



Understanding the role of the planner within climate change adaptation in the city of Groningen

Dealing with dilemmas, overcoming barriers and creating opportunities



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Preface

Dear reader,

Before you lay my thesis for the master Environmental and Infrastructural Planning at the University of Groningen. This will be the final piece of work for this master, which I have followed with great pleasure. A special thanks goes out to Steven Forrest, who has helped me to make this the work that it is.

I hope you will enjoy reading it.

Paul Hartman

Wageningen, august 2019

I feel like butter, scraped over too much butter

~Bilbo Baggins

Abstract

This research studies the role of the planner in dealing with dilemmas, barriers, and opportunities in climate change adaptation within the city of Groningen. Who and what exactly qualifies as a planner was difficult, the discipline reinvents itself constantly. This difference was also observed in their definitions of climate change adaptation. There was a clear divide between a group that believes in incremental change and a group that believes that climate change adaptation requires transformative change.

The role of planners in climate change adaptation was more clear. This role is to break through sectoral walls and bring together stakeholders, which enables institutions to overcome barriers and realize opportunities. Interestingly, this role overlaps with the category in which most barriers and opportunities were observed, which is the social interactions attributes of institutions. Particularly social connectivity among and within the institutions was the most important cause of barriers and opportunities. Although more barriers and opportunities were observed, they were all either directly or indirectly linked to social connectivity. Therefore, the planner has an important task to fulfil in the city of Groningen to further climate change adaptation.

Keywords: Climate change adaptation, planning theory, planner, dilemmas, barriers, opportunities, change, institutional

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List of abbreviations

Abbreviation	Meaning
IPCC	International Panel on Climate Change
DPRA	Delta Plan Ruimtelijke Adaptatie
NAS	Nationale Adaptatie Strategie
UNFCCC	United Nations Framework Convention on Climate Change
UNDP	United Nations Development Programme

1. Introduction

Societal relevance

The climate is changing, and this exposes countries across the world to all kinds of vulnerabilities (IPCC, 2018). For the Netherlands, these vulnerabilities include but are not limited to sea-level rise, saltwater intrusion, changing river discharge, changing precipitation patterns, decreasing freshwater availability and increasing drought (Biesbroek et al., 2011). The impacts of climate change are already noticeable, and they are expected to worsen in the future (Collins et al., 2013). This requires societies to adapt to new circumstances. The EU has recognised this and urges its member states to create a long-term spatial planning approach as an answer to climate change (European Commission, 2009, p.4). Within the EU the Netherlands, the United Kingdom, and Germany are frontrunners in climate adaptation (Greiving and Fleischhauer, 2012). They dedicate a large number of resources to adaptation research and facilitation (Biesbroek et al., 2009a). However, the Netherlands is the only country within the EU where the national government considers spatial planning as key to climate adaptation (Greiving and Fleischhauer, 2012).

The National Adaptation Strategy and the spatial adaptation delta plan (DPRA) of the Netherlands are developed with a spatial planning perspective, which includes the process of climate-proofing (Meijs et al., 2018; Greiving and Fleischhauer, 2012). This is a process that aims to integrate climate adaptation principles into spatial planning and thereby drive technological, institutional and societal opportunities (Kabat et al., 2005). However, the NAS and DPRA are top-down responses to climate change adaptation and there is a consensus among politicians and academics that adaptation to climate change needs to be achieved locally (Biesbroek et al., 2009b). The reasoning behind this is that climate adaptation is both sensitive to context and time, which makes local policies and knowledge most effective in addressing it (Biesbroek et al., 2013). Therefore, the national government of the Netherlands intends to act as a facilitator (Meijs et al., 2018). Most responsibilities will fall onto the municipalities and waterboards, with an additional facilitative role for the provinces (Meijs et al., 2018).

Research explanation

Climate change adaptation is widely discussed among academics (Ford et al., 2011; Hunt and Watkiss, 2011; Adger et al., 2005). However, defining what adaptation to climate change entails is proven to be difficult (Termeer et al., 2012). This is just one of the characteristics of a wicked problem, but they all fit climate change adaptation (Perry, 2015). Therefore, climate change adaptation has been recognised as a typical wicked problem (Davoudi et al., 2009; Jordan et al., 2010; Termeer et al., 2013; Vink et al., 2013). Planners are familiar with wicked problems because they deal with societal problems that are ever-changing, hard to define

and comprehend (Rittel and Webber, 1973). Therefore, it is generally believed that planning is both capable and responsible for reducing climate change vulnerabilities (Stern, 2007).

Wicked problems create dilemmas, which confronts planning with a set of choices, practices, and actions that aim to deal with paradoxes in different contextual situations (Savini et al., 2015). In turn, these dilemmas can present both barriers and opportunities. Interestingly, barriers are closely intertwined with opportunities because they can be interchangeable depending on the context (Uittenbroek et al., 2013; Eisenack et al., 2014). Studies have shown that effective adaptation is dependent on how barriers that emerge in the governance of adaptation are overcome (Adger and Barnett, 2009; Adger et al., 2009; Moser and Ekstrom, 2010; Rijke et al., 2012). However, what exactly embodies a barrier remains vague (Koop et al., 2017).

Institutions play a significant role in overcoming barriers and realizing opportunities to climate change adaptation (Oberlack, 2017). They are the deciding factor in shaping, enabling or constraining adaptation efforts (Oberlack, 2017). Embedded within these institutions is the planner, re-evaluating its role and actively engaging with governmental, private and non-governmental organizations to discuss its function in relation to cities and the environment (Allmendinger, 2017). Therefore, connecting spatial, temporal and governance scales, and accounting for local strengths and vulnerabilities provides planners with the opportunity of playing a key role in climate change adaptation (Cheng and Daniels, 2003). However, most studies neglect the role of spatial planning in adaptation strategies and hardly recognize its coordinative and integrative qualities (Greiving and Fleischhauer, 2012; Roggema et al., 2012).

Aim of the research

Cities are increasingly faced with economic competitiveness, more accountability, more participation, environmental challenges and the will to improve quality of life (Allmendinger, 2017). The municipalities of the Netherlands have been given the responsibility to adapt to climate change because they are best equipped to find local adaptation options (Meijs et al., 2018). Multiple institutions and stakeholders are involved with climate change adaptation in the city of Groningen and this requires mediation. Therefore, this research aims to study the role of the planner in climate adaptation within the city of Groningen. Specifically, how the planner is confronted with dilemmas, institutional barriers, and opportunities with climate change adaptation in the city of Groningen.

Research questions

The main question and the corresponding sub-questions are:

“What are the dilemmas, institutional barriers, and opportunities that planners are confronted with when tackling climate change adaptation as a wicked problem within the city of Groningen?”

- 1. How can climate change adaptation be understood as a wicked problem within the city of Groningen?*
- 2. Who are the planners and how does their definition of climate change adaptation affect the degree of change?*
- 3. Which dilemmas are frequently encountered by planners within the city of Groningen and are they unique to climate change adaptation?*
- 4. What do planners observe to be the institutional barriers and opportunities in the governance of climate change adaptation?*
- 5. What is the role of the planner in the adaptation process and do they help to overcome barriers and create opportunities within the city of Groningen?*

2. Theoretical framework

This chapter will elaborate on the relevant theories and concepts that will be applied to analyse the results. First, the theoretical framework will discuss the concept of climate change adaptation and its relation to planning. Secondly, dilemmas in planning will be discussed. Thirdly, these dilemmas present barriers and opportunities. As will be further explained later this section will specifically focus on institutional barriers and opportunities.

2.1 Climate change adaptation

The concept of adaptation

The concept of adaptation in relation to climate change originates from the academic field of ecology, specifically from the hazard's literature (Bassett and Fogelman, 2013). Other fields of expertise also studied adaptation, but they were not as influential to our current understanding of climate change adaptation (Janssen et al., 2006). The concept of adaptation was first applied in discussions on the relationship between hazards, risk, vulnerability and its impacts on societies (Bassett and Fogelman, 2013). The hazard's school conceptualized vulnerability in relation to human and monetary costs caused by the impacts of hazards (Burton et al., 1978). However, this conceptualization of vulnerability was criticized by political economists (O'Keefe et al., 1976; Susman et al., 1983). Instead, political economists emphasized the underlying social processes that produced vulnerability (Wisner et al., 2005, p. 49). The essence of this disagreement revolves around the hazard's school regarding adaptation as an adjustment of the economic and political system while the political economists regarded adaptation as a transformation of these systems (Bassett and Fogelman, 2013). The disagreement was unresolved, which eventually led to the concept dropping in relevancy until it reappeared in another field (Bassett and Fogelman, 2013).

Before the adaptation concept re-emerged, climate change prevention was solely focused on mitigation (Füssel, 2007). Climate change adaptation did not receive extensive coverage until the third climate change assessment report of the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 2001, p. 881). In this report, adaptation was applied as a concept to better understand vulnerability. At first, mitigation and adaptation were regarded as a dichotomy (Biesbroek et al., 2009a). However, academics and policymakers have come to understand that mitigation and adaptation are instead complementary (Biesbroek et al., 2009a). The development of coming to terms with climate change adaptation was two-fold. First, there was a growing realization that mitigation strategies would not be enough to completely reduce vulnerability to climate change (Biesbroek et al., 2011). Even if mitigation strategies would substantially reduce the use of greenhouse gasses, impacts would still be part of the future due to latency in the climate system (Biesbroek et al., 2011). Second, there

was a lack of political willingness for mitigating climate change (Bassett and Fogelman, 2013). For example, in 2017 the United States of America (USA) withdrew from the climate accord of Paris (NOS, 2017). This has left climate change adaptation as the only viable response to further develop climate change policy (Schipper, 2009). Additionally, these developments had academics starting to question how societies should adapt to climate change and how to reduce its accompanying vulnerabilities (Kates, 2000; Schipper, 2006). To do this effectively, it is necessary to understand what kind of problem climate change adaptation is.

Defining climate change adaptation

When tackling a problem, it is useful to define what the actual problem is. Interestingly, climate change adaptation does not have an agreed-upon definition (Termeer et al., 2013). Consequently, different definitions can lead to different goals and outcomes (Termeer et al., 2012). This can be illustrated by looking at a number of climate change adaptation definitions from bodies within the United Nations (UN). The UN Framework Convention on Climate Change (UNFCCC) defines adaptation as actions that help communities and ecosystems cope with climate change (VCCCAR, 2019). The UN Development Program (UNDP) defines adaptation as a process by which strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented (VCCCAR, 2019). These definitions already show a significant difference, the UNFCCC refers to adaptation as actions while the UNDP defines adaptation as a process. By defining adaptation as an action the UNFCCC gives the impression to approach adaptation as one time measures. In contrast, the UNDP appears to approach adaptation more iteratively by defining it as a process. Consequently, their approaches and results with adaptation to climate change are likely to be different. Generally, academics describe adaptation as a process that is ongoing (Barnett et al., 2015; Nelson et al., 2007; Moser and Ekstrom, 2010).

The IPCC, a prominent UN body for climate change, defines adaptation as adjustments within natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities (IPCC, 2007, p. 27). Similar to the UNDP, the IPCC definition includes the possibility of gaining advantages out of climate change. Furthermore, the definition of the IPCC remains abstract in describing adaptation for whom and where. It broadly refers to natural and human systems without further specification (IPCC, 2007, p. 27). The UNFCCC explicitly mentions communities and ecosystems while the UNDP makes no mention of adaptation for whom or where (VCCCAR, 2019).

The three definitions discussed above are all part of the UN and yet they have noticeable differences in how they interpret climate change adaptation. This clearly highlights the characteristic of a wicked problem, wherein there is no definitive formulation of the problem (Rittel and Webber, 1973). Interestingly, Rittel and Webber (1973) have stated that planning problems are inherently wicked because planning deals with societal problems that are ever-changing, hard to define and comprehend. The familiarity with these uncertainties makes planning a suitable candidate for addressing climate change adaptation (Hurlimann and March, 2012). Therefore, it is necessary to critically review what the role of the planner entails and particularly what it can offer in tackling a wicked problem such as climate change adaptation.

A wicked problem

Climate change affects the whole planet, it cuts through borders, institutions, policy arenas, norms and values (Termeer and Kessener, 2007; Thynne 2008; Verweij et al., 2006; Weber, 2008). As a result, the problems posed by climate change are complex. Before climate change was a relevant issue, similar problems were referred to as wicked (Rittel and Webber, 1973). This concept addressed dilemmas in planning for pluralistic urban societies that cannot be tackled by regular scientific approaches (Zellner and Campbell, 2015). Climate change adaptation fits the characteristics of a wicked problem. In fact, it fits so well that academics refer to climate change adaptation as a 'wicked problem par excellence' (Lazarus, 2008; Davoudi et al., 2009; Jordan et al., 2010; Termeer et al., 2013). Rittel and Webber (1973) attributed a number of distinguishable characteristics to wicked problems. Highlighting these characteristics will provide a way forward in understanding climate change adaptation and describing the role of the planner within it.

A key characteristic of wicked problems is that defining a wicked problem is part of the problem. There is no mutual agreement on how to frame the problem (Termeer et al., 2012). This was illustrated by looking at a number of climate change adaptation definitions from bodies within the United Nations (UN). For example, some definitions acknowledged for whom adaptation was while others did not. It is hard to agree upon a definition because information on climate change is both incomplete and conflicting (Moser et al., 2012). However, these different definitions simultaneously determine different solutions (Rittel and Webber, 1973). This brings us to the next characteristic; wicked problems have no stopping rule. The implications of this are that solving one problem might create new ones elsewhere that hadn't been considered yet. This makes it challenging to frame an end goal to the problem, the work is never really done (Perry, 2015).

Adaptation goals are hard to quantify (Füssel, 2007). This does not only make it hard to frame an end goal but also to determine whether adaptation measures will be effective and successful. Only time will be able to tell which stakeholders' benefit or lose and what the effects of the solutions for a wicked problem will be (Rittel and Webber, 1973). This represents another characteristic of a wicked problem, there are no right or wrong solutions (Perry, 2015). Climate change adaptation requires a willingness to work with uncertainty, assessing what works and what does not. Planning is familiar with this uncertainty and its willingness to act on it makes it an ideal candidate for taking the lead in realizing climate change adaptation (Hurlimann and March, 2012).

Planning and climate change adaptation

Climate change requires drastic measures to minimize its impacts (IPCC, 2018). Although the effects of climate change can be predicted to a degree, the details remain unclear (Measham et al., 2011). Furthermore, cities are faced with economic competitiveness, more accountability, more participation, environmental challenges and the will to improve quality of life (Allmendinger, 2017). This makes it increasingly challenging for planners to respond to both foreseen and unforeseen changes (Sengupta et al., 2016). Therefore, the role of the planner in society, its necessary skills and attributes, and the evolving nature of spatial planning itself is under continuous discussion (Fox-Rogers and Murphy, 2016).

Understanding climate change adaptation as a wicked problem and the temporal dynamics that it accompanies introduces significant uncertainty challenges to planning (Sengupta et al., 2016). Multiple perspectives on uncertainty have been thoroughly discussed by academics (Dessai et al., 2009; Klijn and Koppenjan, 2004; Brugnach et al., 2008). Interestingly, most literature focuses on reducing uncertainty while Dewulf and Biesbroek (2018) believe that planning should focus on embracing uncertainty. Although planning does not provide the answers to dealing with uncertainty, it does provide experience (Allmendinger, 2017).

Furthermore, academics observe that adaptation measures are predominantly incremental (Wise et al., 2014). Incremental adaptation can be understood as making small spatial or institutional changes, thereby maintaining the status quo (Park et al., 2012). In practice, planning happens on the basis of plans, laws, and regulations (Savini et al., 2015). However, current urban theories suggest that cities are complex and self-organizing systems that are inherently unpredictable (Sengupta et al., 2016). Therefore, these plans, laws, and regulations can hamper climate adaptation development because they cannot keep up with initiatives, changing demands and users of spaces (Savini et al., 2015).

Therefore, academics advocate the need for transformational change (Termeer et al., 2017; Kates et al., 2012). However, what transformational change exactly embodies is still under debate (Feola, 2015). In broad terms, Termeer et al. (2017) believe that such change is fundamental, large scale and quick. Furthermore, Kates et al. (2012) believe that transformational changes need to be innovative to ensure that they introduce something new to a particular place or system. This is a challenging task for planners because they need to manage stakeholders' interests while keeping the collective interest within their scope (Hurlimann and March, 2012). Furthermore, plans, laws, and regulations cannot just be set aside, they provide certainty and protection (Savini et al., 2015). Such considerations often confront planning with dilemmas, wherein it is necessary to compromise between two confronting positions (Rittel and Webber, 1973).

2.2 Dilemmas

Planning has a paradoxical nature wherein there is a juxtaposition between control and self-organization (Sundaramurthy and Lewis, 2003). This juxtaposition introduces tensions in planning. Poole and Van de Ven (1989) argue that these tensions should be central in tackling planning problems. Planning isn't about selecting the scientifically grounded best solution. Instead, it requires the acknowledgement of a multifaceted reality wherein the best solution is an alignment of all these realities (Poole and Van de Ven, 1989). This is also relevant to climate change adaptation, wherein definitions and stakeholders' interests differ (Hurlimann and March, 2012). Therefore, aligning these interests requires planners to compromise and this confronts them with dilemmas (Rittel and Webber, 1973).

The concept of dilemmas describes planning as a set of decisions, practices, and actions that aims to deal with paradoxes in different contextual settings (Savini et al., 2015). Savini et al. (2015) argue that understanding the planning of change requires the analyses of the dilemmas that emerge in planning. By doing this, it is possible to understand which trade-offs the dilemmas represent. Although the paradoxical nature of planning should not be oversimplified, Savini et al. (2015) argue that it is necessary to improve our understanding of them.

A number of academics have discussed dilemmas, but they are relatively abstract and descriptive (Bisaro and Hinkel, 2016; Bailey, 2010; Lane and McDonald, 2005). Savini et al., (2015) have a different approach, they categorize dilemmas into three key considerations for planning: First, the bordering of territories to enable targeted intervention. Second, the capacity to control the rules of the game. Third, how to attract financial resources to achieve the desired outcomes and to steer trends (Fainstein, 1994). Subsequently, Savini et al. (2015) translate this into the intervention, regulation and investment dilemma. Furthermore, climate change adaptation literature argues that maladaptation does not get the consideration it deserves (Moser and Ekstrom, 2010; Magnan et al., 2016). However, the possibility of maladaptation confronts the planner with an interesting dilemma. Namely, that some adaptation policies or measures can create unsuccessful or even negative outcomes (Juhola et al., 2016). Therefore, maladaptation will be added as a fourth dilemma.

