovation and sustainability of PS-V. **Crucial decision 2:** 2016-Dec.: Preparatory investment budget for the renovation and sustainability of PS-V. This decision connected a number of long-term sustainability objectives to PS-V: a fish migration system to meet Water Framework directive requirements of 2017, energy efficiency and energy self-sufficiency to meet objectives of the national climate agreement, and the ambition to realize the 'world's most sustainable water pumping station' (GA and EA proposals budget PS-V, Dec. 2016/Feb 2017).

Table 5.1. Continued

Round	Summary empirical narrative and crucial decisions
3.Meeting objectives **2017**	In September 2017, the PS-V team informed the assembly that it would adopt the CD tendering procedure. The presented project scope on the market consultation day included: renovation of installations and pumps to ensure reliability and availability, sustainability (of the energy supply), energy production with wind or solar energy, a fish migration system, emergency power generators, the facilitation of thermal energy, the renovation of the building, maintenance responsibility for 15 years, and applying market innovation (presentation market consultation day). The tender guidelines mentioned the following selection criteria under the heading of sustainability: 'CO_2 reduction after renovation', 'innovation in relation to energy-efficiency', and 'cooperation between client and contractor', and included the ambition to make PS-V 'one of the most sustainable water pumping stations in the world' (tender document shortlisting phase 2018). In March 2018, the assemblies approved participation in a windfarm to realize 'the energy objectives of the regional water authority [in 2022–23, earlier than planned for], including that of becoming energy self-sufficient' (GA proposal windfarm, Mar. 2018). **Crucial decision 3:** 2018-Mar: Participation in windfarm in which RWA-Z bought a share to produce wind energy based on its CO_2 emissions volume and to receive GOs from this windfarm energy. This decision framed PS-V as an energy conservation project.
4. Scoping **1st half 2018**	In February 2018, the business operations manager told the PS-V project team that there was no political mandate based on the 2017 decision about PS-V and a new GA decision was needed (project team minutes of conversation with business operations, 2018; member check). In May, the GA approved the PS-V budget based on an adjusted scope. The scope covered: securing the availability and reliability of the water management system in the north-eastern polder, renewing the pumping installation, renovating the national monument building and other PS-V facilities, realizing the fish migration system, minimum 15 years maintenance, lowering lifecycle costs, reducing the energy consumption and CO_2 emissions of the pumping installation and building, facilitating thermal energy, and other sustainability options (incl. social added value and energy self-sufficiency). However, the facilitation of thermal energy, the energy self-sufficiency of the building, and the social added value were excluded from the investment sum and portrayed as additional options (GA investment budget proposal PS-V). Furthermore, the facilitation of thermal energy would only be done on the basis of a 'closed business case' (GA investment budget proposal PS-V). Three criteria were formulated to judge the most economically advantageous tender (MEAT): (1) CO_2 emissions reduction of the pumping installation; (2) sustainability on the basis of reducing the building's energy consumption and reducing environmental impacts during renovation; and (3) total cost of ownership (TCO) (tender document dialogue and selection phase).

Table 5.1. Continued

Round	Summary empirical narrative and crucial decisions
	Crucial decision 4: 2018-May: The assembly decision changed the overall ambition to 'realizing one of the most sustainable water pumping stations *of its kind*' (italics added), which the project team explained meant: in comparison to other pumping stations with the same pumping capacity and renovating an existing building instead of building an entirely new one (Q&A developed for EA member for GA meeting May 2018).
5. Sticking to budget and scope **2nd half 2018**	Between July and November 2018, the dialogue phase was held. The following sustainability-related proposals or issues of market parties were addressed: emergency power generators (adjustment: allow lease), the available budget (not adjusted), producing solar and wind energy (response: energy production with solar or wind energy not included in CO_2 reduction criterion), realizing a biomass production facility (response: a bridge too far, according to interviewee F, 4 Mar. 2019), the strict demands for the fish passage (adjustment: fish damage changed to fish mortality), flexible pumping ('outside scope', respondent E, fieldnote 26 Sept. 2018), and using generated heat/thermal energy ('something for after this tender', respondent I, fieldnote 3 Oct. 2018) (see also steering group presentation, Aug. 2018; Q&A tender information notice). At the end of August and November, two market parties withdrew because they could not see how to stay within the available budget and because the 'sustainability flag had disappeared' (market evaluation, Apr. 2019). In Jan. 2019, the winning tender was selected. The winning solution included electric direct-drive motors ('permanent magnet'), whose remaining heat was to be used for heating the pumping station building, and the motors would realize more CO_2 emissions reduction than aimed for (market parties' submitted tender offer, Dec. 2018; presentation to executive board, Jan. 2019). **Crucial decision 5:** 2019-Feb.: The EA's final decision to award tender.

5.4.2 Changing sustainability objectives over time

Comparison of the content of the crucial decisions over time reveals a change in long-term sustainability objectives and ambitions between 2010 and 2019. Overall, the PS-V ambition changed from a mere 'renovation of the pumping installation' (water pumping plan 2011–2020), to realizing the 'world's most sustainable water pumping station' (GA proposal, Feb. 2017), to realizing 'the most sustainable water pumping station of its kind' (GA proposal 29 May 2018). To this final ambition, dialogue team members jokingly added 'on these [geographical] coordinates' (fieldnotes dialogue round 2, 3 Oct. 2018). The need for renovation is central to the water pumping plan 2011–2020. In the 2016 decision, the long-term sustainability

objectives of energy efficiency and energy self-sufficiency were connected to the PS-V renovation. In 2018, energy self-sufficiency disappeared again, and the final solution used electricity from the general energy grid for the pumps' permanent magnet engines; and the organization arranged to compensate this by buying GOs from the windfarm in which they agreed to participate. Furthermore, in the decisions from May 2018 onwards about PS-V, sustainability was specifically translated into energy-efficiency and mitigating environmental impact measures (tender document dialogue and selection phase; Table 5.1).

5.4.3 Mechanisms behind disconnecting long-term sustainability objectives from present-day investments in infrastructure

In this section, the mechanisms that explain how sustainability objectives became disconnected from the PS-V renovation are unravelled. The first mechanism is that of *budget compliance* (Figure 5.2). This mechanism was triggered because, in 2010, the department responsible for water pumping stations signalled the approaching technical end-of-lifetime of PS-V and included the PS-V renovation in the multi-annual investment plan (investment plan 2010–2013). Consequent to a cost-benefit analysis, the department set the renovation date at 2017–2020 with a budget of €9.755m for all PS-V investments (incl. €9.5m for the renovation of the pumps; water pumping plan 2011–2020). This initial budget remained the same throughout, despite later connections to sustainability objectives. In discussions about realizing the national climate agreement and organizational energy strategy objectives, the GA pushed for closed business cases and budget neutrality for tasks outside the primary water management tasks (GA minutes, 29 Sept. and 24 Nov., 2015). In response, the sustainable energy project team developed a 'masterplan sustainable energy', which stated that investments in sustainable energy projects had to involve a closed business case with a return on investment within the lifetime of the specific asset. When the PS-V project team created the assembly proposal for allocating investment budget to the PS-V renovation and sustainability in spring 2018, the long-term sustainability goals of thermal energy and energy self-sufficiency received only optional budgets. Such budgets meant that business cases would later have to be approved by the GA, to be decided upon after tendering PS-V (tender document dialogue phase). Market parties perceived the optional budgets as something for which they did not need to develop any further plans (market evaluation, Apr. 2019). RWA-Z explicitly discouraged plans for optional budgets, stating it was 'not allowed to propose measures for optional budgets within quality documents' (Q&A tender information notice). Market parties did not include thermal energy and energy self-sufficiency measures as part of the submitted tenders.

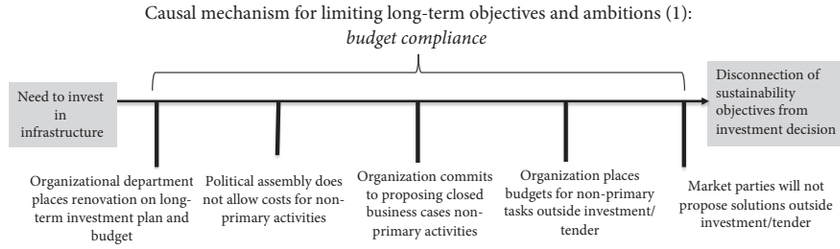

Figure 5.2. Causal mechanism for disconnecting sustainability objectives: budget compliance

A second mechanism that disconnected long-term sustainability objectives was *goal satisfaction* (Figure 5.3). This mechanism was triggered when RWA-Z put a project team in place to translate a 2010 climate change agreement between regional water authorities and the national government (see Table 5.1). The project team developed an energy strategy (2013) and masterplan for sustainable energy (2016). The masterplan included exploring wind energy solutions, which were argued to contribute significantly to reaching the objectives. When the GA discussed the final masterplan, it asked the organization to 'seize opportunities and do what is possible within the [financial] boundaries' (GA proposal masterplan, 26 Sept. 2016; GA minutes, 31 May 2016). The sustainable energy project team started actively exploring options from that point onwards and in 2018 proposed a collaborative investment in a windfarm opportunity. In that proposal, the project team framed the construction of participation and receiving GOs in return as enabling energy self-sufficiency according to a broad definition of the concept (GA proposal windfarm, 27 Mar. 2018). In the same proposal, the energy self-sufficiency measures that were not yet fully developed and that were linked to the organizational water infrastructure were no longer invested in, including solar energy initiatives, wind turbines on dykes, and thermal energy at PS-V. The proposal about the windfarm now framed PS-V as an energy conservation project (GA proposal windfarm, 27 Mar. 2018). In the decision of May 2018 about the renovation and sustainability of PS-V, the thermal energy and energy production activities were placed outside the investment sum (GA proposal PS-V, 29 May 2018). Thermal energy was reduced to mere facilitation (tender document dialogue and selection phase).

Third, there was the mechanism of *risk avoidance* on the side of both the government and the market parties (Figure 5.4). This mechanism was triggered by the start of interactions with the private sector. In 2017, the PS-V project team organized a

market consultation day at which it presented the objective of realizing the 'world's most sustainable pumping station' (purchasing plan for PS-V, Jul. 2017; presentation

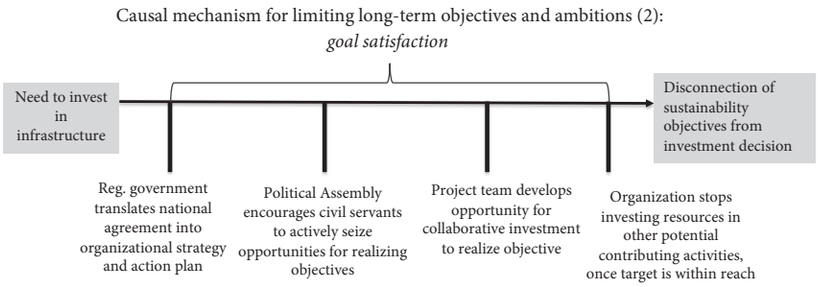

Figure 5.3. Causal mechanism for disconnecting sustainability objectives: goal satisfaction

market consultation day, Sept. 2017). During the market consultation phase, market parties asked RWA-Z to define the sustainability criteria more clearly and separately from CO_2 emissions reduction (project team minutes market consultation conversations, Oct. 2017, incl. Q&A filled in by market). During the investment and tender process, both the responsible assembly member and the department manager strongly emphasized reliability and availability, emphasizing strict capacity requirements and placing emergency stream generators within the scope (water pumping plan 2011–2020; minutes conversation head of pumping stations department, Jun. 2017). Also, the GA requested the specification of award criteria for CO_2 and sustainability to avoid legal claims (GA minutes, 29 May 2018). During the dialogue phase, two market parties critically assessed their motivation to realize an 'iconic' or 'prestigious' sustainability project against the now set sustainability definitions, reliability and availability criteria, and available budget. For them, PS-V started off as a potential flagship project for sustainability but lost this status along the way (market evaluation, Apr. 2019). A detailed risk assessment led these market parties to decide to withdraw because they saw too few opportunities to meet quality requirements while staying within the budget (market evaluation, Apr. 2019).

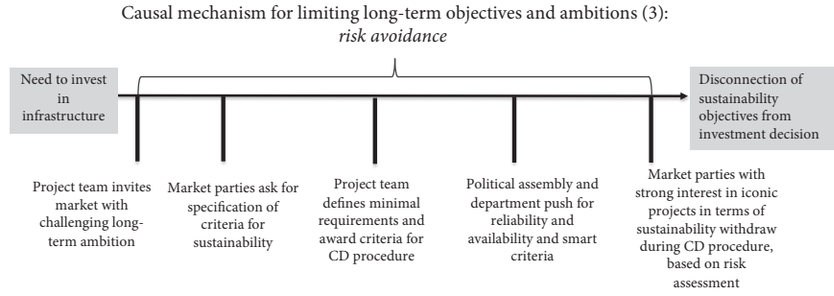

Figure 5.4. Causal mechanism for disconnecting sustainability objectives: risk avoidance

5.5 Discussion

The combination of process tracing and the interactive governance lens exposed all relevant interactions between inter-organizational sustainability agreements and decisions to put infrastructure out to tender. This section discusses the key findings and reflects on the implications for future research.

5.5.1 Key findings

The results revealed three mechanisms, residing at the individual, the organizational, and the inter-organizational level, that together explain how long-term sustainability objectives became disconnected from formal investment decisions in the PS-V case. In each of the mechanisms, politics and market parties played a specific role and each of the mechanisms was triggered by a specific contextual factor (see Figure 5.5).

The identified mechanisms result in three key findings: (1) interactive PPP arrangements do not enhance sustainability when budget or scope do not allow for change during the tender process, (2) multiple decision trajectories impact one another, (3) there are trade-offs between different long-term objectives. These key findings and their implications are now briefly elaborated.

First, high sustainability ambitions at the start of an infrastructure investment process may help to raise the interest of market parties, but these may withdraw once such expectations are not met with financial means (Pr in Figure 5.5). The CD procedure did not deliver on its merits of flexibility and interaction opportunities, because the stability-enforcing mechanisms of risk avoidance and budget compliance

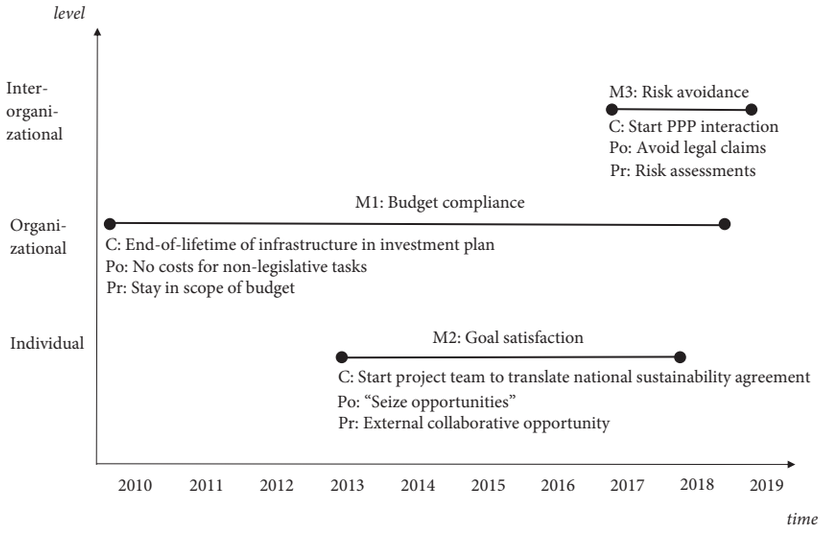

Figure 5.5. Overview of mechanisms (M).

Note: C = Context, Po = role of politics, Pr = role of private sector. The combination of mechanisms explains how sustainability objectives became disconnected from the PS-V infrastructure investment.

(M in Figure 5.5) were triggered. This research, therefore, cannot confirm that PPP arrangements, and in particular the CD procedure, contribute to sustainability objectives (Pinz et al., 2018). The required mandate from the political bodies at an early stage in the procedure (Po in Figure 5.5), and the specification of the contract before the dialogue phase, meant that the dialogue rounds did not provide great room to manoeuvre (Uttam & Le Lann Roos, 2015). Consequently, the process remained quite state-centred and hierarchical, instead of benefiting from the state–market interactions during the tender process to learn and adapt. To benefit from such arrangements and achieve forward-looking and sustainable solutions, more attention should be paid in PPP arrangements to incorporating lessons learnt from state-market interactions.

Second, multiple decisions impacted one another, as revealed by the goal satisfaction mechanism (M2). This mechanism shows that organizational members, stimulated by political actors (Po), seek actions that can satisfy inter-organizational sustainability agreements (C) in the most efficient and pragmatic way. The first satisfactory solution to meet objectives is likely to be chosen (see Simon, 1955), in this case an

external private sector windfarm initiative (Pr). This mechanism highlights the fact that long-term sustainability objectives provide flexibility of meaning and of scale. Constructive ambiguity allows flexibility of meaning because particular sustainability objectives, such as energy self-sufficiency, can be further defined and stretched so as to fit particular solutions to achieve objectives (Hueskes et al., 2017). Scale flexibility means that an organization may choose to achieve its objectives at the organizational scale (e.g. investing in a windfarm) or at the scale of individual assets (e.g. by realizing energy production facilities at infrastructure assets) (Williams et al., 2017). Scale flexibility is useful for realizing long-term sustainability objectives as it can enable an efficient allocation of scarce resources, especially because finance remains an important barrier to sustainable procurement (Cheng et al., 2018).

Third, there are trade-offs between different long-term objectives, in particular sustainability versus robustness. The risk avoidance mechanism (M3) especially can stimulate robustness and system redundancy, because both the government (Po) and the market parties (Pr) aim to avoid infrastructure failure and future legal claims (Marchau et al., 2019). Robustness comes at a price however, especially because market parties tend to use strict risk assessment (Pr) to mitigate the risk of cost overruns (Flyvbjerg et al., 2004). Therefore, less will be available for market parties to spend on sustainability measures, and innovative solutions are less likely to be chosen over proven technology (Koppenjan, 2014). From the perspective of a forward-looking decision (Pot et al., 2018), the PS-V case is not a policy failure (Nair & Howlett, 2014) because the final decision to award the tender still ensures that a robust solution is chosen and that a long-term challenge of climate change mitigation is addressed. Nonetheless, an implementation gap remains (Cairney, 2009): a gap between raised expectations within and outside the organization at the start of the PS-V tender process (C) and the perceived decision outcomes with the final tender award. It is therefore crucial that governments – if possible with input from market parties – dedicate sufficient time and resources to define and prioritize long-term objectives at an early stage, as only the things that will be awarded at tender are likely to be proposed by the market parties (Treuer et al., 2017).

5.5.2 Implications for future research

These findings suggest three areas for future research. First, more research involvement may be needed to establish learning and knowledge co-creation (Sharma & Bansal, 2020) during tender procedures. This could potentially improve tender procedure designs that still suit rule-bound, democratic public sector organizations, while also providing room for change and establishing trust. Second,

it would be valuable to adopt a social-ecological-technical system perspective to create national or organizational inventories of decisions related to critical infrastructure, and of long-term sustainability objectives. This is important for mapping potential interactions between decisions, phasing and scaling investments, avoiding potential lock-ins, and prioritizing conflicting long-term objectives (Staveren & Tatenhove, 2016; Williams et al., 2017). Lastly, a comparative case study design such as qualitative comparative analysis (Schneider & Wagemann, 2012) could be used to test the portability of mechanisms (Falleti & Lynch, 2009) and explore the combinations of identified conditions – e.g. forecasting end-of-lifetime infrastructure, PPP interaction, and organizational project-team strategizing – that allow for higher or lower levels of sustainability in investment decisions.

5.6 Conclusions

This chapter aimed to explain why it is difficult for governments to reach long-term sustainability objectives with their present-day infrastructure investment decisions. It revealed three mechanisms that disconnected long-term sustainability objectives from the investment decision: budget compliance, goal satisfaction, and risk avoidance. On the basis of this research, three main conclusions can be drawn for future implementation of national and international long-term sustainability objectives: (1) the design of procurement processes and PPP arrangements will need to incorporate learning to overcome stability-enforcing mechanisms and increase sustainability; (2) scale flexibility can be embraced proactively to achieve long-term sustainability objectives satisfactorily; (3) governments will need to prioritize potentially conflicting, long-term objectives and define sustainability to ensure successful implementation.

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6

CHAPTER

Governing long-term policy problems: Dilemmas and strategies at a Dutch water authority

ABSTRACT

Despite the increasing need to address long-term challenges, public sector organizations are incentivized to focus on short-term results. This chapter uses an ethnographic approach to analyse how members of a regional water authority understand and deal with long-term policy problems as part of their everyday practices. It reveals three specific dilemmas: investing in the realization of objects or objectives, adopting a stable or responsive approach, and taking a proactive or reactive stance towards the external environment. The concept of strategic agility enables organizations to respond proactively to unexpected developments by devising strategies to steer as well as to accommodate change.

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6.1 Introduction

Climate change, digitalization, technological progress and the transition to renewable energy are among the long-term challenges that further increase the need for public sector organizations to address long-term policy problems in their present-day processes. Governments in particular can find it difficult to develop and execute long-term strategies because of governments' highly politicized and rule-bound nature (Bryson & Berry, 2010; Poister, 2010). Political executives are accountable to their current constituents; and are also accused of being biased towards the short term (Bührs, 2012). Governments that address long-term policy issues are therefore faced with important temporal and substantive tensions. For example, according to Goetz (2014) there is a growing tension between responsive and responsible democratic politics, at the expense of both. Responsibility here refers to deciding about solutions that are effective and sustainable over a long time period, whereas responsiveness encourages speedy action and immediate results. The embracement of New Public Management in the public sector, has also stimulated a focus on short-term, output-oriented, and measurable results at the expense of the consideration of long-term consequences and developments (Höglund et al., 2018). Furthermore, there are tensions between short-term organizational budget cycles and longer term planning cycles within public organizations; as well as tensions between the realization of short-term objectives such as those related to specific projects, and the realization of overarching organizational objectives (van Berkel et al., 2016; Wolf & Van Dooren, 2018).

Within public management literature, the key tension between investing time and resources in short-term, present-day affairs versus in long-term policy problems is identified, but remains underexplored. Three important gaps remain. First, a part of the literature specifically focused on processes of strategy development (Bryson et al., 2018; Hansen & Ferlie, 2016) and strategy enactment (Höglund et al., 2018; Jalonen et al., 2018). But strategy is not the only process or product in which public sector organizations address long-term policy issues. They are also dealt with in other – more everyday – organizational processes, such as investment planning, budgeting, and political decision-making. Second, scholars that did embrace a broader perspective to capture all sorts of everyday practices, especially aimed to grasp what managers actually do, and reveal how managers spend their time (Mintzberg, 1973; Rhodes et al., 2007; van Dorp, 2018). Mintzberg's landmark study 'The Nature of Managerial Work' (1973) underlines the tension between the short and long term, as it revealed that managers spend little time on dealing with long-term issues. But these scholars did not zoom in on the specific time spent on

long-term policy issues, and therefore did not reveal any of the underlying organizational dilemmas or strategies. Third and final, literature has provided tools and methods to facilitate long-term decision making, such as foresight methods (Schmidthuber & Wiener, 2018) and strategic management tools (Hansen & Ferlie, 2016; Williams et al., 2008). But these tools neglect the everyday context of public sector managers, policy makers, and political executives (Bryson & Berry, 2010; Pot et al., 2018), and often do not become integrated within public sector organizational practices (Rickards, Wiseman, et al., 2014; Volkery & Ribeiro, 2009).

This chapter responds to these gaps by focusing on how members of public sector organizations specifically deal with long-term policy problems (gap 2) as part of their everyday practices (gap 1). We adopt an ethnographic research approach to take the full context of public sector decision-making into account (gap 3). As a research setting, we selected the case of a Dutch regional water authority: an organization that, on paper, has a clear need to address long-term policy problems because of its institutional responsibility for long-term water management.

The following broadly defined research question guides this ethnographic research: *How do people in public sector organizations deal with long-term policy problems in their everyday practices*? This question is divided into three sub-questions (RQs):

- RQ1: How do organizational members understand long-term policy problems?
- RQ2: What are the underlying dilemmas that organizational members encounter in everyday practices when addressing long-term policy problems, and under what conditions do these dilemmas appear?
- RQ3: How do organizational members deal with dilemmas related to long-term policy problems in their everyday practices?

In the next section 6.2, the theoretical sensitizing concepts are introduced. We then outline our ethnographic methodological approach in section 6.3. The results section 6.4 presents the answers to the research sub-questions. In the discussion, section 6.5, the dilemmas and strategies are linked to existing theoretical notions, and avenues for future research are suggested. The chapter ends with a short conclusion.

6.2 Theoretical background

In this section, we briefly introduce the key sensitizing concepts that guide our analysis.

6.2.1 Long-term policy problems

Long-term policy problems are sometimes referred to as meta problems (Seidl & Werle, 2018), grand challenges (Ferraro et al., 2015), and super wicked problems (Lazarus, 2008). Sprinz defines long-term policy problems as 'public policy issues that last at least one human generation, exhibit deep uncertainty exacerbated by the depth of time, and engender public goods aspects both at the stage of problem generation as well as at the response stage' (2009, p. 2).

Using this definition, long-term problems are characterized with a long-term time horizon, because these problems will last for a long period of time – according to Sprinz (2009) for at least a generation. The specific time horizon that is adopted to deal with long-term problems, can however differ per individual and organizational department or practice (Segrave et al., 2014).

The long time horizon also implies that uncertainty is another characteristic of long-term policy problems. Scholars speak of radical uncertainty (Ferraro et al., 2015), deep uncertainty (Kwakkel, Walker, et al., 2016) and unknown unknowns (Termeer & van den Brink, 2013). Examples of long-term uncertainties include: inability to predict what the future will look like (substantive uncertainties), different views on what the future problems are (equivocality), conflicting or ill-defined goals (ambiguity) and undeveloped or changing procedures (institutional uncertainty) (Dewulf & Biesbroek, 2018).

To deal with and understand the uncertainties inherent to long-term policy problems, organizational actors may try to make sense of what the future will look like. They may try to calculate and model plausible futures, they may formulate long-term visions and objectives, and with that fill in desirable futures (Bai et al., 2015), or they may explore or develop various scenarios of possible futures (Schmidthuber & Wiener, 2018; Vink et al., 2016).

Given, but not restricted to, these characteristics we explore how regional water authority members understand and deal with long-term policy problems.

6.2.2 Governance dilemmas

This chapter focuses on the dilemmas that arise when governments devote attention and action to long-term policy problems instead of to the short term. Dilemmas are central when it comes to long-term policy problems (Jordan et al., 2010).

Dilemmas consist of choices between two or more courses of action and arise because they oppose existing beliefs, values, priorities or practices (Boswell et al., 2019). Dilemmas can include a clash of values, such as participation versus efficiency, but also be about competing priorities such as prioritizing housing shortages over climate change mitigation. Dilemmas can be related to political choices between alternative courses of action, such as: what are the different ways to frame the problem, at what scale to govern the problem, when to make and plan specific decisions, with what instruments to realize policy goals, how to weigh costs and benefits, and how to implement and enforce policies (Jordan et al., 2010). A costs-and-benefits dilemma for long-term problems is, for example, how to impose costs on current constituents for the benefits of future constituents (Jacobs, 2011). A dilemma for political executives could be how to provide legal certainty, while allowing for flexibility to change policies in response to changing insights about long-term policy problems (van Buuren et al., 2014). For public sector managers, a dilemma could be how to translate long-term objectives and strategic plans to short-term operational plans and budgets (Höglund et al., 2018).

In the analysis, we allowed the specific dilemmas to emerge from the observations; they therefore do not necessarily have to be formulated by respondents but could also be more implicitly present. To start exploring dilemmas, we will first need to focus on the *meanings* that situated agents, hence governmental actors, have (Boswell et al., 2019). Furthermore, dilemmas emerge under specific *conditions* that enable or constrain specific courses of action (Berti & Simpson, 2019). For example, the governance dilemma of diversity versus unity can manifest itself because there is a certain variety of actors involved, while there is also a shared sense of urgency to come up with one alternative (van Buuren & Loorbach, 2009).

6.2.3 Practices and strategies

Dilemmas force individuals to act and find ways to deal with the dilemma, as dilemmas cannot be solved (Poulsen, 2009). A focus on practices allows to reveal the ways that individuals find to take action, despite the controversies that are part of dilemmas (Berti & Simpson, 2019). We conceptualize practices as '*strategies* for coping with *dilemmas* in a world of complex specificity' (Boswell et al., 2019, italics added). Different from the research field 'strategy-as-practice' we do not focus on

the emergency of strategy or on how organizational members enact organizational strategy (Höglund et al., 2018), but will focus on all everyday practices in which long-term policy problems are dealt with. These can, for example, include policy making, budgeting, and decision-making in political arenas.

Figure 6.1 depicts the relationship between long-term policy problems, conditions, dilemmas, and strategies.

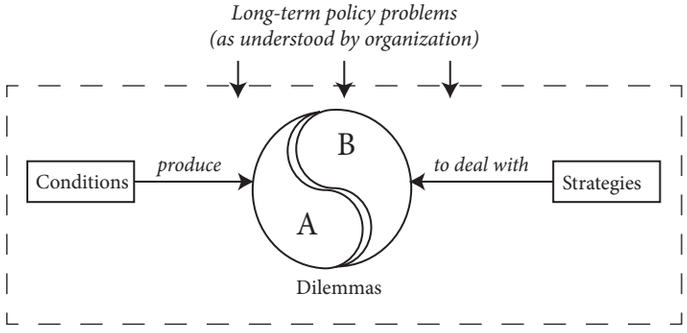

Figure 6.1. Framework to study dilemmas related to long-term policy problems

6.3 Research design

In this chapter, we employ a theory building, exploratory, research design based on ethnography. Ethnography is the study of people and groups in their everyday context (Emerson et al., 2011). The two defining features of ethnography are participant observation, often referred to as fieldwork, and the development of a written record of what is observed (Rhodes, 2014; Van Maanen, 1988). The researcher that performed the fieldwork in this study is the first author and will be called the ethnographer. The ethnographer positioned herself in the field as a professional stranger (Agar, 1996): stranger in the sense that she entered the field as a newcomer, knowing only a few people; professional in the sense that she could build on previous experience in both research and management consultancy. We explain the data collection and analysis steps below, after presenting the field site.

6.3.1 Field site description and selection

Dutch regional water authorities (RWAs) are functional democracies and as such have pre-determined tasks that are limited to water management, are supervised by

higher tiers of government, have specific taxation powers and earmarked revenue, and have their own democratically elected governing bodies (Mostert, 2017). The RWA governing bodies consist of a general assembly and an executive assembly chaired by a chairperson (*dijkgraaf*). Members of the executive assembly are drawn from the general assembly; hence there is no dualistic system in place (Dutch Water Authorities, 2017). This ethnographic study took place in the second half of 2018 and the first quarter of 2019, which was the period just before the RWA elections in March 2019.

RWAs increasingly participate in all sorts of collaborations and innovations (Gieske et al., 2019). In the past decade, RWAs signed several inter-organizational agreements to contribute to specific long-term objectives. An example is the Climate Agreement with the Dutch government that commits RWAs to energy conservation and CO_2 emission reduction objectives (Dutch Water Authorities, 2010).

Their responsibility for long-term water management and role in inter-organizational agreements with long-term objectives, make Dutch RWAS a good empirical setting to study the public sector tension of dealing with long-term policy problems in everyday practices. We specifically selected the RWA *Zuiderzeeland* (*ZZL*) because it has included the most climate change adaptation initiatives as part of its strategic water plan of all 21 Dutch regional water authorities (Kamperman & Biesbroek, 2017). This can be seen as an indicator of a relatively long-term focus. The *ZZL* mission statement also reveals its long-term orientation:

> We think ahead. About sustainability and the production of energy from water, for example. About the effects of climate change and the chances for a circular economy. [...] Our mission? That we safeguard dry feet not only for our current generation, but also for our children and grandchildren.[5]

The RWAs' areas follow water system boundaries (Dutch Water Authorities, 2017). For *ZZL*, this means that the area covers the entire province of *Flevoland* and small parts of the provinces of *Overijssel* and *Friesland* (414,000 inhabitants in total). Almost the entire *ZZL* area came into being because of the impoldering of the Dutch *Zuiderzee* between 1940 and 1968, from which the *ZZL* name derives (Smits, 1970).

5 https://www.zuiderzeeland.nl/over_ons/organisatieverhaal/ (15 December 2019)

6.3.2 Data collection

Ethnographic data were collected over a period of six months between the end of August 2018 and the beginning of March 2019. The ethnographer started with a period of deep immersion followed by two months of yo-yo-ing in and out of the field (Rhodes, 2014) to: (1) get close and to access everyday practices by being there (Huby et al., 2011); and (2) reflect and decide what next steps to take by spending time away from the field (Ybema et al., 2018). To observe everyday practices, four organizational members covering different positions within the organization were shadowed for at least five days: the chairperson of the executive assembly to include observations of the governing bodies; one of the two executive directors to get a broad overview of ambitions and projects within the organization; the operations manager to include operations and investments with regard to water pumping stations and sanitation plants; and a senior policy advisor to cover policy preparation. The observation days were purposively selected, based on digital calendars of and conversations with organizational members, to capture sufficient meetings that potentially dealt with long-term issues.

Additional observations beyond the shadowed individuals were undertaken to gain a better understanding of specific long-term topics (such as the vision trajectory), and to include all decision-making arenas, i.e. the executive directors, the strategy meeting, the management meeting, project meetings, the meeting between each member of the executive committee and civil servants (*portefeuillehoudersoverleg*), the executive assembly and the general assembly. Observation data were complemented with interviews and meeting documents (see Table 6.1).

Table 6.1. Overview of ethnographic data

Data source	Type	Length/number
Observations	Fieldnotes from observed meetings	+/- 90 hours (total time in the field 200 hours)
Interviews	Introductory, informational and member-check interviews	19 (15–90 minutes)
Reflexive journal	Diary kept during data collection and analysis to keep track of process, insights and next steps	6700 words
Documents	Documents (such as presentations, agendas, reports, decision files)	+/- 110 items
Artefacts	Photographs from site visits, buildings, meeting rooms and meeting output	38 items
Peer debriefing conversations	Minutes of peer debriefing conversations with co-authors and other methodological experts	9 (60–90 minutes)

Extensive notes from meetings and interviews were written into full fieldnotes as soon as possible after the observation. In fieldnotes, the literal quotes of observed people were put between quotation marks. Each data source was given a unique identification number: for fieldnotes, the date with a number added; for interviews, the date with the function added; and for documents, the date with 'doc' added (see Supplementary Material D1).

6.3.3 Data analysis

For the data analysis, we used a constant comparison method that consisted of the following steps (see Figure 6.2):

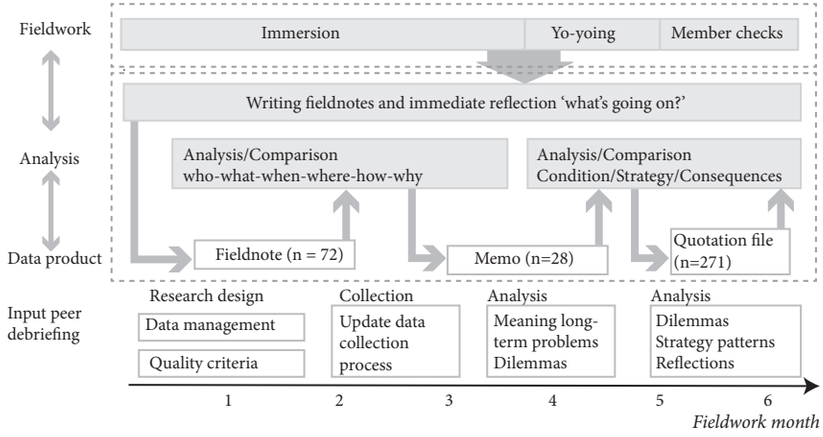

Figure 6.2. Data collection and analysis process

(1) *Open coding*: Inductive coding at the level of fieldnotes resulting in a narrative of events and codes for key topics, people, locations, and arenas based on who-what-when-where-questions (Gioia et al., 2013).
(2) *Axial coding and memo-ing:* Inductive coding focusing on how and why the long-term is understood and dealt with in certain ways in particular observations. This step resulted in memos for recurrent long-term themes (meanings and dilemmas) with different quotations from fieldnotes, interviews and documents
(3) *Constant comparison*: Comparing quotations included in memos to identify recurrent strategy patterns (Boeije, 2002) and distinguish conditions from strategies and consequences (Strauss & Corbin, 1998). For this step, a database of relevant quotations was created, to easily select and compare strategies and conditions per dilemma, per person and per topic.

(4) *Selective coding*: Emergent dilemmas and strategies were compared with existing literature while writing up the results. This was an iterative process that requires abduction: using insights to create new and plausible connections between empirical data and existing theory (Wolf & Baehler, 2018).

For illustrative quotations per code, see Supplementary Materials D2 and D3.

6.3.4 Quality criteria for ethnographic research

Three main limitations, or criticisms, arise in relation to ethnography, to which we would like to respond here. First of all, the ethnographer inevitably influences behaviour and reasoning by being present at the field site. The ethnographer can indeed never be a detached neutral observer but should ensure *credibility*. We ensured credibility by: involving outside researchers as second and third author and organizing peer debriefing sessions (Gioia et al., 2013), using yo-yo fieldwork alongside deep immersion to ensure persistent observation while avoiding going native (Rhodes et al., 2007); and using different data sources to triangulate findings. Secondly, because the ethnographer cannot take in everything (Emerson et al., 2011), it is important that an ethnographer ensures *authenticity* by presenting alternative realities (Van Maanen, 1988). We used an extensive member-checking process to verify observations by organizing reflexive interviews and an openly accessible meeting for all organizational members. Thirdly, results cannot easily be transferred to other settings because ethnographic research is an interpretative methods that often lacks rigour (Gioia et al., 2013). To allow *transferability* of findings, we provided a contextual case description in the method section. And for *traceability and rigour*, we presented our methods of data collection and analysis, established an audit trail and kept a reflexive journal (Erlandson et al., 1993) (see Table 6.1, and Supplementary Material D4 with an overview of the quality criteria).

6.4 Results

In this section, we first explore how long-term policy problems are understood by *ZZL* members, then explain the underlying dilemmas that organizational members encounter and the conditions under which those dilemmas emerge, and end with the individual strategies for dealing with these dilemmas.

6.4.1 RQ1: How do organizational members understand long-term policy problems?

From our data, we deduced four ways that organizational members understood long-term policy problems. In the following, the codes in parentheses refer to the documents in Supplementary Material D1.

First, long-term policy problems were often equalled to the *external environment*. For example, in the organizational water management plan, *ZZL* discusses long-term developments under the heading of 'The regional water authority and its environment' (20141028-doc, p. 13); and, in a strategic discussion about the wastewater chain, a policy advisor stated: 'Connecting with the environment is also important for the future, otherwise you will be eliminated in a couple of years' time' (20181017-1). In the member-check interview, the chairperson saw this frame of external environment as a way to externalize long-term problems. She also explained that 'opportunities [from the external environment] and developments' are often treated as the same, to make it easier to deal with the long term because 'then a development becomes a person' (20190304 - Chairp.). This also gives rise to the dilemma of reactiveness versus proactiveness towards the external environment, which we discuss later.

Second, long-term policy issues were often discussed as *future problems or developments*. For example, the onboarding information that *ZZL* employees compiled for new assembly members who would take their seat after the elections lists a range of 'future problems', including soil subsidence, climate change, circular economy, water safety, legislation and digitalization (20181126-doc). Sometimes, such developments were portrayed as 'autonomous developments': 'Soil subsidence is an autonomous development. Water nuisance caused by soil subsidence is beyond the legal duty of the regional water authority' (20180906-doc). In the member-check interview, the senior wastewater chain policy advisor interpreted autonomous mainly as 'something that just happens, outside of our influence, [...] it happens with or without us' (20190304 - Pol. ad.). The executive director explained, with a smile, that by calling it autonomous 'you are done with it, there is no need to think about it further' (20190226 - Ex. Dir.). This meaning is not restricted to one specific dilemma.

Third, long-term problems were part of *organizational objectives*. One of the executive assembly members, for example, explained to the ethnographer that *ZZL* is making sure that 'in 2035, wastewater treatment plants are 100% [energy] self-sufficient' and that with regard to a 'circular economy [*ZZL*] has set its goals for 2050'

(20180920-2). A senior policy advisor mentioned the organizational objectives of 'robust, sustainable and efficient' in his presentation about the wastewater chain strategy (20181119-1; 20190122-doc). In the member-check interview, he explained that mentioning these objectives without further defining them in executive assembly decision proposals is 'a bit of marketing and sales' (20190304 - Pol. ad.). This is related to the dilemma of responsiveness versus stability, and especially the strategy of framing attractive long-term objectives.

Fourth, long-term problems were sometimes connected to specific *future time horizons*. In a project meeting about future wastewater treatment demands, the executive director explicitly articulated the question 'what is our time horizon', arguing that 'If you have a vision for how this particular city will develop in 20, 30 years' time, you will discover that the municipality has different stakes than we do' (20181004-1). The time horizon also becomes manifest in discussions about long-term investments. The controller stated about the activity to map foreseen investments in infrastructure: 'he [the project manager] will look [...] until who knows how long, until 2040' (20181120-1; see also 20181213 - Ext. cons.). This meaning is related to the dilemma of object versus objective.

Another observation is that the concept of uncertainty was almost entirely absent (i.e. present in only 3/271 quotations). In the member-check interview, the director responded: 'We prefer not to hear the word uncertainty [because] [...] it is seen as a value judgment instead of a concept.' This possibly also relates to the absence of future scenarios to support decisions. In observed meetings where scenarios were used, scenarios did not represent future scenarios but alternative technical solutions (20190122-2; 20181119-1; 20181211-1) or different crisis situations as part of calamity exercises (20181016-1; 20181211-3). During the member-check interview, the executive director explained that he had introduced future scenarios and scenario thinking in the organization in 2008 and 2009 and that 'it was fun to do but now we have something else' (20190226 - Ex. Dir.). The senior policy advisor also referred to these scenarios as 'exercise', stating that 'I guess because it only works if you continuously actualize it and keep [...] bringing it up in discussions' (20190304 - Pol. ad.).

6.4.2 RQ2: What are the underlying dilemmas that organizational members encounter in everyday practices when addressing long-term policy problems, and under what conditions do these dilemmas appear?

Table 6.2 summarizes the three underlying organizational dilemmas that we found.

Table 6.2. Overview of dilemmas

Dilemma	Description
Object–Objective	Central to the object–objective dilemma is the question of how best to invest in long-term policy problems: at the level of separate investments in specific infrastructural *objects* or assets, or at the organizational level by focusing on reaching a specific *objective* and seizing opportunities from the external environment.
Responsiveness–Stability	The responsiveness–stability dilemma is about whether to ensure *stable attention* and dedicated resources for long-term policy problems during budget and election cycles or whether to remain *responsive* to outside impulses and adopt long-term ambitions from inter-organizational agreements.
Reactiveness–Proactiveness	The reactiveness–proactiveness dilemma is about whether to *steer* towards the realization of organizational long-term objectives and prioritize resources for long-term policy issues *proactively* or whether to *reactively* adopt insights, opportunities, ideas about long-term policy problems, as gained from the external environment.

Dilemma 1: Investing in objects or objectives

We illustrate this dilemma (found in 20% of dilemma quotations) with one of the cases in which it became manifest, that of Windfarm Hanze.

Our case description of Windfarm Hanze goes back to 2016, when *ZZL* developed a 'master plan for sustainable energy'. This plan needed to give substance to the long-term ambition of climate neutrality (in 2050) via the steps of energy savings and energy self-sufficiency in 2030 (20160927-doc). In 2017, *ZZL* explored opportunities for wind turbines and from that a specific 'opportunity arose of a collaboration with the Association Windfarm Hanze' (20180327-doc). As part of this collaboration, *ZZL* bought a share in a windfarm, with which it purchased a wind energy capacity to ensure 'that [*ZZL*] will be CO_2 neutral and self-sufficient in 2022 to 2023 instead of 2050' (20180327-doc). In October 2018, a partnership agreement was signed that initiated a project company (20181030-doc). This collaboration had consequences for other organizational efforts to realize renewable energy production. In the second half of 2018, an executive assembly proposal was

decided upon that argued that 'it is no longer necessary to install wind turbines on or close to flood protection structures to support our own energy demands' thanks to Windfarm Hanze (20181030-doc-2). Also, as part of the procurement procedure for a new water pumping station, the project team together with the administrative and political teams placed 'energy production' and 'procurement and supply of sustainable energy [...] out of the scope of the contractor' (20181123-doc; 20180830 - Ex. Dir.).

The dilemma became manifest under three *conditions*. The first relates to the *end-of-lifetime state of objects or assets*. In this case, someone in the organization signals that a specific object or part of an object needs to be renewed, renovated or replaced to remain effective (e.g. water pumping station) and that this renovation task can be connected to existing organizational long-term objectives (e.g. energy self-sufficiency). The second condition is that a specific *initiative in the external environment pops up* that could contribute to organizational long-term objectives (e.g. the windfarm initiative). Hence, the third condition: *long-term objectives* are laid down in inter-organizational agreements or organizational strategies.

Dilemma 2: Stability or responsiveness towards long-term problems

We illustrate this dilemma (found in 25% of dilemma quotations) by using the Vision 2045 trajectory at *ZZL*.

The Vision 2045 trajectory started in the year 2015, around election time (20150326-doc). The vision trajectory became part of the new executive assembly's programme for the years 2015–2019. The Vision 2045 goal was 'not to arrive at one future scenario', but to 'gain insight into challenges of the future, as well as into potential transition pathways and perspectives for action' (20160906-doc). With the way the vision trajectory was organized, the goal was to 'influence the acts and behaviour of assembly members' through 'buzz and dynamics' (20180919 - Corp. strat.). As part of the vision trajectory, sessions were organized with Dutch scientists to which both assembly members and candidate assembly members were invited. These sessions were carefully prepared with an external moderator and aimed to discuss not so much the future trends or the vision itself, but rather 'governing the future', because 'the ideal is the long-term-oriented assembly member with a vision towards society' (20181120-3, external moderator). At the end of the evening session in December, one of the organizers noted: 'now we can also push these terms [used as part of the scientific essays] into the [new] executive assembly's programme' (20181204-4).

Regarding conditions, civil servants acted upon the annual *end-of-budget cycle* because of the need to prioritize resources, leading them to cancel specific long-term budgets. They also used the four-yearly *end-of-election cycle* with the potential of influencing the new assembly's programme with proposals around long-term problems. A third condition was the presence of *inter-organizational agreements*, because those provided long-term objectives to which the political assemblies had committed themselves and that needed to be translated into assembly programmes and organizational vision and strategies.

Dilemma 3: Reacting to the external environment or proactively steering towards long-term objectives

We illustrate this dilemma (found in 50% of dilemma quotations) using the *ZZL* effort to develop a wastewater chain strategy.

In October 2018, a meeting about the wastewater chain strategy was organized for internal stakeholders of both the operations and the policy department at which external consultants presented a 'strategy for the short term (2019)' and a perspective on a 'wastewater chain 2030' (20181017-1). The strategy aimed to fulfil the need for 'structure on how to steer this as organization' and to provide 'clarity about a number of things, [including] where to focus on, and where not to focus on' (20181017-1). During the meeting, participants discussed the 'intrinsic tension' of 'making choices' versus 'leaving everything open'. A couple of participants argued in favour of flexibility towards the external environment: 'Make sure you are also flexible so that you can move towards the environment.' Someone else maintained that 'connecting with the external environment, [is] also needed for the future.' Others on the other hand argued in favour of choosing: 'be clear about your strategy'; 'not all requests fit our organizational objectives'; and signalled the danger of 'losing focus because of the number of ideas and plans' (20181017-1). The presentation with which the strategy and related investments were introduced to the executive assembly in January 2019, mentioned 'an opportunity to collaborate' with another RWA to ensure 'future-proof sludge processing until the end of 2037' (Presentation - Pol ad. 20190122-2; 20190122-2; 20190212-doc).

This dilemma emerged under conditions of *initiatives from the external environment* (e.g. opportunity to work together with another RWA for sludge processing; 20180905-2, 20181004-1, 20181204-2) combined with discussions *about the formal role and tasks of the regional water authority according to legislation* (e.g. resource recovery from wastewater should not be at the expense of the primary task of water quality, 20180927-1) and the need to prioritize resources as part of the annual

budget cycle and preparations for the new budget (e.g. no money for new ambitions, 20180914-3). 'Seizing opportunities' from the external environment was deemed important by *ZZL* members to become more sustainable and innovative (e.g. 20180905-2, 20181004-1, 20181204-2). Both politicians and civil servants referred to the organizational core tasks, i.e. the primary legislative tasks. For example: 'in the upcoming years we will have our hands full to fulfil our core tasks. The Dutch soil is subsiding faster than we thought. The sea level is rising faster than we thought' (assembly member, 20181127-2).

6.4.3 RQ3: How do organizational members deal with dilemmas related to long-term policy problems in their everyday practices?

Organizational members deployed specific strategies to deal with the above dilemmas (see Table 6.3). The strategies elaborated upon all had at least five quotations.

Strategies to deal with the object versus objective dilemma

A first strategy used by six organizational members was to *emphasize (realized) long-term objectives*. The strategy was used to emphasize that, with the collaboration in Windfarm Hanze, the organization would be energy self-sufficient earlier than planned – for example by stating that 'the ambitions have been realized' (20180830 - Ex. Dir.) or that 'officially we are done' (20181108-1).

A second strategy was to *map all planned and foreseen investments and activities*. This strategy was used or proposed by four policy advisors in discussions about the sustainability strategy, the long-term investment plan and the wastewater chain strategy. They used it to 'build coherence and plan investments consecutively' (20181204-2), detect 'gaps' (20181108-1) and provide a 'helicopter view' (20180919 - Pol. ad. other).

A third strategy was to *seek collaboration, especially to align long-term strategies and thinking* and was used at an organizational and an individual level. At an organizational level, *ZZL*'s chairperson took part in the administrative platform for the IJssellake area in which newest insights about sea level rise and water management infrastructure were discussed (20190130-1). At an individual level, the executive director proposed to get in touch with the municipality to align long-term objectives about the wastewater chain (20181004-1; 20190226-1).

Table 6.3. Presence of strategies and dilemmas and number of quotations in which strategy was used

Strategies per dilemma (side)	Number
Object–Objective	
Object side	
Postpone or phase investments	5
Objective side	
Emphasize (realized) long-term objectives	9
Map all planned and foreseen long-term investments and activities	7
Seek collaboration to align strategies and long-term thinking	6
Stability–Responsiveness	
Stability side	
Use political venues to highlight long-term challenges	16
Propose long-term plans and strategies to the current administration	9
Responsive side	
Differentiate ambition levels (hierarchy of objectives)	6
Connect decisions to a specific and politically attractive long-term objective	5
Reactive–Proactive	
Reactive side	
Co-invest in the development of new technologies	11
Leave primary responsibility for long-term with other organizations	9
Co-develop joint long-term visions and plans	9
Use collaborative platform to gain knowledge about long term	9
Proactive side	
Seek collaboration to realize long-term objectives	11
Set criteria for external initiatives based on fit with long-term obligations	8
Emphasize felt and formal responsibilities towards the long term	6

A fourth strategy was to *postpone or phase investments*. This strategy was proposed and used by the process engineer in discussions about wastewater chain investments. For example, he proposed 'to adjust the aeration to ascertain you will be futureproof' as a first step (20181023-1) and to postpone the decision about wastewater plant capacity extension because '[w]e are currently trying to find the most sustainable route for capacity increase. [...] We are not yet ready to ask the executive assembly to make a decision' (20190107 - Proc. eng.). This fourth strategy was mainly object oriented, whereas the others were more objective oriented (Table 6.3).

Figure 6.3 summarizes the object–objective dilemma, conditions, and strategies.

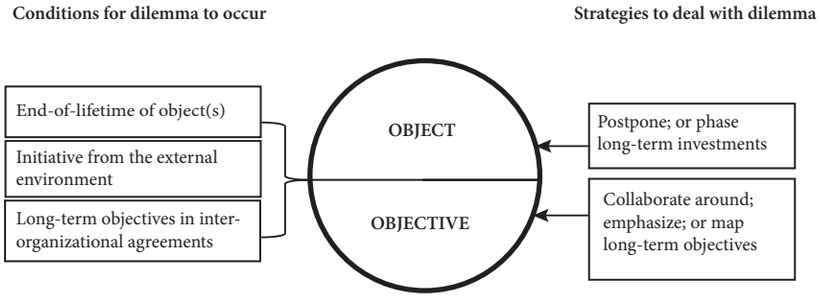

Figure 6.3. Dilemma of *object versus objective* orientation to address long-term problems

Strategies to deal with the responsiveness versus stability dilemma.

The first and most frequent strategy employed was to *actively use political venues to highlight relevant long-term challenges*. Civil servants, for example, used the draft for the new executive assembly's programme to dictate long-term themes and approaches (20181126-1). In fact, the chief executive stated: 'it would be great if the new executive assembly interviewed us, that they will just say copy-paste' about the vision trajectory (20181204-3); and the executive director said that he did not want to call the vision trajectory an 'inheritance but more a continuous line [that] could evolve' (20180919-3).

As a second strategy, civil servants *proposed long-term plans to the current assembly before the elections*. For example, the executive director argued: 'we are not going to wait for the new assembly in order to prevent them asking: 'How about this, did you think about that?' (20181023-1). The chairperson also signalled an 'explosion' of policy proposals in the executive assembly in the two months before the elections (20190122-2).

As a third strategy, civil servants *connected decisions to a specific and politically attractive long-term objective*, such as 'the most sustainable pumping station' (20180913-3, 20180830 - PA Ex. Dir.) or 'the most sustainable regional water authority' (20181204-2). The executive director in particular strongly favoured putting a specific 'flag' on activities that would help to 'sell [them] politically' (20180913-3; see also 20180927-1).

As a final strategy, both the chairperson and civil servants proposed *hierarchies of objectives* in which *different ambition levels* for long-term themes – such as the Vision 2045 themes – and their cost would be outlined. The chairperson proposed this strategy to facilitate political discussions about the cost of 'political dreams' (20181114-2). The civil servants adopted the strategy of 'providing politicians with a choice' (20181108-1) about long-term developments (see also fieldnote 20181029-2). The first two strategies were stability oriented, and the second two responsiveness oriented. Figure 6.4 summarizes the dilemma.

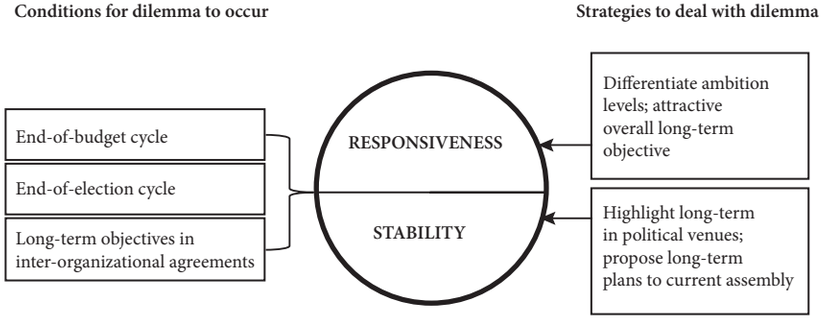

Figure 6.4. Dilemma of using *responsiveness versus stability* towards long-term problems

Strategies to cope with the reactive–proactive stance towards the external environment

The first reactive strategy used by civil servants and most often discussed at meetings with executive assembly members was to *co-invest in the development of new technologies* for the wastewater chain. Proposals and initiatives for co-investments included, for example, sludge processing together with a municipal energy production facility (20190212-2), energy saving techniques together with a university and another RWA (20180920-2) and recovering cellulose from wastewater together with other RWAs and with the support of a consultancy firm (20181010-1).

A second reactive strategy was to leave the *primary responsibility with other organizations*. This was used by executive assembly members and high-level civil servants in conversations about the new Environmental Act, the Delta programme for long-term water safety, and the energy transition. For these long-term themes, high level officials proposed to leave it to other governmental institutions, e.g. the

national government (20181211-2), the Delta programme institute (20181114-3), the province of *Flevoland* and regional energy transition teams (20181211-2), to take the lead in implementation.

Another reactive strategy was to *co-develop joint visions and long-term plans* with other governments, when 'opportunit[ies] for that arose' (20180905-2). The executive director, for example, raised the question of 'how *ZZL* could contribute to the city's resource transition' with its investments in wastewater treatment (20181004-1); and in a later meeting the process engineer stated that he had analysed 'whether there is a chance to produce biogas because of the question that came from [the] municipality' (20181023-1).

A fourth reactive strategy that *ZZL* members adopted to respond to the environment was to *use collaborative platforms* in which RWAs joined forces and that allowed *ZZL* to stay informed on long-term developments – for example about legislation in a joint meeting to discuss future concerns about the EU Urban Wastewater Directive (20180927-1) and about the legal and technological aspects of resource extraction from wastewater in a specific RWA 'frontrunners' group (20181010-1).

On the other hand, to steer environmental and long-term ambitions, *ZZL* members used the following proactive strategies. The first was to *proactively seek collaboration to be able to meet long-term objectives* for tasks in which there was a dependence on, or overlap in, tasks with other governmental institutions. This strategy was used for the topics of climate change adaptation (20181119-1) and water quality (20181127-1) and was embraced by both political assembly members and policy advisors to make sure that municipalities would take preventive measures to ensure a robust system or prevent too much water pollution.

A second proactive strategy was to *set criteria for activities developed by others, based on their fit with organizational long-term obligations*, because 'not all requests are in line with our organizational objectives' (20181017-1) and the organization would not have the capacity to honour them all (20181029-2). Organizational members, for example, proposed to invest in activities based on 'business cases' (20181017-1), 'societal vigour' (20180914-3) or specific 'priorities' (20181029-1).

A third proactive strategy was to *emphasize the organizational and felt responsibilities* regarding long-term developments. This strategy was especially adopted by the chairperson and general assembly members to increase or question the legitimacy of long-term tasks such as climate change adaptation (including large investments

in embankments, e.g. 20181127-2) and contributing to CO_2 emission reduction targets (e.g. 20190107-3). Figure 6.5 summarizes this dilemma.

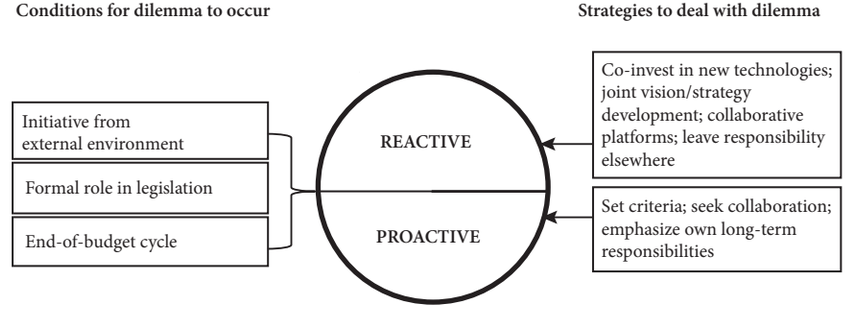

Figure 6.5. Dilemma of *reactive versus proactive* stance towards the external environment

6.5 Discussion

We now first discuss the dilemmas presented in the previous section in relation to existing theory and then reposition them as reflecting an underlying duality. At the end of this section, we reflect briefly on the ethnographic methodology, limitations and discuss directions for future research.

6.5.1 Object and objective focus: crossing scales and making forward-looking decisions

Central to this first dilemma is the question of how best to invest in long-term policy problems: at the level of separate investments in objects or at a more central-organizational level by focusing on reaching a specific objective. Here, long-term policy problems are especially understood by adopting a long time horizon. Therefore, this dilemma encompasses the theoretical cross-scale dilemma, because of the interaction of temporal scales (tackling long-term issues with present-day actions) and spatial scales (local object level or organizational and area level) (Cash et al., 2006). The choice of whether to couple a number of long-term objectives and issues with a single investment is a delicate act (van Buuren et al., 2014). It will also depend on whether organizational members use the need to invest in end-of-lifetime objects as a 'window of opportunity' to reach desired change

(Tukker & Butter, 2007). When more long-term problems are connected to a single investment, it is likely that a forward-looking decision will be the result (Pot et al., 2018).

6.5.2 Stability and responsiveness: using political and bureaucratic resources for long-term objectives

The second dilemma identified, the dilemma of responsiveness versus stability, reflects at its core the tension between the strengths and powers of politics versus bureaucracy (Peters, 2001). Here, long-term problems become part of organizational objectives. Bureaucrats have the advantage of stability because they are likely to stay in office longer than politicians and can therefore develop and implement longer-term plans without the complication of changing priorities (Boston & Pallot, 1997). Bureaucrats also prepare annual budgets and can therefore propose how to allocate resources, including those targeted at long-term objectives. But the long-term plans and budgets of bureaucracy need to be approved by political executives. Because political executives are chosen via public elections, they need to be responsive to the external environment (Noordegraaf et al., 2014). As part of their close connections to the outside world, responsive politicians can signal changing circumstances, long-term trends and collaborative opportunities (Bryson et al., 2015). As others have also argued, both stability and responsiveness are needed to address long-term problems (Janssen & Voort, 2016; Voß et al., 2009).

6.5.3 Reactiveness and proactiveness: strategic interaction with the external environment

The third dilemma is about reactiveness versus proactiveness towards the external environment. Here, long-term policy problems are mainly understood as belonging to the external environment. This environment is the 'dynamic', the 'complexity' that surrounds the organization (Mintzberg et al., 1998, p. 289). A proactive approach to the long term resembles formal strategic planning. It uses objective setting (Kemp & Loorbach, 2007) and methods to grasp external pressures and long-term problems, such as a SWOT assessment (Mintzberg et al., 1998) and foresight (Höglund et al., 2018). Proactivity may stimulate the alignment of budgets and organizational commitment with strategic priorities (Poister, 2010). Pitfalls of proactivity include goal fixation (Klein, 2011), detachment from real-world issues (Mintzberg et al., 1998), overreliance on data (Poister, 2010), and a potential overestimation of the steering capacity of the organization (Underdal, 2010). An outward-oriented reactive approach can help to avoid pitfalls, because it allows the organization to understand, adapt and learn from external pressures, and to signal cues, anomalies and opportunities (Klein, 2011; Termeer & van den Brink, 2013).

Ideally, organizations combine a reactive and proactive strategy towards the external environment by both formulating long-term objectives to address the future and remaining flexible to respond to new insights that emerge (Voß et al., 2009).

6.5.4 Strategic agility as duality for dealing with long-term problems

The theoretical exploration of the dilemmas above, enables us to reposition the dilemmas as reflecting an underlying duality. Instead of representing a choice, a duality forms a both/and perspective (Farjoun, 2010). This expands the repertoire of options available to organizations.

Rather than responding to a dilemma by choosing one side over the other, it becomes possible to devise strategies that address both sides of the underlying duality:

- *Realizing objectives with investments in objects* by assessing what objectives and problems to connect to investments in objects and to determine how investments can contribute to long-term objectives;
- Adopting a *responsive and stable approach* to address long-term problems by dedicating resources to long-term plans, while leaving room to manoeuvre for political executives to select specific long-term objectives to focus on;
- Taking a *reactive and proactive* stance to the organizational environment by both signalling and prioritizing future developments, trends, insights and opportunities to consider.