The intervention dilemma

The intervention dilemma represents the trade-off between exclusion and impact (Savini et al., 2015). Essentially, the dilemma is positioned around the notion of time and space. The challenge with opening up the notions of time and space is that it neglects the need to establish frameworks of reference that enable collective action (Hillier and Gunder, 2003; Huxley and Yiftachel, 2000). If there is no established framework, understanding relations

and spatial problems become an endless process (Mazza, 2002). Consequently, not defining the notions of time and space leaves planning powerless with no actual impact (Mazza, 2002). This is particularly relevant to climate change adaptation, where the timing of measures and determining the right level of governance for intervention are found to be recurrent dilemmas (Bailey, 2010).

Planners use the concepts of space and time to translate interests and objectives into a targeted intervention to create a desirable future (Savini et al., 2015). However, authors such as Innes and Booher (1999), Healey (2007) and Boelens (2010) have rightfully stated that these notions are relationally defined and therefore harbour an expression of power. Furthermore, time and space can also be described as fluid notions that are perceived differently on different scales (Allmendinger and Haughton, 2009). This is also the case for climate change, it does not limit itself to borders and institutions and it has different implications in different contexts (Termeer and Kessener, 2007). For example, a planner might wish to intervene in a specific location that is vulnerable to climate change. Drawing the lines of where the intervention should be targeted would prove to be difficult. A location just outside of the targeted area might be very vulnerable to climate change. This confronts the planner with a trade-off between creating a noticeable impact and minimizing exclusivity and selectivity. In essence, this is the intervention dilemma.

The regulation dilemma

The regulation dilemma represents the trade-off between self-management and protection against opportunism (Savini et al., 2015). Regulation is in place to provide conditional norms and instructions that aim to create a specific output and to limit the degree in which it is possible to deviate from it (Savini et al., 2015). This creates legal certainty for governments, private companies, and people to avoid unwanted development. However, regulation also prevents space to co-evolve with changing preferences over time because it cannot keep up with such change (Mclaughlin, 2012). Consequently, these regulations no longer serve as protection but rather as obstacles (Coglianese and Kagan, 2007). This is also observed in relation to climate change, cities cannot enforce adaptive measures yet while they struggle with problems like the urban heat island effect (Carter, 2011).

It is necessary to provide a degree of protection from opportunism (Savini et al., 2015). Planners have attempted to use instruments such as strategic plans and visions to create a more open approach for future development (Turner et al., 2012). However, over the course of time, these instruments also became standardized and it effectively replaced previous regulation (Savini et al., 2015). This confronts the planner with a trade-off between legal certainty and allowing innovation to respond to changing circumstances. For example,

climate change adaptation measures would benefit from the possibility to co-evolve with its spatial and temporal context. However, the planner also needs to prevent opportunistic behaviour to pursue other interests under the name of climate adaptation.

The investment dilemma

The investment dilemma represents the trade-off between supply- or demand-led development (Savini et al., 2015). Supply-led development focuses on increasing land values that create social and economic conditions in particular areas (Jones, 1996). Development happens on the basis of economic growth, demographic growth and marketability of the real estate. In other words, development is an investment in expectations of the future (Savini et al., 2015). This closely links to adaptation measures, which also attempts to react to expectations of the future. Demand-led development is the opposite, it focuses on local demands and proposes solutions to improve particular spaces (Aalbers, 2013). Although this type of planning is less prevalent, it has gained more relevance since the global financial crises in 2008 revealed some critical weaknesses to supply-led development (Savini et al., 2015). Demand-led development is relevant to climate change adaptation because it focuses on local demands and climate change adaptation requires local answers (Biesbroek et al., 2009b).

Supply- and demand-led development can be related to the notions of risk and income (Savini et al., 2015). Supply-led development is based on quantified and linear models of risk and income (Goldin and Vogel, 2010). It is risk-averse and works as long as it can ensure the permanent inflow of income at low risk (Savini et al., 2015). The idea is that this growth can be used to produce wealth that will be redistributed to other areas that are less fortunate. However, supply-led development is based on the idea of never-ending growth. If this growth slows down there is a need for more risk, which can have negative consequences (Savini et al., 2015). This is especially relevant to climate change. The impacts of climate change have the potential to severely hurt economies, which endangers the idea of never-ending growth (IPCC, 2018).

Demand-led development is less focused on the economic prospect of the area but rather focuses on the capturing of local value (Savini et al., 2015). Demand-led development does not concern itself with the redistribution of costs and income. Instead, it focuses on aspects that are not quantifiable such as place attachment and social cohesion (Savini et al., 2015). In short, the investment dilemma is a trade-off between generating revenue streams that can attract development for emerging demands and the desire for people to create their own spaces that represent local values.

The maladaptation dilemma

In 2014, the fifth assessment report of the IPCC acknowledged maladaptation for the first time. The report stated that there is a large body of literature on how to avoid maladaptation but a lack of clarity on when something should be regarded as maladaptation (IPCC, 2014). Barnett and O'Neill (2010) define maladaptation as measures that did not improve or even worsened vulnerability to climate change. Juhola et al. (2016) add to this that maladaptation is to be regarded as an intentional action that ends up negatively affecting vulnerability to climate change. However, Dupuis and Biesbroek (2013) observed that adaptation can also develop autonomously, which implies that maladaptation is not always intentional and therefore cannot always be prevented.

Planners have no right to be wrong when it comes to wicked problems such as climate change adaptation because the effects would be disastrous (Rittel and Webber, 1973). Yet, the idea that adaptation might turn out to be wrong was recognized as early as the concept itself (Bassett and Fogelman, 2012). Juhola et al. (2016) state that spatial boundaries, temporal boundaries, and thresholds are important to gain further insight into what exactly constitutes maladaptation. Magnan et al. (2016) and Moser and Ekstrom (2010) have similar statements, emphasizing the need for attention to contextual factors. However, these contextual factors also include other dilemmas and this might implicate that the maladaptation dilemma further complicates the other dilemmas. This poses the maladaptation dilemma: Planning needs to consider that interventions, regulations or investments may turn out to be ineffective or even worsen the situation.

2.3 Institutional barriers and opportunities

Climate change adaptation barriers

The concept of barriers to climate change adaptation has been widely applied since the inclusion of the concept in the fourth assessment report of the IPCC (Adger et al., 2007). There are several reasons for the attention that barriers to adaptation have gained. First, climate change impacts and extreme weather events have raised questions among societies whether they have the capacity to adapt to climate change (Adger et al., 2009). Second, academic literature has shifted from a discussion of whether there is a need to adapt to how societies should adapt to climate change. More importantly, this has raised questions on what might constrain adaptation measures (Berrang Ford et al., 2011; Dovers and Hezri, 2010). These constraints are frequently referred to as barriers, or limits if they cannot be overcome (Eisenack et al., 2014). Academics have stated that societies' ability to deal with barriers will be a major challenge (Adger and Barnett, 2009; Adger et al., 2009b; Moser and Ekstrom, 2010; Rijke et al., 2012). Coming to understand how, where and when these barriers and limits arise has, therefore, become a priority in climate change research (Adger et al. 2009a, 2009b, Stafford Smith et al. 2011, Dow et al. 2013).

The literature on barriers sometimes overlap, contradict or use a specific scope (Koop et al., 2017). Moser and Ekstrom (2010) define barriers as obstacles that can be overcome. Biesbroek et al. (2011) define barriers as conditions and factors that either impede, divert or block the process of climate change adaptation. A clear difference in these definitions is that the latter states that some barriers block the adaptation process, thereby implying that such a barrier cannot be overcome. The fifth assessment report of the IPCC defines barriers similar to Moser and Ekstrom (2010), as factors that make the planning and implementation of adaptation challenging (IPCC, 2014). Eisenack et al. (2014) are most detailed, they define barriers as impediments to specific actors for adaptation measures that originate from certain conditions. In short, the definitions predominantly describe barriers as factors that impede adaptation which can be overcome with the right amount of effort (Barnett et al., 2015). Eisenack et al. (2014) add that barriers to adaptation are not necessarily an impediment to every involved actor. Instead, what some actors perceive as a barrier might be an opportunity to others.

Climate change adaptation opportunities

The climate change adaptation literature often covers opportunities as a polar opposite of either barriers, risks or challenges (Uittenbroek et al., 2013; Conway and Schipper, 2011; Scheraga and Grambsch, 1998; Oberlack, 2017; Chu et al., 2016). However, the focus appears to mainly be on the barriers, which is reflected by the lack of conceptual definitions within the articles. Uittenbroek et al. (2013) mention that opportunities present themselves in

social, cognitive, financial, technological and institutional nature. Oberlack (2017) is the only author that defines opportunities. Namely, opportunities are conditions and strategies that allow actors to prevent, alleviate or overcome barriers and dilemmas (Oberlack, 2017).

Uittenbroek et al. (2013) and Eisenack et al. (2014) make the interesting observation that barriers are closely intertwined with opportunities. This means that, depending on the stakeholder or context, barriers can also be opportunities and vice versa. A number of scholars noted available resources, leadership, political and public support, cooperation and extreme events to be frequently observed opportunities in climate change adaptation (Jordan et al., 2010; Bulkeley and Tuts, 2013; Tompkins et al., 2010). Considering the previously noted opportunities, it is plausible that these intertwine with barriers. For example, resources can be either an opportunity or barrier on the basis of their availability. This close connection has its consequences, studying barriers and opportunities may result in an endless list (Biesbroek et al., 2013). Therefore, categorization would help to maintain an overview of barriers and opportunities. Additionally, a specific set of categories allows more in-depth analysis because it can account for place and scale.

Institutional barriers and opportunities

A number of academics have shown that local governments increasingly struggle with climate adaptation barriers (Baker et al. 2012; Measham et al., 2011; Ziervogel and Parnell, 2012). Moreover, Barnett et al. (2015) compiled commonly identified barriers and found institutional support and institutional collaboration to be among them. Interestingly, institutions are found to be one of the most influential factors that enable, constrain and shape climate adaptation (Dovers and Hezri, 2010; Rodima-Taylor et al., 2012).

Furthermore, wicked problems are not technical or managerial of nature but rather of political and institutional nature (Jentoft and Chuenpagdee, 2009). Therefore, it is relevant to identify and understand institutional barriers and opportunities in climate change adaptation.

To analyse institutional barriers and opportunities, it is useful to define what institutions are. Ostrom (2005) defines institutions as formal and informal rules and procedures that structure situations in which decisions are made on both an individual and collective level. A number of academics have observed that institutions influence decision-making by constraining, enabling and incentivising action, linking individual actions, events and outcomes, distributing power, determining rights and responsibilities and shaping beliefs, motivations and social learning (Ostrom, 2005; Paavola 2007; Hagedorn, 2008; Pahl-Wostl, 2009). These are all relevant factors that have the possibility to create barriers or to provide opportunities.

To make more sense of institutional barriers and opportunities and to maintain a clear overview, it helps to categorize them. A number of studies have done this, and it allowed them to identify, classify and analyse barriers and opportunities to climate adaptation (Moser and Ekstrom, 2010; Biesbroek et al., 2011; IPCC, 2014). Interestingly, Oberlack (2017) does this specifically with an institutional focus. Instead of classifying categories into phases of a policy process (Moser and Ekstrom, 2010), the categorization of Oberlack (2017) consists of institutional attributes that are related to climate adaptation. This categorization is the result of a meta-analysis of 52 studies on adaptation. The result presents three main institutional categories: agency, social interaction and inherent attributes (Oberlack, 2017).

2.3.1 Agency attributes of institutions

Oberlack (2017) describes the agency attributes of institutions as rules and actions that influence the decision-making of individuals in climate change adaptation. Subsequently, agency attributes of institutions present barriers and opportunities through the categories of actor eligibility, responsibility, and control.

Actor eligibility

Actor eligibility means which rules define who is and who isn't eligible to be part of the (adaptation) process (Oberlack, 2017). This creates a number of potential barriers and opportunities. First, there is the numbers trade-off barrier. This entails that the inclusion of more stakeholders will introduce higher transactional costs for the participants of the adaptation process. Therefore, this may not always benefit adaptation (Few et al., 2007; Huntjens et al., 2012). However, more involvement can also create opportunities if communication and social learning are emphasized (Johula and Westerhoff, 2011). Additionally, it may help stakeholders to understand the urgency of climate change adaptation (Lövbrand, 2011; Pelling et al., 2008). Second, there is the maladaptive knowledge and value selection barrier. This entails that some stakeholders may be excluded on the basis of their location, knowledge or values (Oberlack, 2017). This creates the possibility of maladaptation. To prevent this, institutions have the opportunity to be more inclusive and flexible (Biesbroek et al., 2010). Third, there is the open-access trade-off barrier. Similar to the numbers trade-off, this is based on the premises that more inclusion can also negatively affect decision-making (Few et al., 2007). On the other hand, this can also create opportunities for collaboration in a setting of low complexity because the discussion will be highly contextualized (Rouillard et al., 2012).

Responsibility

Responsibility stands for the rules that determine what is expected, forbidden and allowed by stakeholders (Oberlack, 2017). This introduces two situations with different types of barriers

and opportunities. A situation wherein responsibilities are unclear and a situation wherein responsibilities are clear. The first situation creates either an incentive or a conflict trap. If responsibilities are unclear, stakeholders might not be incentivized to take the lead in adaptation (Bergsma et al., 2012). Furthermore, conflicts may arise among stakeholders from not being able to equally divide adaptation responsibilities (Daniell et al., 2011). Discussing these responsibilities can present opportunities (Huntjens et al., 2012). However, regulation from a higher governance level is expected to help most (Johula and Westerhoff, 2011).

In the second situation, responsibilities are clear, which presents other forms of barriers and opportunities. First, the rigidity trap presents a barrier that hampers adaptation due to the bordering of the governance system. Institutions are not well equipped for adaptation problems because they do not match the biophysical and socioeconomic effects of adaptation problems (Galaz, 2005). This translates into a higher risk of maladaptation, a loss of effectivity and higher transactional costs (Larsen et al., 2012; Rouillard et al., 2012). Recognising this creates the opportunity for institutions to rethink their scales of problem-solving and to make context-sensitive legislation (Bergsma et al., 2012). Second, responsibilities can be fragmented and overlapping. Both forms significantly increase transactional costs, negatively impact effectivity and create the risk of conflict (Bergsma et al., 2012). This presents an opportunity to improve upon vertical and horizontal integration among institutions, which should help to improve coordination and negotiation for adaptation in a local context (Sharma et al., 2012). Finally, there is the barrier of maladaptive responsibility. This represents the idea that the responsibility of climate change adaptation might be appointed to a stakeholder with interests that are in direct conflict with climate adaptation or they simply do not have the resources (Garrelts and Lange, 2011). Although it is hard to create opportunities out of this particular barrier, it can be prevented by communicating responsibilities and being aware of the abilities and resources of actors (Lövbrand et al., 2011; Petrow et al., 2006).

Control

Control represents the rules that determine how stakeholders are able to influence adaptation outcomes (Oberlack, 2017). Influencing adaptation outcomes can be done in three ways. First, there is the leadership trap, which is a clear example of both a barrier and an opportunity. Leadership has the ability to hamper adaptation but also to stimulate adaptation (Storbjörk and Hedrén, 2011). By clarifying the responsibilities of leaders and creating transparent accountability mechanisms it is possible to create opportunities (Tyler et al., 2007). Second, there is the barrier of vested interests. Institutions may favour the protection of particular interests over others, which creates inequality in the adaptation

process (Sendzimir et al., 2008). Providing transparency on these privileges and limiting them to a reasonable degree provides opportunities for institutions to be more inclusive (Naess et al., 2005). Finally, there is the barrier of control among governance levels. It is possible that institutions favour allocating resources, regulation or information on a scale that does not match with adaptation needs (Wilson, 2006). As a consequence, adaptation might be hampered or even turn out to be maladaptive (Wamsler and Lawson, 2012). However, this presents an opportunity to rescale resources, regulative power or information to the governance level that benefits the most (Larsen et al., 2012).

2.3.2 Interactions attributes of institutions

The interaction attributes of institutions represent how individual actors are linked by procedures and networks (Oberlack, 2017). This is shown in the barriers and opportunities that are found in within the category's social connectivity, conflict, social learning, and accountability.

Social connectivity

The social connectivity of institutions determines how actors are organized by procedures and network structures within and outside of their organisations (Oberlack, 2017). This presents a number of barriers and opportunities in the adaptation process. First, the malcoordination trap describes how organisations suffer from ineffective decision-making and high transaction costs because of a lack of coordination, operating in silo's, loose ties among actors and over-coordination (Biesbroek et al., 2010; Cots et al., 2009). Similar to the rigidity trap of responsibilities, the malcoordination trap provides the opportunity to rethink the scale of addressing adaptation and to create an integrative narrative that frames climate change adaptation as an inter-organisational challenge (Keskitalo et al., 2012; Krysanova et al., 2010). Second, there is the mistrust trap, which describes that distrust among stakeholders will negatively impact communication. Agreeing on methods of evaluation and improving communication channels will provide opportunities to avoid mistrust (Cots et al., 2009; Glaas et al. 2010). Third, a rigidity trap of strong connectivity entails that stakeholders may maintain good connections but that these connections are either ineffective or maladaptive due to their norms and beliefs (Giansante et al., 2002). Extreme events may provide windows of opportunity to stimulate change (Harries and Penning-Rowsell, 2011).

Conflict

Conflict describes how institutions regulate conflicting values, preferences and actions by either preventing or resolving them (Oberlack, 2017). First, preventing or resolving conflict can turn out to be ineffective. This will cause an increase of transactional costs, mistrust

among stakeholders and uncertainty (Runhaar et al., 2012). Creating mechanisms to improve on transparency and conflict resolving will provide opportunities to improve the potential of adaptation (Munaretto et al., 2012; O' Sullivan et al., 2012). Second, conflict can arise from institutional inconsistency. Stakeholders have different languages and cultures, and this may create mismatches (Tyler et al., 2007; Wamsler and Lawson, 2012). Efforts of individuals to collaborate will create key opportunities for understanding each other's language and culture (Larsen et al., 2012; Storbjörk and Hedrén, 2011).