We will call this underlying duality *strategic agility*. Strategic agility refers to the ability to respond proactively to unexpected developments and is a requirement for organizations to deal with a variety of possible futures (Appelbaum et al., 2017; Howlett et al., 2018). Responding proactively requires the presence of both a long-term organizational strategy and specific organizational processes that facilitate learning-by-doing. Responsiveness, reactiveness, and an object focus fit well with the concept of agility because they allow the organization to *accommodate* changing insights and circumstances (Worley & Lawler, 2010). The other part of the dilemmas, stability, proactiveness and objective focus, fit a strategic perspective and allow the organization to *steer* change by formulating long-term objectives and prioritizing activities and scarce resources (Brown, 2010).

6.5.5 Some further reflections on the transferability of research findings

We agree with Rhodes that 'small facts speak to large issues' (2014, p. 321) and that our findings reveal typical dilemmas of addressing long-term policy problems in everyday practices of public sector organizations. The patterns, in the form of the

identified dilemmas and strategies, could serve as transferable heuristics. Also, the data collection and analysis steps and the combination of deep immersion and yo-yo fieldwork could be useful to other researchers who aim to do ethnography. Ethnography allows to capture the external context of public sector organizations and hence enables a more holistic perspective of the embedded nature of public organizational practice (Huby et al., 2011).

As a first direction for future research, ethnography could be used together with narrative or discourse analysis techniques to explore more extensively the different meanings or frames for long-term policy problems. Secondly, we recommend studying other types of organizations on the basis of the same research design to see whether similar or different dilemmas emerge in different contexts. Thirdly, qualitative comparative analysis could contribute to further exploring what combinations of conditions or strategies, that were part of the distinguished dilemmas, enable addressing long-term policy problems in everyday practices. Lastly, it would be valuable to further explore characteristics and empirical evidence of strategic agility in public sector organizations and its implications for organizational design, for example by means of a systematic literature review.

6.6 Conclusion

This chapter adopted an ethnographic research approach to understand how governmental actors deal with long-term policy problems in their everyday practices. As a research setting, we selected the case of a Dutch regional water authority, an organization that, on paper, has a clear need to address long-term problems because of its institutional responsibility for long-term water management. We found four ways to understand and communicate about long-term policy problems: as part of the external environment, connected to a long time horizon, as long-term objectives, and as future developments. We revealed three organizational dilemmas of dealing with long-term policy problems: investing in the realization of objects or objectives, adopting a stable or responsive approach to address long-term issues, taking a proactive or reactive stance towards the external environment. We repositioned these dilemmas as reflecting the underlying duality of strategic agility. This enables organizations to respond proactively to unexpected developments by being able to devise strategies to steer as well as to accommodate change, as both are crucial for dealing with long-term policy problems.

Acknowledgments

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7

CHAPTER

Conclusions and discussion

This dissertation aims to assess, explain, and improve the extent to which governments make forward-looking decisions about their water infrastructure. Forward-looking decisions are especially relevant because many water infrastructure assets are reaching their end-of-lifetime due to technological ageing and changing functional demands. Governments therefore need to invest in the replacement and renewal of current infrastructure or in entirely new infrastructure (Hijdra et al., 2014). The long lifespan of water infrastructure requires governments to take into account possible impacts of developments such as climate change, economic developments, and demographic changes (OECD, 2014; Urich & Rauch, 2014). Furthermore, governments worldwide, including the Dutch government, have committed themselves to international agreements focused on addressing long-term problems such as freshwater availability and climate change mitigation. Governments therefore need to think carefully about the future when they are preparing to invest in water infrastructure. They need to consider the relevance and impact of possible future developments for infrastructure and the potential contributions of infrastructure investments to addressing long-term problems. To ensure that infrastructure can cope with changing circumstances, they need to choose infrastructure that can remain effective across that infrastructure's lifetime. This requires governments to make forward-looking decisions.

This final chapter presents this dissertation's main conclusions, contributions, limitations, future research directions, and recommendations for practice. Furthermore, a new theory is introduced to assess, explain, and establish forward-looking decisions about water infrastructure. The theory connects the various findings of this dissertation and identifies the relationships between conditions, interaction processes, and the outcome of a forward-looking decision. This concluding chapter comprises five sections. Section 7.1 answers the research sub-questions and discusses the contributions of these answers to debates in the literature. Section 7.2 presents the theory of forward-looking decision making. Section 7.3 reflects on the limitations and directions for future research. Section 7.4 presents the recommendations for governmental practice. The dissertation ends with a few closing remarks in section 7.5.

7.1 Answering the research questions and contributions to the literature

The main research question of this dissertation was formulated as follows:

What makes governmental decisions about water infrastructure forward looking?

The main research question was divided into four research sub-questions (RQs):

RQ1: How can forward-looking decisions be conceptualized and measured?
RQ2: How forward looking are governmental investment decisions about water infrastructure?
RQ3: What conditions enable forward-looking decisions?
RQ4: What mechanisms and strategies shape forward-looking decisions?

The five empirical chapters of this dissertation all contributed to answering two or more of these questions. Based on these empirical chapters, this section presents the answers to each of the RQs.

7.1.1 RQ1: How can forward-looking decisions be conceptualized and measured?

This dissertation has conceptualized a forward-looking decision as a decision that anticipates possible future developments by including a:

- Problem definition mentioning a long time horizon and long-term challenges;
- Solution that is robust and/or flexible to remain effective over a long period of time;
- Justification that relies on long-term objectives or visions that formulate desirable futures and/or on scenarios that explore plausible or possible futures.

The concept of a forward-looking decision is of relevance for governmental decisions that need to deal with the long term. This is the case when the solution that will be invested in has a long lifetime of a decade or more (Chapters 2–4), or because governments seek solutions that allow them to address long-term policy problems (Chapters 5–6). Introducing the forward-looking decision concept does not imply that all governmental decisions need to be forward looking (see Chapter 2) or that decisions that do not meet the criteria immediately qualify as policy failures (see Chapter 6). Governments should especially aim for forward-looking decisions when there are many uncertainties regarding the impact of possible future developments. The forward-looking decision concept enables governments to consider future problems, developments, and needs, whilst still addressing short-term problems and needs.

Based on the above conceptualization of a forward-looking decision, it is possible to measure the extent to which governmental investment decisions about water infrastructure are forward looking. Different ways to measure the forward-lookingness of decisions were provided in this dissertation. To measure the absence or presence of forward-looking decisions, a dichotomous measurement for each of the three forward-looking criteria can be used (see Chapter 2 and Table 7.1). This dissertation employed fuzzy set qualitative comparative analysis (fsQCA), which leads to an ordinal measurement for the forward-lookingness of decisions, based on a four-value fuzzy set score (see Chapter 3) (Ragin, 2008b). With a four-value scheme in fsQCA, investment decisions can receive a score for the forward-lookingness of decisions of 0 (not forward looking), 0.33 (mostly not forward looking), 0.67 (mostly forward looking), and 1 (forward looking). The score of 0.5 is not assigned, but forms the cross-over point that determines whether a decision is forward looking or not. A third way of measuring the forward-lookingness of decisions is by counting the number of forward-looking features that are part of governmental investment plans and decisions. In this case, a discrete measurement is used. Such a measurement creates the possibility to rank governments according to their investment decisions as well as to rank investment decisions (see Chapter 4). Table 7.1 presents an overview of the different measurements that this dissertation has provided.

Contributions to understanding use of decision support and governments' preparedness for the future

This dissertation developed the novel concept of a forward-looking decision. This concept (1) contributes to the debate about the use of decision methods and approaches to support governmental decisions about the long-term future and (2) enables scholars to assess and improve governmental anticipatory action in broad terms, not restricted to specific decision support methods or long-term problems.

First, whether developed decision support methods and approaches for future-oriented decision making directly inform governmental decisions is a topic of ongoing debate (Bührs, 2012; Haasnoot & Middelkoop, 2012; Rickards, Wiseman, et al., 2014; Volkery & Ribeiro, 2009). Existing literature that discusses the anticipation of possible future developments has, for example, proposed scenario planning (Tapinos & Pyper, 2018), applying robust and flexible strategies (Kwakkel, Haasnoot, et al., 2016), and developing long-term visions (Loorbach, 2010). The measurements of a forward-looking decision create the possibility to measure the adoption of flexible and robust solutions and the use of future visions and scenarios as part of present-day governmental decisions. Applying this to infrastructure

Table 7.1. Different ways to measure the forward-lookingness of decisions

Dichotomous measurement	Ordinal measurement using fuzzy set score	Discrete measurement
Assessing whether each of the following three criteria are met: • Forward-looking problem definition if it includes a time horizon of minimum 10 years and long-term developments • Forward-looking solution if it is tested for robustness and/or flexible measures are part of it • Forward-looking justification if decision relies on future scenarios, long-term objectives, and/or long-term vision(s)	Providing a score for decisions based on how many of the three criteria for a forward-looking decision are met: • 0 score: none of the three criteria for a forward-looking decision is met; the decision is not forward looking • 0.33 score: one of the three criteria for a forward-looking decision is met; the decision is mostly not forward looking • 0.67 score: two of the three criteria for a forward-looking decision are met; the decision is mostly forward looking • 1 score: all three criteria for a forward-looking decision are met; the decision is forward looking	Measuring the extent of the forward-lookingness of decisions as follows: • Count number of long-term developments in problem definition • Score a 1 for presence of long time horizon • Score a 1 or a 2 for presence of robustness tests applied to infrastructural solution(s) and to the water management system to which the infrastructure belongs • Count the different types of flexible measures included (can differ for particular infrastructure but should include monitoring) • Count number of future scenarios multiplied by number of future developments that are part of these scenarios • Count number of future visions developed for decision, other existing visions to justify decision, and long-term objectives as part of decision

investment decisions reveals the extent to which and the reasons why governments use methods and tools to support decisions about long-term solutions and long-term problems. The answer to RQ2 (section 7.1.2) discusses the extent to which these methods and tools are used for governmental decision making about the long term; and the answer to RQ4 (section 7.1.4) provides explanations for the use of tools and other forward-looking characteristics of decisions.

Second, existing literature often takes a narrow view when conceptualizing and analysing forward-lookingness, by focusing on specific decision support methods or on specific long-term problems. For example, in future studies, forward looking often refers to using foresight (Gavetti & Levinthal, 2000; Havas & Weber, 2017). Furthermore, literature that discusses the anticipation of long-term developments often focuses solely on climate change (Dąbrowski, 2018; van den Brink et al., 2014; van der Voorn et al., 2015). The comprehensive concept of a forward-looking decision does not focus on specific long-term problems or decision support methods, thereby enabling the assessment in more general terms of governments' preparedness for the future. The concept can be used to track anticipatory action over longer periods of time (see how this is done in the field of climate change adaptation in Lesnikowski et al., 2016), to compare decisions between governments (see Chapter 4), and to enable governments to anticipate and couple multiple long-term problems and ambitions as part of decisions (van Buuren et al., 2014). The latter can be done by using the criteria for, and measurements of, a forward-looking decision during the preparation of investment decisions, in order to include scenario studies, formulate long-term objectives and/or visions, and test the flexibility and/or robustness of alternative solutions. I discuss this further as part of the recommendations for practice (section 7.4).

7.1.2 RQ2: How forward looking are governmental investment decisions about water infrastructure?

This dissertation's application of the concept of a forward-looking decision to water infrastructure investment decisions by means of the methodologies of process tracing, fsQCA, and a comparative case analysis produced five main findings:

1. Not all investment decisions about water infrastructure are forward looking. This means that, despite the long lifetime of water infrastructure, governments do not necessarily anticipate possible future developments and commit to addressing long-term problems when they make decisions to renew, replace, or renovate their water infrastructure (Chapters 2, 4, 5).
2. Establishing forward-looking decisions about infrastructural assets is not a goal in itself for governments. Whether a decision becomes forward looking is often motivated by whether forward-looking justifications and problem frames enable civil servants and political executives to realize pet solutions (Chapter 2) or to satisfy inter-organizational long-term objectives (Chapter 5).
3. The level of forward-lookingness of a sequence of decisions about the same infrastructure changes but does not necessarily increase over the course of the decision process (Chapters 2, 5).

4. The large differences between governments in the extent to which they anticipated the future with their investment decisions could be partially attributed to the size of the governmental organization (Chapter 4). The answers to RQ 3 and RQ4 (sections 7.1.3 and 7.1.4) provide more explanations for forward-looking decisions.
5. There were trade-offs between different forward-looking criteria, for example between robust solutions and long-term sustainability objectives (Chapter 5).

Zooming in on the sub-criteria for forward-looking decisions, this dissertation reveals that governments primarily anticipate the long-term development of climate change with their investments in water infrastructure, focusing on both mitigation (Chapter 5) and adaptation (Chapters 2, 4). To a far lesser extent, governments anticipate other possible future developments such as spatial developments and changes in technology. Only in the case of the *IJmuiden* sea lock were economic change (impacting the future supply of, and demand for, goods) and technological change (especially the size of vessels) main drivers of the forward-lookingness of investment decisions. In this case, these developments became part of the dominant problem frame or were included in future scenarios used to support decisions.

Another finding is that governments seemed to avoid uncertainty. The regional water authority did not mention the concept of uncertainty whatsoever in meetings and decision documents (Chapter 6). Furthermore, the analysis of the *IJmuiden* sea lock case in Chapter 2 and of municipal water management in Chapter 4 revealed that scenarios and flexible solutions were rarely used to explore and accommodate uncertainty. Future scenarios that had been developed to understand future uncertainties were not used to support investment decisions (Chapter 6). When future scenarios served to support decisions, they were not used to understand a range of uncertainties (Chapter 4), but rather to support pet solutions by using best case scenarios and/or broadly accepted scenarios (Chapter 2).

Similarly, flexible solutions that can accommodate uncertainty were not often adopted (Chapters 2, 4). For example, only one flexible planning approach that consisted of several short-term and longer-term response strategies was found. This flexible approach was not used to anticipate future uncertainties, but rather to solve a political impasse about the future use of the sea lock that would become redundant once the new *IJmuiden* sea lock was finalized. In Chapter 6, flexibility was used only implicitly by a process engineer when he proposed to focus on incremental measures and postpone large investments in wastewater treatment plants, mainly for pragmatic reasons. Furthermore, many governments did not have processes in

place to use monitoring to adapt solutions to changing circumstances. Chapter 4 revealed that 85% of municipalities were still in the process of collecting or analysing data relevant to the functioning of the water management system, such as precipitation. These municipalities did not yet use this monitoring information to prepare or adjust decisions regarding water infrastructure.

Contributions to understanding governmental myopia

Applying the measurements of a forward-looking decision to recent decisions about water infrastructure reveals the extent to which governments currently anticipate the future, thereby providing valuable insights for the scholarly debate on governmental myopia.

The unanswered question in the field of governmental myopia relates to the extent to which humans, and especially elected officials, can cope with the long term, because it is often assumed that people tend to favour the short term over the long term (Slawinski et al., 2017; Sprinz, 2009). Nair and Howlett (2017, p. 105) define myopia as 'failing to identify the bounds and range of uncertainties'; and this dissertation positions forward-looking decisions as the opposite of myopic decisions. Governmental myopia can be caused, amongst other things, by the dominance of short-term sectional interests, short electoral cycles, and the dominance of new public management values including a focus on short-term measurable results (Bührs, 2012; Höglund et al., 2018; Slawinski et al., 2017). This dissertation contributes to this discussion by showing that: (1) forward-looking decisions are possible within present-day governmental settings characterized by annual budget cycles and four-year election cycles and (2) governments still focus strongly on risks instead of on uncertainties.

First, forward-looking decisions are possible within present-day governmental settings. For example, one of the six decisions about the *IJmuiden* sea lock in Chapter 2, and decisions by 15 of the 40 municipalities in Chapter 3 met all criteria for a forward-looking decision. These decisions included a forward-looking problem definition, a forward-looking solution, and a forward-looking justification. The conditions under which governments are capable of making forward-looking decisions are discussed in answering RQ3.

Second, this dissertation reveals that governments focus strongly on risks instead of on uncertainties. Although uncertainty is a core characteristic of long-term policy problems (Sprinz, 2009), this dissertation has shown that scenarios to grasp future uncertainties were only used to a limited extent and that governments

avoided using the word uncertainty. Governments especially supported investment decisions and the choice of solutions with cost-benefit analyses and risk assessments (Chapters 2, 5), thereby focusing on probable futures and what can be known instead of on possible and uncertain futures (Howlett et al., 2018). Decision makers tend to avoid uncertainty in order to create a sense of security (Khosravi & Jha-Thakur, 2019; Lipshitz & Strauss, 1997); this can become an even stronger tendency when large sums of money need to be invested in infrastructure. Uncertainty avoidance can, however, lead to myopia within organizations (Slawinski et al., 2017) and may therefore explain some of the gaps found in the forward-lookingness of decisions.

7.1.3 RQ3: What conditions enable forward-looking decisions?

This third RQ moves beyond the analysis of the decision to the analysis of the decision-making process to be able to explain the conditions under which forward-looking decisions come about. To understand decision making, this dissertation has proposed a decision-making lens that integrates elements from the garbage can model (Cohen et al., 1972), the multiple streams framework (Kingdon, 1984, 2011), the rounds model (Klijn & Koppenjan, 2016; Teisman, 2000), and proposed changes to the multiple streams framework by Howlett and colleagues (2015, 2016; 2019). Adopting elements from these theories, this dissertation has argued that the context of governmental decision making is shaped by the independent streams of politics, problems, solutions, and choice opportunities. These streams provide the conditions in which actors operate (Jones et al., 2016). To reveal conditions that enable forward-looking decisions, three methods were used. The process tracing method revealed conditions triggering causal mechanisms behind forward-looking decisions (Chapter 2). A cross-case analysis using fsQCA and applied to 40 cases of Dutch municipalities resulted in four combinations of conditions from the different streams that enable forward-looking decisions (Chapter 3). The ethnographic study in Chapter 6 allowed further enrichment of the contextual understanding of forward-looking decision making. This study revealed six conditions that enable governments to address long-term problems and decide on infrastructural investments as part of their everyday practices.

By combining these three methods, this dissertation found that combinations of the following conditions from the four streams enable forward-looking decisions (see Table 7.2 for an overview):

- The problems stream includes focusing events (especially extreme weather events) that direct the attention of governments to long-term problems, as well as collaborative opportunities that stimulate governments to share knowledge and resources to invest in the long term. Examples of the latter are a joint investment in a more sustainable wastewater processing technology and the development of joint long-term visions and water management plans for urban water management.
- The politics stream includes the conditions of the election cycle, the leadership style of the political executive that is responsible for water infrastructure, and the risk of losing office, as perceived by political executives. In this dissertation, the end-of-election cycle stimulated civil servants to steer the attention of politicians towards long-term problems and plans. In response, politicians in the legislative and executive branches needed to decide whether to allocate organizational resources to address long-term problems. When political executives responsible for water management were equipped with a collaborative or long-term oriented leadership style and organizations were confronted with extreme weather events, this further enabled forward-looking decisions. Jacobs (2011) argues that political executives will make long-term investment decisions only when they feel safe electorally. This dissertation finds that politicians' fear of losing office stimulates them to seek more forward-looking support for long-term investment decisions, for example by asking for the exploration of worst-case scenarios as part of cost-benefit analyses.
- The solutions stream includes the conditions of the capacity of the organization in terms of its overall size (i.e. inhabitants), the organizational analytical capacity of water management departments, and water infrastructure reaching its end-of-lifetime. Organizational analytical capacity consists of the water management budget, departmental knowledge about long-term problems, and human resources dedicated to water management. A strong analytical capacity and relatively large size enabled governments to reach more forward-looking decisions about end-of-lifetime water infrastructure.
- The choice opportunities stream includes the opportunities for decisions within organizations and formal legislation, procedures, and agreements. An essential choice opportunity within public sector organizations is the end-of-budget cycle. This dissertation found that the end-of-budget cycle facilitated discussions about the allocation of resources to long-term problems and objectives. The choice opportunities stream also provided legislation from, and agreements with, other governmental actors that dictate organizational long-term responsibilities (e.g. for water safety), long-term objectives (e.g. reducing carbon emissions), and future-oriented information to be used for investment decisions (e.g. specific future scenarios).

Table 7.2 Conditions per stream

Problems stream	Politics stream	Solutions stream	Choice opportunities stream
• Focusing events: experience with extreme weather events (Ch. 3) • Collaborative opportunities that arise from the external environment (Ch. 6)	• Long-term-oriented or collaborative political leadership (Chs. 2, 6) • Perceived political risks (Ch. 2) • End-of-election cycle (Ch. 6)	• Organizational analytical capacity (Ch. 3) • End-of-lifetime of water infrastructure (Chs. 2, 6) • Organizational size (Ch. 3)	• End-of-budget cycle (Ch. 6) • Legislation and agreements prescribing long-term objectives, scenarios, performance requirements (Chs. 2, 6) • Legislative organizational responsibilities for the long term (Ch. 6)

Contributions to understanding governmental decision making about the long term

By using and further developing a horizontal decision-making lens to understand decision-making processes, this dissertation contributes to scholarly debates about (1) the missing political, historical, and institutional context in methods and models for adaptation and anticipation and (2) the use of the multiple streams framework to understand decision-making processes instead of agenda-setting processes.

First, decision methods that aim to support governments in making decisions about the future, such as adaptation pathways and scenario planning, are criticized in the literature because such methods do not represent the actual decision context. Instead, they rely on a context with clearly identified decision makers and unambiguous goals (Wise et al., 2014) and ignore institutional and political variables (Nilsson et al., 2011; Volkery & Ribeiro, 2009). However, institutions and politics are critical enablers and constraints for establishing decisions and achieving desired outcomes. Using the streams from the multiple streams framework reveals the dynamic and often ambiguous context in which decision-making actors operate (Jones et al., 2016). More specifically, the choice opportunities stream enables inclusion of institutional conditions such as legislation and responsibilities in models and frameworks for long-term governmental decision making (Brugge & Roosjen, 2015). Using the notion of crucial decisions from the rounds model (Teisman, 2000) enables recognition of the historical context of decisions (Wise et al., 2014) by enabling a longitudinal retrospective analysis of the decision-making process.

Second, the answer to RQ3 contributes to existing scholarship that discusses whether and how the multiple streams framework can be applied beyond the agenda-setting phase (Howlett et al., 2016; Rawat & Morris, 2016; Teisman, 2000; Zahariadis, 2014). To make the multiple streams framework suitable for understanding decision-making processes, this dissertation has re-introduced the choice opportunities stream that was originally included in the garbage can model (Cohen et al., 1972). Adding the choice opportunities stream allows inclusion of the missing institutional context in the original multiple streams framework (Zohlnhöfer et al., 2016). Besides the choice opportunities stream, this dissertation has added the notion of crucial decisions to further improve the usability of the multiple streams framework for decision-making processes. It is necessary to add the notion of crucial decisions because decision-making processes, especially about long-term solutions such as infrastructure, do not result in one clearly identifiable governmental decision. Instead, decision-making processes result in numerous crucial decisions that divide decision-making processes in retrospect (Teisman, 2000). During the decision-making process, problem definitions and solutions can change until governments make the final investment decision, through which they choose the market consortium and infrastructure solution to be realized (Klijn & Koppenjan, 2016). Whereas the four streams of problems, politics, solutions, and choice opportunities provide the conditions within which actors operate, the notion of crucial decisions helps to shed light on the interaction processes between actors that shape the outcomes of decision-making processes. This dissertation therefore recommends adding the concepts of the choice opportunities stream and crucial decisions to the multiple streams framework when that framework is used for understanding decision-making processes.

7.1.4 RQ4: What mechanisms and strategies shape forward-looking decisions?

The mechanisms that explain how forward-looking decisions are produced were identified by using the process tracing method. Causal mechanisms are composed of combinations of strategies from actors in response to conditions and provide direct explanations for the outcome (Beach & Rohlfing, 2018). Mechanisms therefore explain whether or not specific criteria for a forward-looking decision are met and explain, for example, the presence of long-term visions, the disconnection of long-term objectives from investment decisions, and the adoption of flexible solutions. Chapters 2 and 5 revealed the following causal mechanisms: strategic reframing, risk avoidance, budget and rule compliance, and goal satisfaction.

In addition, Chapter 6 included an ethnographic study of the regional water authority *Zuiderzeeland* and revealed actors' strategies in response to dilemmas

that arose when actors dealt with long-term problems and solutions. Dilemmas provided choices between seemingly paradoxical courses of action. The three organizational dilemmas that actors encountered when dealing with long-term problems and solutions were: (1) whether to invest in the realization of infrastructure objects and in improving existing functionalities or to invest in reaching organizational long-term objectives; (2) whether to adopt a responsive or stable approach to address long-term issues, especially during end-of-budget and end-of-election cycles; and (3) whether to take a proactive or reactive stance towards initiatives and insights that arose from the organization's external environment. The strategies that actors used to cope with these dilemmas and their potential impact on forward-looking decisions are included in Table 7.3.

The strategies and mechanisms found can be clustered into three intra-organizational processes and two inter-organizational processes. Intra-organizational processes involve interactions between actors within organizations, whereas inter-organizational processes involve interactions between actors from different organizations. The first intra-organizational process is that of *framing the long term*. This process includes the strategies of civil servants and political executives that frame, reframe, and emphasize specific long-term problems or objectives (Mukherjee et al., 2019). The second intra-organizational process, *political selling*, encompasses the acts of civil servants that try to actively exploit and create political decision-making venues and use the election cycle to ensure enduring commitment for long-term policies and action plans (Albrechts, 2004; Boswell & Rodrigues, 2016). Political selling includes the strategies by which civil servants try to sell long-term objectives or long-term issues to politicians in the executive and legislative branches. The third intra-organizational process of *compliance* refers to compliance with existing investment budgets and with rules that prescribe the long term. Governmental actors have a tendency to follow formal rules (March, 1994), thereby stimulating forward-looking decisions when rules prescribe long-term investments, objectives, future scenarios, responsibilities, and long-term performance requirements for infrastructure. Such rules can be found, for example, in administrative agreements and investment guidelines. The tendency of civil servants to comply with existing, already approved, budgets can hinder forward-looking decisions when the approved budget does not leave room for activities that contribute to achieving long-term objectives with investments in end-of-lifetime infrastructure.

The first inter-organizational process is that of *minimizing future risks*. Minimizing risks was found to be both positive and negative for forward-looking decisions. The fear of future risks, such as system failure or disinvestment, can stimulate the use of

forward-looking justification and robust solutions that become part of decisions (Chapter 2). However, a too strong focus on risks can mean that organizations are particularly concerned with realizing reliable and, hence, robust solutions instead of with realizing organizational long-term objectives with investment decisions. This trade-off between robustness and realizing long-term objectives occurs when actors emphasize the importance of reliable robust solutions and proven technologies, thereby causing the available investment sum not – or to a limited extent – to be spent on ambitious long-term objectives (Chapter 5). The second inter-organizational process, *collaborating*, was actively used by actors to achieve desired long-term objectives or long-term solutions. To achieve such long-term aims, public sector organizations were found to participate actively in collaborations such as public–private partnerships (PPPs) and regional governmental partnerships (Chapters 2, 4, 5). They also used several collaborative strategies to deal with long-term problems, develop long-term objectives, and gain new knowledge about new solutions and future developments (Chapter 6). Collaborating did not contribute to forward-looking decisions when governments decided to realize their long-term objectives via new collaborative opportunities and not by using their investments in end-of-lifetime water infrastructure.

Contributions to understanding long-term governance

The revealed intra-organizational and inter-organizational processes contribute to (1) existing literature that proposes new frameworks and institutions to enable long-term governance, by providing mechanisms and strategies that contribute to forward-looking decisions in present-day governmental settings and (2) debates about the role of collaborations and collaborating to achieve long-term objectives and address long-term problems.

First, the answer to RQ4 provides explanations for the extent to which governments anticipate the future with their present-day decisions. Existing literature has not provided many explanations for forward-looking decisions, because many scholars instead have proposed new institutions to address future generations' needs (Boston, 2017; Tonn, 2018), decision support approaches to make decisions under deep uncertainty (Marchau et al., 2019; Rowe et al., 2017), governance frameworks to steer long-term transitions (Loorbach, 2010), and strategic planning and scenario planning tools and processes to facilitate long-term planning (Amer et al., 2013; Höglund et al., 2018). Instead of proposing changes to the decision-making context and processes of governments, this dissertation focuses on how existing governmental contexts and processes enable governments to anticipate the future. The dissertation in particular has revealed the conditions characterizing deci-

Table 7.3. Overview of mechanisms and strategies shaping forward-looking decisions

Interaction process	Mechanism found	Strategies found	Consequences for forward-lookingness of decisions
		Intra-organizational processes	
Framing the long term	Strategic reframing	· Framing specific politically attractive long-term objectives · Emphasizing realized long-term objectives · Emphasizing felt and formal responsibilities for the long term · Communicating information from long-term scenarios	Positive impact on justification
		· Using end-of-lifetime arguments about water infrastructure	Positive impact on problem definition
Political selling of the long term by civil servants	*none*	· Proposing long-term plans and strategies to the current administration	Positive impact on justification
		· Using political venues to highlight long-term developments	Positive impact on problem definition
		· Differentiating ambition levels	Positive impact on solution
Complying with existing standards that prescribe the long term	Rule compliance	· Using formal guidelines, procedures, and legislation that prescribe long-term objectives, scenarios, monitoring, and performance requirements for solutions	Positive impact on solution and justification
	Budget compliance	· Mapping planned and foreseen investments	Positive impact on solution
		· Adhering to pre-set budgets and demanding closed business cases	Negative impact on justification (long-term objectives)

Table 7.3. Continued

Interaction process	Mechanism found	Strategies found	Consequences for forward-lookingness of decisions
		Inter-organizational processes	
Minimizing future risks	Risk avoidance	· Postponing or phasing investments · Proposing no-regret measures	Positive impact on solution (flexibility)
		· Using joint visions · Using multiple scenarios (for cost–benefit analyses, risk assessments)	Positive impact on justification
		· Emphasizing and communicating strict availability and reliability requirements for infrastructure solutions to avoid failure	Negative impact on justification (long-term objectives), positive impact on solution (robustness)
Collaborating for long-term aims	Goal satisfaction	· Realizing long-term objectives by co-investing in new collaborative solutions instead of in existing water infrastructure	Negative impact on justification (long-term objectives)
		· Seeking collaboration to align strategies, realize long-term objectives, and develop joint long-term visions · Setting criteria for participation in external initiatives	Positive impact on justification
		· Collaborating to co-invest in the development of new technologies and knowledge	Positive impact on solution
		· Leaving the primary responsibility for the long term with other organizations	Negative impact on decision

sion-making contexts that enable governments to make forward-looking decisions (Table 7.2). Furthermore, the dissertation has revealed the mechanisms and actor strategies that emerge from existing governmental settings that explain how and why governments address long-term problems and make forward-looking decisions. This dissertation has found that these mechanisms and strategies were part of many practices of public sector organizations in which actors deal with long-term problems and decide on long-term solutions. These practices are not restricted to strategy, scenario, or vision development but encompass, amongst other things, investment planning, collaborative partnerships for co-investments, budgeting, and political decision making.

Second, the answer to RQ4 contributes to ideas about the role of single actors versus collaborations in literature about long-term governance. This dissertation finds that forward-looking decisions are not necessarily caused by specific change agents (Grandia, 2015; Turker & Altuntas Vural, 2017) or policy entrepreneurs (Meijerink & Stiller, 2013; Mintrom & Luetjens, 2017). Instead, it shows how multiple governmental organizations collaborated and strategically framed objectives to facilitate joint investments in infrastructure (Chapter 2), and how civil servants tried to influence political executives to address long-term problems (Chapter 6). Studies in adaptive governance and transition management advocate collaboration for learning, experimentation and developing strategies (Berkes, 2017; Foxon et al., 2009; Rijke et al., 2013; Van de Meene et al., 2011). The strategies in Table 7.3 underline that collaborating is important for sharing information (e.g. outputs from pilots), resources (e.g. investments in new technologies), activities (e.g. joint development of visions and strategies), capabilities (e.g. scenario building capability), and for realizing public infrastructure (e.g. a sea lock). Collaborations also have the capacity to form institutional rules and norms that structure the behaviour of actors and stimulate actors to address long-term problems (Koontz et al., 2015). A specific example is administrative agreements prescribing long-term objectives. The causal mechanisms found in Chapter 5, however, also show that collaborations, and more specifically public-private partnerships, can be, but are not necessarily, appropriate instruments for forward-looking decisions (Pinz et al., 2018). The advantage of PPPs is especially limited when both partners focus strongly on risks and do not operate from a new public governance mode that fosters co-creation, partnership, and joint action (Conteh, 2013).

7.1.5 Answering the main research question

The multi-method research design of this dissertation enabled complementary answers to be found to the main research question, which was formulated as follows:

What makes governmental decisions about water infrastructure forward looking?

The answer to this question consists of the following parts:

- The criteria for, and measurements of, a forward-looking decision that define whether a governmental investment decision can qualify as forward looking (see section 7.1.1 and Table 7.1)
- The enabling conditions of forward-looking decisions that characterize the decision-making context (see section 7.1.3 and Table 7.2)
- The strategies and mechanisms that can be clustered into five main interaction processes that shape the extent to which governmental investment decisions about water infrastructure become forward looking (see section 7.1.4 and Table 7.3)

The next section, section 7.2, uses the outcome of a forward-looking decision, conditions, and interaction processes to propose a new theory of forward-looking decision making.

7.2 Towards a theory of forward-looking decision making

In this section, I develop a theory of forward-looking decision making. In general, decision-making theories include the elements that are important to consider in order to analyse decision-making processes; the relationships between these elements; and explanations for the outcome of decision-making processes. Theories provide a defined scope and level of analysis; an outcome to be explained; the context within which actors act; assumptions about the individual and about interactions between actors; and explanations for, or predictions about, changes in the outcome (Schlager, 2007). This section discusses each of these building blocks as part of a theory of forward-looking decision making. The aim of this theory development exercise is to synthesize the findings and to provide directions for future research in a systematic way.

7.2.1 Scope and level of analysis

The key question that this theory answers is: What makes governmental decisions about water infrastructure forward looking?

The governmental decision to invest in water infrastructure is the primary unit of analysis of the theory, and governmental organizations are the primary level of analysis. In terms of scope, the theory applies to governmental organizations that own and maintain water infrastructure in the Netherlands.

The theory can be used to (1) assess, (2) explain, and (3) improve the extent to which governments make forward-looking decisions about their water infrastructure, by respectively:

- Applying the criteria for a forward-looking decision to assess governmental decisions;
- Providing the combinations of conditions and processes that explain how investment decisions become forward looking; and
- Using the criteria for a forward-looking decision to prepare investment decisions and using the causal mechanisms to provide recommendations to improve the governance capability for making forward-looking decisions (see section 7.4).

7.2.2 Outcome: forward-looking decision

A forward-looking decision is a decision whereby governments anticipate possible future developments that could impact the long-term effectiveness of water infrastructure. The main criteria for a forward-looking decision focus on three elements of a governmental decision. These elements are the agreed-upon problem definition, the chosen solution, and the justification for the decision. The criteria are as follows:

- The problem definition is forward looking when it refers to long-term challenges and includes a long time horizon to discuss these long-term challenges.
- The chosen solution is forward looking when it is robust, flexible, or both to remain effective under a range of future circumstances. Robust solutions are solutions that can maintain their critical functions, even when stress-tested against different and extreme-case scenarios. Flexible solutions are solutions that can be adapted to changing insights and circumstances, and for which a monitoring system is in place to detect and respond to changes in a timely manner.
- The justification of the decision is forward looking when it relies on scenarios to understand possible futures and/or on visions or long-term objectives that formulate desirable futures.

Governmental decisions to invest in water infrastructure can meet none, one, two, or three of these criteria. The number of criteria that are met determines the extent to which a decision can be called forward looking. Decisions qualify as fully forward looking when they meet all three criteria. The criteria for forward-looking decisions can also be used, during the formulation of long-term investment plans and decisions, to evaluate the extent to which it is likely that desired outcomes will be reached. Furthermore, not all decisions need to be forward looking. The criteria for a forward-looking decision are meant to be applied to decisions that include solutions with a very long lifespan (such as infrastructure) and/or address long-term problems (such as the circular economy), and the extent to which a forward-looking decision is needed depends on the level of uncertainty involved. Decisions about solutions with a long lifespan are long-term investment decisions, whereas decisions to address long-term problems are not necessarily long-term investment decisions but can also be short-term decisions with an immediate impact. Short-term decisions can qualify as forward looking when the decision is explicitly targeted at addressing long-term problems. An example of a short-term and forward-looking decision is a decision whereby government designates a city park as a place for water storage during periods of heavy rainfall to anticipate climate change.

7.2.3 The decision-making context: conditions from multiple streams

The theory proposed in this dissertation adopts the streams metaphor from the garbage can model (Cohen et al., 1972) and the multiple streams framework (Kingdon, 1984, 2011) to reveal the dynamic and often ambiguous decision-making context in which actors operate (Jones et al., 2016). The streams relevant to understanding decision-making processes are the politics stream, the problems stream, the solutions stream, and the choice opportunities stream (Howlett et al., 2016). These streams provide the conditions of the decision-making context. Conditions are the relatively fixed characteristics of organizations, such as organizational analytical capacity, and the reality outside organizations that actors cannot directly influence during decision-making processes, such as opportunities to collaborate. Different combinations of conditions can create a decision context that enables governments to make forward-looking decisions. I now elaborate upon the conditions that can enable forward-looking decisions when they are part of the four streams.

The first stream is the *problems stream*. In general terms, this stream consists of the societal, environmental, and organizational problems that compete for decision makers' attention. Exogeneous focusing events and collaborative opportunities can raise the attention on long-term problems, thereby enabling forward-looking

decisions. Focusing events can enable forward-looking decisions when people in the organization connect such events to long-term problems. For example, when heavy showers or long periods of drought occur, the attention of political executives and policy advisors may be drawn towards the long-term problem of climate change. The problems stream also brings opportunities to collaborate with others (Bryson et al., 2015). Such collaborative opportunities can contribute to forward-looking decisions when they include initiatives to pool knowledge or resources to invest in the development of new knowledge, technologies, and solutions, or to create shared visions and strategic plans. Sometimes, new collaborations are formed (e.g. an investment vehicle for a windfarm); sometimes, existing collaborations raise the attention on long-term problems (e.g. a joint working group of water authorities that discusses actions to achieve a circular economy). The main actors involved in dealing with focusing events and collaborative opportunities are people with strong external connections such as policy advisors or organizational strategists. These actors will need to recognize events and opportunities to mobilize resources and partners to achieve specific long-term goals and/or address long-term problems.

The second stream is the *politics stream*. This stream includes the legislative and executive bodies of organizations, the election cycle, and political parties. For forward-looking decisions, the main actor in the politics stream is the political executive. Political executives that are equipped with long-term-oriented or collaborative leadership styles can especially contribute to forward-looking decisions. Long-term-oriented, i.e. transformative and entrepreneurial, leaders can be particularly strong in developing and communicating organizational goals, initiating strategic action, and mobilizing resources to adapt the organization to a changing environment (Ricard et al., 2017). Collaborative political leaders can establish connectivity across organizational boundaries and sectors, and can coordinate action to work on long-term issues, for example by initiating the development of joint visions. Furthermore, political executives can contribute to forward-looking decisions when they actively seek to avoid electoral risks (Jacobs, 2011). When political executives perceive a relatively high political risk of losing office at the moment that investment decisions need to be made, they are stimulated to seek more support for decisions and to choose solutions that are less likely to fail. Specific phases in the election cycle can form an opportunity for civil servants to push political executives' attention towards long-term problems, long-term solutions, and long-term objectives.

The *solutions stream* includes a 'soup' of ideas and solutions from experts (Kingdon, 2011). With regard to governmental water infrastructure, experts are the civil servants responsible for asset management, infrastructure planning, and signalling the end-of-lifetime of infrastructure, and civil servants responsible for developing and executing strategic plans to address long-term problems. Experts also include the external parties that these civil servants consult. External advisors and other private sector parties are often consulted by public sector experts to assess infrastructure lifetimes, co-develop long-term investment plans and solutions, and realize infrastructure after tender procedures. The developed solutions that become part of investment decisions are influenced by organizational size (as reflected in the number of inhabitants in the governmental administrative area) and the organizational analytical capacity of the department(s) responsible for long-term water planning. This capacity includes the human resources dedicated to policy making, the budget devoted to infrastructure investment, and the available knowledge about long-term problems.

The last stream is the *choice opportunities stream*. This stream includes the formal rules and procedures that regulate decision-making behaviour and practices (Cairney, 2011). Actors try to undertake actions that fit the rules as they understand them. Rules therefore provide a certain stability in actors' behaviour and, through that stability, rules have an impact on decision outcomes without fully determining these. Relevant rules can be shaped by the organization that needs to make the investment decision, but can also come from other organizations. Rules that can contribute to forward-looking decisions include: legislation that prescribes formal responsibilities for long-term tasks (such as water safety); agreements with long-term objectives to which public sector organizations have committed themselves (such as reducing carbon emissions); rules that dictate the opportunities for decisions (such as budget cycles and agendas of the executive branch); rules that prescribe the information that needs to guide governmental decisions (such as the use of scenarios in investment guidelines); and rules that prescribe the long-term performance norms for infrastructure (such as ratios for risk of failure or acceptable water safety risks).

7.2.4 The actors and the interaction processes that link conditions to outcomes

Actors that take part in decision-making processes can be a single individual, a group of individuals that function as a specific part of the organization, or a group of individuals that function as one organization or collaborative entity. Actors are boundedly rational in that they do not pay attention to all characteristics of the decision-making context and are unable to evaluate all possible solutions and

consequences of actions (Simon, 1955). Instead, their actions depend on how they interpret the context and with whom they interact.

Individual and organizational actors respond to the decision-making context by developing strategies. A strategy is understood as a set of actions that display a certain pattern that can remain quite stable across time (Boswell et al., 2019). By choosing or using specific strategies, actors influence the forward-lookingness of investment decisions. Strategies can become part of mechanisms. Mechanisms are the causal processes that link conditions to the outcome of a forward-looking decision and provide direct explanations for this outcome (Hedstrom & Swedberg, 1996). Mechanisms and strategies together form the interaction processes between organizations and within organizations.

These interaction processes can therefore be both intra-organizational and inter-organizational. Intra-organizational processes emerge from the interactions between actors that belong to the same governmental organization. Three intra-organizational processes can be distinguished. The first intra-organizational process is formed by political executives and civil servants who frame, reframe, and emphasize particular long-term problems and objectives. The second intra-organizational process involves civil servants who try to sell long-term problems, plans, and solutions in political venues. The third intra-organizational process involves the tendency of involved decision-making actors to comply with existing standards that prescribe long-term objectives, responsibilities, the use of future scenarios and monitoring, performance requirements, and investment budgets.

Inter-organizational processes emerge from the interactions between several organizations. These organizations can be public sector as well as private sector organizations. Two inter-organizational processes can be distinguished. The first inter-organizational process considers the minimization of future financial and political risks of investments. This minimization of future risks occurs when civil servants and politicians seek more forward-looking support for decisions and focus on realizing reliable, and hence, robust solutions. The second inter-organizational process involves actors' strategies to collaborate in order to align strategies, realize long-term objectives, develop joint visions, co-invest in new infrastructure, and develop new technologies and knowledge. Governments participate in many collaborations to achieve particular long-term aims, including, for example, regional governmental partnerships.

Decisions emerge as a result of these interaction processes between actors. The development of long-term plans, policies, and solutions requires several rounds of such interactions and therefore results in multiple *crucial decisions* (Teisman, 2000). For example, investing in new water infrastructure involves rounds in which different public sector organizations interact to agree upon the problem and/or solutions, as well as rounds in which public sector organizations interact with private sector parties to explore specific solutions. Whether a decision was crucial for the decision-making process can only be recognized in retrospect, based on changes in the composition of actors, the course of interactions, and/or the problems and solutions that are part of these interactions (Klijn & Koppenjan, 2016). Each crucial decision can be evaluated on the basis of the criteria for a forward-looking decision in order to determine the extent to which the decision is forward looking.

Figure 7.1 provides an overview of the conditions and interaction processes that contribute to forward-looking decisions. I elaborate upon the relationships between combinations of conditions, interaction processes, and forward-looking decisions in the next section.

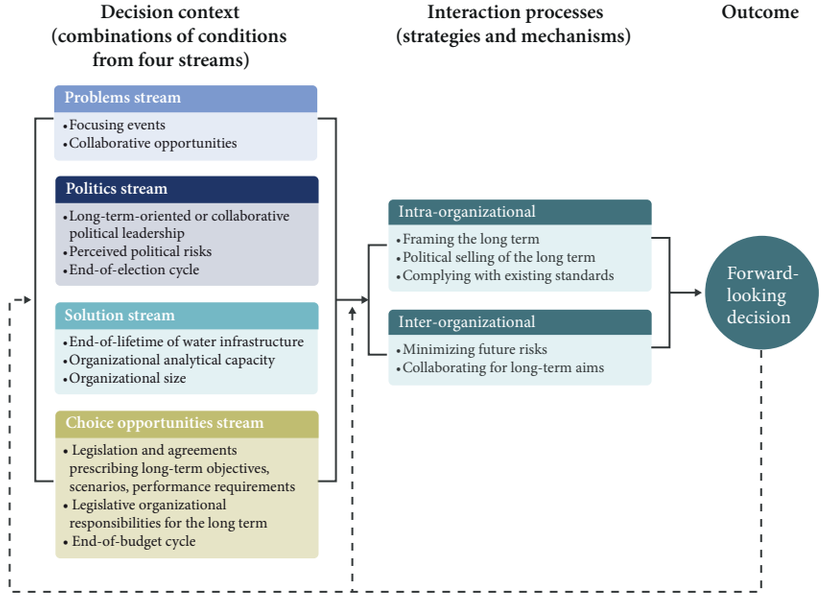

Figure 7.1 Overview of conditions and processes behind forward-looking decisions

7.2.5 Explanations for forward-looking decisions

This section introduces the causal explanations behind forward-looking decisions, as supported by the evidence from this dissertation. Each explanation consists of a combination of conditions from the four streams, an interaction process, and the specific impact of this process on the forward-lookingness of decisions (positive or negative). There are eight of these explanations, indicated by numbers 1–8 in Figure 7.2.

Written in full, the eight explanations for forward-looking decisions, as depicted in Figure 7.2, are as follows:

(1) *Framing the long term leads to forward-looking decisions* when a collaborative opportunity or focusing event is used by political executives or civil servants to frame long-term objectives, emphasize responsibilities for the long term, or frame problems such as end-of-lifetime infrastructure as long-term problems, especially during end-of-budget and end-of-election cycles.
(2) *Political selling leads to forward-looking decisions* when civil servants emphasize long-term problems, long-term solutions, and long-term objectives in political decision-making venues, during end-of-budget and end-of-election cycles.
(3) *Compliance with existing standards leads to forward-looking decisions* when civil servants signal or map investments in end-of-lifetime infrastructure and apply rules that prescribe long-term responsibilities, performance requirements for water management solutions, scenarios, and/or long-term objectives.
(4) *Compliance with existing standards leads to decisions that are less forward looking* when civil servants comply with already approved budgets for planned investments in end-of-lifetime infrastructure, despite the potential contribution of the infrastructure to long-term objectives that requires a change of scope and potentially budget.
(5) *Minimizing future risks leads to forward-looking decisions* when civil servants propose postponing or phasing investments in end-of-lifetime infrastructure to minimize political risks; or when political executives perceive high political risks and demand more support for decisions (for example by requesting the development of joint visions and use of multiple future scenarios), and/or more robust solutions with a low chance of failure.
(6) *Minimizing future risks leads to decisions that are less forward looking* when civil servants signal the end-of-lifetime of infrastructure and emphasize the importance of highly reliable solutions over other long-term objectives (such as sustainability) as part of their collaboration with market parties.
(7) *Collaborating for long-term aims leads to forward-looking decisions* when an opportunity to collaborate is used by civil servants to develop long-term plans, new solutions, and strategies or visions in order to meet long-term objectives, responsibilities, or performance requirements for infrastructure.
(8) *Collaborating for long-term aims leads to decisions that are less forward looking* when civil servants satisfy long-term objectives via new collaborative opportunities rather than via investments in end-of-lifetime infrastructure.

These causal explanations should be further validated in future research. The next section elaborates upon the limitations of the presented theory.

7.3 Limitations and directions for future research

In this section, the limitations of the theory of forward-looking decision making are first outlined by discussing the causal relationships that should be explored in further research (section 7.3.1). The avenues for future research that go beyond the initial scope of the presented theory are then discussed (section 7.3.2).

7.3.1 Strengthening the causal explanations

Some relationships in the presented theory will need to be further explored and addressed in future research. First, not all combinations of conditions have been tested to discover whether they indeed enable forward-looking decisions. The theory of forward-looking decision making reveals seven combinations of conditions that can enable forward-looking decisions and a total of 11 conditions (see Figure 7.2). The conditions were revealed on the basis of the research methodologies of qualitative comparative analysis, process tracing, and ethnography. Qualitative comparative analysis was used to find enabling combinations of conditions using only four conditions: focusing events, political leadership style, organizational analytical capacity, and size (see Chapter 3). The other possible combinations of conditions from the streams could also be tested in future research with qualitative comparative analysis. To limit the number of conditions, an analysis at the level of the four streams is recommended. These streams can then be operationalized on the basis of the conditions that are part of the presented theory of forward-looking decision making. Another option is to increase the number of cases of investment decisions to be able to test all possible combinations of conditions in a qualitative comparative analysis or to test the correlation of separate conditions by means of a regression analysis (see Vis, 2011 who discusses the strengths of both approaches).

Second, Figure 7.2 includes two interaction processes (combinations of actor strategies and a causal mechanism) that are indicated as unknown and for which an explanation has not yet been found regarding how specific conditions contribute to

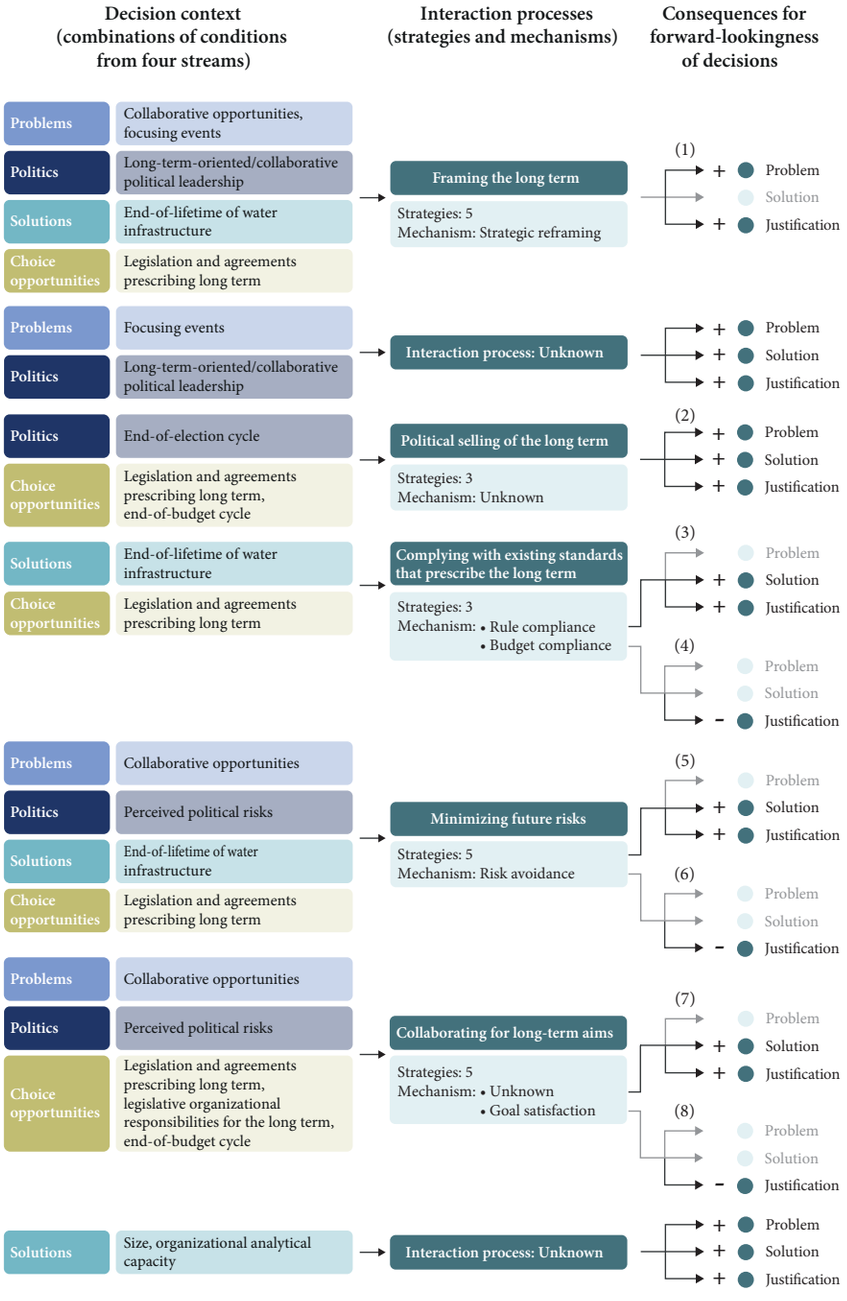

Figure 7.2. Causal explanations for forward-looking decisions about water infrastructure. Each explanation consists of a combination of conditions in the decision context, which can trigger interaction processes (in the form of mechanisms or strategies) that result in more or less forward-looking problems, solutions, and justifications as part of investment decisions. The numbered explanations (1–8) refer to the explanations for forward-looking decisions supported by the present research, the unnumbered explanations indicate interaction processes (mechanisms and/or strategies) that do not have empirical support. Where the interaction processes or mechanisms are not supported by the present research, they are indicated as unknown.

forward-looking decisions. The first interaction process to be revealed is the one that could explain how the combination of conditions of focusing events and political leadership style enables forward-looking decisions. Future research could study how focusing events impact the strategies of governmental actors, including political executives, for example by using within-case analyses of the governments that experienced extreme weather events, included in Chapter 3. Given the leadership styles that can contribute to forward-looking decisions, i.e. collaborative and long-term-oriented styles, it can be expected that the interaction processes of framing and collaborating can potentially explain how extreme weather conditions are linked to long-term problems and solutions. The second interaction process to be revealed is the process that explains how organizational size and analytical capacity enable forward-looking decisions. The relationship between organizational size and analytical capacity and forward-looking decisions confirms that the availability of sufficient resources can enhance governments' capacity to address future challenges (Koop et al., 2017; van den Brink et al., 2014). However, it is not fully clear what water management departments with a strong capacity in terms of human resources, budget, and knowledge actually *do* to prepare forward-looking decisions. Further research could explore what knowledge these departments use, explicitly (e.g. monitoring information) as well as implicitly (their heuristics), how they arrive at robust and flexible solutions, and what strategies they use towards political executives to influence decisions. It is expected that well-equipped water management departments are especially good at political selling, but it is likely that there are more interaction processes to be found.

Third, not all strategies that contribute to forward-looking decisions could be connected to a causal mechanism based on this dissertation's findings. The two missing causal mechanisms are indicated as unknown in Figure 7.2. No causal mechanism could be linked to the strategies belonging to the interaction process of political selling, because the forward-lookingness of investment decisions after end-of-budget and end-of-election cycles has not yet been analysed. Analysing and

comparing investment decisions before and after end-of-budget and end-of-election cycles can reveal relevant insights into the role of political and organizational cycles and whether more forward-looking decisions are made at certain points during these cycles. Furthermore, no causal mechanism was revealed that can explain the positive contribution of collaborative strategies and collaborations to forward-looking decisions. One explanation for the contribution of collaborations is that actors realize that long-term problems span the boundaries of governmental organizations and jurisdictions and that actors therefore decide to jointly develop visions, strategies, and investment plans (Scarlett & McKinney, 2016). Furthermore, collaborations, often in the form of PPPs, are a necessity for establishing public infrastructure (Fleta-Asín et al., 2019). This dissertation, however, underlines that PPPs do not necessarily contribute to achieving desired long-term objectives (Hueskes et al., 2017; Pinz et al., 2018; Taylor & Harman, 2016). Future research could observe different types of collaborations to discover how and which collaborative arrangements between governments and between governments and market parties contribute to forward-looking decisions.

7.3.2 Future research beyond the scope of the presented theory

There are three avenues for future research that move beyond the scope of this dissertation and the presented theory.

From object to system

This dissertation has focused on analysing governmental investment decisions about water infrastructure objects (e.g. a water pumping station) rather than systems (e.g. a combination of water pumping stations that manage water levels in a specific area). Infrastructure objects belong to a larger interconnected system that serves a particular function for society (such as managing water levels) (Roelich et al., 2015). Decisions about one infrastructural object can therefore impact the decisions about other related objects that fulfil the same function. The concept of a forward-looking decision enables a comparison of governmental decisions about different objects belonging to the same system, as well as across domains (e.g. water sanitation and water safety). Future research could use the forward-looking decision concept to compare investment decisions that belong to the same system to assess the resilience of the water management system in general (Boyd et al., 2015). Furthermore, future research comparing decisions by the same government across different domains would provide greater insight into the general capability of governments to make forward-looking decisions. This could strengthen the dissertation findings about governmental myopia and validate and complement conditions that are part of this theory of forward-looking decision making.

From decision to implementation

This dissertation has focused on analysing present-day governmental decisions and has not looked beyond the decision-making phase to the realized infrastructure and the intended contribution of new or renovated infrastructure to long-term objectives. Plans and decisions can still diverge from implementation (Cairney, 2009). It could be the case that, during implementation, solutions fail to deliver what was promised as part of the investment decision. The case of the *IJmuiden* sea lock, for example, dealt with cost overruns during realization (Flyvbjerg et al., 2004) but that did not affect the forward-lookingness of the decision as conceptualized in this research. An example in which the forward-lookingness of a decision is affected is when flexible solutions are chosen that are, however, left in place for a long period of time and are not adapted to changing circumstances (Nair & Howlett, 2017). The question that future research could address is the extent to which forward-looking decisions result in solutions that remain effective over long time periods, and whether decisions have contributed to long-term problems and objectives. This can be done by comparing implemented solutions against the intentions and chosen solutions of forward-looking decisions preceding these solutions.

From the Dutch water domain to other contexts

Finally, this dissertation has focused on the Netherlands, a country with a specific tradition and institutional context in terms of water management. To assess and explain forward-looking decisions, it makes sense to study this frontrunner country in water management. Both the water sector and the country are well-known for their long-term orientation on water management (OECD, 2014). This dissertation has shown that formal rules existing in the Dutch institutional context are part of many of the explanations behind forward-looking decisions about water infrastructure. This contradicts scholars who have argued that there is no institutionalized place for long-term issues in regular policy making (Loorbach, 2010). Institutionalized rules enable forward-looking decisions when they prescribe long-term objectives, responsibilities, and/or the use of decision support methods. Future research could study the extent to which forward-looking decisions are possible in other institutional (and hence country) contexts.

Application of the theory to other country contexts allows assessment of the portability of conditions and interaction processes and their impact on outcomes in other contexts (Falleti & Lynch, 2009). A thesis student whom I supervised has, for example, analysed forward-looking decisions about Indonesian dams, using the conceptualization of forward-looking decisions provided in this study. He concluded that the conceptualization was eminently usable; nonetheless, an

analysis based on formal decision documents could be problematic in certain developing country contexts where such documents are not easily accessible. Of the drivers and barriers that he revealed, six out of nine overlapped with the conditions and mechanisms that this dissertation reveals: political leadership, formal rules, a lack of guidelines, organizational capacity, risk avoidance, and sense of urgency (i.e. focusing events) (Assegaf, 2018). This shows that the theory of forward-looking decision making may well apply to other country contexts.

7.4 Recommendations for practice: Improving the capability for making forward-looking decisions

Focusing on the governance capability that is required for forward-looking decisions, this section addresses the aim of this dissertation, which is concerned with improving the extent to which governments make forward-looking decisions about their water infrastructure.

7.4.1 Strategic agility as the governance capability for making forward-looking decisions

Chapter 6 introduced the concept of strategic agility as a way of responding proactively to changing circumstances. Strategic agility is a dual concept that combines the ability to proactively steer towards desired change (strategy) with the ability to respond flexibly to constantly changing environments (agility) (Appelbaum et al., 2017; Lewis et al., 2014). A duality implies that public sector organizations make efforts to serve both sides. Strategy requires the presence of a desired long-term perspective, and agility implies that new insights are applied to emergent decisions. By combining a long-term perspective with emergent decisions, strategic agility fits well with forward-looking decisions and can be positioned as the capability of governmental organizations to make forward-looking decisions. The OECD (2011) even positioned it as a new governance mode and an alternative to the dominant new public management paradigm. Meanwhile, not much literature can be found that further develops, explores, and applies this concept to public sector organizations. In the sub-sections that follow, I will connect the concept of strategic agility to the main mechanisms that shape forward-looking decisions, to provide more specific recommendations to governmental decision makers and water managers.

7.4.2 Commit to a bold long-term goal to spur action to address long-term problems

The first more specific recommendation is to formulate, and commit to, a bold long-term goal to spur forward momentum and stimulate people to take proactive action towards addressing long-term problems. A bold long-term goal envisions the desired future and adopts a time horizon of 10 to 30 years. Collins et al. (1996, p. 1) describe such goals as 'Big, hairy, audacious goals', or BHAGs (pronounced as bee-hags). A BHAG is different from a mission statement or purpose because it represents the envisioned future and does not describe the core identity, or raison d'être, of the organization. Bold long-term goals combine concreteness with dreams, and, although they can be reached, they are not yet within reach and require transformative change to be so. A bold long-term goal should be a bit hairy in the sense that goals allow room for organizations to explore possible solutions that can contribute to reaching the goal (OECD, 2011). By being hairy as well as audacious, goals can stimulate both agility and strategy (see Table 7.4). Examples of bold long-term goals are: 'in 2035, wastewater treatment plants will be 100% energy self-sufficient' (see Chapter 6), and 'in 2050 our organization will be climate neutral' (see Chapter 5).

Bold long-term goals should be used only to address long-term policy problems. New bold goals can be formulated by public sector organizations themselves, but can also be derived from rules that prescribe long-term objectives such as administrative agreements (see Chapters 5 and 6). Goals derived from such agreements can help to maintain long-term political commitment. In both cases, a participatory process is advised to choose and specify goals and ensure commitment. The people leading a participatory process are most likely senior executives and policy advisors in close consultation with political executives. Collins et al. (1996) suggest that private sector organizations should adopt only one bold long-term goal at a time. It is plausible that public sector organizations can commit to more than one bold goal, but the goals should be in separate domains to allow the organizations to stay focused. The bold goals should be emphasized regularly by the organizations' leaders in to enable people to remember them. Once a bold goal is reached, a new goal should be formulated.

A bold long-term goal can contribute to forward-looking decisions because it triggers the *strategic reframing mechanism*. A bold long-term goal specifically frames long-term objectives and problems and enables water managers to connect planned investments to long-term objectives. Such goals can also stimulate long-term-oriented political leadership by allowing political executives to steer towards societally attractive goals and to create support for investment decisions.