Social learning

Social learning stands for the institutional attributes that shape how information and knowledge are created, exchanged and agreed upon among stakeholders (Oberlack, 2017). The coordination of exchanging knowledge and learning among stakeholders can be limited. Consequently, decisions are made on a less-informed basis than they could be, and this makes adaptation less effective (Demeritt and Langdon, 2004). Institutionalising communication channels and emphasizing learning both formally and informally would create opportunities for adaptation (Amundsen et al., 2010). Furthermore, an ineffective exchange between scientific research and policy can create barriers. Not utilizing science to its full ability hampers the effectiveness of adaptation (Westerhoff and Johula, 2010). Involving academics and other research organisations from the start will strengthen the linkages and create opportunities to help decision-making become more effective (Weichselgartner and Kaspersen, 2010). Finally, the creation and exchange of knowledge can cause the information to be filtered or selective. Interests of stakeholders can create settings wherein information isn't fully disclosed (Falaleeva et al., 2011; Petrow et al., 2006). Therefore, stakeholders should strive for transparency, even with vested interests. By doing this, opportunities can be created by reasonably accounting for such interests. This will lead to adaptation measures with a broader consensus (Runhaar et al., 2012).

Accountability

The accountability of institutions entails how their responsibilities are monitored, evaluated and rewarded (Oberlack, 2017). Barriers and opportunities can present themselves in situations where accountability is either absent or inefficient. An absence of accountability disincentives adaptation and creates the risk of high costs when an extreme event occurs (Bergsma et al., 2012). Furthermore, inefficient accountability can lead to maladaptation (Runhaar et al., 2012). Additionally, extreme events can lead to political promises that cause either overcompensation or the prioritization of vulnerable recovery instead of long-term adaptation (Petrow et al., 2006). Fortunately, there are a number of opportunities for institutions to prevent or overcome these barriers. First, it is of the essence to create a clear context of rules and procedures that monitor, evaluate and reward adaptation efforts

(Inderberg, 2011). Second, providing standards and clear goals helps institutions to envision effective climate adaptation (Werners et al., 2009). Finally, knowledgeable actors can inform decision-makers of the benefit of long-term measures for adaptation (West and Hovelsrud, 2010).

2.3.3 Inherent attributes

Inherent attributes of institutions are self-explanatory. They are an integral part of institutions and present barriers and opportunities in the temporal and spatial scale, adaptiveness and formality (Oberlack, 2017).

Temporal and spatial scale of institutions

The temporal and spatial boundaries of institutions determine when and if they act (Oberlack, 2017). This is tricky for climate change because political terms and development strategies typically do not match with climate change's time and spatial scope (Arnell and Delaney, 2006). Consequently, this may present barriers of temporal mismatch, wherein the effectiveness of adaptation is limited due to the prioritisation of short-term benefits.

Additionally, rules and procedures can be outdated and require too much time to adapt to unexpected extreme events (West and Hovelsrud, 2010). Focusing on no-regret adaptation measures will provide opportunities to adapt to climate change for the longer term (Wilson, 2006).

Adaptiveness of institutions

The adaptiveness of institutions represents the trade-off between stability and flexibility (Oberlack, 2017). Most institutions were created long before climate change was a relevant issue. Therefore, suddenly changing how they work is difficult because they have become path-dependent (Daniell et al., 2011). Furthermore, suddenly changing course can also come at the cost of stability and subsequently hamper effective adaptation (Werners et al., 2009). Herrfardt-Pähle and Pahl-Wostl (2012) argue that maintaining the stability of institutions can provide opportunities by making use of nested rule systems. This entails that higher levels of governance determine the rules and allow lower levels of governance to deviate from them to a certain degree to benefit adaptation within their own context.

Formality of institutions

The formality of institutions describes the degree in which goals and procedures are formally noted in laws, plans and documents (Oberlack, 2017). This can present barriers when there is an absence of formal laws, plans, and documents. A lack of such formality is likely to lead to less commitment from stakeholders and the prioritization of other responsibilities (Krysanova et al., 2010). However, an absence of rules and procedures can also create the

opportunity to speed up collaboration and its voluntary basis is likely to help build trust (Mcfadden et al., 2009).

3. Conceptual model

The conceptual model is built up out of the theory and concepts that have been discussed in the theoretical framework. The result is a comprehensive model that can be used to visualize relationships between the theory and concepts, which provides an anchor for the study (Baxter and Jack, 2008). Furthermore, it helps to interpret the gathered data at a later stage of this study (Baxter and Jack, 2008).

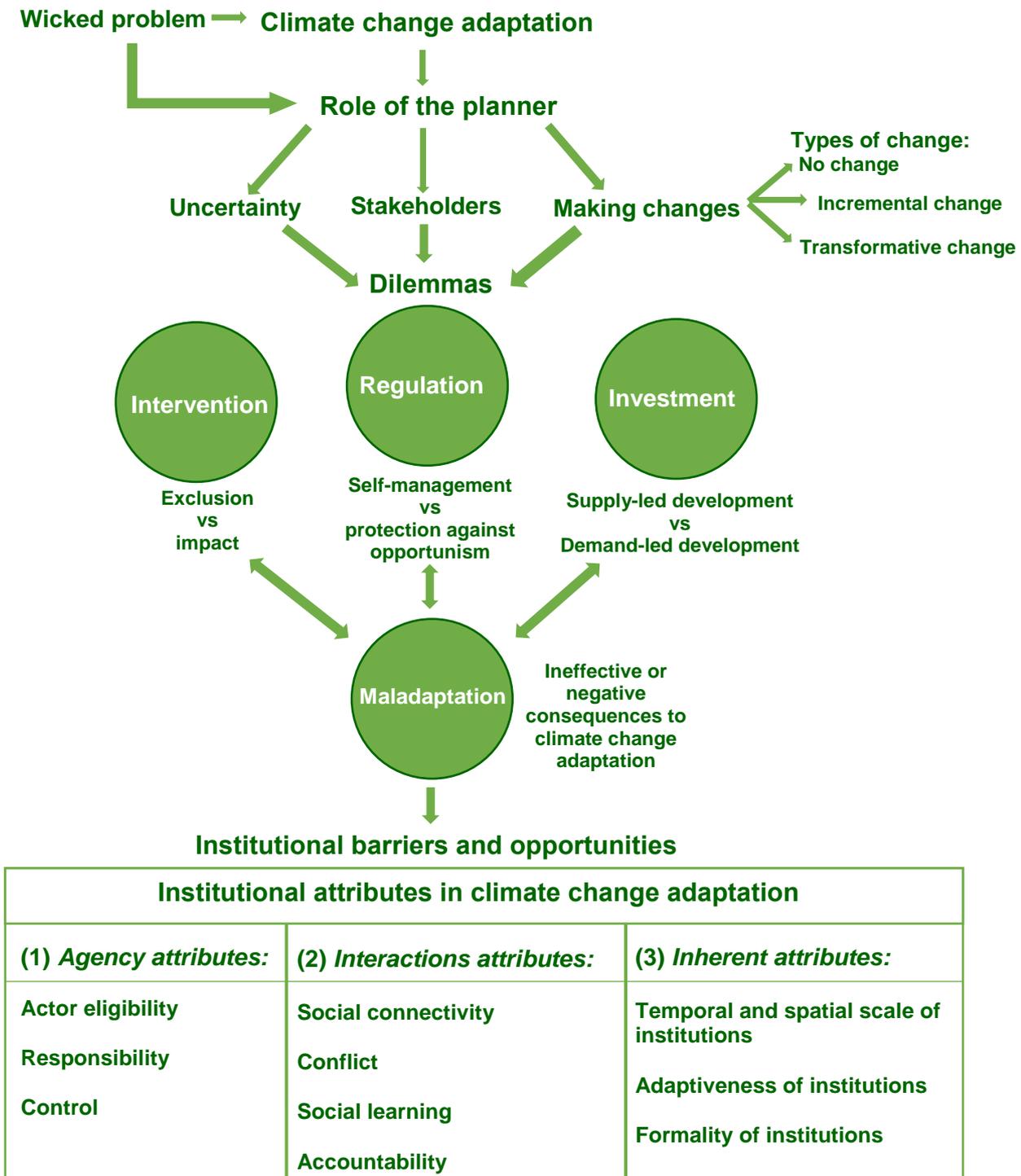


Figure 1: the conceptual model that shows the linkages between theory and logic

4. Methodology

This chapter will discuss the methodology of this thesis and the choices that have been made with the research strategy. Furthermore, the chapter will consider the unit of analysis, the collection of data, positionality, the analysis of data and ethics.

4.1 Qualitative research

Qualitative research is an interpretive method to understand complex phenomena within a specific context (Baxter and Jack, 2008). In this thesis, the complex phenomena are related to climate change adaptation within the city of Groningen. Whereas quantitative research controls variables and their relations, qualitative research observes complex phenomena (Flyvbjerg, 2006; Swanborn, 2010). Climate change adaptation is a complex topic that we haven't fully grasped yet, therefore qualitative research suits better (Dessai et al., 2009). Research can be done through multiple ontological perspectives. The most appropriate and useful perspective is dependent on the subject of study. In this thesis, the subject of study is the institutional setting wherein planners deal with dilemmas, barriers, and opportunities. Therefore, a constructivist perspective fits best. Constructivism is based on the idea that reality is constructed, interpreted and experienced differently by people through interactions and social systems (Maxwell, 2012; Bogdan and Biklen, 1997; Lincoln and Guba, 1985).

Climate change adaptation involves complex relationships between humans, climate, resources, politics, culture and other dimensions (Nightingale, 2015). To analyse such a complex concept, it is necessary to simplify relations (Hulme, 2011). Although that is not a problem in itself, it should be accounted for that the conceptualizations that emerge from this are merely representations of reality (Haraway, 1997). Furthermore, climate change adaptation is relevant to multiple disciplines and they are all accompanied with established theories, histories and habits (Hulme, 2011). Therefore, the conceptualization of the relationship between biophysical and social-political change determines the ontological and epistemological nature of this research (Nightingale, 2015). This is important to keep in mind because it may produce insights that unintentionally describe different phenomena (Nightingale, 2015).

Case study

A qualitative case study enables the researcher to explore complex phenomena by analysing various data sources such as individuals, organizations, interventions, relationships, communities or programs (Baškarada, 2014). Instead of using one particular lens, a variety of lenses are used to better understand and reveal the essence of the object of study (Baxter and Jack, 2008). A case study is to be considered under a number of conditions. First, the focus of the research is on 'how' and 'why' questions. Second, the

behaviour of the involved actors is not manipulated. Third, accounting for contextual conditions with the object under study. Fourth, boundaries between the phenomena and context are unclear (Yin, 2017).

According to Edmonds and Kennedy (2012), a case-study has three requirements that determine its quality: external validity, construct validity and reliability. External validity refers to whether findings are generalizable to other cases (Baškarada, 2014). This is challenging to ensure because climate change adaptation predominantly creates local effects that can differ depending on the context (Boswell et al., 2012). Fortunately, the theoretical framework will help to generalize findings to a degree on the basis of what has thus far been found in other studies. The second requirement is to construct validity, which refers to the operationalisation of concepts. This is deemed the most challenging for case-studies, which is why Yin (2017) advocates the improvement of construct validity by using multiple sources of evidence, continuously reviewing the case-study report and maintaining a chain of evidence. This is realized by combining the theoretical framework with a contextual reading of policy documents and interviews. Finally, the reliability of the research should be ensured. This means that other researchers can reproduce the results by following the same data collection procedures (Baškarada, 2014).

4.2 Unit of analysis

Baxter and Jack (2008) state that one of the common mistakes with case-studies is that the questions and objectives are not narrowed down enough. Therefore, Stake (1995) suggests that it is helpful to create boundaries for the case. This can be done by defining time and place (Creswell, 1998), time and activity (Stake, 1995) and definition and context (Miles and Huberman, 1994). These will be discussed shortly and, for the sake of clarity, are referred to as spatial and institutional boundary and timeframe.

Spatial boundary

Defining the contextual boundaries is challenging, especially with an overarching problem like climate change. Therefore, it is useful to make a distinction between the spatial boundary and the institutional boundary. The motivation behind this distinction will be clarified by explaining both boundaries respectively. The spatial boundary of the research will be the city of Groningen. This decision was made because the impacts of climate change are unique and more extreme in urban areas (Lindley et al., 2006). Furthermore, most economic and political activity is centred in cities and they have recently gotten more attention as a scale level to improve climate policies (Hunt and Watkiss, 2011). Discovering the barriers and opportunities in the city is therefore relevant. The city of Groningen can be seen in figure 1, which previously also represented the municipality of Groningen. However,

since January 2019 Ten Boer and Haren have merged with the municipality. This has certain implications for the institutional boundaries, which will be explained shortly.

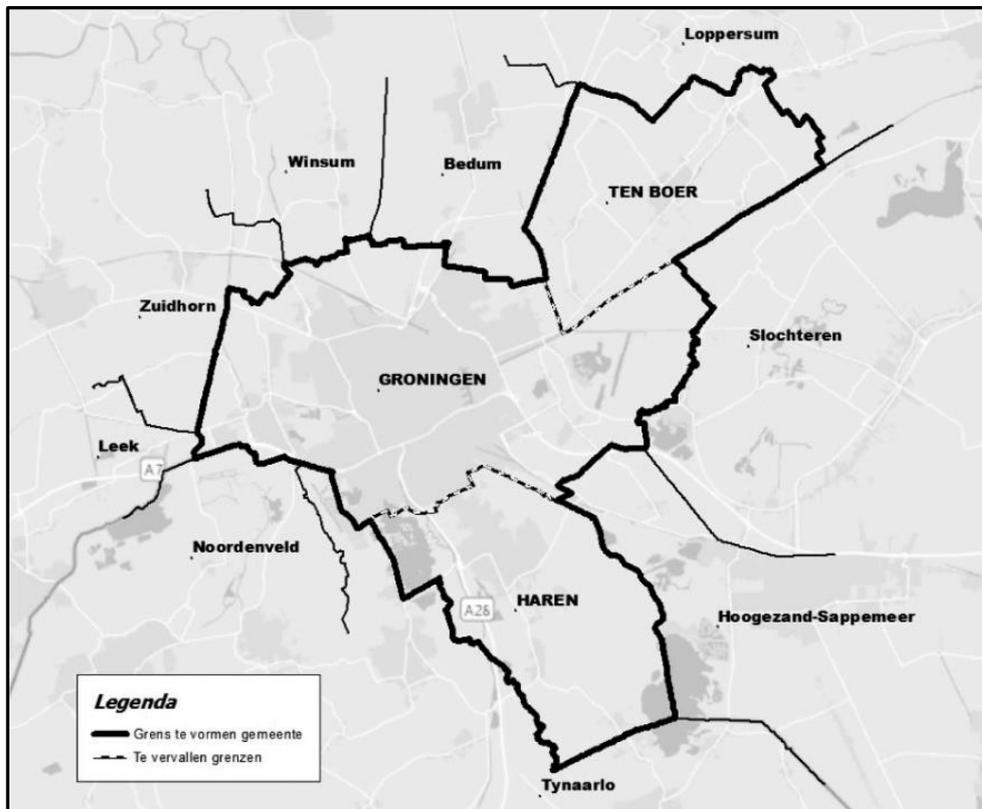


Figure 2: The municipality of Groningen before and after the absorption of Ten Boer and Haren. Source: Staatsblad 266, 2018. Available at: <https://zoek.officielebekendmakingen.nl/stb-2018-266.html>

Institutional boundary

The institutional boundary of the research is different than the spatial boundary. Multiple institutions have a responsibility in climate change adaptation within the city of Groningen. However, their responsibility does not stop there, and it is self-explanatory that other areas within their institutional borders require attention too. This is also the case for the municipality of Groningen, who merged with Haren and Ten Boer on January 2019. Thus, although Haren and Ten Boer are now part of the municipality of Groningen, they are not as urbanized as the city of Groningen. Therefore, they are not included in the research. Furthermore, the waterboards Noorderzijvest and Hunze en Aa's both have a responsibility within the city of Groningen. This is because their borders meet in the centre of the city, which is depicted in figure 2. Therefore, it is important to clarify to the interviewees that although their work focuses on a larger area than the city, this research focuses solely on adaptation within the city. Finally, there is also Sweco, which is an engineering and consultancy company with an international focus. They have a location just outside the city.

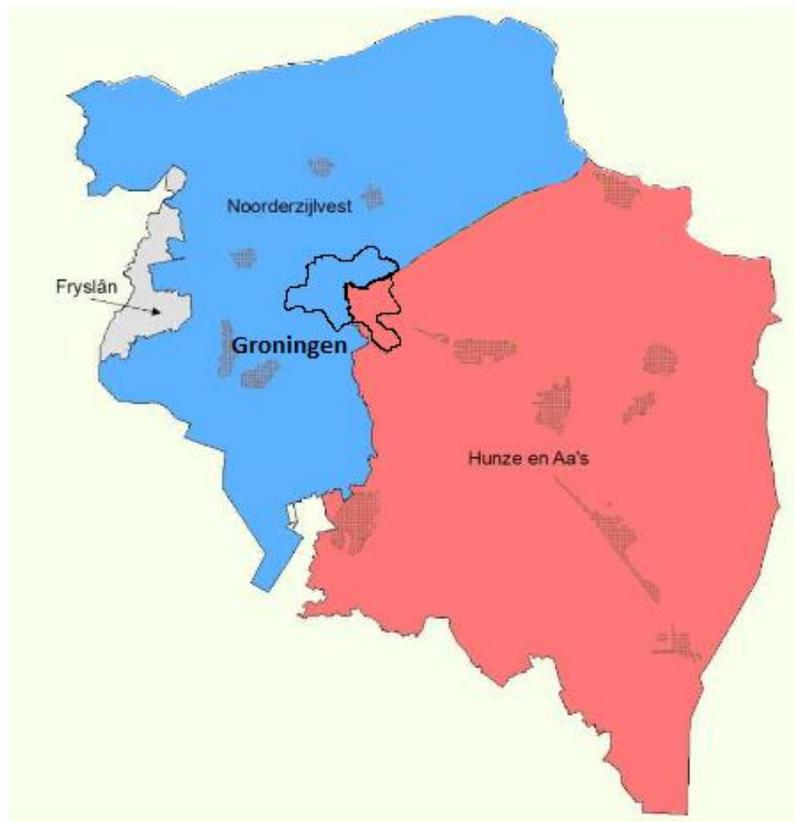


Figure 3: The borders of the waterboards Noorderzijlvest and Hunze en Aa's meeting in the city of Groningen. Edit of: <https://www.hunzeenaas.nl/actueel/bekendmakingen/Lists/WaterschapsbladInvoer/Attachments/626/Advies%20project%20Drogen%20Voeten%202050%20-%20>

Timeframe

Climate change adaptation is constantly evolving and so are institutions and other factors such as political coalitions. Therefore, clarifying a timeframe in which the research takes place is crucial for the validity and reliability of the research. The research was conducted from November 2018 until July 2019 and the collection of the data occurred between the 21st of March 2019 until the 25th of April 2019.