7.4.3 Develop scenarios to establish a joint vocabulary about the future while avoiding blind spots

Future scenarios describe alternative possible futures that reflect different perspectives and can serve as a basis for action (van Notten, 2005). The development of context-specific future scenarios facilitates organizations and sectors in establishing a joint vocabulary to communicate about the long term, with terms such as uncertainty, no regret, and flexibility. Scenarios can contribute to identifying blind spots by increasing the diversity of future perspectives and possible strategies to cope with different futures (Head, 2014; Tschakert et al., 2016). This will help public sector organizations to accept instead of avoid uncertainty, remove imprudent ignorance, and prepare for changes and surprises (Janssen & Voort, 2016). To develop scenarios, facilitators with strong communication skills are needed to lead a participatory or collaborative process. Diverse members should participate in this process, including, for example, asset managers, project managers, and policy advisors. The facilitator should aim to develop scenarios that provide both diverse future perspectives and a shared understanding of the way to communicate about these future perspectives. Future scenarios could also be developed in existing regional partnerships in which governments collaborate, as long as these governments operate within a comparable context (for example, having a comparable type of soil and population density).

The development of scenarios can stimulate forward-looking decisions by triggering positive instead of negative *risk avoidance*. Positive risk avoidance can be triggered when future scenarios are used by water managers to build support for investment decisions and to choose more robust solutions. This facilitates the strategic side of strategic agility. Too strong a focus on risks, however, stimulates organizations to focus on the knowns instead of on the unknowns and encourages the use of cost-benefit analyses and risk assessments over future scenarios to capture rather than explore the future (Howlett et al., 2018). Scenarios can help to mitigate this negative impact of the risk avoidance mechanism by raising awareness of the many unknowns. This awareness increases the organization's flexibility to respond to changing circumstances, thereby facilitating agility.

7.4.4 Embed forward-lookingness in rules

The development of future scenarios and bold long-term goals is not meant to be executed as a stand-alone activity. Instead, scenarios and goals should become embedded in formal organizational rules (such as procedures and guidelines), and the same goes for other forward-looking decision elements. Rules are especially suitable for prescribing robustness checks (such as reports of climate impact scans

and scenario analyses as part of investment proposals), embedding long-term goals (for example, reporting progress as part of annual budget plans), demanding timely and regular policy revision to ensure flexibility (for example by including expiry dates in policy proposals), and providing checklists to prepare forward-looking decisions. Checklists for investment decisions can, for example, include questions such as:

- What existing and new functionalities will this infrastructure have and what future developments could possibly impact these functionalities?
- What uncertainties about functionalities are involved in assessing future scenarios?
- How effective are alternative solutions according to robustness tests?
- To what extent do alternative solutions contribute to bold long-term goals?
- What are the consequences of alternative solutions for other planned or foreseen investments?
- When are future decisions needed, and what do these decisions entail when a specific alternative is being chosen?
- How will relevant future developments be monitored and how will this information be used?

Of course, water managers should not use these checklists, or the measurements of a forward-looking decision provided in section 7.1.1, as a box-ticking exercise. These checklists are not there to prescribe that investment proposals should meet all forward-looking criteria. Instead, checklists can stimulate water managers to assess the extent to which investments need to be forward looking, as not all decisions need to be forward looking. The extent to which a forward-looking decision is needed depends on the level of uncertainty involved (see Chapter 1). Raising questions like the ones above can help decision makers to become aware of, and accept, the inherent uncertainties involved in making decisions about long-term investments.

Governments can also develop new rules that prescribe certain criteria for forward-looking decisions, for example, using specific future scenarios for investment decisions. Senior executives and their staff members will then need to thoroughly consider the process to implement new rules: what type of rule is this, who should commit to these rules, and where should the rule be embedded? Some rules will need to be integrated in investment guidelines, others in budgeting guidelines, and others in legislation. Depending on the type of rule, the new rules should be confirmed by either political or senior executives.

Rules can enable forward-looking decisions by triggering the *rule compliance mechanism*. Rules can come from higher levels of government as well as from the organization itself. They can help organizations to stimulate the strategic side of strategic agility by focusing attention on long-term problems, committing to long-term objectives, and prescribing the use of future scenarios for investment decisions. Rules can also increase agility by, for example, prescribing flexibility of solutions and revision of policies.

7.4.5 Play consciously with planned investments and investment opportunities

Water managers can strategically 'play' with their investment portfolio to realize bold long-term goals (such as goals about carbon emissions reduction, improving water quality levels) as well as to ensure that the system, as a whole, safeguards existing and future primary functionalities (such as water safety, sufficient freshwater). As a first step, to enhance the strategy side of strategic agility, water managers are advised to have a long-term investment plan that includes all foreseen investments in infrastructure. When starting the process to invest in infrastructure, water managers should ask themselves:

- What is the estimated or potential contribution of investing in existing or new functionalities of infrastructure to achieving bold long-term goals? An infrastructure that is about to reach its end-of-lifetime forms an opportunity for organizations to use investments to realize dual aims: not only to replace the infrastructure but also to contribute to specific ambitions with this investment, for example to contribute to cutting carbon dioxide emissions.
- Whether the long-term investment plan is still accurate or whether it is wise to accelerate or postpone investments. This will depend on, for example: whether new opportunities have arisen to invest in particular or new infrastructure, whether the infrastructure is still functioning, whether other planned investments will impact the functionalities of infrastructure that will soon need to be renewed or replaced, whether functionalities can and should be added to existing infrastructure to contribute to long-term goals, whether new technologies have been launched or should be awaited, and whether specific formal requirements have changed or are likely to change soon.
- What the possible connections are of a particular investment with other planned or foreseen investments. Consider, for example, the relationships between different infrastructures with the same functionality (for example, different pumping stations that together maintain water levels of a specific area), the relationships between infrastructure with different functionalities (for example, roads and urban drainage), the consequences for other investments once a specific solution is chosen, and the consequences for other investment proposals that are currently under development.

To enhance agility, at a particular point in time, water managers should be able to respond to opportunities to invest in new or existing infrastructure that differ from the existing investment plan and portfolio. First, water managers will need to appraise and analyse the opportunity in terms of its contribution to long-term goals and potential consequences for other planned investments. Based on this analysis, water managers can, for example, seek another opportunity, propose to invest in this opportunity instead of in a particular planned investment, or decide to postpone or accelerate planned investments.

Playing consciously with investments can enable forward-looking decisions by counterbalancing the *goal satisfaction mechanism*. This mechanism can stimulate organizations to choose merely satisficing solutions instead of thoroughly weighing the consequences and contributions of investing in a particular infrastructure against those of other planned or foreseen investments.

7.4.6 Appoint organizational scouts to sense changes

To enhance agility, it is recommended that organizations appoint scouts who operate at the boundaries of the organization to signal and appraise changing developments and opportunities to deal with long-term problems. After an initial appraisal, scouts should introduce these developments and opportunities to the organization. Scouts can, for example, be asked to regularly report back trends, opportunities, and signals of change to political executives and senior executives in the organization. As a follow up, senior executives can connect scouts to policy advisors or asset managers to prepare policy proposals or investment decisions. Within one organization, several scouts can be appointed for different long-term challenges, such as for local climate change adaptation and for the circular economy. No additional budget for scouts should be needed, as scout roles would become part of existing connector roles within the organization. Suitable roles of people who could be appointed as scouts include, for example, process engineers, project managers, and stakeholder managers. Besides their position, scouts should be carefully selected based on their skills. They should be able to communicate with different people in different roles within the organizations (from operator to political executive), have analytical skills to appraise developments and opportunities, and have strong external and internal connections and networking skills. Externally, scouts should participate actively in collaborative networks to be able to develop joint visions and long-term plans, share knowledge, and follow progress on the development of new technologies. Internally, they should work closely

together with asset managers, policy advisors, and political executives to develop strategies and investment proposals. Political executives can provide important information to scouts by using their position as a representative of the public and representative member of the organization in collaborative networks. These networks enable political executives to pick up signals of changing circumstances, collaborative opportunities, and agreements and visions that are under development.

Organizational scouts can contribute to forward-looking decisions by ensuring flexibility and a timely reaction to changes in the external environment. Scouts can signal changes that should be used to revise policies or investment plans, revise developed future scenarios, and signal opportunities that can contribute to achieving bold long-term goals.

Table 7.4 presents an overview of recommendations for enhancing strategic agility and making forward-looking decisions.

7.5 Closing remarks

This dissertation has focused on assessing, explaining, and improving the extent to which governments make forward-looking decisions about water infrastructure. Forward-looking decisions are especially relevant because, in many countries around the world, water infrastructure assets are reaching their end-of-lifetime due to technological ageing and changing circumstances. The long lifespan of water infrastructure requires governmental decision makers to look into the far future to anticipate possible developments and to decide on solutions that can cope with changing circumstances over a long period of time. Furthermore, governments worldwide have committed themselves to international agreements focusing on addressing long-term policy problems such as freshwater availability and climate change. Governments therefore need to think carefully about the future when they prepare to make decisions to invest in end-of-lifetime water infrastructure.

This dissertation has provided new insights about the difficulty of addressing long-term problems within present-day governmental settings and reveals conditions and strategies that help governments to decide for tomorrow, today. I hope that the findings and recommendations will provide useful assistance to governmental decision makers and water managers in dealing with long-term problems and achieving desired long-term objectives.

Table 7.4. Overview of recommendations for practice

Recommendation	Contribution to making forward-looking decisions	Contribution to enhancing strategic agility
1. Embrace strategic agility	The capability to make forward-looking decisions.	*Strategy:* steer change with a long-term perspective *Agility:* respond flexibly to change in emergent investment plans and decisions
2. Commit to a bold long-term goal (BHAG)	Strategic reframing mechanism	*Strategy:* formulate bold long-term goals *Agility:* goals are hairy, i.e. leave room to explore and find ways to realize goals
3. Develop scenarios	Risk avoidance mechanism	*Strategy:* think hard about the very long term, use scenarios to support decisions *Agility:* raise awareness of uncertainties, increase preparedness to deal with surprises
4. Embed forward-lookingness in rules	Rule compliance mechanism	*Strategy:* include long-term goals, norms, scenarios in rules *Agility:* include adaptation requirements in rules, such as policy revision and monitoring
5. Play consciously with investments	Goal satisfaction mechanism	*Strategy:* create portfolio of planned investments *Agility:* play with investments and new investment opportunities to find the best way to safeguard systems' functions and contribute to long-term goals with investments
6. Appoint organizational scouts	Timely adjustments to previous decisions, planned investments, and solutions under development	Especially *agility:* sense, appraise, and respond to changes in external environment

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Supplementary materials

Supplementary material A

Belonging to Chapter 2.

What makes long-term investment decisions forward looking: A framework applied to the case of Amsterdam's new sea lock.

Contents:

Table A1. Overview of data collection and analysis

Type of data	# relevant and unique	Collection	Analysis	Used for
Interviews	16	Interviewees were identified through decision documents and peer recommendation.	Keyword search related to forward looking, manual analysis	RQ 1+2 Identify investment decisions
Parliamentary documents 1996–2016	177 (of 360) 7 part of decision documents	Database: https://zoek.officielebekendmakingen.nl/ Search terms: zeesluis ijmuiden / zeetoegang ijmond / zeepoort ijmond Additional check with broad term 'ijmuiden' did not add any documents.	Coded paragraphs about sea lock with Atlas.ti	RQ 2 Events in streams
Provincial documents 1996–2016	107 (of 239) 1 part of decision documents	Databases: https://zoek.officielebekendmakingen.nl/ http://bit.ly/Provincedatabase Search terms: zeesluis ijmuiden / zeetoegang ijmond / zeepoort ijmond	Manual analysis of documents to fill 'black boxes'	RQ 2 Events in streams
Municipal documents 1996–2016	99 (of 395) 10 part of decision documents	Database: http://bit.ly/CouncilinfoAdam Search terms: zeesluis ijmuiden / zeetoegang ijmond / zeepoort ijmond	Manual analysis of documents to fill 'black boxes'	RQ 2 Events in streams
Decision documents	64	Databases: Municipality: http://bit.ly/CouncilinfoAdam Province: http://bit.ly/CouncilinfoProvinceNH http://bestanden.noord-holland.nl/internet/ latter only needed for budget change 2010. Search within specific meeting dates Parliament: through abovementioned search and database.	Coded forward-looking characteristics with Atlas.ti	RQ 1 Forward-looking characteristics
Additional documents	9 MIRT (4 also part of parl. doc.) 5 CPB (all part of decision doc.)	Multi-annual infrastructural plans: http://bit.ly/MIRT07-15 CPB Netherlands Bureau for Economic Policy Analysis (CPB): CPB reports https://www.cpb.nl/publications?type=	Coded lock sections and decision characteristics with Atlas.ti	RQ 2 Events in streams
Speeches 2000–2003; 2008–2014	11	Identification of importance through interviewees; collection through speech writers ministries (years 2004–2007 not in archive)	Coded paragraphs about sea sluice with Atlas.ti	RQ 2 Events in streams

Table A2. List of interviewees

Interviewee	Case involvement	Type	Interview date
1. Policy advisor Spatial Planning Municipality of Amsterdam	2012–2014	Face-to-face, written record checked by interviewee	9/5/2016
2. Project manager Planning Study Sea Access IJmond, Rijkswaterstaat	2010–2014	Face-to-face, audio record, and transcript	9/26/2016
3. Project director Sea Access IJmond, Port of Amsterdam	2013–2016	Face-to-face, audio record, and transcript	10/7/2016
4. CFO Municipality of Amsterdam	2011–2014	Face-to-face, audio record, and transcript	10/6/2016
5. Programme director North Sea Canal area, Province of North-Holland	2005–2016	Face-to-face, audio record, and transcript	10/4/2016
6. Project director Sea Access IJmond, Rijkswaterstaat	2014–2016	Face-to-face, audio record, and transcript	10/10/2016
7. Team lead waterways and Project lead Sea port / Access IJmond	2004–2014	Face-to-face, audio record, and transcript	10/14/2016
8. Project director Sea Access IJmond, Rijkswaterstaat	2009–2012	Face-to-face, audio record, and transcript	10/18/2016
9. Member of Provincial Executive, Province of North-Holland	2003–2009	Face-to-face, audio record, and transcript	10/20/2016
10. Member of Provincial Executive, Province of North-Holland	2009–2016	Face-to-face, audio record, and transcript	10/27/2016
11. Alderman, Municipality of Amsterdam	2008–2014	Face-to-face, audio record, and transcript	10/31/2016
12. Project manager, Ministry of Infrastructure and Environment	2008–2014	Face-to-face, audio record, and transcript	10/20/2016
Second round			
13. Programme director Sluices, Rijkswaterstaat	2013–2016	Phone, audio record, and transcript	11/25/2016
14. CEO Port of Amsterdam	2000–2009	Face-to-face, audio record, and transcript	1/6/2017
15. CEO Port of Amsterdam	2009–2016	Face-to-face, audio record, and transcript	1/10/2017
16. Director General Aviation and Maritime Affairs, Ministry of Infrastructure and Environment	2008–2011	Face-to-face, audio record, and transcript	1/12/2017

Table A3. Overview and numbering of decision documents

Document	Belonging to decision	Type
1. National Parliament, 2003–2004, 29 200 A, no. 24.	2002	National level
2. National Parliament, 2002–2003, 28 600 A, no. 43.	2002	National level
3. Province of North-Holland (2001) Nota PS Commissie Plannen van aanpak Prioritaire UNA-Projecten. 29 November.	2002	Provincial level
4. Province of North-Holland (2001) Plannen van Aanpak Prioritaire UNA-projecten, 28 November, Diction no. 89.	2002	Provincial level
5. Municipality of Amsterdam (2001) Variantkeuze in het kader van Trajectnota/MER voor de Grote Sluis, gelegen ten zuiden van de huidige Noordersluis. 11 December. Diction no. 000008915.	2002	Municipal level
6. Municipality of Amsterdam (2001) Raadsvergadering 14 November. Minutes no. 000008713.	2002	Municipal level
7. RWS (2001). Trajectnota/MER Zeepoort IJmond. Den Haag: Opmeer Drukkerij bv.	2002	Study report
8. CPB (2001) Analyse zeetoegang Noordzeekanaalgebied: een second opinion.	2002	Cost benefit analysis
9. National Parliament, 2005–2006, 30 300 A, no. 17.	2005	National level
10. CPB (2005) Kosten-batenanalyse Zeetoegang IJmuiden, een second opinion.	2005	Cost benefit analysis
11. SEO (2004) Kosten-batenanalyse Zeetoegang IJmuiden.	2005	Cost benefit analysis
12. National Parliament, 2006–2007, 29 862, no. 8.	2007	National level
13. National Parliament, 2006–2007, 29 644, no. 74, appendix 2.	2007	National level
14. CPB (2007). Zeetoegang IJmuiden, tussentijdse visie. Den Haag: Centraal Planbureau.	2007	Cost benefit analysis
15. Covenant Ministry of Transport and Water, Province of North-Holland, Municipality of Amsterdam (2009) "Planstudie fase Zeetoegang IJmond", 24 November	2009-10	Multi-party agreement
16. National Parliament, 2009–2010, 32 123 A, no. 80.	2009-11	National level
17. Rijkswaterstaat (2010) Letter of assignment MIRT Planning study Sea Access IJmond, 26 May.	2009-12	National level
18+19. Municipality of Amsterdam (2010) Instemmen met het convenant planstudiefase Zeetoegang IJmond en beschikbaar stellen van een bedrag voor de realisatie van de Nieuwe Zeesluis; Council decision and council diction no. 76, 2010: and appendices:	2009-13	Municipal level
20. Municipality of Amsterdam (2010) letter of alderman Ossel to the city council (2010) 'Covenant planning study Seaport IJmond', 22 January.	2009-14	Municipal level
21+22. Municipality of Amsterdam (2010) letter of Mr. Jacobs (2009) 'Discussion sea lock IJmuiden', 12 January; and response Deloitte to letter Mr. Jacobs (2010) 'discussion sea lock IJmuiden', 15 January.	2009-15	Municipal level
23. RWS and Witteveen+Bos (2008) MIRT-Verkenning Zeetoegang IJmond. Main report. Document ref.: RW1664-10/dijw/084.	2009-16	Study report
24. CPB (2008) Second opinion kKBA rapportage in de MIRT-Verkenning Zeetoegang IJmond, 28 November.	2009-17	Cost benefit analysis
25. Rijkswaterstaat North-Holland and Witteveen+Bos (2008) MIRT-Verkenning Zeetoegang IJmond. Achtergrond report kKBA. Document ref.: RW1664-10/dijw/078.	2009-18	Cost benefit analysis
26+27. Ministry of Infrastructure and Environment (2012) Letter to Province of North-Holland 'agreements between national government and province for the spatial integration of a new sea sluice in the sea access of Ijmond', 7 June. Document Feature 2012/108924; and response of Province of North-Holland (2012), letter with feature 59909.	2012	National level
28+29. Ministry of Infrastructure and Environment (2012) Letter to Municipality of Amsterdam 'preference decision Sea Access IJmond', 13 June. Document feature 2012/112984; and response of Municipality of Amsterdam (2012), letter with feature ZD2012-002959.	2012	National level
30. Council diction no. 68. Province of North-Holland (2012) 'vaststellen startnotitie Provinciaal Inpassingsplan (PIP) Zeetoegang IJmond, August 6.	2012	Provincial level
31+32. Province of North-Holland (2012) Decision list and Minutes of Provincial Council Meeting 24 September.	2012	Provincial level
33. Province of North-Holland (2012) Startnotitie PIP Zeetoegang IJmond, August.	2012	Provincial level
34+35. Municipality of Amsterdam (2012) Instemmen met het eerste 'go / no go'-besluit over de voorkeursvariant en het ingaan van fase 2 van de planstudie inzake het Project Zeetoegang IJmond, 11 and 12 July. Council diction and decision no. 533.	2012	Municipal level
36. Rijkswaterstaat (2012) Notitie Reikwijdte en Detailniveau MER Inpassingsplan Zeetoegang IJmond, document no. MD-AF20121208/MR, 5 July.	2012	Study report
37. Rijkswaterstaat (2012) Milieutoets Planstudie Nieuwe Zeesluis IJmuiden – fase 1, April, Document no. WPMIL-20111128-CME-01.	2012	Study report
38. Rijkswaterstaat (2012) Proof of concept. Planstudie Nieuwe Zeesluis IJmuiden – fase 1, 12 March, Document no. WPPoC-20111215-EBR-01.	2012	Study report
39. Rijkswaterstaat (2012) Final report. Planstudie Nieuwe Zeesluis IJmuiden – fase 1, 21 May, Document no. WPEI-20120103-MVB-01.	2012	Study report

Table A3. Continued

Document	Belonging to decision	Type
40. DHV/Province of North-Holland (2011) Optimale benutting bestaand havengebied Noordzeekanaal. December.	2012	Study report
41. Municipality of Amsterdam (2008) Slimme Haven. Port Vision 2008-2020, 19 November.	2012	Study report
42. Ministry of Infrastructure and Environment/Policy Research Corporation (2012) Roadmap Noordersluis.	2012	Cost benefit analysis
43. CPB opinion report: CPB (2012). Second opinion KBA Zeetoegang IJmond, 28 March, Den Haag: Centraal Planbureau.	2012	Cost benefit analysis
44. Rijkswaterstaat (2012) Maatschappelijke Kosten Batenanalyse Zeetoegang IJmond. Planstudie fase 1 Zeetoegang IJmond. Document no.: WPMKBA-20120216-SRI-02, 16 February.	2012	Cost benefit analysis
45. S. Newton, Y. Kawabata, R. Smith, N. in 't Veld (2012) Netherlands Port Traffic Forecasts and Capacity Planning. Zoetermeer: NEA.	2012	Cost benefit analysis
46. Netherlands Commission for Environmental Assessment (NCEA) (2012) Zeetoegang IJmond Toetsingsadvies over de Milieutoets, 20 March, Document no. 2525–138.	2012	Cost benefit analysis
47. Dynamar B.V. (2011) Toetsing Goederenstroomprognose 2020 - 2040. Noordzeekanaalgebied achter de zeesluis, April.	2012	Cost benefit analysis
48. Administrative agreement: Ministry of Infrastructure and Environment, National Government, Province of North-Holland, Municipality of Amsterdam (2014). Bestuurlijke overeenkomst zeetoegang IJmond, 11 December	2014	Multi-party agreement
49. National Parliament, 2014–2015, 34 000 A, nr. 49.	2014	National level
50. Rijkswaterstaat (2014) Letter Opdracht realisatie Zeetoegang IJmond, 4 September.	2014	National level
51. Council diction no. 69. Province of North-Holland (2014) Zeetoegang IJmond, 22 September.	2014	Provincial level
52+53. Province of North-Holland (2014) Decision list and Minutes Provincial Council 22 September 2014.	2014	Provincial level
54-61. Municipality of Amsterdam (2014). Instemmen met een definitief go-besluit tbv het rijksproject Zeetoegang IJmond, 26 November. Council diction and decision no. 302/1117. Including council motions no. 1156-1161.	2014	Municipal level
62. Rijkswaterstaat (2014) Milieueffectrapport Zeetoegang IJmond, 17 January, document no. MD-AF20140072/PO.	2014	Study report
63. Rijkswaterstaat (2014) Bijlage Provinciaal Inpassingsplan Waterkering Zeetoegang IJmond, 18 July.	2014	Study report
64. Royal Haskoning (2014) Inpassingsplan Zeetoegang IJmond planstudie Zeetoegang fase 2 - ter vaststelling. 20 August, Document no.: BB1189104115.	2014	Study report
65. National parliament 2006-2007, h.tk. 233-268 and 294-351.	n/a	Additional document referred to in chapter
66. Municipality of Amsterdam, 2001, document no. 00000110	n/a	Additional document referred to in chapter
67. National parliament, 2000–2001, 27 408, no. 2.	n/a	Additional document referred to in chapter
68. National parliament, 2011–2012, appendix no. 3243.	n/a	Additional document referred to in chapter

Table A4. Code book Atlas.ti

Case IJmuiden	
1. Actors	European Union Municipality of Amsterdam National government/Ministry National Water Authority (Rijkswaterstaat) Port of Amsterdam Province of North-Holland
Document or interview of actor	Document / interview of Municipality of Amsterdam Document / interview of national government/Ministry Document / interview of National Water Authority Document / interview of Port of Amsterdam Document / interview of Province of North-Holland
2. Multiple Streams	
Stream problems	Problem stream: Cope with climate change Problem stream: Cope with disrupting events Problem stream: Problem of multiple future challenges Problem stream: Functional end-of-lifetime challenge due to changed or already changing functional demands Problem stream: Technical end-of-lifetime and replacement task Problem stream: Technical future developments, growth of sea ships Problem stream: Economic future developments, market growth Problem stream: Spatial future developments: development of North Sea Canal area Problem stream: Focusing event Problem stream: Sustainability transitions
Stream politics	Politics stream: Focus on current national mood Politics stream: Focus on current or currently changing situation Politics stream: Focus on immediate impact or short-term need Politics stream: Focus on long-term developments and needs Politics stream: Willingness to make decisions despite incomplete information and/or uncertainties Politics stream: Focus on <10 years Politics stream: Focus on long-term vision and goals
Stream solutions	Solution stream: 0-alternative maintain existing lock Solution stream: 0+alternative capacity management Solution stream: 1-alternative lightening, deepening gutter Solution stream: Replacing lock for Middle or North lock Solution stream: Short-term measures decrease certain sea transport types Solution stream: 60m lock Solution stream: 65m lock Solution stream: 70m lock Solution stream: Large new lock Solution stream: Climate change is part of solution
Stream choice opportunities (C.O.)	C.O. stream: Assessment framework Nat Government for large investments in sea ports C.O. stream: Long-term orientation in Multi-Annual Infrastructure Plan or yearly budget round C.O. stream: Mildly positive support for decision based on expert opinion, cost benefit analysis C.O. stream: Negative support for decision based on expert opinion, cost benefit analysis C.O. stream: Neutral support for decision based on expert opinion, cost benefit analysis C.O. stream: Positive support for decision based on expert opinion, cost benefit analysis C.O. stream: Process innovations C.O. stream: Positive cooperation between actors
Crucial decisions	Decision 2002 delay and co-financing Decision 2005 end of planning phase Decision 2007 start of exploration phase Decision 2009–2010 Proof of Concept and covenant Decision 2012 market orientation and detailed study Decision 2014–2015 administrative agreement and spatial integration
3. Forward looking (FWL)	
FWL problem definition	FWL Future developments FWL FD Climate change FWL FD Economy and market developments FWL FD Spatial-demographic trends FWL FD Technology FWL Time horizon FWL Time horizon of <10 years

Table A4. Continued

Case IJmuiden	
	FWL Time horizon of >10–<25 years FWL Time horizon of >25–<50 years FWL Time horizon of >50 years
FWL robustness of solution	FWL Robustness experiments and pilots FWL Robust solution tested with scenarios
FWL flexibility of solution	FWL Adaptive iterative decision-making process FWL Adaptive monitoring FWL Adaptive solution can be adapted
FWL justification (backcasting)	FWL Future goals FWL Vision connected to FWL Vision developed for
FWL justification (forecasting)	FWL Scenario & prognoses 1 scenario 2 scenarios 3 scenarios _>4 scenarios Extrapolation historic data
4. Short term	Short-term economic reasoning Short-term process (c.o.) focus Short-term technological reasoning Short-term time horizon 0–5 years

Supplementary material B

Belonging to Chapter 3.

What makes decisions about urban water infrastructure forward looking? A fuzzy-set qualitative comparative analysis of investment decisions in 40 Dutch municipalities.

Contents:

B1. Case selection protocol

To select 40 municipalities from the total of 388 Dutch municipalities (2017), we used three exclusion criteria and two inclusion criteria. The three exclusion criteria were financial dependence, restructured municipalities, and lack of information. Financial dependence means that we excluded municipalities that received additional payments from their province between 2013 and 2016. By excluding financially dependent municipalities, we aimed to avoid a very skewed score for our organizational analytical capacity condition. We also excluded municipalities that were restructured after 2009, because these municipalities were expected not to have a recent Municipal Sewerage and Drainage Plan (MDP). Last, to ensure that the selected municipalities would be willing and able to provide us with required information, we used an indicator of information availability. Using four existing surveys from the Dutch urban sewerage and drainage foundation *Rioned* between 2010 and 2016 (Stichting RIONED, 2010, 2013, 2015, 2016), we excluded municipalities that provided 50% or less of answers to topics in which we were interested (such as financial resources).

The two inclusion criteria used were soil type and size. We used these two criteria to allow for variation between the municipalities we would select. For soil type, we used the soil factor that Statistics Netherlands (CBS) registered in 2017 as part of the Financial Standard for a Dutch Proportional Law (*Maatstaven Financiële-verhoudingswet: Fvw*). The soil factor refers to the composition of the soil of the built areas of a municipality, which can consist of (a combination of) sand, clay, and peat. By using soil type as an inclusion criterion, we created variation in the region in which municipalities were located as well as in the usual lifetime of the underground water infrastructure. For size, we used the number of inhabitants in the municipality. For the number of inhabitants in each municipality, we used the registered number of inhabitants in *Rioned*'s benchmark sewerage and urban water management for the years 2010–2016, depending on the year in which the investment decision was made. We used the median number of inhabitants (= 25996.5) to divide municipalities between medium-to-large and small.

We categorized the municipalities in four groups: (1) medium-to-large municipalities with a non-sand soil, (2) medium-to-large municipalities with a sand soil, (3) small municipalities with a non-sand soil, and (4) small municipalities with a sand soil. We randomly selected 10 municipalities from each of these groups using the RAND formula in Microsoft Excel. We also selected four additional municipalities from each group that could be used as an alternative in case we were confronted with data collection issues. We used one municipality from this back-up list and replaced *Schinnen* with *Ooststellingwerf* because we only found an outdated MDP, valid until 2013, and an effort to evaluate this MDP in 2014, in the council registration system of Schinnen. This seemingly lack of a valid MDP can be explained because Schinnen replaced its MDP with a differently labelled Waste Water policy and execution plan in 2014 that was written with other municipalities in the region.