4.3 Data collection

Contextual documents

To analyse the complex phenomena at hand it is necessary to understand the context in which it is embedded. This can be achieved by studying documents that are relevant to climate change adaptation in Groningen and national policy documents. It is important to note that these documents have been used to gain a contextual understanding of climate change adaptation in the Netherlands and Groningen and for illustrative purposes in the results. Apart from this, they have not been included in the analysis.

Title of	Description	Publication	Reviewed
Plan van aanpak: Klimaatadaptief Groningen	A plan of action that sets out the preliminary goals of climate change adaptation in the city of Groningen.	2018	November 2018
The Next city Groningen	A visionary document for future development that lays out strategies and goals.	March/April 2018	February 2019
Groningen klimaatbestendig	A document that provides impact analysis and clarifies the urgency of climate change for the city	May 2016	November 2018
Delta plan ruimtelijke adaptatie	A national policy document that presents an approach for climate adaptation and water robustness on the basis of seven ambitions.	2018/2019	November 2018
Nationale adaptatie strategie	A national policy document with an integral focus that highlights local, national and international efforts, and sets ambitions	2018/2019	December 2018

Table 1: the analysed contextual documents

Semi-structured interviews

Interviews are one of the most important sources for case studies (Yin, 2017). They can either be structured, semi-structured or unstructured (Baškarada, 2014). Semi-structured interviews enable the researcher to prepare a set of questions, while also allowing for the exploration of interesting points that come up in particular interviews (Brinkmann, 2014). This research is best suited for semi-structured interviews because it allows a degree of flexibility and to better understand the perspective of the interviewees (Daymon and Holloway, 2002).

Whenever an interview is requested, the candidates will be informed on the goal of the research and that their answers will be anonymized. In case the candidate agrees to an interview they are given the option to choose the location of the interview. Since the goal of the research has been stated, the interviewees can pick a location where they feel comfortable to speak freely (Elwood and Martin, 2000). Furthermore, it is important to notify the interviewees that they are free to withdraw from the interview at any given time and that

they are free to ask any questions. Finally, to ensure that respondents can express themselves easily the interviews will be held in Dutch.

The interviewees were selected in two ways. The first candidates were chosen on the basis of the contextual documents. These gave insight into relevant institutions and candidates with expertise. Furthermore, a number of candidates were found with the snowballing method. This entails that interviewees recommended candidates out of their network which they believed to be helpful in answering the research questions (Bryman, 2012). The list of interviewees can be found in the tables on the next page. To further clarify the relationship between the interviewees there is also figure 4 below:

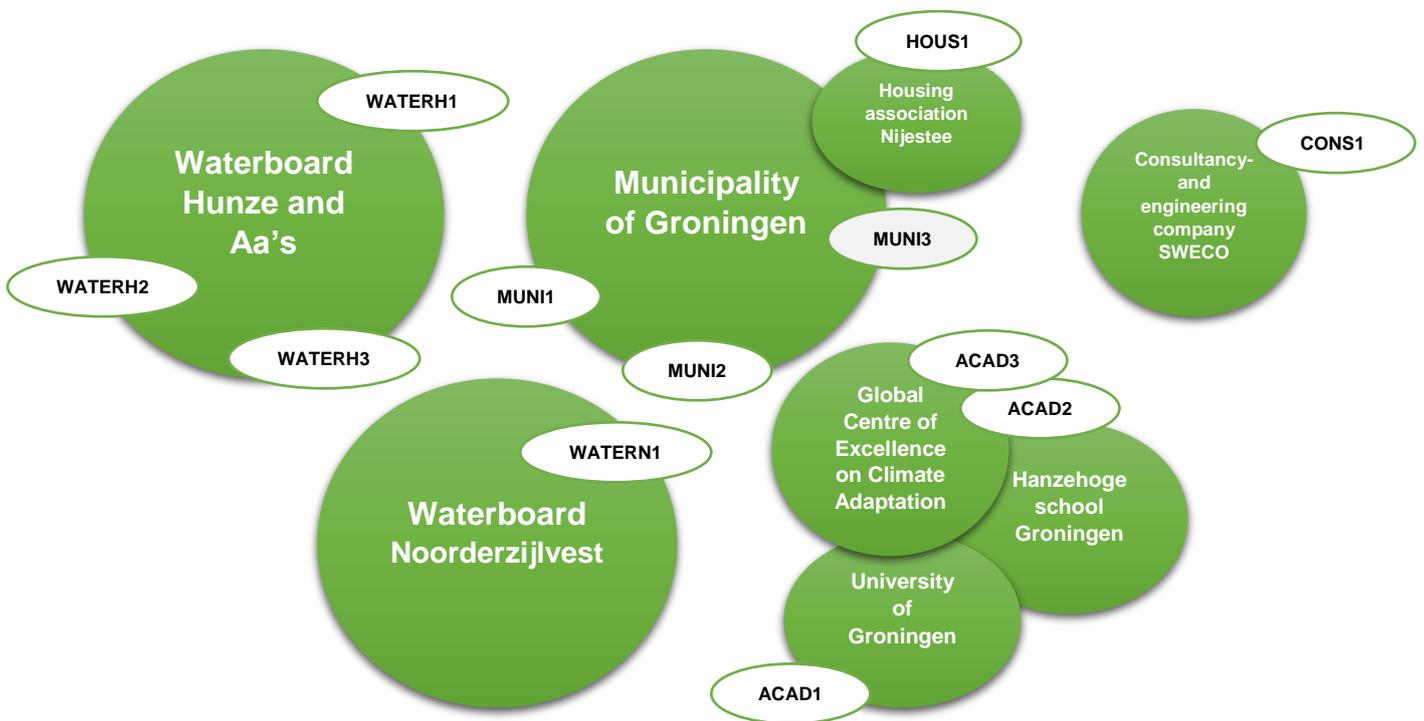


Figure 4: visual representation of the interviewees and their organizations within the city of Groningen

Municipality of Groningen			
Location and date	Code	Role	Interview duration
1. Groningen, 21-03-2019	MUNI1	Policy employee	1:02:54
2. Groningen, 22-03-2019	MUNI2	Urban planner	36:48
3. Groningen, 25-03-2019	MUNI3	Policy employee	39:52

Table 2: The interviewees of the municipality of Groningen

Waterboard Hunze and Aa's			
Location and date	Code	Role	Interview duration
4. Veendam, 21-03-2019	WATERH1	Board member	55:14
5. Veendam, 25-03-2019	WATERH2	Policy employee	32:25
6. Veendam, 25-03-2019	WATERH3	Policy employee	38:42

Table 3: The interviewees of the waterboard Hunze and Aa's

Waterboard Noorderzijlvest			
Location and date	Code	Role	Interview duration
7. Groningen, 17-04-2019	WATERN1	Policy employee	55:01

Table 4: The interviewee of the waterboard Noorderzijlvest

Academic institutions				
Location and date	Code	Role	Institution	Interview duration
8. Groningen, 22-03-2019	ACAD1	Expert	University of Groningen	32:02
9. Groningen, 25-03-2019	ACAD2	Expert	Hanzehogeschool Groningen & GCECA	27:51
10. Groningen, 18-04-2019	ACAD3	Expert	Hanzehogeschool Groningen & GCECA	33:23

Table 5: The interviewees of the academic institutions

Consultancy- and engineering company Sweco			
Location and date	Code	Role	Interview duration
11. Groningen, 25-04-2019	CONS1	Environmental impact report employee	43:02

Table 6: The interviewee of the consultancy- and engineering company Sweco

Housing association Nijestee			
Location and date	Code	Role	Interview duration
12. Groningen, 25-04-2019	HOUS1	Neighbourhood coordinator	37:24

Table 7: The interviewee of the housing association Nijestee

4.4 Data analysis

To successfully analyse the interviews it is necessary to record and transcribe them. The interviews will be recorded with the use of a mobile phone. Subsequently, the interviews will be transcribed with the help of oTranscribe. oTranscribe is an open-source and free web application that allows the user to privately transcribe audio files. Once the interviews are transcribed, the gathered data needs to be coded. This means that the transcriptions will be broken down into relevant themes that represent findings that are of use in answering the research question(s) (Cope, 2010, p. 440). Coding is an iterative process in which there is a continuous exchange between theory, data, and codes (Auerbach & Silverstein, 2003). Initially, the codes will be based on the theoretical framework and the contextual documents. However, during the process of interviewing noteworthy themes or elements may turn up and create additional codes or alter previous codes. This unrestricted manner of coding is what Strauss (1987) refers to as open coding. To structure the codes this research makes use of a codebook, which is essential for analysing qualitative research (DeCuir-Gunby et al., 2011). The codebook can be found in appendix 2.

Positionality

Positionality includes both the researcher's worldview and the position that is taken in relation to the research itself (Foote and Bartell, 2011). The positionality of the researcher in relation to its research is determined by the subject of study, the interviewees and the context and process of the research (Howell Major and Savin-Baden, 2013, p. 71). Positionality is a part of qualitative research, it is important to critically self-reflect how this influences the research (Bryman, 2012. p. 393). For instance, the researcher cannot exactly know how they are viewed by the interviewees (Rose, 1997). A notable aspect of the researcher's identity is being a student. This might mean that it is not being taken as seriously as when someone with a professional background would conduct the research. Furthermore, the research focuses on a topic that has the possibility to include sensitive information. Interviewees might not want to entirely share personal opinions with a student because they do not wish that such information would be public (Barnett, 1997).

Ethical considerations

It is important to maintain high ethical standards during the research. This means that the research is carried out thoughtful, informed and reflexive (Dowling, 2010). A key part of ethical research is integrity (Hay, 2010). There are three principles of ethical behaviour in scientific research: justice, beneficence, and respect (Hay, 2010). First, justice entails the balancing of benefits and burdens. For example, the interviewees will receive a copy of the research once it is done and they can pick a location they prefer. Second, beneficence entails to maximize benefit and to avoid any harm or discomfort. Finally, respecting the

individuals in the research (Hay, 2010). By maintaining a reflexive attitude the researcher has honoured these principles to the best of his ability.

5. Results

This chapter will present the information that was obtained during the interviews. First, climate change adaptation will be presented as a wicked problem. Second, the planners and their perspectives on climate change adaptation within the city of Groningen. Thereafter, the dilemmas, institutional barriers, and opportunities observed within the city of Groningen will be presented.

5.1 Climate change adaptation as a wicked problem

Wicked problem → Climate change adaptation

Figure 5: A portion of the conceptual model on seeing climate change adaptation as a wicked problem

Climate change adaptation within the city of Groningen has found to be a wicked problem for several reasons. The first characteristic of a wicked problem that is discussed in the theoretical framework considers that defining a wicked problem is part of the problem. This was found to be the case, there were notable differences among the interviewees in how they defined climate change adaptation. However, this particular characteristic will be further elaborated on in 5.2.

The second characteristic considers that wicked problems have no stopping rule. Solving problems might create unforeseen problems elsewhere. This characteristic was found to be present in the city of Groningen and recognised by MUNI1, who aims to combat this by an integral approach. This integral approach is aimed at ensuring that everyone is aware of unforeseen problems as quickly as possible when they arise. By doing this, problems can be quickly linked to different stakeholders to determine their implications in the broader context. The stakeholders provide different perspectives that help to prevent any unforeseen circumstances. Nevertheless, they cannot be entirely prevented.

Finally, wicked problems have no right or wrong solutions. Only by trying and testing interventions it is possible to determine what is effective. Although the interviewees do not explicitly recognise that climate adaptation has no right or wrong solutions, there are mentions of testing grounds for adaptive measures (ACAD3; WATERH2; MUNI3). These testing grounds are used for the exact purpose of experimenting:

“Our engineers are actively using test grounds to experiment on which material works best in letting through water but is also easy in maintenance.” MUNI3

5.2 Planning, climate change adaptation and types of change

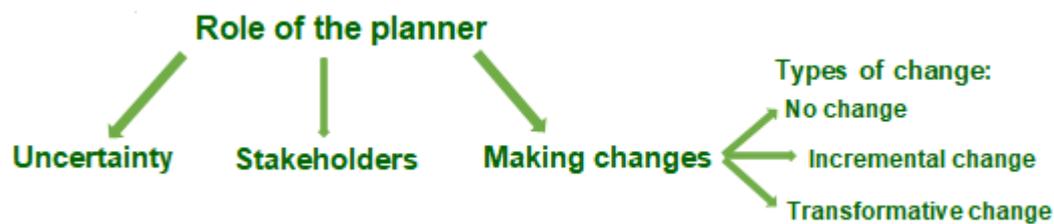


Figure 6: A portion of the conceptual model on the role of the planner

One of the introductory questions that were posed during the interviews required the interviewees to define climate change adaptation. This was asked to find out whether there were notable differences in how they perceived climate change adaptation. Their definitions can be found in tables 3 to 7 below. Interestingly, the definitions showed both similarities and differences. Most interviewees that worked at the municipality, waterboards and housing association defined adaptation to climate change as making physical changes to space (MUNI1/3; WATERH1/2; WATERN1; HOUS1).

“If we want climate change adaptation to work it is very important to ensure public support, that people understand what climate change is and what it is about but also what they can do about it.” MUNI3

However, some of them did pay attention to institutional or behavioural change in the later stages of the interviews (MUNI1/3; WATERN1; HOUS1). The inclusion of behavioural and institutional changes is explicitly mentioned by a number of interviewees (MUNI2; WATERH3; ACAD1/2; CONS1). The academics are exposed to scientific views on a day to day basis and are generally well-read into the literature. Therefore, their broader definition does not come as a surprise. However, it is interesting that the interviewee from the engineering and consultancy company Sweco provided such a concise definition.

The definitions of the interviewees that worked with water would sometimes have a narrow focus on their particular responsibilities (MUNI1; WATERH1; WATERH2). This is somewhat understandable because climate change is directly linked to water management. However, different kinds of expertise are now also involved in climate change adaptation. Although some of the interviewees also defined it more narrowly within their expertise (MUNI3; HOUS1), there was also a group that included the broader implications of climate change adaptation within their definition (MUNI2; WATERH3; CONS1).

Interviewee	Climate change adaptation definition	Physical	Institutional/ Behavioural
MUNI1	<i>The long-term relationship with climate change adaptation and space. Knowing what is necessary to change in order to keep our feet dry.</i>	X	
MUNI2	<i>It is not only about sewage, planting trees but also about bridges that no longer function in heat, neighbourhood policy, loneliness, crisis management and safety. These are completely different levels and people that sit at the table.</i>	X	X
MUNI3	<i>We will be confronted with extremer variance in weather, more drought, more heat etc. but also sea level rise. How you prepare for such a thing and how do you manage to maintain a pleasant environment for everyone during that process.</i>	X	

Table 8: The climate change adaptation definitions of the municipality interviewees

Interviewee	Climate change adaptation definition	Physical	Institutional/ Behavioural
WATERH1	<i>As a waterboard, the changing climate brings two challenges. Rising sea levels and more rainfall. We have to find solutions that look beyond a technical approach, we have to involve spatial planning.</i>	X	
WATERH2	<i>Ensuring there is enough water, not too much water and safety in its broadest term. You have to plan ahead while considering this in relation to climate change.</i>	X	
WATERH3	<i>As a society, organisation or whatever kind of institution you pick, we have to adapt to the changing circumstances of climate change.</i>	X	X
WATERN1	<i>Adapting the environment to withstand circumstances that can be attributed to climate change and to reduce vulnerability.</i>	X	

Table 9: The climate change adaptation definitions of the waterboard interviewees

Interviewee	Climate change adaptation definition	Physical	Institutional/ Behavioural
ACAD1	<i>Dealing with, improving how we deal with climate change, both institutionally and physically.</i>	X	X
ACAD2	<i>Climate change adaptation for me is both the physical adaptation of space but also mental change.</i>	X	X
ACAD3	<i>We can't stop climate change anymore and therefore we have to think about how we're going to deal with its consequences. This involves questions on heat, water, local scale and national scale etc.</i>	X	

Table 10: The climate change adaptation definitions of the academic interviewees

Interviewee	Climate change adaptation definition	Physical	Institutional/ Behavioural
HOUS1	<i>Responding to future expectations about climate change. It's going to be hotter, increasing frequencies of rainfall. Therefore, we need to think about how to harbour it, adapt the environment for it.</i>	X	

Table 11: The climate change adaptation definition of the housing association interviewee

Interviewee	Climate change adaptation definition	Physical	Institutional/ Behavioural
CONS1	There is spatial adaptation , which we do, but it is also broader than that, change your behaviour in anticipation of climate change . Both involve future orientation for being ready for climate change.	X	X

Table 12: The climate change adaptation definition of the consultancy and engineering company Sweco interviewee

To gain an understanding of whether climate change had any impact on their role as planners the interviewees were also asked whether climate change had any impact on their jobs. Interestingly, the interviewees unanimously believed that climate change had a considerable impact on their jobs. For the interviewees of the waterboards and the water department of the municipality this was rather straightforward (WATERH1/2/3; WATERN1; MUNI1). They stated that their jobs involve accounting for future expectations of rainfall and drought, which is directly influenced by climate change (Biesbroek et al., 2011).