Table B2. Raw and calibrated data values for outcome and conditions

Municipality	Outcome				Conditions													
	Forward-looking decision				Political leadership style		Focusing event		Organizational analytical capacity								Size	
	Problem		Solutions		Justification		FWL				Financial resources		Human resources		Knowledge		CAP			
	Calibrated		Calibrated		Calibrated		Calibrated		Raw	Calibrated	Raw	Calibrated	Raw	Calibrated	Raw	Calibrated	Calibrated	Raw	Calibrated
Alblasserdam	**0**		**0**		**0**		**0**		Networking	**0.33**	1 l.i.	**0**	8976	**0.67**	1.26	**0.33**	6.5	0.33	**0.33**	19861	**0**
Amsterdam	**1**		**1**		**1**		**1**		Transactional	**0**	7 l.i., 3 h.i.	**1**	6118	**0.67**	2.05	**0.67**	8	1	**1**	825898	**1**
Appingedam	**1**		**1**		**1**		**1**		Transactional	**0**	0	**0**	3888	**0.33**	0.67	**0**	7	0.67	**0.33**	12053	**0**
Barneveld	**1**		**1**		**1**		**1**		Transactional	**0**	0	**0**	2509	**0**	1.58	**0.67**	6	0	**0.33**	53521	**0.67**
Berkelland	**0**		**1**		**1**		**0.67**		Networking	**0.33**	2 l.i. 1 h.i.	**1**	14726	**1**	1.09	**0.33**	7	0.67	**0.67**	44911	**0.67**
Beuningen	**0**		**0**		**1**		**0.33**		Transformative	**1**	4 l.i.	**0.67**	7052	**0.67**	1.06	**0.33**	7	0.67	**0.67**	25433	**0.33**
Boekel	**0**		**1**		**1**		**0.67**		Transformative	**1**	0	**0**	4391	**0.33**	1.01	**0.33**	7.5	1	**0.33**	10119	**0**
Cranendonck	**0**		**1**		**1**		**0.67**		Networking	**0.33**	2 l.i., 1 h.i.	**1**	8582	**0.67**	1.78	**0.67**	7.25	0.67	**1**	20542	**0.33**
Den Haag	**1**		**1**		**1**		**1**		Networking	**0.33**	6 l.i.	**0.67**	11390	**1**	1.24	**0.33**	7	0.67	**0.67**	514861	**1**
Den Helder	**0**		**0**		**1**		**0.33**		Networking	**0.33**	2 l.i., 1 h.i.	**1**	3641	**0.33**	0.96	**0.33**	4	0	**0**	57065	**0.67**
Dongen	**1**		**1**		**1**		**1**		Networking	**0.33**	2 l.i.	**0.33**	9346	**0.67**	1.19	**0.33**	7	0.67	**0.67**	25395	**0.33**
Eindhoven	**1**		**1**		**1**		**1**		Transformative	**1**	5 l.i., 1 h.i.	**1**	8157	**0.67**	2.21	**1**	8.5	1	**1**	223.898	**1**
Giessenlanden	**0**		**0**		**0**		**0**		Interpersonal	**0**	0	**0**	4183	**0.33**	2.59	**1**	8	1	**0.67**	14508	**0**
Gorinchem	**1**		**1**		**0**		**0.67**		Entrepreneurial	**0.67**	2 l.i., 2 h.i.	**1**	3309	**0.33**	1.27	**0.33**	6.5	0.33	**0**	35206	**0.67**
Hardinxveld-Giessendam	**0**		**1**		**0**		**0.33**		Entrepreneurial	**0.67**	0	**0**	6346	**0.67**	1.71	**0.67**	7.5	1	**1**	17654	**0**
Heemstede	**1**		**1**		**1**		**1**		Transformative	**1**	0	**0**	6680	**0.67**	1.57	**0.67**	7.5	1	**1**	26480	**0.33**
Hilversum	**1**		**1**		**1**		**1**		Networking	**0.33**	4 l.i., 2 h.i.	**1**	3854	**0.33**	0.76	**0**	7.5	1	**0.33**	87175	**0.67**
Hoogezand-Sappemeer	**1**		**1**		**1**		**1**		Networking	**0.33**	1 l.i.	**0**	821	**0**	0.37	**0**	6	0	**0**	34778	**0.67**
Koggenland	**0**		**1**		**1**		**0.67**		Entrepreneurial	**0.67**	2 l.i.	**0.33**	4215	**0.33**	1.57	**0.67**	6	0	**0.33**	22345	**0.33**
Krimpen aan den IJssel	**1**		**1**		**1**		**1**		Interpersonal	**0**	1 l.i., 2 h.i.	**1**	14692	**1**	0.48	**0**	8	1	**0.67**	28692	**0.33**
Laarbeek	**0**		**1**		**1**		**0.67**		Transactional	**0**	2 l.i.	**0.33**	2416	**0**	0.75	**0**	6	0	**0**	21608	**0.33**
Lingewaal	**1**		**0**		**0**		**0.33**		Networking	**0.33**	1 h.i.	**0.67**	1764	**0**	2.78	**1**	7	0.67	**0.67**	10895	**0**
Medemblik	**1**		**1**		**1**		**1**		Networking	**0.33**	2 l.i.	**0.33**	533	**0**	1.03	**0.33**	6	0	**0**	43604	**0.67**
Middelburg	**0**		**0**		**1**		**0.33**		Interpersonal	**0**	4 l.i.	**0.67**	9555	**0.67**	0.98	**0.33**	6.5	0.33	**0.33**	47768	**0.67**
Nieuwegein	**0**		**1**		**0**		**0.33**		Networking	**0.33**	1 l.i.	**0**	5182	**0.67**	1.64	**0.67**	6	0	**0.67**	60720	**0.67**
Noord-Beveland	**0**		**1**		**0**		**0.33**		Networking	**0.33**	2 l.i.	**0.33**	5825	**0.67**	1.06	**0.33**	6	0	**0.33**	7416	**0**
Ooststelling-werf	**1**		**0**		**0**		**0.33**		Transformative	**1**	0	**0**	1667	**0**	1.35	**0.33**	7	0.67	**0.33**	25652	**0.33**
Oudewater	**0**		**0**		**1**		**0.33**		Transformative	**1**	0	**0**	583	**0**	2.54	**1**	6.5	0.33	**0.33**	9850	**0**
Overbetuwe	**0**		**1**		**1**		**0.67**		Networking	**0.33**	6 l.i., 1 h.i.	**1**	2743	**0**	1.71	**0.67**	7	0.67	**0.67**	46269	**0.67**
Rhenen	**0**		**1**		**1**		**0.67**		Interpersonal	**0**	4 l.i., 1 h.i.	**1**	19552	**1**	2.02	**0.67**	6.5	0.33	**0.67**	19253	**0**

Table B2. Continued

Municipality	Outcome				Conditions											
	Forward-looking decision				Political leadership style		Focusing event		Organizational analytical capacity						Size	
	Problem	Solutions	Justification	FWL					Financial resources		Human resources		Knowledge	CAP		
	Calibrated	Calibrated	Calibrated	Calibrated	Raw	Calibrated	Raw	Calibrated	Raw	Calibrated	Raw	Calibrated	Raw	Calibrated	Calibrated	Raw	Calibrated
Roerdalen	**1**	**1**	**1**	**1**	Entrepreneurial	**0.67**	1 l.i.	**0**	2025	**0**	0.96	**0.33**	7.5	1	**0.33**	20699	**0.33**
Rotterdam	**1**	**1**	**1**	**1**	Networking	**0.33**	7 l.i., 2 h.i.	**1**	13600	**1**	1.71	**0.67**	9	1	**1**	623652	**1**
Sliedrecht	**0**	**1**	**0**	**0.33**	Networking	**0.33**	1 l.i.	**0**	3535	**0.33**	0.67	**0**	7	0.67	**0.33**	24232	**0.33**
Tiel	**0**	**1**	**1**	**0.67**	Transactional	**0**	1 l.i.	**0**	15860	**1**	2.61	**1**	4	0	**0.67**	41527	**0.67**
Uithoorn	**1**	**1**	**1**	**1**	Interpersonal	**0**	0	**0**	8320	**0.67**	1.5	**0.33**	6.5	0.33	**0.33**	28307	**0.33**
Vlaardingen	**1**	**1**	**1**	**1**	Networking	**0.33**	2 l.i.	**0.33**	3290	**0.33**	0.36	**0**	7.5	1	**0.33**	71042	**0.67**
Voorst	**0**	**1**	**1**	**0.67**	Interpersonal	**0**	3 l.i.	**0.67**	4376	**0.33**	1.09	**0.33**	7	0.67	**0.33**	23908	**0.33**
Wageningen	**0**	**1**	**1**	**0.67**	Entrepreneurial	**0.67**	0	**0**	3421	**0.33**	1.61	**0.67**	7.5	1	**0.67**	37049	**0.67**
Woudrichem	**0**	**1**	**0**	**0.33**	Entrepreneurial	**0.67**	0	**0**	10080	**1**	2.64	**1**	6	0	**0.67**	14442	**0**
Zundert	**0**	**1**	**0**	**0.33**	Networking	**0.33**	1 l.i.	**0**	6487	**0.67**	1.62	**0.67**	6	0	**0.67**	21363	**0.33**

Table B3. Calibrated data matrix

Municipality	Outcome	Conditions			
	Forward-looking decision	Focusing event	Political leadership style	Organizational analytical capacity	Size
Alblasserdam	0	0	0.33	0.33	0
Amsterdam	1	1	0	1	1
Appingedam	1	0	0	0.33	0
Barneveld	1	0	0	0.33	0.67
Berkelland	0.67	1	0.33	0.67	0.67
Beuningen	0.33	0.67	1	0.67	0.33
Boekel	0.67	0	1	0.33	0
Cranendonck	0.67	1	0.33	1	0.33
Den Haag	1	0.67	0.33	0.67	1
Den Helder	0.33	1	0.33	0	0.67
Dongen	1	0.33	0.33	0.67	0.33
Eindhoven	1	1	1	1	1
Giessenlanden	0	0	0	0.67	0
Gorinchem	0.67	1	0.67	0	0.67
Hardinxveld-Giessendam	0.33	0	0.67	1	0
Heemstede	1	0	1	1	0.33
Hilversum	1	1	0.33	0.33	0.67
Hoogezand-Sappemeer	1	0	0.33	0	0.67
Koggenland	0.67	0.33	0.67	0.33	0.33
Krimpen aan den Ijssel	1	1	0	0.67	0.33
Laarbeek	0.67	0.33	0	0	0.33
Lingewaal	0.33	0.67	0.33	0.67	0
Medemblik	1	0.33	0.33	0	0.67
Middelburg	0.33	0.67	0	0.33	0.67
Nieuwegein	0.33	0	0.33	0.67	0.67
Noord-Beveland	0.33	0.33	0.33	0.33	0
Ooststellingwerf	0.33	0	1	0.33	0.33
Oudewater	0.33	0	1	0.33	0
Overbetuwe	0.67	1	0.33	0.67	0.67
Rhenen	0.67	1	0	0.67	0
Roerdalen	1	0	0.67	0.33	0.33
Rotterdam	1	1	0.33	1	1
Sliedrecht	0.33	0	0.33	0.33	0.33
Tiel	0.67	0	0	0.67	0.67

Table B3. Calibrated data matrix

Municipality	Outcome	Conditions			
	Forward-looking decision	Focusing event	Political leadership style	Organizational analytical capacity	Size
Uithoorn	1	0	0	0.33	0.33
Vlaardingen	1	0.33	0.33	0.33	0.67
Voorst	0.67	0.67	0	0.33	0.33
Wageningen	0.67	0	0.67	0.67	0.67
Woudrichem	0.33	0	0.67	0.67	0
Zundert	0.33	0	0.33	0.67	0.33

B4. Solution terms

The conservative solution is:
CAP*SIZE + lead*eve*SIZE + lead*EVE*size + LEAD*EVE*SIZE => FWL
(consistency: 0.946; coverage: 0.671)

The intermediate solution is:
M1: eve*SIZE + LEAD*SIZE + lead*EVE*size + (CAP*SIZE) => FWL
(consistency: 0.946; coverage: 0.671)
M2: eve*SIZE + LEAD*SIZE + lead*EVE*size + (lead*EVE*CAP) => FWL
(consistency: 0.945; coverage: 0.658)

The parsimonious solution is:
M1: eve*SIZE + (CAP*SIZE + LEAD*SIZE + lead*EVE*size) => FWL
(consistency: 0.946; coverage: 0.671)
M2: eve*SIZE + (CAP*SIZE + LEAD*EVE*cap + lead*EVE*size) => FWL
(consistency: 0.946; coverage: 0.671)
M3: eve*SIZE + (LEAD*SIZE + EVE*cap*size + lead*EVE*CAP) => FWL
(consistency: 0.962; coverage: 0.658)
M4: eve*SIZE + (LEAD*SIZE + lead*EVE*CAP + lead*EVE*size) => FWL(consistency: 0.945; coverage: 0.658)

Notes: the absence of conditions is indicated with lowercase letters and the presence is indicated with capital letters. EVE/eve refers to focusing event. LEAD/lead refers to political leadership style. CAP/cap refers to organizational analytical capacity. FWL refers to the outcome of a forward-looking investment decision. M1 to M4 indicates model ambiguity: multiple models, all logically true, display the different configurations of conditions that produce the outcome.

The *conservative solution* does not use logical remainders. A logical remainder is a truth table row without empirical evidence that may be assigned a score for the outcome still, so that it can be included in the truth table minimization. The *parsimonious solution*, on the other hand, uses all logical remainders 'without any evaluation of their plausibility' (Ragin, 2009, p. 111). For the *intermediate solution*, only logical remainders are included that 'make sense given the researcher's substantive and theoretical knowledge' (ibid.). This means that it only includes so-called 'easy counterfactuals' in the truth table minimization (see further Schneider & Wagemann, 2012).

Supplementary material C

Belonging to Chapter 5.

The governance challenge of implementing long-term sustainability objectives with present-day investment decisions.

Contents:

Table C1. Overview of documents

Document / meeting date	Document reference (if available)
	Budget files
16 Oct. 2000	Budget 2001 / Multi-annual budget 2002–2005
15 Nov. 2001	Budget 2002 / Multi-annual budget 2003–2006
6 Nov. 2002	Budget 2003 / Multi-annual budget 2004–2007
25 Nov. 2003	Budget 2004 / Multi-annual budget 2005–2008
23 Nov. 2004	Budget 2005 / Multi-annual budget 2006–2009
22 Nov. 2005	Budget 2006 / Multi-annual budget 2007–2010
27 Nov. 2006	Budget 2007 / Multi-annual budget 2008–2011
26 Nov. 2007	Budget 2008 / Multi-annual budget 2009–2012
Dec. 2008	Multi-annual budget 2009–2012
26 May 2009	Investment plan 2010–2013
Dec. 2009	Multi-annual budget 2010–2013
27 May 2010	Investment plan 2011–2014
25 Nov. 2010	Multi-annual budget 2011–2014
May 2011	Rolling forecast 2012–2015
Dec. 2011	Multi-annual budget 2012–2015
8 May 2012	Rolling forecast 2013–2016
27 Nov. 2012	Multi-annual budget 2013–2016
28 May 2013	Rolling forecast 2014–2017
28 May 2013	Investment plan 2013–2022
27 Nov. 2013	Multi-annual budget 2014–2017
27 May 2014	Rolling forecast 2015–2018; appendix investment plan 2013–2023
Dec. 2014	Multi-annual budget 2015–2018
26 May 2015	Rolling forecast 2016–2019; appendix investment plan 2014–2024
26 May 2015	Rolling forecast 2016–2019
Jan. 2016	Multi-annual budget 2016–2019
31 May 2016	Rolling forecast 2017–2020; appendix investment plan 2017–2020
Feb. 2017	Multi-annual budget 2017–2020
May 2017	Rolling forecast 2018–2021; appendix investment plan 2018–2021
28 Nov. 2017	Multi-annual budget 2018–2021
May 2018	Rolling forecast 2019–2022
27 Nov. 2018	Multi-annual budget 2019–2022
	Related strategies and decisions
25 Mar. 2010	Water pumping plan 2011–2020
8 Aug. 2012	LCC calculation document 2012 (also mentioned in budget 2012)
12 Apr. 2010	National climate agreement 2010–2020, Association of Regional Water Authorities and Dutch national government

Table C1. Continued

Document / meeting date	Document reference (if available)
28 May 2013	Energy strategy: General Assembly (GA) proposal + minutes Energy Strategy; internal ref. no. 168175
29 Sept. 2015 / 27 Sept. 2016	Masterplan sustainable energy: Masterplan Sept. 2016 + GA proposals and minutes about masterplan in Sept. 2015 /May 2016/Sept.2016. Internal ref. no. 446447, 470071, 477590
22 Nov. 2016	Business cases Energy and Pumping Stations: GA proposal + minutes, business cases; internal ref. no. 484563
24 Nov. 2015	Project Energy and Pumping Stations: GA proposal energy and pumping stations; internal ref. no. 452382
Oct. 2015	Water management plan 2016–2021
Jun. 2015	GA programme 2015-2019 "sustainably connected, known, and trusted"
27 Mar. 2018	Windfarm: GA proposal + minutes, windfarm Hanze, internal ref. no. 529352; 532475
4 Apr. 2017	GA audit committee report – investment projects, internal ref. no. 015156-019/lro/hpo/ppa
24 Apr. 2018	GA proposal + report audit committee investment projects; internal ref. no. 529589
	Decision making files PS-V
28 Nov. 2013	Combined heat and power generation PS-V: Executive Assembly (EA) proposal + attachments; internal ref. no. 180310
6 Dec. 2016 / 2 Feb. 2017	Preparatory budget PS-V: EA proposal + minutes 6 Dec. 2016; GA proposal 2 Feb. 2017. DenH 6-12-2016; internal ref. no. 488204, 490455, 488203
25 Apr. 2017	Collaborative agreement fish migration: GA proposal + agreement, internal ref. no. 498812
5 / 12 Sept. 2017	Information tender process PS-V, EA + GA presentation and GA minutes, internal ref. no. 513993
8 / 29 May 2018	Investment budget PS-V: EA Proposal 8 May 2018; GA proposal 29 May 2018; internal ref. no. 533262, 535171, 533263
8 May 2018	Q&A developed by PS-V project team for EA member for GA and EA meetings about PS-V budget May 2018
28 Aug. / 25 Sept. 2018	Information letter to GA about tender process PS-V + minutes EA, internal ref. no. 536392
11 Oct. 2018	Collaborative agreement thermal energy; information to EA, internal ref. no. 548568
12 Feb. 2019	Presentation to EA about selected market consortium + minute, internal ref. no. 562432
26 Feb. 2019	Tender award decision EA, EA proposal + minutes + decisions + Q&A EA member + information letter to GA about tender award, internal ref. no. 559384, 555003, 563318

Table C1. Continued

Document / meeting date	Document reference (if available)
	Procurement files and files of procurement procedure PS-V
26 Jul. 2017	Purchasing plan for PS-V
20 Sept. 2017	Market consultation day: presentation, minutes, project plan, tender criteria
Oct. 2017	Minutes of conversations market parties – market consultation phase
Oct. 2017	Questions and answers market consultation – consulted market parties
1 Nov. 2017	Advice to department manager about PS-V tender after market consultation
14 Feb. 2018	Tender document shortlisting phase
6 Jun. 2018	Tender document dialogue and selection phase
6 Jun. 2018 / 23 Nov. 2018	Tender agreement before dialogue phase and final version
21 Mar. 2019	Tender agreement with selected market party
6 Jun. 2018	Contract specifications of tender requirements + 15 annexes
1–4 Jul. 2018	Agenda + minutes market dialogue conversations – dialogue round 1
23 Nov. 2018	Q&A tender information notice during CD procedure, with questions from market parties and answers from RWA-Z.
1 / 3 Oct. 2018	Agenda + minutes market dialogue conversations – dialogue round 2 + draft market solutions
31 Oct. / 5–6 Nov. 2018	Agenda + minutes market dialogue conversations – dialogue round 3
20 Nov. 2018	Minutes of market dialogue conversations – dialogue round 4
Dec. 2018	Selection: submitted tender offer of market parties: quality documents + technical solution of two market parties
6 Jun. 2018	Selection: selection protocol
15 Jan. 2019	Selection day: assessment notes + filled in forms of assessment team
	Presentations of PS-V project team
11 May 2016	Presentation of director about PS-V history and ambitions at external symposium
19 May 2016	Project start up "innovative approach for renovation and sustainability" PS-V
Dec. 2016	Presentation to EA, incl. speakers' notes
5 Jan. 2018	Presentation contract manager – choice of CD procedure
31 Jan. 2018	Presentation to EA member
20 Mar. 2018	Presentation to EA member
6 Jun. 2018	Presentation to director and department head, shortlisting phase
11 Jun. 2018	Kick off presentation dialogue phase
28 Jun. 2018	Presentation to EA member + minutes
26 Aug. 2018	Presentation to director and department head, dialogue round 1
26 Aug. 2018	Presentation to steering group

Table C1. Continued

Document / meeting date	Document reference (if available)
30 Aug. 2018	Presentation EA member – thermal energy
20 Sept. 2018	Presentation EA member + minutes, dialogue round 1
17 Dec. 2018	Kick off presentation selection phase
22 Jan. 2019	Presentation to director and department head, end of selection phase
31 Jan. 2019	Presentation to executive board, end of selection phase, and selected market party

Table C2. Observations

When	Description	Length
20 Sept. 2017	Market consultation day PS-V	4 hours
26 Sept. 2018	Preparations dialogue team round 2	7.5 hours
1 Oct. 2018	Dialogue round 2, market party 1 – breakout and evaluation project team	1 hour
3 Oct. 2018	Dialogue round 2, market parties 2 and 3 – breakout and evaluation project team, recording of dialogue market party 3	7 hours
24 Oct. 2018	Preparations dialogue team round 3	3 hours
5 Nov. 2018	Dialogue round 3, market party 1 – breakout and evaluation project team	4 hours
6 Nov. 2018	Dialogue round 3, market party 2 – breakout and evaluation project team	4 hours
4 Dec. 2018	Preparation kick off selection phase, project team PS-V	1 hour
15 Jan. 2019	Selection day by selection team	7 hours
22 Jan. 2019	Presentation to department head/director by project team/ procurement advisor about selected market consortium	2 hours
31 Jan. 2019	Preparation assembly proposal department head/director/ stakeholder and financial manager	0.5 hour
31 Jan. 2019	Presentation to executive board about selected market consortium	0.5 hour
12 Feb. 2019	Presentation to EA about selected market consortium	1.5 hour
26 Feb. 2019	EA meeting incl. tender award decision PS-V	1.5 hour
17 Apr. 2019	Evaluation with market parties	4 hours
18 Sept. 2019	Member check meeting with project team PS-V	1.5 hour

Table C3. List of interviewees

When	Interviewee	Role	What	Length
30 Aug. 2018	Interviewee / respondent B and F	Director + procurement advisor	Introductory interview	60 min
5 Sept. 2018	Interviewee / respondent A	Project manager	Introductory interview	60 min
13 Sept. 2018	Interviewee / respondent E	Stakeholder manager	Introductory interview	45 min
19. Sept. 2018	Interviewee / respondent B	Director	Conversational interview	15 min
19. Sept. 2018	Interviewee / respondent F	Procurement advisor	Conversational interview tender process	45 min
22 Oct. 2018	Interviewee / respondent G	Market party tender manager	Interview dialogue round 2	60 min
22 Nov. 2018	Interviewee / respondent F	Procurement advisor	Interview next steps dialogue phase	45 min
22 Nov. 2018	Interviewee / respondent G	Market party tender manager	Interview dialogue round 3	40 min
13 Dec. 2018	Interviewee / respondent F	Procurement advisor	Interview withdrawal market party	30 min
13 Dec. 2018	Interviewee / respondent H	External consultant investment planning	Interview long-term investment planning	30 min
13 Dec. 2018	Interviewee / respondent I	Technical manager	Interview entire PS-V process	1h15min
16 Jan. 2019	Interviewee / respondent C	Financial advisor	Interview selection procedure	15 min (phone)
7 Jan. 2019	Interviewee / respondent C	Financial advisor	Interview entire PS-V process	60 min
22 Jan. 2019	Interviewee / respondent F	Procurement advisor	Interview assembly decision process	15 min
4 Feb. 2019	Interviewee / respondent J	Department manager	Interview evaluation PS-V process	10 min
4 March 2019	Interviewee / respondent F	Procurement advisor	Interview evaluation process	15 min
5 Mar. 2019	Interviewee / respondent K	EA member	Interview entire PS-V process	45 min (phone)
18 Apr. 2019	Interviewee / respondent E	Stakeholder manager	Interview reflection on tender process	30 min
18 Apr. 2019	Interviewee / respondent B	Director	Interview evaluation PS-V process	30 min

Supplementary material D

Belonging to Chapter 6.

Governing long-term policy problems: Dilemmas and strategies at a Dutch water authority.

Contents:

Table D1. Overview of data sources

Reference in text	Date (dd/mm/yyyy)	With or what	Length (mins)	Quotations
Introduction interviews (used to discuss field study and possibilities for observing and getting to know the person)				
20180830 - PA Ex. Dir.	30/8/2018	PA Executive director	60	0
20180830 - Ex. Dir.	30/8/2018	Executive director	90	3
20180919 - Corp. strat.	19/9/2018	Corporate strategist	40	3
20181004 - Ops mgr.	4/10/2018	Operations manager	10	0
20181101 - Pol. ad.	1/11/2018	Senior policy advisor	10	0
20181109 - Chairp.	9/11/2018	Chairperson	65	2
Conversational interviews (unplanned but content rich and minimum 30 minutes in length)				
20180919 - Pol. ad. other	19/9/2019	Policy advisor for infrastructural assets		3
20181113 - Ex. Dir.	13/11/2018	Executive director	30	4
20181119 - Pol. ad.	19/11/2018	Senior policy advisor	60	4
Informational interviews (interviews scheduled to ask specific questions about a specific topic)				
20181016 - Team mgr.	16/10/2018	Team manager wastewater treatment	60	5
20181213 - Ext. cons.	13/12/2018	External consultant long-term investment plan	30	3
20190107 - Proc. eng.	7/1/2019	Process engineer	30	2
Member checks (used to discuss and reflect on results of field study)				
20190226 - Ex. Dir.	26/2/2019	Executive director	90	5
20190228 - Corp. strat.	28/2/2019	Corporate strategist	90	3
20190304 - Chairp.	4/3/2019	Chairperson	90	4
20190304 - Ops mgr.	4/3/2019	Operations manager	90	3
20190304 - Proc. eng.	4/3/2019	Process engineer	90	7

Table D1. Continued

Reference in text	Date (dd/mm/yyyy)	With or what	Length (mins)	Quotations
20190304 - Pol. ad.	4/3/2019	Senior policy advisor wastewater chain	90	11
20190307 - Ass. adv.	7/3/2019	Advisor to assembly	90	3
Observations				
20180905-1	5/9/2018	Directors-business operations Budget 2019	45	3
20180905-2	5/9/2018	Bila executive director/executive assembly member	50	4
20180905-3	5/9/2018	National inspection visit regarding water safety	45	1
20180906-1	6/9/2018	Executive assembly members–civil servants meeting water quantity and agriculture	120	6
20180913-1	13/9/2018	Strategy meeting	30	1
20180913-2	13/9/2018	Management meeting	30	2
20180913-3	13/9/2018	Project meeting sludge and waste water treatment	60	3
20180914-1	14/9/2018	General director - Project and programme management	30	1
20180914-2	14/9/2018	Management meeting business operations	75	0
20180914-3	14/9/2018	Forecast and budget	75	2
20180919-3	19/9/2018	Steering group Vision trajectory 2045	60	1
20180920-1	20/9/2018	Executive assembly members–civil servants meeting business operations	90	1
20180920-2	20/9/2018	Executive assembly members–civil servants meeting water quality	90	4
20180927-1	27/9/2018	Working group wastewater of Association for Regional Water Authorities	150	9
20181004-1	4/10/2018	Project meeting waste water treatment, collaboration with municipality	60	8
20181010-1	10/10/2018	Frontrunners group cellulose–water sector partnership on recovery of resources from wastewater	120	5

Table D1. Continued

Reference in text	Date (dd/mm/yyyy)	With or what	Length (mins)	Quotations
20181016-1	16/10/2018	Training scenario thinking	180	1
20181016-2	16/10/2018	Bila programme manager water safety–executive assembly member	60	2
20181016-3	16/10/2018	Executive assembly members–civil servants meeting water safety	60	1
20181017-1	17/10/2018	Wastewater chain strategy *ZZL*	180	11
20181023-1	23/10/2018	Project meeting waste water treatment, preparation executive assembly information	60	5
20181023-2	23/10/2018	Department meeting wastewater treatment and pumping station projects	120	0
20181029-1	29/10/2018	Programme lead team meeting	120	1
20181029-2	29/10/2018	Project meeting sustainability	90	5
20181031-1	31/10/2018	Meeting of virtual shared services partnership of five regional water boards	240	3
20181101-1	1/11/2018	National conference Dutch Delta programme	390	2
20181108-1	8/11/2018	Project meeting sustainability	180	3
20181108-2	8/11/2018	Executive assembly members–civil servants meeting water quality	60	2
20181113-1	13/11/2018	Project meeting sustainability	120	6
20181114-1	14/11/2018	Chairperson–staff, organization of new year party *ZZL* for regional political council and board members	30	0
20181114-2	14/11/2018	Chairperson with executive director and corporate strategist about Vision 2045	90	9
20181114-3	14/11/2018	Bila chairperson and senior policy advisor about freshwater and Delta programme	45	1
20181114-4	14/11/2018	Chairperson–province about set up of new expert council for agriculture	60	3
20181119-1	19/11/2018	Meeting programme managers–business operations	60	6
20181119-2	19/11/2018	Project meeting sustainability	60	1

Table D1. Continued

Reference in text	Date (dd/mm/yyyy)	With or what	Length (mins)	Quotations
20181119-3	19/11/2018	Programme lead team meeting	90	1
20181120-1	20/11/2018	Bila corporate strategist–controller about long-term investments and executive assembly's programme	45	2
20181120-2	20/11/2018	Project meeting Vision 2045	60	0
20181120-3	20/11/2018	Preparatory meeting organization of evening session Vision 2045 with external moderator	120	3
20181126-1	26/11/2018	Chairperson–civil servants meeting	120	4
20181127-1	27/11/2018	Executive assembly members–civil servants meeting water quality	90	5
20181127-2	27/11/2018	General assembly meeting	198	11
20181204-2	4/12/2018	Steering group sustainability	5	6
20181204-3	4/12/2018	Strategy meeting	60	6
20181204-4	4/12/2018	Evening session Vision 2045 with assembly members	240	12
20181211-1	11/12/2018	Executive assembly themed meeting municipal spatial planning project + water vision and management programme	180	9
20181211-2	11/12/2018	Executive assembly decision-making meeting		3
20181211-3	11/12/2018	Calamity training exercise with chairperson	150	1
20190107-1	7/1/2019	New year reception *ZZL*	120	1
20190107-2	7/1/2019	Project meeting sustainability	30	1
20190107-3	7/1/2019	Chairperson–civil servants meeting	60	1
20190122-1	22/1/2019	Executive assembly decision-making meeting	15	1
20190122-2	22/1/2019	Executive assembly themed meeting wastewater chain strategy + rainwater policy	75	5
20190130-1	30/1/2019	Collaborative administrative platform IJssellake area	120	5
20190131-1	31/1/2019	Steering group water safety programme with executive director	60	3

Table D1. Continued

Reference in text	Date (dd/mm/yyyy)	With or what	Length (mins)	Quotations
20190212-1	12/2/2019	Executive assembly decision-making meeting	120	6
20190212-2	12/2/2019	Executive assembly themed meeting water pumping station renovation + water safety task outer-dyke areas	90	2
20190226-1	26/2/2019	Executive assembly decision-making meeting	90	1
20190418-1	18/4/2019	Plenary member-check session for *ZZL* assembly members and employees	90	4
20141028-doc	28/10/2014	Water management plan 2016-2021 of *ZZL* Sept. 2014; URL: https://www.zuiderzeeland.nl/over_ons/beleid-regelgeving-0/beleid-regelgeving/veilig-0/waterbeheerplan-2016/		
20150326-doc	26/3/2015	Presentation corporate strategist Vision trajectory Zuiderzeeland 2045, executive board meeting 26 March 2015		
20160906-doc	6/9/2016	General Assembly information Development of Vision Zuiderzeeland 2045, General Assembly 6 Sept. 2016, organizational reference no. 482248		
20160927-doc	27/9/2016	General Assembly proposal Masterplan Sustainable Energy, General Assembly 27 Sept. 2016, organizational reference no. 477590		
20180327-doc	27/3/2018	General Assembly proposal Decision making cooperation Windfarm Hanze, General Assembly 27 Mar. 2018, organizational reference no. 529352		
20180906-doc	6/9/2018	Letter to Dutch agricultural organization about soil subsidence; organizational reference no. 537017; fieldnote 20180906-1		
20180920-doc	20/9/2018	Executive assembly member–civil servants meeting - Informative memo collaboration Blue Battery research application wastewater treatment plants, dated 12 Sept. 2019, discussed in 20180920-2		
20181030-doc	30/10/2018	General Assembly proposal Cooperation Windfarm Hanze, General Assembly 30 Oct. 2018, organizational reference no. 548924		
20181030-doc-2	30/10/2018	General Assembly proposal Wind turbines in combination with Delta embankment, General Assembly 30 Oct. 2018, organizational reference no. 539990		

Table D1. Continued

Reference in text	Date (dd/mm/yyyy)	With or what	Length (mins)	Quotations
20181123-doc	23/11/2018	Prior information notices Water Pumping Station, 23 Nov. 2018; also discussed in interview 20180830		
20181126-doc	26/11/2019	Information transfer to new assembly members, factual information; fieldnote 20181126-1		
20181127-doc	30/11/2019	ARWA agenda for meeting of committee for wastewater chain and emissions on 30 Nov. 2019; fieldnote 20181127-1		
20190122-doc	22/1/2019	Presentation entitled Wastewater chain 2015–2019 and how to move forward? Executive Assembly themed meeting of 22 Jan. 2019; fieldnote 20190122-2).		
20190212-doc	12/2/2019	Executive Assembly proposal Sludge processing strategy 2022 and beyond. See also: General Assembly 12 Mar. 2019, organizational reference no. 560962		

Table D2. Illustrative quotations for meaning of long-term policy problems

Quotation	Source
Understood as belonging to external environment	
Policy advisor: 'Connecting with the environment is also important for the future, otherwise you will be eliminated in a couple of years' time.'	20181017-1
'Because the entire dilemma of the sludge processing strategy is eventually caused by: ok, we see [the contract] ends in 2022. We have three years left but [...] we do not expect that we will have a better case than this. That is also something like this now comes along, and we will get on that train or not. That is what you have asked the [assemblies]. The way I feel it, that also reflects that notion of today's delusions'	20190304 - Pol. ad.
Understood as future problems or (autonomous) developments	
Process engineer: 'we have always said, we need to be prepared for innovations that are currently under development. [...]' Senior policy advisor: 'medicine residues are something you need to consider in the back of your mind.' Executive director: 'you will need to take those into account [...]' Operations manager: 'you will also need to have a look at carbon monoxide, nitrous oxide. These will all play a role in the future, we need to consider them carefully.'	20181023-1)
'Soil subsidence is an autonomous development. Water nuisance caused by soil subsidence is beyond the legal duty of the regional water authority.'	20180906-doc
A *ZZL* employee: 'we then have population growth.' External consultant answers: 'that I see as an autonomous development, we have a pretty clear picture of that.'	20181017-1

Table D2. Continued

Quotation	Source
Understood as organizational objectives or ambitions	
'in 2035, wastewater treatment plants are 100% self-sufficient'	20180920-2
'contributing to a circular economy in the Netherlands in 2050 and 49% less carbon monoxide in 2030'	20181127-doc
Understood as requiring future time horizon	
Executive director: 'in 2020 it needs to happen, we should not move beyond 2024,' but he then adds: 'If you have a vision for how this particular city will develop in 20, 30 years' time, you will discover that the municipality has different stakes than we do.'	20181004-1
In the multi-annual budget, they look 'two years ahead in time', the team manager explains, but in an [investment] 'matrix' they look 'ten years ahead'. I ask when a particular need for an investment is signalled. The team manager: because of 'technical ageing', 'technical state', 'population growth in the city'	20181016 - Team mgr.
I ask him what he means by 'forecast' and the external consultant working on the long-term investment plan answers: 'a textual description of all investments that the regional water authority foresees in the period until 2040 [...] This organization mainly looks four years ahead, those are the things that are most specific, and are included in the multi-annual budget. There are also some projects with a longer [time] horizon. And things that result from [national] legislation such as the [Dutch] water safety programme.'	20181213 - Ext. cons.
A policy advisor states: 'we can try to look ahead two years in time, but that is pretty difficult. That is why we discuss [expenses] with the [financial department] each quarter.'	20181119-3

Table D3. Illustrative quotations for the three dilemmas and strategies to deal with them

Condition (C)	Strategy (S)	Consequence (Cs)	Exemplar quotation	Source	Topic
Object vs. Objective					
Long-term objectives in inter-organizational agreements	Co-invest in the development of new technologies	No investment on object level	Executive director: 'It also has consequences for this project, because we already organized our own energy supply [...] [d]ue to the fact that we in collaboration with windfarm operators can exploit three, four wind turbines (S) [...] In 2022, 23 we will be energy neutral, based on wind energy. This means that realizing an energy generating facility at [the water pumping station] is not an issue anymore (Cs). [...] With the regional water authorities and the national government we agreed to become [...] energy self-sufficient in 2035' (C).	20180830 - Ex. Dir.	Windfarm Hanze
	Emphasize realized long-term objectives		Manager business operations: 'Windfarm Hanze, once that is implemented: we have completed our efforts for the energy transition' (S).	20180913-2	Annual budget
End-of-lifetime of object(s)	No regret	Keeping options open	Process engineer: '*ZZL* needs to be ready in 2025 to receive sufficient wastewater, and to keep fulfilling the legal requirement of wastewater purification (C). [...] Sludge fermentation is no regret (S) because applying new technologies remains possible' (Cs).	20180913-3	Wastewater chain strategy
	Phase investments	Investments embedded system's choice	The process engineer 'proposes to integrate' several executive assembly proposals. He aims to 'establish one proposal with everything for the wastewater treatment plants of Almere and Dronten. A system's choice with which the assembly can decide which option they would like to explore further' (Cs). It will include the 'final decision for the energy-, nutrients-, wastewater plant.' The policy advisor asks: 'what is then the choice you are proposing to the assembly?' Process engineer: 'the first phase for [wastewater treatment plant] Almere to adjust the aeration to ascertain you will be futureproof' (S). The executive director complements: 'for a couple of years ahead.'	20181023-1	Wastewater chain strategy

Table D3. Continued

Condition (C)	Strategy (S)	Consequence (Cs)	Exemplar quotation	Source	Topic
	Map all planned/ foreseen long-term investments/activities		The sustainability coordinator proposes a 'matrix [...] what is currently being executed in the organization, who does what, what ambitions, means, people, are currently involved? And: where are the blank spots?' (S)	20181108-1	Sustainability strategy
Responsiveness vs. Stability					
	Differentiate ambition levels (objective hierarchy)		A project team member imagines that they will 'provide the executive assembly with a range of options from which they can choose. If the assembly chooses a theme, or chooses the highest level of ambition for resource recovery from wastewater (S), then there will be less room [i.e. budget] available for a different theme. Making a choice in coherence with other things.'	20181108-1	Sustainability strategy
	Connect decisions to a specific and politically attractive long-term objective		After the meeting, the executive director tells me that he mainly had insinuated two things: '[...] [of which the second entails] adding an ambition.' As an example, he mentions: 'the most sustainable regional water authority in the year ...' In the minutes of the meeting by one of the project team members, I read afterwards: 'Ambition: in x time the most ... something of the Netherlands' (S).	20181204-2 + minutes of meeting	Sustainability strategy
Long-term objectives in inter-organizational agreements			Annotation of policy advisor for executive assembly member: 'A Circular Economy in the Netherlands by 2050 is an amazing shout-out that we as regional water authorities should embrace to motivate all decision makers to reach this ultimate sustainability goal' (C).	20181127-1	Energy-nutrients-water factory
	Differentiate ambition levels (objective hierarchy)		Executive director: 'to some of my pals I shout: what overarching goals do we have? Sustainability, circular economy, our tasks, the relationship with the environment, oh by the way we also aim to do it efficiently and effectively. [name chairperson], while you are mentioning that you also want to take into account a way of measurement.' Chairperson: 'or at least as an instrument for assembly members, it is about a hierarchy of objectives' (S)	20181114-2	Vision 2045
	Connect decisions to a specific and politically attractive long-term objective		Executive director: 'We slowly need to involve the assembly members. What flag is on this? The connection with society slash the municipality, or the Energy-Nutrients-water factory? Or both? I can help out about how to sell this politically' (S).	20180913-3	Energy-nutrients-water factory
		Continued attention for long-term themes	The executive director explains that he has discussed this with executive assembly members. He states that he does not want to call it 'heritage' but rather a 'continuous line [that] could arise' [...] [and a bit later]: 'ensuring that the image we are putting on the table will stick' (Cs).	20180919-3	Vision 2045
	Insert long-term developments in political venues		Executive director: 'We tried a couple of times in this [working group of the association for regional water authorities] to characterize a longer-term perspective. Thinking about the longer term very often is frustrated with what should have been finalized yesterday. We attempted with [this working group] to go in that direction, but it is very difficult to establish. You need to continuously feed the political engine' (S).	20180927-1	Vision wastewater chain
End-of-budget cycle	Propose long-term plans and strategies to the current administration		One of the project team members explains that the executive director would like to bring it [the sustainability strategy] to the current assembly (S), but she notes that the current assembly does not have, or does not have the room to have, much ambition in this area: 'The budget is tight,' therefore 'this is one of the first things' that will go, and 'we are energy neutral, we already have a resource recovery strategy,' hence 'it may not cost anything' (C).	20181029-2	Sustainability strategy
End-of-election cycle	Insert long-term developments in political venues		'What we need is a coherent concept. Intuitively, we know quite well what is smart to do in the long run. The overarching objective is to make sure the first step towards that becomes part of the executive assembly programme (S). But you will not be able to secure that within two months' time, in which they [the assembly members] will also be discussing who will take a seat [in the assembly]' (C).	20181114-2	Vision 2045
		Continued attention on long-term themes	General director: 'It would be great if the new executive assembly interviewed us, that they will just say copy-paste' (Cs).	20181204-3	Vision 2045

Table D3. Continued

Condition (C)	Strategy (S)	Consequence (Cs)	Exemplar quotation	Source	Topic
Reactive vs. Proactive					
Initiative from external environment	S1: Co-invest in the development of new technologies S2: Set criteria for long-term initiatives		The process engineer explains that he found out 'yesterday' that [another regional water authority] will not continue developing a [specific] alternative, and he then illustrates the 'choice of a future sludge processing alternative' including a 'shareholder agreement with [a market party] [...] and [co-investing] with another regional water authority' (presentation to executive assembly) (C) (S1). With this alternative, the process engineer argues that sludge treatment will be 'futureproof [for the period] 2022–2037,' and the alternative has a 'positive business case and value case' that is more attractive compared to contracting out (S2).	20190122-2	Wastewater chain strategy
Initiative from external environment	S1: Co-invest in the development of new technologies		'An opportunity arose to dry our wastewater sludge and that of [another regional water authority] with residual heat from the waste and energy factory in Amsterdam. [...] [T] his collaborative effort [...] appears to be more sustainable compared to our current way of processing wastewater sludge.'	20190212-doc	Wastewater chain strategy
C1: Formal role in legislation C2: Initiative from external environment	Align strategies and long-term thinking with other organizations		Executive assembly member mentions 'adaptation stress-tests, buffering freshwater. With regard to the long term.' Chairperson: 'I would like to propose peeling the onion, what is our legal-administrative position (C1), what does it mean for water quality and [...] what are the instruments?' Policy advisor: 'We would also like to connect it to climate change adaptation, so that it connects well with the way municipalities approach it' (S). In his previous presentation to the responsible executive assembly member: 'There seem to be chances and possibilities to reach the desired target, i.e. to maintain or reach water quality standards (C2). This together with developments such as climate change (increasing heavy rainfall) and the usage of new chemicals demands an upgrade of the 'rain water policy.'	20190122-2 + presentation 20181127-1	Urban water management/ climate change adaptation
	Co-develop joint long-term visions and plans		Senior policy advisor about the upcoming effort to renew the existing water management plan: 'In conversation with the province we said that there are different planning instruments, what should we keep separate and what could we pursue together?' [...] He prefers to develop a joint vision together with the province. [...] Chairperson also 'sees it as an advance, it is rather functional to do this together with a relatively small province.' The general director agrees that it fits the 'aim to collaborate' (S).	20181211-1	Water management plan 2021–2026
Initiative from external environment	Set criteria for long-term initiatives		Manager operations: 'I am mainly concerned with the initiatives of third parties' (C). The senior policy advisor responds: 'we still need to assess what exactly this means, but considering the capacity [that we] have, we think two business cases for processing industrial wastewater' (S).	20181017-1	Wastewater chain strategy
	Set criteria for long-term initiatives		A line manager responds: 'They [all sorts of initiatives from the external environment] all approach you. You need to do something, to choose. That does not mean that you will execute them. [We need to weigh] the time we have for it, to set criteria' (S). Another policy advisor argues: 'Of course, we need to have a strong basis. But we also need to remain connected to our external environment, this is also important for the future.'	20181017-1	Wastewater chain strategy
		Allocate resources to long-term objectives	Project team member: 'What does *ZZL* mean by sustainable regional water authority?' She shows a slide, which also mentions: 'Prioritization, allocation of scarce resources (C), how do we reward creativity, proactivity towards the assembly instead of reactivity?' I ask what she means by proactivity versus reactivity and she explains: 'Currently, all sorts of small solutions are proposed by the executive assembly.' She mentions an example of 'gliders'. She then expresses the need to 'have room to propose suggestions, to say: this is what we think is sustainable, to steer as regional water authority with what you will be working on.'	20181029-2	Sustainability strategy
	Leave primary responsibility for long-term with other organizations		Senior policy advisor: 'And we have received a vision for the IJssellake area as part of the Delta programme.' Chairperson: 'I only saw it this morning, what do you want me to do?' Senior policy advisor: [...] 'we do not have a very sharp ambition.' She proposes to 'not be very proactive,' to leave 'it to others' (S). Chairperson: 'Sounds healthy to me.'	20181114-3	Delta programme
Formal role in legislation			Conservative Party: 'A proactive attitude therefore, in search of unconventional solutions [...] Society increasingly expects an active role, even if that is beyond our formal legal position (C). That will change anyhow, because citizens do not want medicine residues, pesticides and micro-plastics in ditch water and will, sooner or later, knock at our door.'	20181127-2	Annual budget

Table D3. Continued

Condition (C)	Strategy (S)	Consequence (Cs)	Exemplar quotation	Source	Topic
Formal role in legislation	Seek collaboration to realize long-term objectives		Progressive Christian Party: 'The regional water authority can make an important contribution to establishing a more sustainable society. The water authority should therefore not restrict itself to its core tasks (C), but embrace a broad view to address the problems of today as well as tomorrow. Collaboration is key, [...] we cannot do it by ourselves' (S).	20181127-2	Annual budget
Initiative from external environment	Use societal initiative as key criterion for energy-production activities		The senior policy advisor asks what to do in case of 'future requests' that may arise about 'wind turbines on embankments, or close to pumping stations.' The executive assembly member responds: 'a passive stance will suffice. The existing policy is: it is not allowed. Only if a specific request arises can we take up this information letter and see whether we can formulate a specific answer to it' (C) (S).	20180906-1	Energy production
Formal role in legislation	Emphasize felt and formal responsibilities for long term		Chairperson: 'I heard something else. Are we doing something on our account that should actually be taken care of by the municipality?' and she continues: 'What exactly is our task at hand?' (C). The senior policy advisor explains that they have added three goals, which are mentioned on the slide, i.e.: 'collaboration for climate change adaptation, climate proof spatial planning, connecting to society.' The chairperson responds: 'The legitimacy for the other goals is included in different things, the executive assembly's programme, the water management programme, [..] the Delta programme' (S).	20181126-1	
Initiative from external environment	Co-invest in the development of new technologies		'Last year, and as a result of the Master plan Sustainable Energy, we explored the possibilities for energy storage close to our working processes. From this exploration, we concluded that it is too expensive to invest in energy storage technologies ourselves. Therefore, it seems more efficient to connect to an existing initiative, namely, an initiative of [another regional water authority] together with a [Dutch start-up company]' (C).	20180920-doc	Renewable energy/new technology

Table D4. Criteria and techniques for establishing trustworthiness

Criterion	Techniques used in this research
Credibility (*Truth value*)	*Prolonged engagement*: the ethnographer spent approximately 200 hours in the field over a six-month period (Sept. 2018–Mar. 2019).
	Persistent observation: the authors decided what and whom to observe based on previous observations. A period of deep immersion was followed by a period of yo-yoing in and out of the field to avoid going native and using insights from fieldnote analysis.
	Triangulation: the ethnographer observed people in different positions and complemented observations with interviews and meeting documents to avoid gaps and verify findings.
	Peer debriefing: the second and third author, who were both familiar with ethnographic and interpretive research, challenged the observations and interpretations of the ethnographic researcher in monthly meetings. Drafts were shared with researchers outside the author team.
	Member checking: the ethnographer (1) verified observations through questions or summaries after meetings and conversations; (2) held reflexive interviews with seven key informants to test and verify categories, observed patterns, conclusions; and (3) organized an open plenary meeting for all employees to present results.
	Referential adequacy: the ethnographer took pictures of brainstorming sessions and meeting locations and collected other organizational documents (e.g. presentations, e-mails, intranet posts) to provide a clear picture of the research context.
Authenticity	The ethnographer shared a data management plan with the first point of entry; communicated the researcher's role through intranet and in meetings upon request; held interviews or conversations with insiders who wanted to share information or exchange thoughts; organized additional observations when a specific reality seemed important; shared observations after meetings upon request; and used member checking (see above).
Transferability (*Applicability*)	*Thick description*: the ethnographer developed a description of the cultural and institutional context, focusing on the conditions needed to understand the results (see Methods for the institutional context).
	Purposive sampling: the ethnographer selected relevant respondents and documents based on observations and open conversational interviews at the first phase (months 1–3) of the fieldwork.
Dependability (*Consistency*) and Confirmability (*Neutrality*)	*Audit trail*: the ethnographer documented the research inputs, process, products and outputs by: storing different types of raw data in separate folders; storing written peer debriefing notes; writing and storing memos with theoretical, methodological and coding reflections; keeping a reflexive diary to document the research process; keeping a record of interviewees, meetings and amount of time spent.
	Reflexive journal: the ethnographer documented researcher actions, reflections and decisions after each day of fieldwork: at the end of fieldnotes (for reflections on specific meetings), in a separate action and planning log (for specific next steps in data collection), an analysis log (for specific next steps in data analysis) and in a reflexive journal (for emerging thoughts and personal reflections).

Summary

Deciding for tomorrow, today.

What makes governmental decisions about water infrastructure forward looking?

Introduction and research questions

This dissertation aims to assess, explain, and improve the extent to which governments make forward-looking decisions about their water infrastructure. Forward-looking decisions are especially relevant because many water infrastructure assets are reaching their end-of-lifetime due to technological ageing and changing functional demands. Governments therefore need to invest in the replacement and renewal of current infrastructure or in entirely new infrastructure. The long lifespan of water infrastructure requires governments to take into account possible impacts of developments such as climate change, economic developments, and demographic changes. Furthermore, governments worldwide, including the Dutch government, have committed themselves to international agreements focused on addressing long-term problems such as freshwater availability and climate change mitigation. Implementing such agreements requires national and local governments to exploit investments in end-of-lifetime infrastructure to achieve specific long-term objectives. Governments therefore need to think carefully about the future when they are preparing to invest in water infrastructure. They need to consider the relevance and impact of possible future developments for infrastructure and the potential contributions of infrastructure investments to addressing long-term problems. To ensure that infrastructure can cope with changing circumstances, they need to choose infrastructure that can remain effective across that infrastructure's lifetime. This requires governments to make forward-looking decisions. This dissertation introduces forward-looking decisions as decisions in which governments anticipate possible future developments that could impact the long-term effectiveness of water infrastructure. Making forward-looking decisions can be especially challenging for governments because of their short budget and election cycles, their accountability to current constituents, their responsibility to provide legal certainty, and their focus on short-term results.

The general research question was formulated as: What makes governmental decisions about water infrastructure forward looking? This general research question is divided into the following four research sub-questions (RQs):

- RQ1: How can forward-looking decisions be conceptualized and measured?
- RQ2: How forward looking are governmental investment decisions about water infrastructure?
- RQ3: What conditions enable forward-looking decisions?
- RQ4: What mechanisms and strategies shape forward-looking decisions?

Results

This dissertation includes five empirical chapters that together provide the answers to these RQs.

Chapter 2: This chapter develops the criteria and a dichotomous measurement for forward-looking decisions, and a decision-making lens to understand governmental decision-making processes that is based on, amongst others, the multiple streams framework. The decision-making lens and criteria for forward-looking decisions are applied to the case of the *IJmuiden* sea lock in The Netherlands, using the process tracing method, with interviews (n=16) and a content analysis of primary documents (n=430). This chapter concludes that decisions became forward looking because politicians and civil servants used long-term problem frames, scenarios, visions, and flexible solutions to build support (strategic reframing mechanism), avoid political risks (risk avoidance mechanism), and comply with formal rules (rule compliance mechanism). These mechanisms were triggered by the conditions of rules with forward-looking features, entrepreneurial political leadership, and perceived political risks.

Chapter 3: This chapter further operationalizes the concept of forward-looking decisions for comparing investments in urban water infrastructure. It combines the configurational multiple streams framework with an explicitly configurational method – fuzzy-set qualitative comparative analysis – to explain what enables municipalities to make forward-looking decisions. The chapter concludes that enabling conditions differ for small versus medium-to-large municipalities. For medium-to-large municipalities, forward-looking decisions are stimulated by: (1) organizational analytical capacity, (2) transactional/networking political leadership in situations without focusing events, or (3) entrepreneurial/transformative political leadership in situations with focusing events. For small municipalities, forward-looking decisions are stimulated by networking/interpersonal political leadership combined with the occurrence of focusing events.

Chapter 4: This chapter develops a comprehensive index, or discrete measurement, for forward-looking decisions about urban water management, to assess the extent to which, and how, Dutch municipalities anticipate the future with their investment decisions on urban water infrastructure. The results are based on a systematic comparison of investment decisions of 40 Dutch municipalities (about 10% of the population). The findings show that: 1) the extent to which municipalities anticipate the future differs largely; 2) only half of municipalities adopt a long time perspective; 3) there are no commonly applied robustness tests; 4) flexibility is not explicitly adopted – rather, different flexible measures are applied; and 5) a minority of municipalities develop strategic visions or scenarios for urban water management to support decisions. The index provided can be used for *ex ante* development and *ex post* assessment of investment decisions, to increase governments' preparedness for the future.

Chapter 5: This chapter combines a governance lens with a process tracing approach to explain why it is difficult for governments to reach long-term (sustainability) objectives with infrastructure investments. The results derive from a longitudinal case study of the investment process in a Dutch water pumping station and are based on primary documents, interviews, and observations of the tender procedure between 2017 and 2019. The research reveals that the mechanisms of risk avoidance, goal satisfaction, and budget compliance interfere with the implementation of national and international sustainability objectives at a local level. The chapter concludes that more attention should be paid to learning as part of procurement procedures, to scale flexibility to realize sustainability objectives efficiently and effectively, and to prioritization of conflicting long-term objectives to avoid implementation gaps.

Chapter 6: This chapter uses an ethnographic approach to analyse how members of a regional water authority understand and deal with long-term policy problems as part of their everyday practices. It reveals core dilemmas that governments encounter when addressing long-term policy problems as part of their everyday practices, as well as the conditions under which these dilemmas emerge. The findings reveal three specific dilemmas: investing in the realization of objects or objectives, adopting a stable or responsive approach to addressing long-term problems, and taking a proactive or reactive stance towards the external environment. The chapter

provides an overview of accommodating and steering strategies that actors use to deal with these dilemmas. Using combinations of these strategies can enhance strategic agility. Developing the capability of strategic agility enables governments to respond proactively to unexpected developments.

Conclusions

The multi-method research design of this dissertation enabled complementary answers to be found to the main research question of *What makes governmental decisions about water infrastructure forward looking?* The answer consists of the following three parts:

1. *The criteria for, and measurements of, a forward-looking decision that define whether a governmental investment decision can qualify as forward looking*

The main criteria for a forward-looking decision focus on three elements of a governmental decision. These elements are the agreed-upon problem definition, the chosen solution, and the justification for the decision. The criteria are as follows:

- The problem definition is forward looking when it refers to long-term challenges and includes a long time horizon to discuss these long-term challenges.
- The chosen solution is forward looking when it is robust, flexible, or both to remain effective under a range of future circumstances. Robust solutions are solutions that can maintain their critical functions, even when stress-tested against different and extreme-case scenarios. Flexible solutions are solutions that can be adapted to changing insights and circumstances, and for which a monitoring system is in place to detect and respond to changes in a timely manner.
- The justification of the decision is forward looking when it relies on scenarios to understand possible futures and/or on visions or long-term objectives that formulate desirable futures.

Based on these criteria for a forward-looking decision, it is possible to measure the extent to which governmental investment decisions about water infrastructure are forward looking. Different ways to measure the forward-lookingness of decisions were provided in this dissertation: a dichotomous measurement, an ordinal measurement, and a discrete measurement. These measurements can be used to assess the forward-lookingness of decisions as well as for governments to prepare more forward-looking investment plans.

2. *The enabling conditions of forward-looking decisions that characterize the decision-making context*

This dissertation adopts the streams metaphor from the garbage can model and the multiple streams framework to reveal the dynamic and often ambiguous decision-making context in which actors operate. The streams relevant to understanding decision-making processes are the politics stream, the problems stream, the solutions stream, and the choice opportunities stream. These streams provide the conditions of the decision-making context. Conditions are the relatively fixed characteristics of organizations and the reality outside organizations that actors cannot directly influence during decision-making processes. Different combinations of conditions can create a decision context that enables governments to make forward-looking decisions. This dissertation found that combinations of the following conditions from the four streams can enable forward-looking decisions:

- Problems stream: Experience with extreme weather events (focusing events) and collaborative opportunities from the external environment;
- Politics stream: Long-term-oriented or collaborative political leadership, perceived political risks, and the end-of-election cycle;
- Solutions stream: Organizational analytical capacity of water management departments, organizational size (as reflected in the number of inhabitants belonging to an administrative area), and water infrastructure reaching its end-of-lifetime;
- Choice opportunities stream: The end-of-budget cycle, legislation and agreements prescribing long-term objectives, scenarios, performance requirements, and legislative organizational responsibilities for the long term.

3. *The strategies and mechanisms that can be clustered into five main interaction processes that shape the extent to which governmental investment decisions about water infrastructure become forward looking*

Individual and organizational actors respond to the decision-making context by developing strategies. A strategy is understood as a set of actions that display a certain pattern that can remain quite stable across time. By choosing or using specific strategies, actors influence the forward-lookingness of investment decisions. Strategies can become part of mechanisms. Mechanisms are the causal processes that link conditions to the outcome of a forward-looking decision and provide direct explanations for this outcome. Mechanisms and strategies together form the interaction processes between organizations and within organizations.

These interaction processes can therefore be both intra-organizational and inter-organizational:

- Intra-organizational processes emerge from the interactions between actors that belong to the same governmental organization. Three intra-organizational processes can be distinguished: framing specific long-term problems or objectives; selling of the long term by civil servants in political decision-making venues to ensure enduring commitment to long-term policies and action plans; and complying with existing standards that prescribe long-term investments, objectives, future scenarios, responsibilities, and long-term performance requirements for infrastructure.
- Inter-organizational processes emerge from the interactions between several organizations. Two inter-organizational processes can be distinguished: minimizing future risks to avoid system failure or disinvestment; and collaborating to achieve desired long-term objectives or long-term solutions.

The following figure provides an overview of the conditions and interaction processes that contribute to forward-looking decisions.

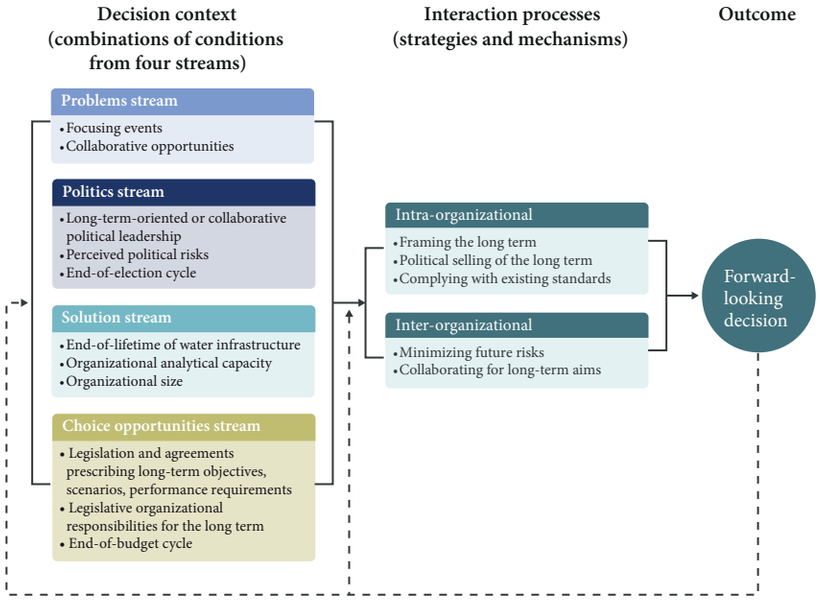


Figure Overview of conditions and processes behind forward-looking decisions

Contributions

The dissertation introduces the novel concept of a forward-looking decision and presents a new theory of forward-looking decision making. The theory can be used to assess, explain, and improve the extent to which governments make forward-looking decisions about their water infrastructure, by respectively:

- Applying the criteria for a forward-looking decision to assess governmental decisions;
- Providing the combinations of conditions and processes that explain how investment decisions become forward looking; and
- Using the criteria for a forward-looking decision to prepare investment decisions and using the causal mechanisms to provide recommendations for improving the governance capability for making forward-looking decisions.

The measurements of a forward-looking decision create the possibility to measure the adoption of flexible and robust solutions and the use of future visions and scenarios as part of governmental decisions. Applying this to infrastructure investment decisions reveals the extent to which, and the reasons why, governments use methods and tools to support decisions about long-term solutions and long-term problems. This contributes to scholarly debates about the use of decision support methods and tools by governments, and about the presence of governmental myopia. The dissertation shows that forward-looking decisions are possible within present-day governmental settings characterized by annual budget cycles and four-year election cycles. The results also show that governments still focus strongly on risks instead of on uncertainties when deciding upon infrastructure investments, by avoiding references to the concept of uncertainty and by using future scenarios and flexible solutions only to a limited extent. This dissertation also contributes to scholarly debates about the missing political, historical, and institutional context in methods and models for adaptation and anticipation; and to debates about the use of the multiple streams framework to understand decision-making processes instead of agenda-setting processes. Re-introducing the choice opportunities stream as part of the multiple streams framework enables inclusion of institutional conditions. Adding the notion of crucial decisions from the rounds model for analysing decision making, enables the recognition of the historical context of decisions and helps to shed light on the interaction processes between actors that shape the outcomes of decision-making processes. Finally, the dissertation provides specific explanations for forward-looking decisions that emerge from the existing governance context, whereas much literature on long-term governance is particularly concerned with proposing new types of governance arrangements.

Recommendations

To improve the extent to which governments make forward-looking decisions about their water infrastructure, this dissertation positions strategic agility as the governance capability required for making forward-looking decisions. Strategic agility is a dual concept that combines the ability to proactively steer towards desired change (strategy) with the ability to respond flexibly to constantly changing environments (agility). By connecting the concept of strategic agility to the main mechanisms that shape forward-looking decisions, the dissertation has formulated the following five specific recommendations to enhance the governance capability for making forward-looking decisions:

Commit to a bold long-term goal to spur action to address long-term problems. A bold long-term goal specifically frames long-term objectives and problems and enables water managers to connect planned investments to long-term objectives. Bold long-term goals should be a bit hairy in the sense of allowing room for organizations to explore possible solutions that can contribute to reaching the goal.

Develop scenarios to establish a joint vocabulary about the future while avoiding blind spots. Water managers can use future scenarios to build support for investment decisions and to choose more robust solutions. Furthermore, scenarios can help in raising awareness of the many unknowns, thereby increasing organizations' flexibility to respond to changing circumstances.