A number of interviewees had jobs that specifically included climate change adaptation as part of their responsibilities (MUNI1/2/3; WATERH3; WATERN1; CONS1). Some of the interviewees were even specifically hired for climate change adaptation within their organization (WATERH3; WATERN1; MUNI3). Especially for the interviewees within the municipality climate change was observed to have changed their jobs:

“My job has shifted much more towards water, liveability, developing instruments to stimulate a healthy environment because of climate change adaptation.” MUNI2

The interviewed academics were asked how they perceived the role of the planner in relation to climate change adaptation. They believed that planners had an important role to play in climate change adaptation for a number of reasons (ACAD1/2/3):

“We are trained to think integrally. I think planners are perfectly equipped to connect interests and stakeholders. It wouldn’t surprise me if a large number of people that will work on climate change adaptation are going to be planners” ACAD1

To find out the interviewees perspectives on what change they believed to be necessary the interviewees were also asked whether they believed that climate change adaptation would be successful in the current context of policies, politics and goals. The answers can be divided into two groups. The first group was the largest by far and they were critically positive. They generally observed that incremental changes would make climate adaptation possible (MUNI1/3; WATERH1/2; WATERN1; HOUS1; CONS1).

“I think climate adaptation would work perfectly fine within this context if you let people do a bit more themselves. But I think the current context is well enough equipped to make it happen, depending on the scale you desire.” WATERN1

There was also another group that believed in the need for transformational change (ACAD1/2; MUNI2). All of them found it difficult to envision how this transformational change should look like. They expressed that the sectoral approach to problems like climate adaptation is no longer good enough (ACAD1/2; MUNI2). However, MUNI2 believed that the Omgevingswet would introduce this transformational change.

5.3 Dilemmas

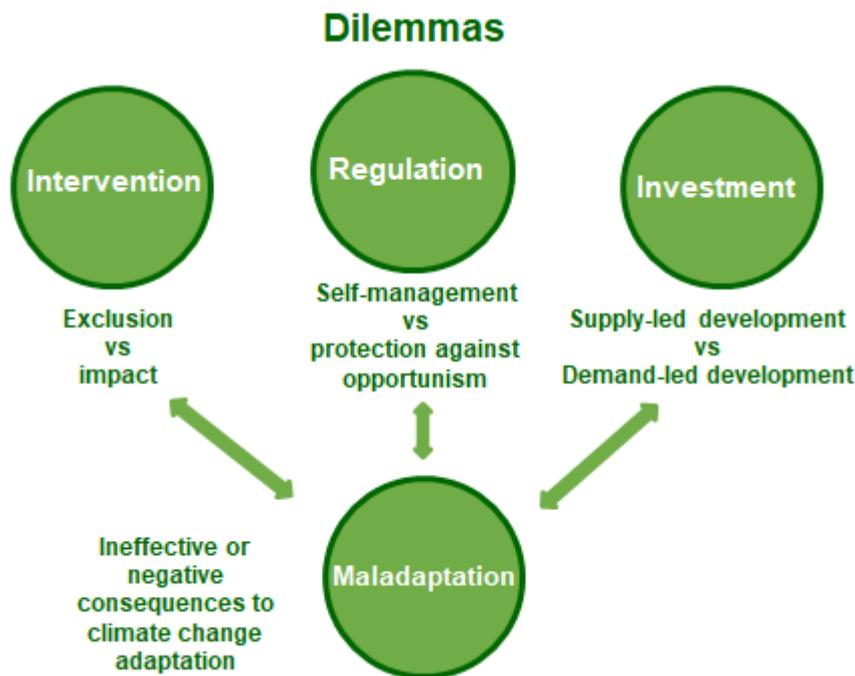


Figure 7: A portion of the conceptual model on dilemmas

The interviewees all reported being frequently confronted with dilemmas. When asked whether any dilemmas arose specifically because of climate change the answer was a unanimous no. MUNI2 gives an explanation for this:

“Thus far we have only really done an assessment, next year we will be making choices and prioritize. I think that is the moment when we will meet certain dilemmas, such as where to invest in.” MUNI2

Nevertheless, they did observe dilemmas and these are still relevant to climate change adaptation. Therefore, these findings will now be presented.

The intervention dilemma

Intervening in the city of Groningen was often observed as a dilemma by the interviewees. The city is dense and therefore space is scarce. Furthermore, the city of Groningen has many stakeholders with interests of their own. Therefore, planners have to find the right balance in these interests and compromise (Rittel and Webber, 1973). The interviewees from the municipality of Groningen were often confronted with the intervention dilemma (MUNI1/2/3). The municipality has the ambition to further densify the city to keep up with the growing demand for housing. However, the municipality also has the ambition to adapt to climate change. These ambitions are challenging to combine and are expected to pose considerable dilemmas:

“There is a housing demand that we have to meet because we are a growing city and we want to accommodate those people. How this is going to relate to climate adaptation policy is going to present dilemmas in the coming years.” MUNI2

For the waterboards, the intervention dilemma was experienced differently. Their role within the city of Groningen is on an advisory basis (WATERH2/3). An interesting dilemma observed by an interviewee of the waterboard Hunze and Aa's was deciding whether to intervene in a project. Although it was not within the domain of the waterboard, there was an opportunity to create additional adaptation measures for a project:

“When I see the perfect opportunity for implementing water storage in an intervention, I will let the other stakeholders know. I'm not supposed to do that; it is not within my responsibility.” WATERH2

WATERH2 observes an opportunity to improve the impact of an intervention without a loss of inclusion. This creates a dilemma wherein he has the opportunity to improve the impact of an intervention but also where WATERH2 is not responsible or accountable for providing this idea. WATERH2 appears to be limited by laws or regulations that are in place to determine his responsibility. Therefore, this dilemma also touches upon the regulation dilemma.

The regulation dilemma

The regulation dilemma was predominantly observed by the interviewees that worked at the waterboards (WATERH1/2/3; WATERN1). Possibly, they observe this dilemma more frequently because their role within the city of Groningen is less clear than it is for the municipality. Furthermore, the municipality is its own political entity, while the waterboards are functional governments with less political influence (WATERH2). Additionally, the waterboards have many municipalities within their domains. These all have different electorates and regulations that they have to account for.

Interestingly, the national climate change adaptation strategy (NAS) and the delta programme (DPRA) do not point towards an owner of the problem (WATERH3). This was observed to lead to dilemmas on the interpretation of regulative responsibilities between governments and waterboards:

“As a waterboard, we do not feel like we are the implementer of the delta plan within the city. No, those are the spatial governments, municipalities and provinces. However, when they do not do it either you end up in a dilemma because nobody is doing it.” WATERH3

The interviewees of the municipality also experienced the regulation dilemma (MUNI2/3). This dilemma was caused by the fact that 60% of space in the city is privately owned, which leaves them with less regulative power to ensure adaptive change (MUNI2). It could be

argued that in this situation regulation prevents change that is necessary for climate change adaptation. However, if the municipality would intervene in privately-owned space this would not be self-management either. Therefore, the municipality approaches this differently:

“Privately-owned space also needs a lot of work and that requires us to take on another role. We have to set the example and take on a facilitating role, but also give subsidies or raise taxes. MUNI2

Investment dilemma

Every interviewee observed money as a significant driver in the confrontation with dilemmas. The interviewees observed plenty of options available to make the city of Groningen more adaptable. However, there is a limited amount of resources available to spend. Therefore, the interviewees were repeatedly confronted with investment dilemmas. According to the interviewees, this did not present a trade-off between supply-led or demand-led development but rather a trade-off between resources and effectiveness. Frequently, fewer resources were reported to result in less adaptive measures within the project than intended (MUNI1/2/3; HOUS1; WATERN1; WATERH1). MUNI3 explained that this would often lead to relatively cheap adaptation measures that added the most value. The interviewees observed the lack of resources as an investment dilemma. However, following the reasoning of MUNI3, it could also be argued that resources were appropriated more effectively.

Another investment dilemma that was observed considered whether the cost of the adaptive measures would outweigh the cost of potential damages (CONS1; MUNI1/2). For example, while flooded roads are certainly a nuisance, the frequency and intensity of such events are important in justifying whether it requires investment. If traffic is only slightly hindered by such events and they do not happen frequently, resources might be spent more effectively elsewhere. Therefore, determining what level of risk is acceptable requires a public discussion, which needs to be weighed against the amount of available investment.

Maladaptation dilemma

A number of interviewees acknowledged that climate change adaptation involves uncertainty. However, they did not consider that this uncertainty could also mean that adaptation turns out to be ineffective or damaging (MUNI2; WATERH2/3). Interestingly, only one of the interviewees considered maladaptation as a dilemma (CONS1):

“There is clear dilemma wherein we have to decide how much risk we find acceptable. A little bit of damage is no problem and it is plain stupid to develop an expensive water storage zone that turns out to be unnecessary in a hundred years. Making decisions on this now is difficult because the impacts of climate change are uncertain” CONS1

The quote of CONS1 is an example of how the maladaptation dilemma can affect other dilemmas. They require the additional consideration that intervention, regulation or investment may be ineffective or maladaptive to climate change. The fact that most interviewees did not consider this could be attributed to their belief that climate change adaptation measures will work with incremental change (MUNI1/3; WATERH1/2; WATERN1; HOUS1).

5.4 Institutional barriers

Institutional attributes in climate change adaptation		
(1) Agency attributes:	(2) Interactions attributes:	(3) Inherent attributes:
Actor eligibility	Social connectivity	Temporal and spatial scale of institutions
Responsibility	Conflict	Adaptiveness of institutions
Control	Social learning	Formality of institutions
	Accountability	

Figure 8: A portion of the conceptual model on barriers and opportunities

This section will present the institutional barriers that were observed by the interviewees. The barriers and opportunities have been deliberately split up into two sections within the results chapter because merging them at this point would come at the cost of in-depth analysis. The barriers will be categorized according to the conceptual model, which can be found in figure 8 above.

5.4.1 Agency attributes of institutions

In the theoretical framework, agency attributes are further categorized into actor eligibility, responsibility, and control.

Actor eligibility

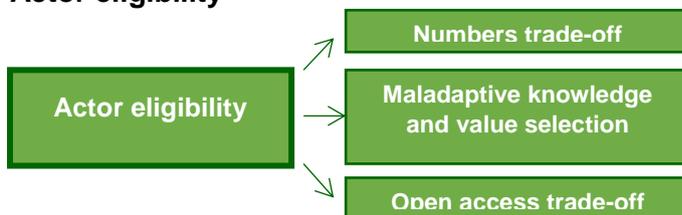


Figure 9: the categories of actor eligibility

Actor eligibility was not often observed as a barrier, which can be attributed to the broad involvement of stakeholders (MUNI2/3; CONS1). The broad involvement of stakeholders could have negative implications for the numbers and open access trade-offs. It is possible that the broad involvement has created higher transactional costs among the stakeholders, but these were not reported by the interviewees. MUNI3 did experience a barrier in actor eligibility when they invited the housing associations to be part of the stakeholder meetings. The housing associations were eligible to join the adaptation process but they did not feel any responsibility in climate change adaptation:

“In the stakeholder sessions, we invited the housing associations. Only of the associations showed up and they did not see how it was relevant to their work” MUNI3

Although the stakeholder involvement had a broad setup, it seems that the municipality did not succeed in creating a sense of urgency for climate adaptation with the housing associations.

Responsibility

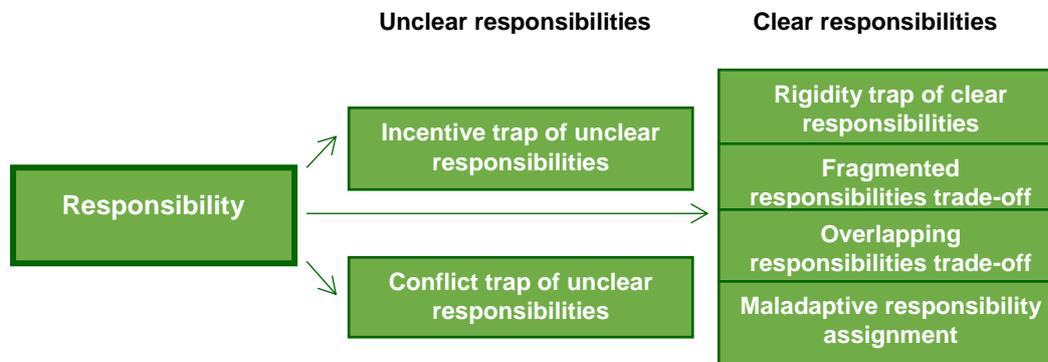


Figure 10: the categories of responsibility

Unfortunately, the housing associations did not feel any responsibility in climate change adaptation. Two interviewees pointed to national policies (DPRA and NAS) as the cause of these barriers (WATERH3; MUNI2). Namely, the DPRA and the NAS do not clearly point towards an owner of the climate adaptation problem. Although this is done intentionally, it creates problems:

“The problem of not having directed an owner of the problem is that some stakeholders ignore or do not understand that they are addressed as owners of the problem because they either are not familiar with the problem or do not have the capacity to address it.” WATERH3

For the housing associations, it appears that their responsibility was unclear to them when it was discussed in the stakeholder sessions (MUNI3). Adaptation efforts are currently not on the housing associations agenda, but it is expected to be in the future (HOUS1). The interviewee of the housing association explained that everyone within their organization has enough work to do already and money is not available in excess. Therefore, at this moment it comes down to individual initiative to include adaptive measures (HOUS1). This could be explained as both an incentive or a conflict trap. First, since the housing associations are not appointed as an owner of the problem they might not feel an incentive to adapt. Second, the housing association do not see any benefit in implementing adaptation measures.

The second type of responsibility barriers occurs in a setting where responsibilities are clear. The interviewees particularly expressed their concerns on the fragmentation and overlapping of responsibilities, which they observed to be present both internally and externally (MUNI1/2/3; WATERH1/2; HOUS1; ACAD1/2).

“You really need each other, you really need the water boards and you really need the province but that is not always seen that way, from both sides” MUNI3

This also closely relates to the rigidity trap of clear responsibilities, wherein the governance system does not match with the scale of the climate adaptation problem. Climate change affects the city in a much larger area than the municipality governs. Some interviewees of the municipality and waterboards observe that this mismatch sometimes creates situations wherein either no one is responsible or multiple stakeholders are (MUNI2/3; WATERH1/2/3; WATERN1):

“With climate change adaptation you quickly get the problem that everyone governmental body acts on its own behalf. This creates situations wherein it is unclear how responsibilities are divided and who’s doing what. Adaptation would be more effective if we would work together as a single government.” WATERH3

Finally, none of the interviewees observed a barrier in the category of maladaptive responsibilities.

Control

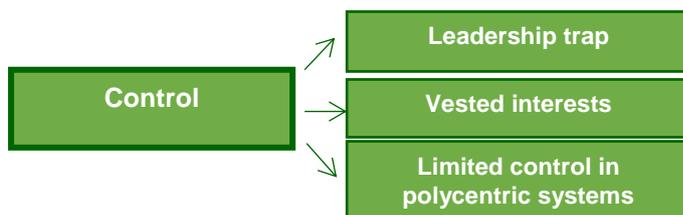


Figure 11: the categories of control

The interviewees did not explicitly mention any control barriers. However, a number of interviewees did mention that political leadership within the municipality was a deciding factor in climate change adaptation (MUNI1/2/3; WATERH1/2/3; WATERN1; HOUS1). Additionally, both of the waterboards were in the middle of forming a new coalition. One of the interviewees expressed how the provincial elections are expected to negatively affect climate change adaptation:

“We now had the provincial elections and it seems that we are turning more right-wing oriented. They are not particularly pro-climate change goals. This puts a brake on these developments, and we have to deal with that.” WATERH2

5.4.2 Interactions attributes of institutions

In the theoretical framework interactions, attributes are further categorized into social connectivity, conflict, social learning, and accountability. The interactions attributes of institutions presented most barriers and opportunities to climate change adaptation within the city of Groningen.

Social connectivity

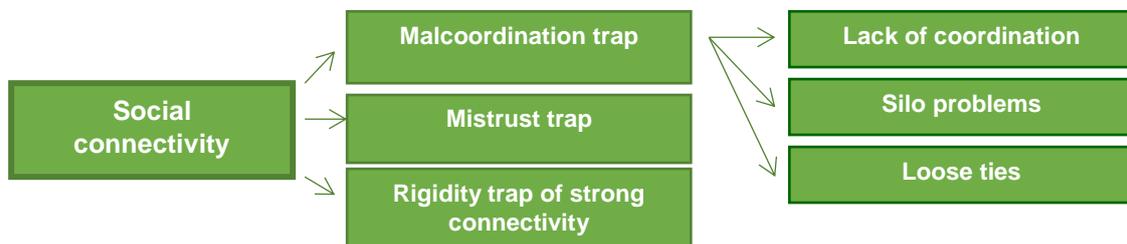


Figure 12: the categories of social connectivity

All the interviewees observed social connectivity as a barrier to climate change adaptation in the city of Groningen. This expressed itself in a malcoordination trap, which represents challenges such as a lack of coordination, silo problems and loose ties problems. Due to a spatial and governmental scale mismatch, actions are not always effectively coordinated among the different stakeholders. The interviewees observe this both within their departments but also in cooperation with other stakeholders. Internally, the interviewees of the municipality experienced challenges in raising awareness among colleagues in different departments (MUNI1/2/3):

“The trick is to also involve the people of infrastructure and green because they think in a sectoral way. When I come by to talk about including adaptive measures into their projects, they have their blinkers on. You need to take the time to convince them of these measures and why you want them.” MUNI1

Externally, the malcoordination trap expressed itself too. Interviewees of the waterboards and municipality believe that the coordination and involvement of other stakeholders could be improved (WATERH1; WATERN1; MUNI1; MUNI2; HOUS1):

“How are you going to cooperate, how are you going to coordinate, on which topics, how are you going to connect financial resources... We could do a lot more internally, but I also think externally.” MUNI2

Silos were also observed to be a problem, but particularly by the interviewees of the municipality (MUNI1/2/3; WATERH2; WATERN1). The interviewee of the waterboard Noorderzijvest explained that people working with water are generally more knowledgeable on climate adaptation whereas the knowledge of other disciplines can be more problematic (WATERN1). Understandably, the municipality requires a broader range of expertise to fulfil its duties. However, that can also implicate that knowledge on climate change adaptation differs between specific departments. Originally, climate change adaptation has been an issue that involved the water department of the municipality and the water boards (MUNI1/2). Mainly because climate change at first influenced the municipality in whether the sewage system would be able to handle changing weather patterns (MUNI1). MUNI1 observes that this difference still creates barriers:

“People have to get used to the idea that it is part of their job to involve other departments. When they are planning to do something, they should realize to involve other parties where they previously didn’t. We have to stop with navel-gazing,” MUNI1

A number of the interviewees also observed loose ties (HOUS1; MUNI2/3). For example, the housing association Nijestee mainly interacts with the real estate department of the municipality of Groningen (HOUS1). Unfortunately, one interviewee of the municipality expressed that this department does not feel the same level of urgency for climate change adaptation yet (MUNI3). Therefore, this likely contributes to a lower sense of urgency for the housing association Nijestee too. It is challenging to express the urgency of climate change adaptation when they communicate in a lesser degree with the departments that prioritize climate change adaptation as an issue.

“We don’t talk a lot with other departments within the municipality. I think it would help if we would have better connections with them. It sounds harsh but if you don’t have a personal connection with someone in the municipality you get run-around.” HOUS1

Conflict

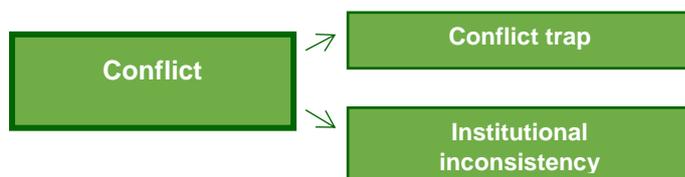


Figure 13: the categories of conflict

A number of interviewees observed institutional inconsistencies as the cause of conflict barriers (MUNI1/2/3; WATERH1/2/3; WATERN1; CONS1). The stakeholders have different cultures, languages and priorities. For example, the two waterboards speak a language that

is very similar because they share the same expertise. This is not the case for the municipality. Apart from the water department, they do not speak the same language as the waterboards. Furthermore, they also struggle to equally prioritize climate adaptation across all of their departments (MUNI1/2/3). Nevertheless, the problem of climate adaptation crosses these organizational boundaries and requires cooperation. Unexpectedly, the most striking institutional inconsistency was observed to be between the two waterboards. Noorderzijlvest has taken a proactive approach to climate change adaptation. They take the lead in raising awareness and actively help in finding effective solutions (WATERN1). On the other hand, there is Hunze and Aa's, which has consciously taken a more reactive approach. They believe the municipality is in the lead and should come to them if they need help (WATERH2). This can sometimes create conflict:

“Sometimes we have conflicting interests because we have different responsibilities [...] Then we need to either find a middle road or remain in opposites. WATERH3

Another point of conflict that is frequently mentioned involves financial resources (MUNI1/2/3; HOUS1; WATERN1; WATERH1). Financial resources are never in abundance and every department has to carefully manage its budget. Therefore, departments are not keen on spending resources on measures that do not directly fall within their responsibilities. The interviewee from the department of water in the municipality noted that they usually have money to spare because they raise their own taxes. Therefore, they try to help other departments to include adaptation benefits (MUNI1).

Social learning

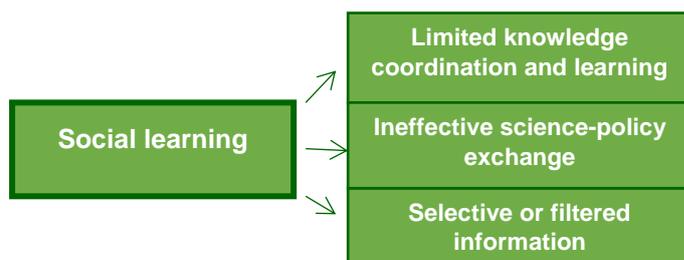


Figure 14: the categories of social learning

A noticeable barrier in adapting to climate change within the city of Groningen is limited knowledge coordination. Some interviewees observed that climate adaptation was hindered by a lack of knowledge (MUNI1/2/3; HOUS1; CONS1; WATERN1). Interestingly, they did not observe a lack of knowledge on possible measures, but rather a lack of knowledge on the overarching impact that climate change has. A number of the interviewees observed a clear difference in experience and knowledge, therefore it takes time to explain the urgency and long-term benefits of adaptation measures (MUNI1/2/3; HOUS1; WATERN1):

“People that work with water are usually well informed, but you notice that involving other disciplines is challenging. That’s why I give workshops with MUNI2 to learn other people about the possible benefits of adaptation.” WATERN1

Interestingly, one of the academics also expressed that more could be achieved with the Global Centre of Excellence on Climate Adaptation (ACAD3). This centre and the universities are institutions that can help to share knowledge. The GCECA is relatively new, but apart from putting setting climate adaptation on the agenda its added knowledge is thus far experienced to be limited (ACAD2/3). Two interviewees have also made a remark on the lack of knowledge coordination from the national government level (MUNI1; WATERH2). They stated that the DPRA does not provide any tools or standardizing, which would help regional governments to better understand what is expected of them when adapting to climate change (MUNI1; WATERH2).

Accountability

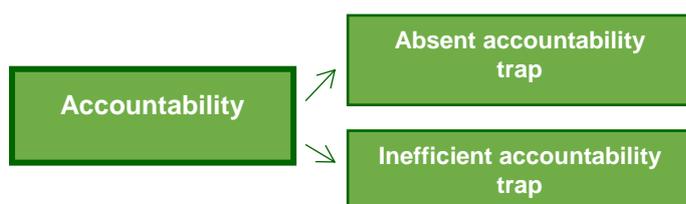


Figure 15: the categories of accountability

Accountability barriers appear to be closely related to the observed responsibility barriers. Since there is no appointed owner of the adaptation problem, everyone is accountable. Unfortunately, this can also create situations wherein no one feels accountable (HOUS1; WATERH2/3). WATERH2 also observes these situations:

“The question is whether we should do more, maybe we should, I don’t know. I’m not sure whether we are directly accountable for this, we probably are. If it turns out that the municipality has not done anything with adaptation, we will be held accountable too.”

WATERH2

It appears that the stick does not suffice in stimulating stakeholders to dedicate enough resources to climate adaptation, and a carrot was not observed to be present either. The municipalities are expected to evaluate the risks in their domains by means of a stress test before the end of 2019. However, there is little to no guidance on what this stress test should consist of. The interviewee of Sweco stated that municipalities could hire a student to do the stress test (CONS1). The municipality of Groningen hired Sweco to execute a professional

stress test but this wasn't a requisite. This gives an indication that the current accountability that is in place is somewhat inefficient.

5.4.3 Inherent attributes of institutions

In the theoretical framework, inherent attributes of institutions are further categorized into temporal and spatial scale, adaptiveness and formality of institutions. These presented interesting barriers that could either directly or indirectly be related to some of the earlier discussed barriers in agency attributes and interactions attributes of institutions.

Temporal and spatial scale of institutions

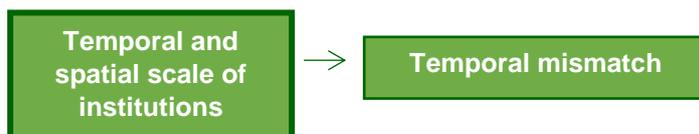


Figure 16: the category of temporal and spatial scale of institutions

The city of Groningen has undergone a number of changes that had a significant impact on its temporal and spatial scale. For example, this year the municipality of Groningen has merged with the municipalities of Haren and Ten Boer. Previously, the municipality only governed the city of Groningen whereas it now also governs two areas that are considerably less urbanized. For climate change adaptation this means that the municipality has to account for different approaches and measures. It takes time to adapt to these new circumstances. Nevertheless, climate change doesn't stop at these new borders either and effective adaptation requires stakeholders to cooperate outside of their spatial domains. This is found to be a barrier by MUNI2:

"The municipality also has a border and, of course, what happens outside of that border is also our responsibility, we are good neighbours, we want to align climate adaptation measures because it never stops at borders and I see an important role for the region there. However, if I'm honest that is not organized yet." MUNI2

The temporal scale within the city of Groningen also presented barriers (CONS1; ACAD1/2/3; MUNI2). For example, the municipality of Groningen does not want the city to sprawl more. However, they also want to keep up with the housing demand. This creates a mismatch between short-term prioritization of housing and long-term climate change adaptation. For example, Reitdiep was previously the ecological highway of the city and now it's going to be occupied with housing (ACAD3). Although these projects account for climate adaptation, this does tend to maladaptive behaviour. More housing increases the likelihood of rainfall flooding and stimulates the urban heat island effect. CONS1 has its doubts about this mismatch:

“Increasing the density within the city is very risky. You can state and write down that everything will be done adaptively but these are contradictory goals that create a lot of tension.” CONS1

Adaptiveness of institutions

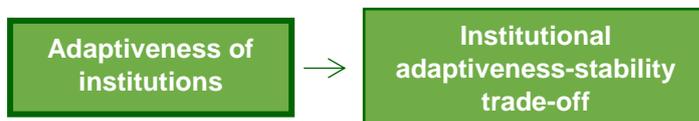


Figure 17: the category of adaptiveness of institutions

Another clear barrier in climate change adaptation that presented itself in the city of Groningen is the degree in which institutions are able to make changes that benefit climate adaptation. Multiple interviewees observed barriers in making changes that benefit climate change adaptation (MUNI1/2/3; HOUS1; WATERN1; ACAD1/2). Some of the interviewees attributed these barriers to silos and a lack of coordination, which they believed to limit raising awareness and aligning interests (MUNI1/2/3; HOUS1). Two of the academic interviewees specifically attributed the barriers to path dependency (ACAD1; ACAD2).

“The municipality is predominantly a sectoral organization. Sometimes you get different information on climate adaptation depending on who you talk to. That should no longer be the case, but it is very hard to make changes because they have worked like this for years. A bit of path dependency that makes it really challenging to cooperate.” ACAD2

Not only does climate adaptation requires new approaches, but it also introduces new problems. An interviewee of the waterboard Noorderzijlvest shared that there is an ongoing discussion within their organization on the topic of heat (WATERN1). Heat is a challenge that has gained relevance during the last years. Especially the summer of 2018 showed the urgency of the problem in the Netherlands. However, there is disagreement within the waterboard whether heat is a topic that falls within their domain and whether they should take responsibility upon it. This also reflects a form of path-dependency. The waterboard historically has not dealt with heat directly and it appears to have a hard time adapting to this. As a consequence, this creates a barrier that can directly be related to the rigidity of an institution.

Formality of institutions

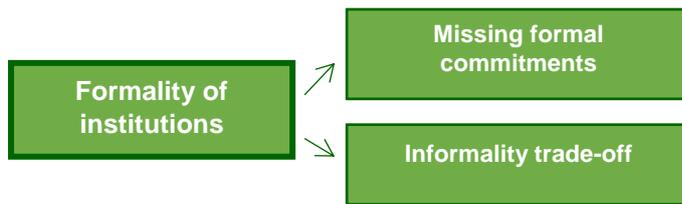


Figure 18: the categories of formality of institutions

Climate change adaptation is fully not integrated yet into formal commitments in the city of Groningen. While it is incorporated in The Next City and strategic documents, it largely comes down to individual initiative (MUNI1/2/3; HOUS1). This creates situations wherein developments are sometimes overseen by the particular individuals that would inform them to include adaptive measures (MUNI1):

“The city of Groningen is big but not super big. However, sometimes they manage to implement something where you don’t know the existence of. Therefore, you have to be there upfront to inform them.” MUNI1

This can be attributed to a lack of formal rules that require stakeholders to include adaptive measures within their projects. These situations can also be directly related to social connectivity, social learning and accountability barriers. If social connectivity and learning would be better, it is expected that stakeholders are more informed. This should make them think twice about climate adaptation when developing projects. As a final resort, they could also be held accountable if they would not include such measures. Although formal commitments would be helpful, informal networks would equally help to raise awareness and urgency. This allows stakeholders to solve these issues among themselves, without creating an atmosphere of negativity. MUNI2 acknowledges this:

“On the one hand we need formal policy, on the other hand, we need an ongoing conversation with stakeholders and seek out cooperation so that we can create awareness”
MUNI2

5.5 Opportunities

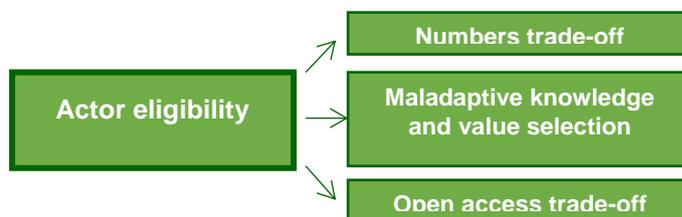
Institutional attributes in climate change adaptation		
(1) Agency attributes:	(2) Interactions attributes:	(3) Inherent attributes:
Actor eligibility	Social connectivity	Temporal and spatial scale of institutions
Responsibility	Conflict	Adaptiveness of institutions
Control	Social learning	Formality of institutions
	Accountability	

A copy of figure 8

Having presented the barriers, it is now time to cover the opportunities for climate change adaptation in the city of Groningen. The first thing that should be acknowledged is that the interviewees were aware of most barriers. In a sense, recognising these barriers is an opportunity in itself because it enables them to come up with solutions to overcome the barriers. The opportunities will be presented according to the conceptual model, which can be seen above in figure 10.

5.5.1 Agency attributes of institutions

Actor eligibility



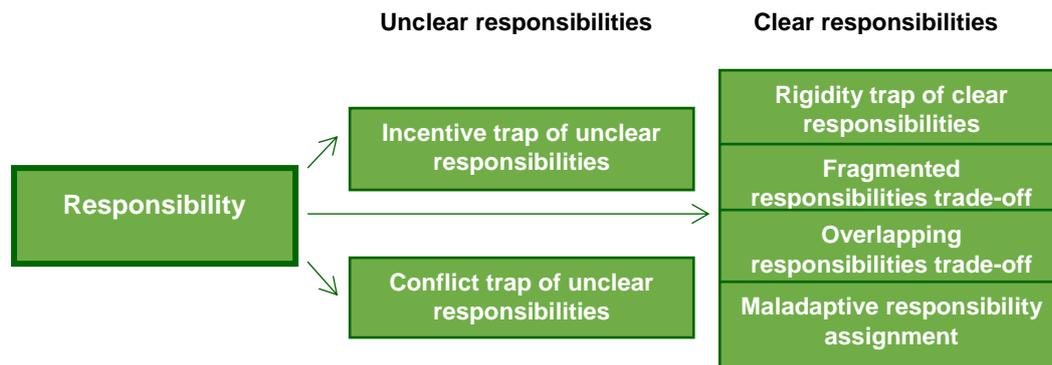
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A number of interviewees observed the broad involvement of stakeholders (MUNI2/3; CONS1). This allows the city of Groningen to create adaptation measures with a broad consensus. CONS 1 was particularly surprised by this:

“It was pretty special in Groningen that a lot of stakeholders were involved [...] The setup was pretty broad and everyone was invited to think along and discuss climate change adaptation.” CONS1

Two interviewees of the municipality specifically expressed their efforts in ensuring the eligibility of actors (CONS1; MUNI2/3). These personal efforts have certainly helped to broaden the involvement.

Responsibility



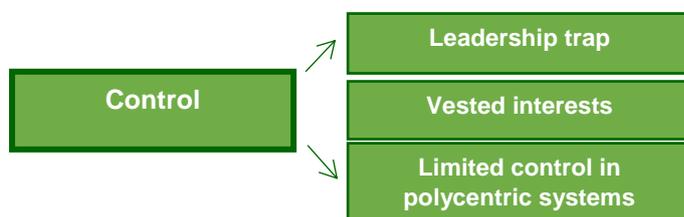
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Luckily, the responsibilities surrounding climate change adaptation were predominantly observed to be clear but either fragmented or overlapping (MUNI1/2/3; WATERH1/2; HOUS1; ACAD1/2). The fact that responsibilities were clear provided opportunities to improve social interactions and inter-organisational cooperation. For example, the use of multiple avenues will help to better communicate and distribute responsibilities. Multiple interviewees reported to have set up or taken part in different avenues and groups to improve on this (WATERH1; MUNI1/2/3; HOUS1):

“We organize multiple stakeholders’ sessions that involve different themes. Health, climate change, biodiversity and landscaping, urban areas and so on. We invited different groups of people to discuss what to expect, how to prepare for it, what we need to do.” MUNI3

All of these interactions create linkages and networks that lower transaction costs and provide opportunities to better negotiate responsibilities within climate adaptation. At the very least, it helps stakeholders to become aware of each other’s position and climate adaptation.

Control



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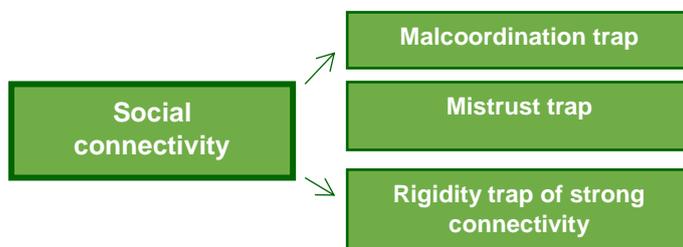
The control category presented some interesting opportunities, especially for the municipality of Groningen. Recently a new coalition has formed within the municipality, which has ambitious sustainability goals. A number of interviewees observed that this ambition has given significantly more weight to climate change adaptation (MUNI1/2/3; ACAD1/2/3; CONS1; WATERH1):

“The new coalition and their program help enormously. Whenever there is disagreement, we tell them to go back to the drawing board because it electorate wants them to consider sustainable ambitions. So yeah, it is really helpful.” MUNI3

Notably, for the first time in history, an alderwoman in the municipality of Groningen has climate change adaptation included in her portfolio. The coalition’s ambition creates momentum, which is an opportunity for individuals like MUNI3 to convince others to consider climate change adaptation. This momentum could also allow the city of Groningen to pioneer climate change adaptation for the province and thereby inspire the waterboards and surrounding municipalities to join in.