Embed forward-lookingness in rules. Rules can stimulate focusing attention on long-term problems, commit public sector organizations to long-term objectives, and prescribe the use of future scenarios in preparing investment decisions. Rules can also increase agility by, for example, prescribing flexibility of solutions and revision of policies.

Play consciously with planned investments and investment opportunities. Water managers can strategically 'play' with their planned investments in water infrastructure to realize bold long-term goals as well as to ensure that the system, as a whole, safeguards existing and future primary functionalities. Governments are advised to develop a long-term investment plan that includes all foreseen investments in infrastructure. Water managers should be able to deviate from this investment plan in order to respond to opportunities to invest in new or existing infrastructure that contribute to achieving bold long-term goals.

Appoint organizational scouts to sense changes. Appointing organizational scouts can contribute to forward-looking decisions by ensuring flexibility and a timely reaction to changes in the external environment. Scouts can signal changes that should be used to revise policies or investment plans, revise developed future scenarios, and signal opportunities that can contribute to achieving bold long-term goals. The scouts' role can be merged with existing organizational roles such as policy advisory roles.

The following table presents an overview these recommendations.

Table Overview of recommendations for practice

Recommendation	Contribution to making forward-looking decisions	Contribution to enhancing strategic agility
1. Embrace strategic agility	The capability to make forward-looking decisions	*Strategy:* steer change with a long-term perspective *Agility:* respond flexibly to change in emergent investment plans and decisions
2. Commit to a bold long-term goal (BHAG)	Strategic reframing mechanism	*Strategy:* formulate bold long-term goals *Agility:* goals are hairy, i.e. leave room to explore and find ways to realize goals
3. Develop scenarios	Risk avoidance mechanism	*Strategy:* think hard about the very long term, use scenarios to support decisions *Agility:* raise awareness of uncertainties, increase preparedness to deal with surprises
4. Embed forward-lookingness in rules	Rule compliance mechanism	*Strategy:* include long-term goals, norms, scenarios in rules *Agility:* include adaptation requirements in rules, such as policy revision, monitoring
5. Play consciously with investments	Goal satisfaction mechanism	*Strategy:* create portfolio of planned investments *Agility:* play with investments and new investment opportunities to find the best way to safeguard systems' functions and contribute to long-term goals with investments
6. Appoint organizational scouts	Timely adjustments to previous decisions, planned investments, and solutions under development	Especially *agility:* sense, appraise, and respond to changes in external environment

Samenvatting

Vandaag beslissen voor morgen.

Wat maakt overheidsbeslissingen over waterinfrastructuur vooruitziend?

Introductie en onderzoeksvragen

Deze dissertatie beoogt de mate waarin overheden vooruitziende beslissingen over hun waterinfrastructuur nemen, te beoordelen, te verklaren en te verbeteren. Vooruitziende beslissingen zijn van belang, omdat veel infrastructurele objecten in het waterdomein hun einde levensduur bereiken door technologische veroudering en veranderende functionele vereisten. Overheden moeten daardoor investeren in de vervanging en vernieuwing van hun bestaande infrastructuur of in volledig nieuwe infrastructuur. De lange levensduur van waterinfrastructuur vereist dat overheden rekening houden met mogelijke lange termijn ontwikkelingen zoals klimaatverandering, economische ontwikkelingen en demografische veranderingen. Bovendien hebben overheden wereldwijd, en zo ook de Nederlandse overheid, zich gecommitteerd aan internationale verdragen die betrekking hebben op het aanpakken van lange termijn problemen zoals zoetwaterbeschikbaarheid en klimaatmitigatie. Het implementeren van deze verdragen vereist dat nationale en lokale overheden hun investeringen in verouderde infrastructuur benutten om specifieke lange termijndoelstellingen te bereiken. Overheden moeten daarom goed nadenken over de toekomst wanneer zij investeringen in waterinfrastructuur voorbereiden. Ze moeten nadenken over de relevantie en de impact van mogelijke toekomstige ontwikkelingen op infrastructuur en over hoe investeringen in infrastructuur kunnen bijdragen aan de aanpak van lange termijnproblemen. Om te zorgen dat infrastructuur bestand is tegen verschillende omstandigheden, moeten overheden infrastructurele oplossingen kiezen die effectief blijven gedurende hun levensduur. Dit verlangt van overheden dat zij vooruitziende beslissingen nemen. Deze dissertatie introduceert vooruitziende beslissingen als beslissingen waarbij overheden rekening houden met mogelijke toekomstige ontwikkelingen die de effectiviteit van infrastructuur op de lange termijn kunnen beïnvloeden. Het nemen van vooruitziende beslissingen kan in het bijzonder lastig zijn voor overheden, vanwege hun korte budgettaire en electorale cycli, de verantwoording die ze moeten afleggen richting hun huidige inwoners, de juridische zekerheid die ze moeten bieden en hun focus op korte termijn resultaten.

De algemene onderzoeksvraag is geformuleerd als: Wat maakt overheidsbeslissingen over waterinfrastructuur vooruitziend? Deze onderzoekvraag is verdeeld in de volgende vier sub-vragen (SV's):

- SV1: Hoe kunnen vooruitziende beslissingen worden geconceptualiseerd en gemeten?
- SV2: Hoe vooruitziend zijn overheidsinvesteringsbeslissingen over waterinfrastructuur?
- SV3: Welke kenmerken van de besluitvormingscontext maken vooruitziende beslissingen mogelijk?
- SV4: Welke mechanismen en strategieën geven vooruitziende beslissingen vorm?

Resultaten

Deze dissertatie bevat vijf empirische hoofdstukken, die gezamenlijk de antwoorden geven op deze vragen.

Hoofdstuk 2: Dit hoofdstuk ontwikkelt de criteria en een dichotome meting voor vooruitziende beslissingen, als ook een besluitvormingsbril om besluitvormingsprocessen binnen de overheid te analyseren. Deze theoretische bril is gebaseerd op, onder meer, het stromenmodel. De besluitvormingsbril en de criteria voor vooruitziende beslissingen worden toegepast op de casus van de zeesluis IJmuiden in Nederland, waarbij gebruik wordt gemaakt van de methode *process tracing*, met interviews (n=16) en een inhoudsanalyse van primaire documenten (n=430). Dit hoofdstuk concludeert dat beslissingen vooruitziend worden doordat politici en ambtenaren lange termijnprobleemdefinities, scenario's, visies en flexibele oplossingen gebruiken om steun te organiseren (het strategische herframingsmechanisme), omdat ze politieke risico's willen mijden (het risicomijdingsmechanisme) en omdat ze willen voldoen aan formele regels (het regelnakomingsmechanisme). Deze mechanismen treden in werking door de aanwezigheid van regels met vooruitziende kenmerken, ondernemend politiek leiderschap en waargenomen politieke risico's.

Hoofdstuk 3: Dit hoofdstuk operationaliseert het concept van vooruitziende beslissingen verder om investeringen in stedelijke waterinfrastructuur te vergelijken. Het hoofdstuk combineert het configurationele stromenmodel met een expliciete configurationele methode – *fuzzy set qualitative comparative analysis* – om te verklaren wat het mogelijk maakt dat gemeenten vooruitziende beslissingen nemen. Het hoofdstuk concludeert dat contextkenmerken voor vooruitziende beslissingen kunnen verschillen voor kleine versus middelgrote tot grote gemeentes. Bij middelgrote tot grote gemeentes worden vooruitziende beslissingen mogelijk gemaakt door: (1) analytische capaciteit van de watermanagementafdeling, (2) transactioneel of netwerkend politiek leiderschap in gemeenten waar zich geen extreme neerslaggebeurtenissen (*focusing events*) hebben voorgedaan, of (3) ondernemend of transformatief politiek leiderschap in situaties waar zich extreme neerslaggebeurtenissen voordeden. Bij kleine gemeenten worden vooruitziende beslissingen mogelijk gemaakt door netwerkend of interpersoonlijk politiek leiderschap in combinatie met ervaren extreme neerslaggebeurtenissen.

Hoofdstuk 4: Dit hoofdstuk ontwikkelt een veelomvattende index, ook wel een discrete meetwijze, van vooruitziende beslissingen met betrekking tot stedelijk waterbeheer, om de mate waarin beslissingen vooruitziend zijn te beoordelen en te analyseren op welke wijze Nederlandse gemeenten zich voorbereiden op de toekomst met hun investeringsbeslissingen over waterinfrastructuur. De resultaten zijn gebaseerd op een systematische vergelijking van investeringsbeslissingen van 40 Nederlandse gemeenten (ongeveer 10% van de populatie). De bevindingen laten zien dat: (1) de mate waarin gemeenten zich voorbereiden op de toekomst enorm verschilt; (2) slechts de helft van de gemeenten een lange termijn tijdshorizon hanteert; (3) er geen algemeen toegepaste robuustheidstesten zijn; (4) flexibiliteit niet expliciet wordt omarmd – al worden uiteenlopende flexibele oplossingen wel toegepast; (5) een minderheid van de gemeenten strategische visies of scenario's ontwikkelt voor stedelijk waterbeheer om hun beslissingen te onderbouwen. De ontwikkelde index kan gebruikt worden voor *ex ante* ontwikkeling en *ex post* beoordeling van investeringsbeslissingen, om de mate waarin overheden zich voorbereiden op de toekomst te verbeteren.

Hoofdstuk 5: Dit hoofdstuk combineert een theoretische *governance* bril met een methodische *process tracing* benadering om te verklaren waarom het lastig is voor overheden om lange termijn (duurzaamheids) doelstellingen te bereiken met hun investeringsbeslissingen. De resultaten komen voort uit een longitudinale analyse van een casus van een investering in een Nederlands gemaal en zijn gebaseerd op primaire documenten, interviews en observaties van de tenderprocedure tussen 2017 en 2019. De resultaten onthullen dat de mechanismen van risicomijdendheid, doelbereiking en budgetcompliance in de weg zitten van de implementatie van nationale en internationale duurzaamheidsdoelstellingen op het lokale niveau. Het hoofdstuk concludeert dat meer aandacht nodig is voor leren als onderdeel van inkoopprocedures, voor schaalflexibiliteit om duurzaamheidsdoelen efficiënt en effectief te bereiken en voor de prioritering van conflicterende lange termijndoelen om onvolledige verwezenlijking van doelen te voorkomen.

Hoofdstuk 6: Dit hoofdstuk gebruikt een etnografische benadering om te analyseren hoe leden van een waterschap lange termijnproblemen begrijpen en hiermee omgaan als onderdeel van hun dagelijkse praktijken. Het onthult hoofddilemma's die overheden tegenkomen wanneer ze lange termijnproblemen oppakken in hun dagelijkse praktijken, als ook de omstandigheden waaronder de dilemma's zich voordoen. De resultaten onthullen drie specifieke dilemma's: investeren in het verwezenlijken van objecten of doelstellingen, het kiezen van een stabiele of responsieve aanpak van lange termijnproblemen en het aannemen van een proactieve of reactieve benadering richting de externe omgeving. Het hoofdstuk geeft een overzicht van accommoderende en sturingsstrategieën die actoren gebruiken om met de dilemma's om te gaan. Het benutten van een combinatie van deze strategieën kan de strategische wendbaarheid van de organisatie vergroten. Het ontwikkelen van strategische wendbaarheid geeft overheden de mogelijkheid om proactief te reageren op onvoorziene ontwikkelingen.

Conclusies

De combinatie van onderzoeksmethoden in deze dissertatie maakte het mogelijk om complementaire antwoorden te vinden op de hoofdonderzoeksvraag *Wat maakt overheidsbeslissingen over waterinfrastructuur vooruitziend?* Het antwoord bestaat uit de volgende drie onderdelen:

1. *De criteria voor, en metingen van, een vooruitziende beslissing die bepalen wanneer een overheidsinvesteringsbeslissing kan worden gekwalificeerd als vooruitziend.*

De hoofdcriteria van een vooruitziende beslissing hebben betrekking op drie elementen van een overheidsbeslissing. Deze elementen zijn de overeengekomen probleemdefinitie, de gekozen oplossing en de onderbouwing voor de beslissing. De criteria zijn als volgt:

- De probleemdefinitie is vooruitziend wanneer het refereert aan lange termijn uitdagingen en een lange termijn tijdshorizon bevat om deze lange termijnuitdagingen te bespreken.
- De gekozen oplossing is vooruitziend wanneer deze robuust, flexibel of beide is om zo effectief te blijven onder diverse toekomstige omstandigheden. Robuuste oplossingen zijn oplossingen die hun kritieke functies behouden, zelfs wanneer ze gestress-test worden in verschillende en extreme situaties. Flexibele oplossingen zijn oplossingen die kunnen worden aangepast aan veranderende inzichten en omstandigheden en waarvoor een monitoringssysteem is ingesteld om veranderingen op te sporen en hier tijdig op te reageren.
- De onderbouwing van een beslissing is vooruitziend wanneer de onderbouwing ondersteund wordt met scenario's om mogelijke toekomsten te begrijpen en/of op visies of lange termijndoelstellingen die gewenste toekomsten weergeven.

Op basis van deze criteria van een vooruitziende beslissing, is het mogelijk om te bepalen in welke mate overheidsinvesteringsbeslissingen over waterinfrastructuur vooruitziend zijn. Deze dissertatie heeft diverse manieren gegeven om de vooruitziendheid van beslissingen te meten: een dichotome meting, een ordinale meting en een discrete meting. Deze wijzen van meten kunnen gebruikt worden om de vooruitziendheid van beslissingen te beoordelen, alsmede door overheden worden gebruikt om meer vooruitziende investeringsplannen voor te bereiden.

2. *De kenmerken van de besluitvormingscontext die vooruitziende beslissingen mogelijk maken*

Deze dissertatie gebruikt de metafoor van de stromen vanuit het *garbage can* model en het stromenmodel, om de dynamische en vaak ambigue besluitvormingscontext waarbinnen actoren opereren, te onthullen. De stromen die relevant zijn om besluitvormingsprocessen te begrijpen zijn de politieke stroom, de problemenstroom, de oplossingenstroom en de keuzemomentenstroom. In deze stromen bevinden zich de kenmerken van de besluitvormingscontext. Contextkenmerken, ook wel condities, zijn de relatieve vaststaande karakteristieken van organisaties en de werkelijkheid buiten organisaties, die actoren niet direct kunnen beïnvloeden tijdens besluitvormingsprocessen. Verschillende combinaties van contextkenmerken kunnen een besluitvormingscontext creëren die ervoor zorgt dat overheden vooruitziende beslissingen kunnen nemen. Deze dissertatie heeft ontdekt dat de volgende combinaties van contextkenmerken vanuit de vier stromen vooruitziende beslissingen mogelijk maken:

- Problemenstroom: ervaren extreme weersomstandigheden (*focusing events*) en samenwerkingskansen vanuit de externe omgeving;
- Politieke stroom: lange termijngericht of samenwerkingsgericht politiek leiderschap, waargenomen politieke risico's en het einde van de electorale cyclus;
- Oplossingenstroom: analytische capaciteit van de watermanagementafdeling, organisatiegrootte (weergegeven in het aantal inwoners in een gebied dat behoort tot een bepaalde overheid) en waterinfrastructuur die haar eindelevensduur bereikt;

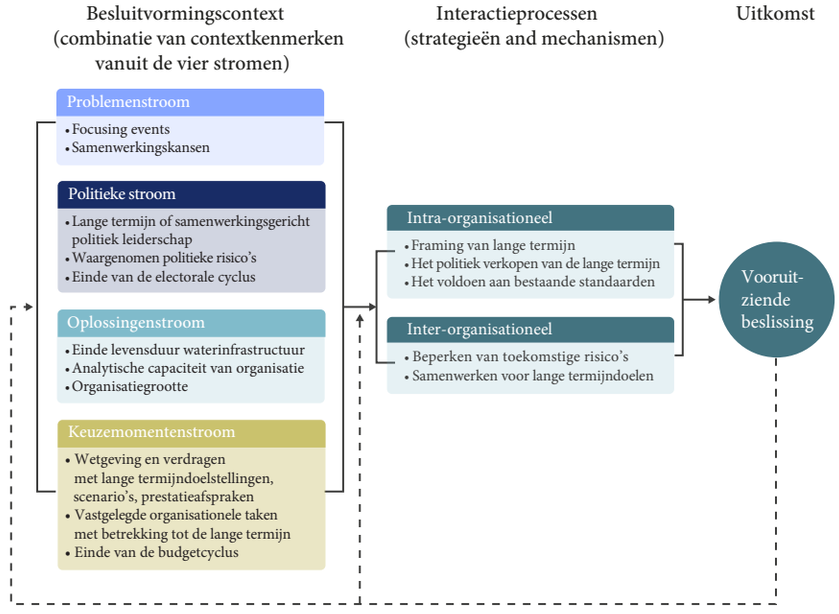
- Keuzemomentenstroom: het einde van de budgetcyclus, wetgeving en verdragen die lange termijndoelstellingen, scenario's, prestatieafspraken en wettelijke organisatietaken voor de lange termijn bevatten.

3. *De strategieën en mechanismen die kunnen worden geclusterd in vijf hoofdinteractieprocessen, die de mate van vooruitziendheid van overheidsinvesteringsbeslissingen bepalen*

Individuele en organisationele actoren reageren op de besluitvormingscontext door het ontwikkelen van strategieën. Een strategie moet worden begrepen als verschillende acties van actoren die gezamenlijk een patroon vormen, dat gedurende langere tijd vrij stabiel blijft. Door het kiezen of gebruiken van specifieke strategieën, beïnvloeden actoren de vooruitziendheid van investeringsbeslissingen. Strategieën kunnen onderdeel worden van mechanismen. Mechanismen zijn de causale processen die contextkenmerken verbinden aan de uitkomst van vooruitziende beslissingen en die deze uitkomst direct verklaren. Mechanismen en strategieën vormen gezamenlijk de interactieprocessen tussen organisaties en binnen organisaties. Deze interactieprocessen kunnen daarom zowel intra-organisationeel als inter-organisationeel zijn:

- Intra-organisationele processen ontstaan uit de interacties tussen actoren die behoren tot dezelfde overheidsorganisatie. Drie intra-organisationele processen kunnen worden onderscheiden: de *framing* van specifieke lange termijnproblemen of doelstellingen; het verkopen van de lange termijn door ambtenaren op plaatsen waar politieke besluitvorming plaatsvindt om te zorgen dat er langdurige commitment ontstaat voor lange termijn beleids- en actieplannen; en het voldoen aan bestaande regels en budgetten die lange termijn investeringen, doelstellingen, toekomstscenario's, verantwoordelijkheden en prestatieafspraken voor infrastructuur vastleggen.
- Inter-organisationele processen ontstaan uit de interacties tussen meerdere organisaties. Twee inter-organisationele processen kunnen worden onderscheiden: het beperken van toekomstige risico's om systeemfalen of desinvestering uit te sluiten en samenwerken om gewenste lange termijndoelstellingen of lange termijnoplossingen te realiseren.

Het volgende figuur geeft een overzicht van de contextkenmerken en interactieprocessen die bijdragen aan vooruitziende beslissingen:



Figuur Overzicht van contextkenmerken en processen achter vooruitziende beslissingen

Wetenschappelijke bijdrage

Deze dissertatie introduceert het nieuwe concept van een vooruitziende beslissing en presenteert een nieuwe theorie voor vooruitziende besluitvorming. De theorie kan gebruikt worden om de mate waarin overheden vooruitziende beslissingen nemen over hun waterinfrastructuur te beoordelen, te verklaren en te verbeteren, door respectievelijk:

- De criteria van een vooruitziende beslissing toe te passen om overheidsbeslissingen te beoordelen;
- De combinaties van contextkenmerken en processen weer te geven die verklaren hoe investeringsbeslissingen vooruitziend worden; en
- De criteria voor een vooruitziende beslissing te gebruiken om investeringsbeslissingen voor te bereiden en de causale mechanismen te gebruiken om aanbevelingen te geven voor het versterken van het vermogen van de overheid om vooruitziende beslissingen te nemen.

De metingen voor een vooruitziende beslissing creëren de mogelijkheid om het gebruik van flexibele en robuuste oplossingen en het gebruik van toekomstvisies en scenario's als onderdeel van overheidsbeslissingen te meten. Als de metingen worden toegepast op investeringsbeslissingen over infrastructuur, ontstaat inzicht in de mate waarin en de redenen waarom overheden methoden en hulpmiddelen gebruiken om beslissingen over lange termijnoplossingen en lange termijnproblemen te ondersteunen. Dit draagt bij aan academische discussies over het gebruik van middelen en methoden die overheden moeten ondersteunen in hun besluitvorming en aan discussies over de aanwezigheid van korte termijngerichtheid binnen de overheid. Deze dissertatie laat zien dat vooruitziende beslissingen mogelijk zijn binnen de bestaande overheidscontext, die wordt gekenmerkt door jaarlijkse budgetcycli en vierjaarlijkse electorale cycli. De resultaten laten zien dat overheden zich sterk richten op risico's in plaats van op onzekerheden wanneer zij beslissen over investeringen in infrastructuur. Dat doen zij door het vermijden te spreken van onzekerheid en door slechts beperkt gebruikt te maken van toekomstscenario's en flexibele oplossingen. Dit proefschrift draagt ook bij aan de academische discussie over de ontbrekende politieke, historische en institutionele context bij ontwikkelde methoden en modellen voor adaptatie en anticipatie en aan debatten over het gebruik van het stromenmodel voor het verklaren van besluitvormingsprocessen in plaats van agendavormende processen. De herintroductie van de keuzemomentenstroom als onderdeel van het stromenmodel maakt het mogelijk om institutionele contextkenmerken te analyseren. Het toevoegen van het begrip van cruciale beslissingen uit het rondenmodel voor het analyseren van besluitvorming, maakt het mogelijk om de historische context van besluiten te erkennen en de interactieprocessen tussen actoren te belichten die de uitkomsten van besluitvormingsprocessen bepalen. Tot slot, dit proefschrift geeft specifieke verklaringen voor vooruitziende beslissingen die voortkomen uit de bestaande overheidscontext, terwijl veel literatuur over lange termijn *governance* zich vooral richt op het doen van voorstellen voor nieuwe arrangementen voor overheidssturing.

Aanbevelingen

Om de mate waarin overheden vooruitziende beslissingen nemen over hun waterinfrastructuur te verbeteren, positioneert dit proefschrift strategische wendbaarheid als de overheidscompetentie die nodig is voor het nemen van vooruitziende beslissingen. Strategische wendbaarheid is een duaal concept dat het vermogen om proactief te sturen richting gewenste verandering (strategie) combineert met het vermogen om flexibel te reageren op constant veranderende omstandigheden

(flexibiliteit). Door het concept strategische wendbaarheid te koppelen aan de hoofdmechanismen die vooruitziende beslissingen vormgeven, heeft dit proefschrift de volgende vijf aanbevelingen geformuleerd om het vermogen van de overheid om vooruitziende beslissingen te nemen, te versterken:

Committeer je aan een gewaagd lange termijndoel om actie te ondernemen voor het aanpakken van lange termijnproblemen. Een gewaagd lange termijndoel bevat specifieke lange termijndoelstellingen en problemen. Een dergelijk doel maakt het mogelijk voor waterbeheerders om geplande investeringen hieraan te koppelen. Gewaagde lange termijndoelen moeten richting geven maar 'harig' genoeg zijn om organisaties ruimte te bieden voor het verkennen van mogelijke oplossingen die bijdragen aan het bereiken van het doel.

Ontwikkel scenario's om een gedeeld vocabulaire over de toekomst te creëren en blinde vlekken te vermijden. Waterbeheerders kunnen toekomstscenario's gebruiken om steun voor investeringsbeslissingen te organiseren en voor robuustere oplossingen te kiezen. Bovendien kunnen scenario's helpen om bewustzijn over de vele onbekendheden te vergroten, waardoor de wendbaarheid van de organisatie wordt vergroot om te reageren op veranderende omstandigheden.

Leg vooruitziendheid vast in regels. Regels kunnen publieke sectororganisaties stimuleren om de aandacht op lange termijnproblemen te richten, zich te committeren aan lange termijndoelstellingen en benut worden om het gebruik van toekomstscenario's voor het voorbereiden van investeringsbeslissingen voor te schrijven. Regels kunnen de wendbaarheid van organisaties vergroten, door bijvoorbeeld de flexibiliteit van oplossingen en het herzien van beleidsplannen voor te schrijven.

Doelbewust spelen met geplande investeringen en investeringskansen. Waterbeheerders kunnen strategisch 'spelen' met hun geplande investeringen in waterinfrastructuur om de gewaagde lange termijndoelen te behalen en de bestaande en toekomstige functionaliteiten van het gehele watermanagementsysteem te verzekeren. Overheden worden geadviseerd om een lange termijninvesteringsplan te ontwikkelen, waarin alle voorziene investeringen in infrastructuur zijn opgenomen. Het moet mogelijk zijn voor waterbeheerders om af te wijken van dit plan, om te kunnen reageren op kansen die zich voordoen om te investeren in nieuwe of bestaande infrastructuur die bijdragen aan het bereiken van gewaagde lange termijndoelen.

Benoem organisatiescouts die veranderingen signaleren. Het benoemen van organisatiescouts kan bijdragen aan vooruitziende beslissingen door de flexibiliteit te

vergroten en een tijdige reactie te verzekeren op veranderingen in de externe omgeving. Scouts kunnen veranderingen signaleren en moeten ingezet worden om beleids- of investeringsplannen te herzien, toekomstscenario's te herzien en kansen te signaleren die bijdragen aan het bereiken van gewaagde lange termijndoelen. De rol van scouts kan worden samengevoegd met bestaande organisatierollen zoals beleidsadviesrollen.

De volgende tabel geeft een overzicht van de aanbevelingen.

Tabel Overzicht van praktijkaanbevelingen

Aanbeveling	Bijdrage aan het nemen van vooruitziende beslissingen	Bijdrage aan het vergroten van strategische wendbaarheid
1. Omarm strategische wendbaarheid	De competentie voor het nemen van vooruitziende beslissingen	*Strategie:* stuur verandering met een lange termijnperspectief *Wendbaarheid:* reageer flexibel op verandering in totstandkomende investeringsplannen en beslissingen
2. Committeer aan een gewaagd lange termijndoel	Strategisch herframingmechanisme	*Strategie:* formuleer gewaagde lange termijndoelen *Wendbaarheid:* doelen laten ruimte om te ontdekken en manieren te vinden om doelen te realiseren
3. Ontwikkel scenario's	Risicomijdingsmechanisme	*Strategie:* denk hard na over de lange termijn, gebruik scenario's om beslissingen te onderbouwen *Wendbaarheid:* creëer bewustzijn van onzekerheden, vergroot de paraatheid om met verrassingen om te gaan
4. Leg vooruitziendheid vast in regels	Regelnakomingsmechanisme	*Strategie:* neem lange termijndoelen, normen en scenario's op in regels *Wendbaarheid:* neem vereisten voor aanpassing op in regels, zoals het herzien van beleidsplannen en monitoring
5. Speel bewust met investeringen	Doelbereikingmechanisme	*Strategie:* creëer een portfolio voor geplande investeringen *Wendbaarheid:* speel met investeringen en nieuwe investeringskansen om de beste manier te vinden om systeemfuncties te garanderen en bij te dragen aan lange termijndoelen met investeringen
6. Benoem organisatie-scouts	Tijdige aanpassingen van eerdere beslissingen, geplande investeringen en oplossingen die worden ontwikkeld	Vooral *wendbaarheid:* signaleer, beoordeel en reageer op veranderingen in de externe omgeving

About the author

About the author

Wieke Pot is Assistant Professor 'Governance of social-ecological-technical systems for improving resilience' at the Public Administration and Policy Group of Wageningen University and Research. As member of the 4TU Centre for Resilience Engineering, Wieke aims to increase understanding of what enables governments, sometimes in collaboration with private sector actors, to make decisions about deeply uncertain long-term challenges in order to achieve sustainable and resilient societies. Wieke is an editorial board member of the Dutch journal *Water Governance* and acts as a reviewer of academic journals. Her work has been published in international peer-reviewed journals such as *Technological Forecasting & Social Change*, *Land Use Policy,* and *Water Resources Management*. Wieke has a background in public administration (MSc. 2009, Leiden University, *cum laude*). During her PhD research, she initiated and co-organized different PhD activities such as a writing retreat and peer consultation sessions. She has also been a visiting researcher at regional water authority *Zuiderzeeland*. In the final year of her PhD project, she was half-time employed as a lecturer and coordinated a bachelor course on Public Administration and Environmental law, and gave lectures and tutorials for courses on public administration and policy. Before starting her PhD project, Wieke worked for over 5 years in the private sector and had project management, consultancy, and management roles at, amongst others, management consulting firm Boer & Croon and AkzoNobel Salt Specialties (currently part of Nouryon). In her work, Wieke likes to combine her practical consultancy and management skills with her research interests.

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Education certificate

Education certificate graduate school

Wieke D. Pot
Wageningen School of Social Sciences (WASS)
Completed Training and Supervision Plan

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
Writing of own Research Proposal	WUR/PAP	2015-2016	6
Organizing and presenting at yearly science-practitioners workshops for own PhD research project	WUR/PAP	2016-2019	4
PhD masterclass on conceptual foundations of public governance Guy Peters	WASS	2016	0.5
ECPR Summer School: QCA course	ECPR	2017	6
Qualitative Data Analysis	WASS	2017	2.5
Scientific artwork and infographics	WUR Library	2019	0.9
B) General research related competences			
PhD Introduction course	WASS	2016	1
Scientific writing	Wageningen in'to languages	2016	1.8
Efficient writing strategies	Wageningen in'to languages	2016	1.3
NIG course Getting it Published	NIG	2017	1
High Impact Writing in Science	WIAS	2017	1.3
Reviewing of scientific papers for journals: 1. Bestuurskunde; 2. Regional Env. Change; 3. Env. Policy and planning	None	2017-2019	0.9
Organizer & participant of writing retreats for cluster PhD candidates	WASS/WCGS	2017, 2019	1.5
'Forward-looking investment decisions about end-of-lifetime infrastructure: the role of politics and rules in investments in a Dutch sea lock'	WASS PhD day, Wageningen	2017	1
'Deciding about the future? Embedding the long term in today's governance' (chair and organizer of session)	ECPR Conference, Hamburg	2018	1

'Institutions and governance arrangements enabling forward-looking decisions under uncertainty by governments' (chair and organizer of session)	DMDU Conference, Delft	2019	1
'The governance challenge of addressing grand challenges with current-day decisions in water infrastructure'	ICPP Conference, Montreal	2019	1
C) Career related competences/personal development			
Convening session Diversity in Science and participant at WUR PhD Symposium	WUR	2017	1.3
PhD representative for PAP and Cluster	PAP/WGSG	2017-2018	0.5
Contributing author to the contract research 'Innovation in Water Governance' for the Dutch Environmental Assessment Agency (PBL)	PAP/PBL	2016	1.5
Editor for Dutch journal Water Governance	Water Governance journal	2018-2019	2
Initiator and participant of Intervision (peer consultation) sessions for cluster PhD candidates	WCGS	2017-2019	1.5
Career assessment	WGS	2019	0.3
'Vooruitziendheid in stedelijk waterbeheer. Invited Speaker Knowledge Table'	Stichting Rioned	2018	1
'De adaptieve capaciteit van instituties in het Anthropoceen. Invited Speaker at event 'Care for the future in the Anthropocene'	Society for Environmental Professionals (VVM)	2019	0.3
Teaching and supervising of two master thesis students: tutorials/guest lecture Public Administration and Policy Making and tutorials Studying Public Governance	PAP	2016-2019	4
Total			45

*One credit according to ECTS is on average equivalent to 28 hours of study load

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