5.5.2 Interactions attributes of institutions

Social connectivity



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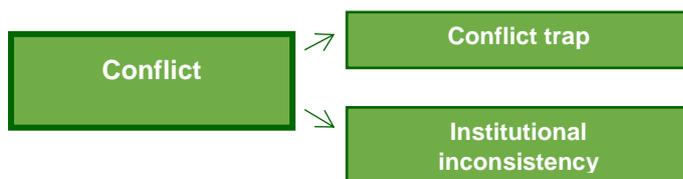
Some of the interviewees have noted to be actively involved in outreach within their organization and outside of their organization (WATERH1; WATERN1; MUNI2/3). This helps to build a narrative on climate adaptation that emphasizes the need for inter-organisational cooperation, the exchange of ideas and information. The municipality has already invited a broad range of stakeholders to risk dialogues and other climate change adaptation events (MUNI1/2/3). Interestingly, these meetings are not a meant as one-time occurrence but rather a continuous and regular exchange of knowledge and ideas (MUNI2/3). Likewise, the waterboards have noted to be in regional meetings and also organize workshops to talk about climate change adaptation (WATERH1; WATERN1). This helps to create awareness and provides opportunities to discover mutual benefits among stakeholders:

“We have organized a symposium here for municipalities within our territory because we felt they did not feel any urgency for climate change adaptation yet. Both formally and informally we have notified them what they should expect and discussed how to cooperate and develop a plan.” WATERH1

As reported by WATERN1, people that work with water generally are well informed on climate adaptation. The municipality has likely also observed this discrepancy and created an interdepartmental climate change adaptation core team (MUNI1/2/3). This creates

opportunities to align departmental objectives in climate adaptation, which benefits adaptation measures internally and externally. Understandably, the water department of the municipality has a deeper social connection with the waterboards than the department of green. Nevertheless, the climate adaptation core team has helped to align interests among the departments. This allows the department of water to effectively translate these interests to the waterboards because they understand the same language and therefore transaction costs are likely to be lower.

Conflict



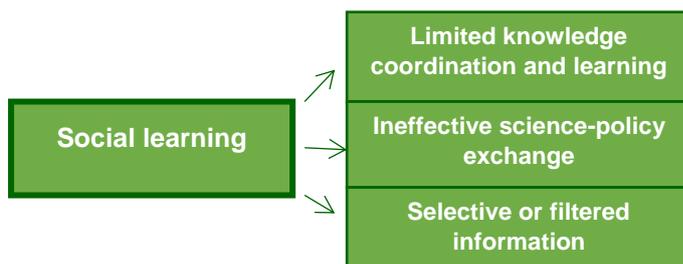
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The lack of financial resources was often reported as a barrier (MUNI1/2/3; WATERH1/2/3; WATERN1; CONS1). However, some interviewees also acknowledged that after raising awareness there generally is the willingness to include adaptation measures (MUNI1/2/3; WATERH1/2; HOUS1). This creates opportunities to find mutual benefits among stakeholders. Bundling resources and objectives could net in adaptation benefits with little or no extra cost. These opportunities were also expressed by the interviewees:

“We need to exchange knowledge but also cooperate financially. This helps us to fine-tune our financial budget and bundle objectives to make a more climate robust region. Of course, this presents a lot of opportunities.” MUNI2

A number of interviewees have also mentioned that they are actively seeking out other stakeholders to discuss institutional inconsistencies (WATERH1; WATERN1; MUNI2/3). This provides opportunities in improving social connectivity and simultaneously helps to prevent conflicts. If the stakeholders are aware of each other positions and objectives, conflicts are less likely to occur.

Social learning

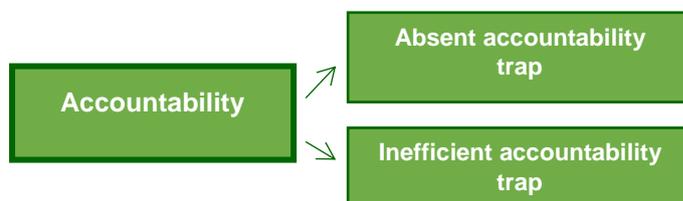


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A number of interviewees have expressed that there is a lot to gain in outreach both internally and externally (MUNI1/2/3; WATERH1/3; WATERN1; ACAD1/2/3; HOUS1). Improving the exchange of knowledge and information helps to institutionalize climate change adaptation and may eventually lead to lower transaction costs among the involved stakeholders. Ultimately, this may even result in overarching regional objectives for climate change adaptation.

A significant opportunity for the city of Groningen is the universities and the GCECA. The municipality welcomed the GCECA this year and this centre has the potential to share and create knowledge, which to a degree has already been initiated in the form of meetings and a testing ground (HOUS1; ACAD3; MUNI3).

Accountability



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At the moment accountability is observed to be inefficiently present within climate change adaptation (MUNI1/2/3; HOUS1; WATERH2/3). Municipalities are expected to execute a stress test by the end of the year and engage in risk dialogues with relevant stakeholders. These requirements are intended to provide the city of Groningen with insights into its vulnerabilities to climate change. The insights that this will present provides opportunities for the municipality to create more clarity on expectations and goals for climate adaptation:

“We have just executed a stress test and have published it on the internet. People are now going taking a look at it, also internally. What’s in it, is anything expected of us, yes something is expected of you, you need to do this, this and that.” MUNI2

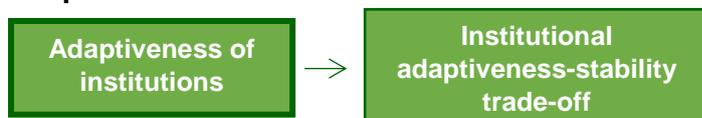
The municipality and the housing association are in the process of creating policies that lay down the rules and procedures for climate adaptation (HOUS1; MUNI2/3). However, the current lack of accountability also provides opportunities because it allows for low complexity and informal cooperation. The lack of accountability was not explicitly mentioned as an opportunity by any of the interviewees. However, the interviewee of the housing association did report to innovate in a specific neighbourhood by realizing mutual climate adaptation benefits (HOUS1). The municipality was performing sewage system renewal and therefore they decided to also take on the neighbourhood and realize climate adaptation measures. This allows experimentation with climate change adaptation:

“We want to make Kosverloren the greenest neighbourhood of Groningen.[...] Often you stay in upper-level discussion and now we can try and test things.” HOUS1

5.5.3 Inherent attributes of institutions

Finding opportunities for the inherent attributes of institutions is difficult simply because they are inherent to institutions. Nevertheless, the interviewees observed a number of opportunities that are worth mentioning in the categories adaptiveness and formality of institutions.

Adaptiveness of institutions



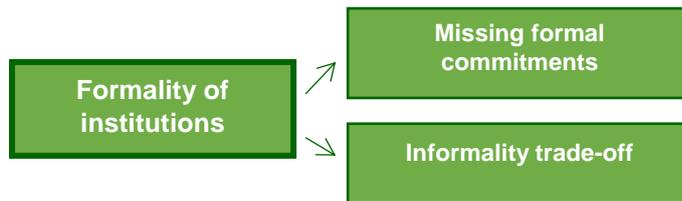
A copy of figure 16

A number of interviewees expressed the importance of flexibility for climate change adaptation (WATERH2/3; MUNI2/3; CONS1). Therefore, they observed opportunities in the upcoming Omgevingswet. This new law is expected to stimulate stakeholders to look for integrative approaches to climate change adaptation, which provides opportunities:

“The new Omgevingswet is constructed in a way that citizens only need to address one government. We have to take care of things inter-organisational behind the scenes. I think that is one of the challenges of climate adaptation and the Omgevingswet helps to solve this.” WATERH3

The idea of one-government requires expertise in climate change adaptation to be translated into a language that is understandable for every organization and department (WATERH3). Speaking or at least understanding the same language is likely to help enable the stakeholders to create better measures for climate change adaptation.

Formality of institutions



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As was covered in the responsibility and accountability section, the municipality of Groningen is in the process of writing a new policy on sustainability (MUNI2). This will integrate climate adaptation into formal laws and regulations. Expectedly, the new policies will institutionalize climate change adaptation. This will obligate stakeholders to include climate adaptation into their projects and this creates new opportunities to increase the effectiveness of adaptation measures with mutual benefits.

6. Discussion

This chapter will discuss the results in relation to the theory and formulate answers to the secondary research questions. The secondary research questions will first be discussed, which will lead up to answering the main research question.

6.1 Climate change adaptation as a wicked problem

Can climate change adaptation be understood as a wicked problem within the city of Groningen?

Wicked problems have a number of distinguishable characteristics (Rittel and Webber, 1973). By comparing these characteristics to the observations of the interviewees it is possible to determine whether it is justified to label climate change adaptation as a wicked problem within the city of Groningen. A key characteristic of a wicked problem is disagreement on how to frame the problem, which subsequently determines its solutions (Termeer et al., 2012). In some degree, this characteristic was observed by the interviewees. Interviewees that worked at governmental organizations predominantly defined climate change adaptation as making physical changes to the environment (MUNI1/3; WATERH1/2; WATERN1; HOUS1). However, two interviewees among the governmental organizations were the exception, together with the academics and the consultant they included behavioural and institutional change into their definitions (ACAD1/2; CONS1; MUNI2; WATERH3). The inclusion of behavioural and institutional change is a noticeable difference among the definitions of the interviewees. Therefore, definitions of framing climate adaptation do not seem to entirely align.

Another key characteristic is that wicked problems have no stopping rule. Solving problems can create unforeseen new ones due to information being incomplete or conflicting (Moser, Williams and Boesch, 2012). As a consequence, framing an end goal is challenging (Perry, 2015). A number of interviewees shared to experience difficulties with unforeseen problems because the impacts of climate change cannot be entirely predicted (Measham et al., 2011; Füssel, 2007) (MUNI1/2/3; WATERH3; WATERN1; CONS1). Furthermore, the lack of current policies logically has the consequence that there is not a specific end goal. This could change when the expected new policies will be introduced. The final characteristic considers that wicked problems have no right or wrong solutions (Perry, 2015). This was explicitly observed by two interviewees, who believed that climate change adaptation requires changes that could only retrospectively be determined to be effective (MUNI1; CONS1). Furthermore, MUNI3 mentioned that they were actively trying and testing to address this.

Considering the discussed characteristics above, it can be concluded that it is justified to understand climate change adaptation as a wicked problem within the city of Groningen.

6.2 Planners, adaptation and change

Who are the planners and how does their definition of climate change adaptation affect the degree of change?

Being a planner in the city of Groningen can have different implications. For example, MUNI1 is a planner from the water department within the city of Groningen while MUNI3 is an urban planner from the green department. Both of them qualify as planners but their priorities and jobs differ. What exactly embodies a planner is observed to be challenging because the meaning has broad implications. This makes it challenging to pinpoint who the planners are within the city of Groningen. Although this research has successfully spoken to nine planners and three academics that study planning theory, defining who the planners are within the city of Groningen was challenging. This could be explained by the continuous discussion of what planners are supposed to be (Fox-Rogers and Murphy, 2016). The theory is not settled on this, which makes the demarcation of planners difficult.

The difference among the planners was also noticeable in their definitions of climate change adaptation. For example, interviewees from the waterboards and water department defined it more narrowly than the other interviewees (MUNI1; WATERH1; WATERH2). Although the difference in definitions may highlight the difference between planners, it has also been discussed that this is a characteristic of a wicked problem (Termeer et al., 2012). The degree to which factor plays a role would be challenging to determine. However, the most noticeable difference in definitions among the interviewees was the inclusion of behavioural change and institutional change (ACAD1/2; CONS1; MUNI2; WATERH3).

This difference among the interviewees also has certain implications for the types of change that are expected for climate change adaptation within the city of Groningen. There is growing number of academics that advocate transformational change to be necessary for climate change adaptation (Termeer et al., 2017; Kates et al., 2012; Wise et al., 2014; Smith et al., 2011; Rockström et al., 2009; Dow et al., 2013). However, most interviewees believed that climate change adaptation would also work if the right incremental changes would be made (MUNI1/3; WATERH1/2/3; WATERN1; HOUS1; CONS1). Incremental adaptation can be understood as making small spatial or institutional changes which maintain the status quo (Park et al., 2012). Generally, this belief was founded on the idea that the passing of time and the introduction of a specific set of adaptation policies would help institutions to adjust accordingly. However, two interviewees argued that there currently isn't a better alternative to what we have in terms of institutions (WATERH3; ACAD3). They are not wrong, as the literature is also still debating what exactly embodies transformational change (Feola, 2015).

The other interviewees were convinced that transformational change was necessary for effective climate change adaptation (MUNI2; ACAD1/2). Interestingly, one interviewee of the municipality stated that he already expected transformational change with the introduction of the Omgevingswet (MUNI2). Although he was the only one that explicitly stated the Omgevingswet as an initiator of transformational change, there were also others that were anticipating the changes that the Omgevingswet will introduce (WATERH2/3; WATERN1; HOUS1).

In conclusion, the planners appear to predominantly believe that incremental change will be enough for climate change adaptation in the city of Groningen. This would explain why adaptation measures are currently largely incremental (Wise et al., 2014). Some interviewees do anticipate considerable changes because of the Omgevingswet, which will require governmental organizations to act as one-government (WATERH3). Whether this change will actually be transformational remains to be seen. Nevertheless, the interviewees give the impression that Omgevingswet does meet the transformational characteristic of introducing something new and innovative to governmental organizations (Kates et al., 2012).

6.3 Dilemmas in planning and climate change adaptation

Which dilemmas are frequently encountered by planners within the city of Groningen and are they unique to climate change adaptation?

In the theoretical framework, dilemmas were chosen to be categorized on the basis of the argument that it would help to improve our understanding of them (Savini et al., 2015). Subsequently, this was done into three broad dilemmas: the intervention, regulation and investment dilemma. Furthermore, climate change adaptation literature presented the dilemma of maladaptation (Barnett and O'Neill, 2010; Moser and Ekstrom, 2010; Juhola et al., 2016). Unfortunately, none of the interviewees believed that any dilemmas were unique to climate change adaptation. However, considering the stage wherein climate adaptation currently is within the city of Groningen it might be that such dilemmas will be observed at a later point (MUNI2).

The intervention dilemma

The interviewees observed intervention dilemmas in relation to climate change adaptation. Interestingly, the trade-off between exclusion and impact was present but observed in other conditions than posed by the theory. This is likely caused by the institutional focus of this research, while the theory focused more on spatial intervention. The dilemmas mainly presented themselves in the municipality's ambition to further densify the city while also having the ambition to adapt to climate change (MUNI1/2/3; CONS1). The city of Groningen wants to keep up with the housing demand. However, this is likely to come at the cost of climate adaptation. For example, a further densified city makes it more vulnerable for the urban heat island effect (Carter, 2011). Furthermore, the trade-off between exclusion and impact also represented itself in the cooperation with other governmental organizations (MUNI2/3; WATERH2/3 HOUS1). Climate change does not limit itself to physical and institutional borders and overlapping or fragmented responsibilities sometimes created situations wherein a lack of cooperation negatively affected impact of certain projects (Termeer and Kessener, 2007; WATERH2).

The regulation dilemma

The regulation dilemma appeared to mainly arise from the lack of appointed ownership in the climate adaptation problem (MUNI2; WATERH2/3; CONS1). Interestingly, the degree of self-management within climate adaptation policy did not appear to create opportunism (Savini et al., 2015). Instead, some of the interviewees observed negligence within their organizations or among other stakeholders (MUNI1/2/3; WATERH1/2/3; HOUS1; CONS1). Therefore, it does not appear that the lack of regulation enables the co-evolution of space with changing circumstances (Mclaughlin, 2012). In this sense, it could be argued that climate change adaptation did create a unique version of the regulation dilemma. Namely, the lack

of regulation did not appear to introduce opportunism, but neither does it appear to provide enough protection to climate change. At this moment, the relatively low number of regulation dilemmas that were observed by the interviewees can be clearly attributed to the lack of regulation within climate change adaptation. The expected introduction of local climate adaptation policies in the future will likely change this.

The investment dilemma

Although financial resources were unanimously reported as a creator of dilemmas, they can hardly be related to a trade-off between demand or supply-led demand (Savini et al., 2015). Instead, the lack of financial resources presented dilemmas for the in- or exclusion of particular adaptive measures (MUNI1/2/3, WATERH1, WATERN1, HOUS1). However, following the reasoning of MUNI3, the shortage of financial resources has also led to more effective investment. It could be argued that these investments showed similarities to demand-led development by focusing on the local context and choosing the most effective measure for that area (Aalbers, 2013; Biesbroek et al., 2009b).

Another investment dilemma that presented itself was the trade-off between cost and risk. Some interviewees had trouble to determine when investment in adaptation was justified enough in relation to the risk that such a measure would reduce vulnerability to climate change (MUNI1/2; CONS1). This resembles the maladaptation dilemma, but it is not exactly the same because it does not include the consideration of possible ineffectiveness or even damage.

The maladaptation dilemma

Maladaptation was rarely observed as a dilemma. In fact, it was barely considered a possibility. Some interviewees considered whether adaptation costs would outweigh costs of risk (MUNI1/2; CONS1). However, this did not necessarily mean that ineffective or negative developments were considered. Only the interviewee of Sweco explicitly considered maladaptation as a dilemma (CONS1). The rare observation of the maladaptation dilemma could be explained by the belief of most interviewees that climate change adaptation will be successful with incremental changes (MUNI1/3; WATERH1/2/3; WATERN1). This shows a tendency to an optimistic view of climate change adaptation, which could also explain why ineffective or damaging measures are not really considered.

6.4 Institutional barriers and opportunities for climate change adaptation

What do planners observe to be the institutional barriers and opportunities for climate change adaptation in the city of Groningen?

The interviewees observed a number of institutional barriers and opportunities in the adaptation process. To make sense of them, the barriers and opportunities have been categorized according to the conceptual model. Namely, the categories of agency attributes of institutions, interactions attributes of institutions and inherent attributes of institutions (Oberlack, 2017). Furthermore, the barriers and opportunities have been reintegrated from the results to stimulate a more in-depth discussion.

Agency attributes of institutions

The agency of institutions presented barriers and opportunities in terms of actor eligibility, responsibility and control. Barriers were observed in the categories of actor eligibility and responsibility. The observed barrier within actor eligibility stems from a responsibility barrier, the housing associations did not see any responsibility in climate change adaptation (MUNI3). The interviewees predominantly observed fragmented and overlapping responsibilities (MUNI1/2/3; WATERH1/2; HOUS1; ACAD1/2). A number of interviewees attributed this to the lack of ownership within the DPRA and NAS (WATERH3; MUNI2). However, the interviewees also gave the impression that the integrative way of working that is necessary for climate adaptation requires a change of mindset and adjustment within the institutions that are not present yet at this moment (MUNI1/2/3; WATERH1/2; HOUS1; ACAD1/2). This clearly reflects a degree of rigidity within the institutions (Galaz, 2005). Not in terms of biophysical or socioeconomic status, but rather in the sense of feeling responsible and accountable for a problem like a climate change adaptation. As a consequence, this is observed to create higher transactional costs and negatively impacts the effectivity of climate adaptation (Larsen et al., 2012; Rouillard et al., 2012).

The interviewees also observed opportunities in the categories of actor eligibility, responsibility and control. The broad involvement of stakeholders was mentioned by a number of interviewees and this helps to raise the awareness on climate change adaptation (Lövbrand, 2011). MUNI2/3 actively worked on broad involvement and maintained on-going conversations with other stakeholders. This will help to integrate the institutions and improve coordination within the city of Groningen in the long-term (Huntjens et al., 2012). Furthermore, it also provides opportunities to overcome responsibility barriers. When coordination among the institutions improves, it will also benefit the coordination of responsibilities (Sharma et al., 2012). Nevertheless, better regulation from the national level would help the most (Johula and Westerhoff, 2011). Finally, control is observed as a significant opportunity to the city of Groningen (MUNI1/2/3; ACAD1/2/3; CONS1;

WATERH1). The new coalition has green ambitions and for the first time in history, an alderwoman has climate adaptation in her portfolio. This provides opportunities to stimulate adaptation by showing willingness. Furthermore, it helps to emphasize the expected responsibilities among stakeholders by means of implementing accountability mechanisms (Storbjörk and Hedrén, 2011; Tyler et al., 2007).

Interactions attributes of institutions

The interactions attributes of institutions presented the most barriers and opportunities to climate change adaptation within the city of Groningen. Most importantly, social connectivity presented itself as a key barrier. Every interviewee observed this barrier and predominantly attributed it to a lack of coordination, silos and loose ties (MUNI1/2/3; WATERH1/2/3; WATERN1; ACAD1/2/3; HOUS1; CONS1). In particular, the interviewees of the municipality observed silos internally (MUNI1/2/3). This hurts effective decision-making and creates higher transaction costs than is necessary (Bergsma et al., 2012; Biesbroek et al., 2010; Cots et al., 2009). Nevertheless, there also noticeable opportunities in terms of social connectivity. A number of interviewees were actively involved in outreach within and outside of their organization (MUNI1/2/3; WATERH1; WATERN1). This includes on-going conversations with stakeholders, symposia, regional meetings and adaptation core-teams. The efforts of these individuals help to create key opportunities for climate change adaptation (Larsen et al., 2012; Storbjörk and Hedrén, 2011). For example, raising awareness among the stakeholders internally and externally creates a sense of urgency. Furthermore, these exchanges allow the stakeholders to interact more frequently and to improve on their communication, which also benefits adaptation (Glaas et al., 2010).

Conflict was also observed to create barriers and this was attributed to institutional inconsistencies (MUNI1/2/3; WATERH1/2/3; WATERN1; CONS1). Although the interviewees did observe linguistic and cultural differences between the municipality and waterboards, the largest discrepancy presented itself in the contradictory approaches of the waterboards (MUNI1/2/3; WATERH2/3; WATERN1). Hunze and Aa's has chosen a reactive position in climate adaptation, while Noorderzijlvest chooses to be proactive. This is particularly relevant to the city of Groningen because both waterboards are responsible for different parts of the city. As of yet, this has not actually caused conflict within the city. However, this may create problems once more adaptation will be implemented. Fortunately, the previously discussed efforts of individuals within the organizations also provide opportunities to discuss these inconsistencies and to prevent conflicts (Larsen et al., 2012; Storbjörk and Hedrén, 2011).

The interviewees also observed social learning as a barrier in terms of limited knowledge coordination (MUNI1/2/3; HOUS1; CONS1; WATERN1). As a consequence, decision-making was less informed than it could be and this negatively affects climate adaptation (Demeritt and Langdon, 2004). The GCECA and universities can help to share and create knowledge, which is reported to take place to a degree already (MUNI3; HOUS1; ACAD3). This will contribute to the strengthening of linkages and creates opportunities to make decision-making more effective (Westerhoff and Juhola, 2010). Additionally, the previously discussed exchanges within and among institutions also help to create opportunities for learning on beneficial adaptation measures.

Finally, accountability also presented itself as a barrier. This creates situations where no one feels accountable for climate adaptation (WATERH2/3, HOUS1). This barrier is closely connected to the responsibility barrier because they are both caused by the lack of ownership within climate adaptation and rigid institutions that need time to adjust to these new responsibilities (Galaz, 2005). However, the new coalition within the municipality is improving these accountability mechanisms with newly written policies (MUNI2/3; HOUS1). A clear set of laws that monitors, evaluates and rewards adaptation will certainly provide opportunities to further climate adaptation efforts (Inderberg, 2011).

Inherent attributes of institutions

The inherent attributes of institutions presented a number of barriers and opportunities within the city of Groningen. In terms of barriers, the inherent attributes of institutions are difficult to tackle. Political terms and development strategies do often not align with the temporal and spatial scope of climate change (Arnell and Delaney, 2006). The interviewees underlined this, who reported the temporal scale to be a barrier within the city of Groningen among institutions. This predominantly expressed itself in the contradictory short-term ambition to meet the housing demand versus the long-term ambition of adaptation measures (MUNI2; CONS1; ACAD1/2/3).

Another notable barrier is the adaptiveness of institutions. This is closely connected to the barriers found within the interaction's attributes of institutions, which represent challenges to raising awareness and creating a sense of urgency (MUNI1/2/3; WATERN1; HOUS1; ACAD1/2). It is difficult to make changes when people or procedures have worked in a specific way for years (MUNI1). Most institutions were created long before climate change adaptation was relevant and changing how they work is difficult due to path-dependency (Daniell et al., 2011). Interestingly, the upcoming national Omgevingswet is expected to provide opportunities to stimulate adaptiveness and ultimately benefit adaptation measures (MUNI2/3; WATERH2/3; CONS1). The Omgevingswet will require governmental

organizations to act as a single-government for citizens, wherein the organizations solve discrepancies behind the scenes without bothering the citizen. This could both help to maintain stability among the institutions and provide opportunities to climate adaptation by using nested rule systems (Herrfardt-Pähle and Pahl-Wostl, 2012). Nevertheless, one interviewee expressed that the Omgevingswet is likely to be disruptive in the short-term because governmental organizations are not prepared enough for it yet (WATERH2).

Finally, the formality of institutions is the predominant cause of the barriers to responsibility and accountability. The national policies of the DPRA and NAS do not point towards an owner of the adaptation problem (WATERH3; MUNI2). The lack of these formalities causes less commitment and prioritization in climate change adaptation (Krysanova et al., 2010). Although climate change adaptation is incorporated in The Next City, adaptation largely comes down to individual initiative (MUNI1/2/3; HOUS1). Fortunately, the new coalition in the municipality and the upcoming introduction of new climate adaptation policies are expected to benefit adaptation (MUNI2). Furthermore, the Omgevingswet could help to introduce more formal accountability mechanisms in the long run.

6.5 The role of the planner in the adaptation process

What is the role of the planner in the adaptation process and how does it help to overcome barriers and create opportunities within the city of Groningen?

Determining the role of the planner within climate change adaptation has proven to be a difficult task. In practice, planning represents a wide variety of jobs and this was also the case with the interviewees. For example, MUNI3's role is an urban planner with an internal focus on climate change adaptation while MUNI2 is an ecology planner with an external focus on climate change adaptation. This difference of an internal and external focus can already introduce different perspectives on the role of the planner in the adaptation process. Considering that the other interviewees worked at waterboards, a housing association and a consultancy company this further complicates describing a particular role of the planner within the adaptation process. Nevertheless, there are a few broader findings that give indications of what the role of the planner within climate change adaptation might be.

Interestingly, the interviewees unanimously stated that climate change had a considerable impact on their jobs. Furthermore, a number of them had jobs that specifically involved climate change adaptation as part of their responsibilities (MUNI1/2/3; WATERH3; WATERN1; CONS1). This underlines that planning is actively considering its role within society and evolves as circumstances change (Fox-Rogers and Murphy, 2016). To gain further understanding of the role of the planner within climate change adaptation, the interviewed academics were particularly helpful. They described planning as a discipline that breaks through the sectoral walls of organizations and a discipline that connects stakeholders' interests and knowledge to stimulate an integrative approach to climate change adaptation (Hurlimann and March, 2012) (ACAD1/2). This was clearly reflected in the interviews with the planners (MUNI1/2/3; WATERH1/2/3; WATERN1; HOUS1; CONS1).

The description of the academics also indicates how planners help to overcome barriers and create opportunities within the city of Groningen. Most interviewees were actively involved with climate change adaptation by making stakeholders aware and involved, improving on communication and coordination internally and externally and finding mutual adaptation benefits (MUNI1/2/3; WATERH1/2/3; WATERN1; HOUS1; CONS1). By doing this, planners integrate a diverse set of systems and interests and pave the way forward in finding solutions for the collective concern that is climate change (Hurlimann and March, 2012). Therefore, Allemendinger (2017) is right that planning does not necessarily provide solutions but experience with the uncertainty of climate change adaptation.

7. Conclusion

This chapter will conclude the findings of the research and thereby answer the main research question.

What are the dilemmas, institutional barriers and opportunities that planners are confronted with when tackling climate change adaptation as a wicked problem within the city of Groningen?

This research set out to uncover the dilemmas, institutional barriers and opportunities that planners face in climate change adaptation. The city of Groningen has proven to be an interesting location to study this. Interestingly, the institutions relevant to the city of Groningen appear to be at the dawn of incorporating climate change adaptation as a fact of life. This is, without a doubt, fuelled by the ambition of the municipality to pioneer in climate change adaptation. However, climate change adaptation is relatively new to the local institutions and the dilemmas, barriers and opportunities this introduces are as follows.

The most frequently observed dilemma was the lack of financial resources. All of the planners observed it, and this meant that they had to find a balance in the trade-off between impact and cost (MUNI1/2/3; WATERH1; WATERN1; HOUS1). Unexpectedly, this did not align with the theory on investment dilemmas which refers to a trade-off between demand or supply-led development (Savini et al., 2015). A number of the interviewees also observed intervention dilemmas (MUNI1/2/3; WATERH2/3; HOUS1; CONS1). The ambition of the municipality to further densify the city, while also having the ambition to adapt to climate change is largely perceived to be the cause of these dilemmas (MUNI1/2/3; CONS1). This requires planners within the city of Groningen to find a balance between meeting housing demands for its growing population and the efforts in climate change adaptation.

The interviewees solely observed the regulation dilemma due to a lack of ownership within the climate change adaptation problem (MUNI2; WATERH2/3; CONS1). Strangely, the observed lack of rules did not introduce opportunism (Savini et al., 2015). Instead, the interviewees observed negligence among the stakeholders (MUNI2/3; WATERH1/2/3; HOUS1; CONS1). Finally, none of the interviewees observed any of the dilemmas they were confronted with as unique to climate change adaptation. This can be attributed to the fact that almost none of the interviewees acknowledged the possibility of maladaptation. Only the interviewee of Sweco considered dilemmas that could be introduced by maladaptation (CONS1). The current stage of where the city of Groningen is in terms of climate change adaptation is likely to contribute to this as well.

In terms of barriers and opportunities, the most important category is the interactions attributes of institutions. The barriers and opportunities that presented itself in this category

are either directly or indirectly connected to the barriers and opportunities in the other categories. The most important barriers and opportunities were observed within social connectivity. This considers situations wherein a lack of coordination, loose ties and silos influence decision-making and determines transaction costs (Bergsma et al., 2012; Biesbroek et al., 2010; Cots et al., 2009). Subsequently, they are observed to have a significant impact on the negotiation of responsibilities, accountability, rigidity among and within institutions, conflicts and mutual benefits. If the coordination and communication of the institutions would improve internally and externally, then these barriers would likely be easier to overcome, and opportunities could be better realized (Glaas et al., 2010).

Interestingly, the interactions attributes of institutions is a category of barriers and opportunities that enables planners to play a significant role in tackling a wicked problem like climate change adaptation. By breaking through the sectoral walls of the institutions and connecting stakeholders' objectives and interests, planners can create an integrative approach towards climate change adaptation (Hurlimann and March, 2012)(ACAD1/2). Subsequently, this may positively influence the barriers and opportunities within the other categories because they have shown to be interconnected. Nevertheless, it should also be considered that planners do not offer a panacea to climate change adaptation. The planners are a part of the institutions and this became evident when the interviewees predominantly expressed that incremental change would suffice for climate change adaptation (Zellner and Campbell, 2015) (MUNI1/3; WATERH1/2/3; WATERN1; HOUS1; CONS1). By making small spatial and institutional adjustments the status quo is maintained (Park et al., 2012). However, the literature advocates that transformational change is necessary for climate change adaptation to be successful and it appears that not all the interviewees share this perspective yet (Termeer et al., 2017; Kates et al., 2012; Wise et al., 2014; Smith et al., 2011; Rockström et al., 2009; Dow et al., 2013).

Relevance to planning theory and practice

This research offered a comprehensive overview of relevant topics to planning theory and practice. Climate change is one of the biggest challenges of our lifetime and institutions are crucial for climate change adaptation to succeed (Oberlack, 2017). Planners are a part of these institutions and they engage with stakeholders to address wicked problems like climate change adaptation (Allmendinger, 2017). Therefore, exploring the role of the planner and how they deal with dilemmas, barriers and opportunities within climate change adaptation offer valuable insights to planning theory.

This research highlights climate change adaptation within the city of Groningen. Cities are particularly relevant to climate change research because they are the most vulnerable to its

extremes (Carter, 2011). Therefore, gaining insights into what hinders or stimulates climate change adaptation within the city of Groningen is particularly relevant. Additionally, this research offers insights to planners on the institutional barriers and opportunities that can be encountered with climate change adaptation in a city like Groningen. This research has helped to expose institutional barriers and opportunities that the institutions and planners might have previously been unaware of. Furthermore, the research explains the interconnectedness of the different institutional barriers and opportunities. This allows the planners and the institutions within the city of Groningen to look for changes that address a number of them at the same time.

Recommendations

Climate change adaptation was observed to be relatively new to the governmental organizations within the city of Groningen. The interviewees were actively involved with climate adaptation but organizational policies and a clear formulation of goals appear to be lacking at this moment. Although there were interesting developments that deserved studying, doing this research again at a later point in time will likely lead to more comprehensive findings. Climate change adaptation within the city of Groningen will then have grown out of its initiation phase. Therefore, it would be interesting to see whether this has affected the role of the planner and the observed dilemmas, barriers and opportunities.

Another interesting recommendation would be to study the effects of the Omgevingswet on institutions in relation to climate change adaptation. Multiple interviewees referred to the Omgevingswet and anticipated that it will have a noticeable influence on climate change adaptation. The implications of the Omgevingswet and the role of the planner in climate change adaptation would be an interesting topic to explore. Finally, it would also be interesting how the city of Groningen compares to other cities that are involved in climate change adaptation. Observing the similarities and differences may create interesting results in the contextual dependence of climate change adaptation. For example, such research may reveal what contextual factors contribute to certain barriers or opportunities. Vice versa, it may also reveal certain barriers or opportunities that are less dependent on contextual factors.

8. Reflection

This chapter will reflect on the personal process, the gathered data and outcomes of this research.

The personal process

Both the supervisor and the author were familiar with the city of Groningen, which was determined as the scope. After the scope was determined, it was time to create a theoretical framework. This was challenging to do because it was difficult for the author to decide on relevant or irrelevant theory. A more thorough selection of theories would certainly have helped to create a sharper focus within the research. Most candidates were willing to free up some time at short notice. Determining who to in- or exclude as candidates for the interviews was difficult due to indecisiveness on what makes someone a planner. Nevertheless, in the end, a clear set of candidates has been spoken to. The only regret is the skewed amount of interviewees that have been spoken to among the waterboards. The author interviewed three employees of Hunze en Aa's were interviewed whilst interviewing only one of Noorderzijlvest due to unavailability.

Gathered data

Retrospectively, semi-structured interviews were the right choice. A quantitative approach would have not revealed the in-depth intricacies that are a part of climate change adaptation. During the first interviews, it was observed that a particular question wasn't understood very well. The interviewer attempted to correct this by better explaining the question in later interviews, but this proved to be difficult. Better preparation could have helped to prevent this. For example, by doing a test interview with a relative or friend.

The aim of the interviews was that the candidates would feel comfortable to express their opinions in a safe environment. While the author feels that this has been achieved, it cannot be guaranteed. The interviews were held at the location of the interviewee's choice. Without exception, this led to the author visiting their place of work. The interviewees often chose locations that were specifically designed to dampen volume, which provide a somewhat disclosed setting of discussion. However, they are still in a place where people could walk by. In some instances, it would have been better to request a more private area to guarantee that they would express their opinions honestly. Then again, the author did not experience that the candidates attenuated their opinions.

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10. Appendices

9.1 Appendix 1: Interview guides

Interview guide for the planners

Algemeen

1. Kunt u mij kort wat vertellen over uw functie en hoe deze zich verhoudt tot klimaatadaptatie in Groningen?
2. Wat verstaat u onder klimaatadaptatie?
3. Welke rol speelt de gemeente Groningen in klimaatadaptatie?
4. Welke stakeholders zijn betrokken bij klimaatadaptatie in Groningen?

Institutionele uitdagingen

5. Welke institutionele uitdagingen spelen er bij klimaatadaptatie in Groningen? (Bijv. fragmentatie, verantwoordelijkheid, conflicten)
6. Wat denkt u dat de oorzaken zijn van de voorheen genoemde uitdagingen? Komen deze alleen voor bij klimaatadaptatie?
7. Denkt u dat de voorheen genoemde stakeholders sommige uitdagingen anders ervaren? Kunnen zij deze ook zien als kansen?
8. *Indien ja*, hoe denkt u dat het verschil in de ervaring van uitdagingen en kansen te verklaren is?

Verandering

9. Hoe wil de gemeente Groningen in de toekomst de institutionele uitdagingen bij klimaatadaptatie overkomen?
10. Zijn er in het verleden al eens dingen veranderd? Was de verandering succesvol?

De rol van de planner

11. Heeft klimaatverandering/klimaatadaptatie invloed gehad op uw rol?
12. Heeft klimaatadaptatie u in uw rol geconfronteerd met dilemma's waarin keuzes gemaakt moesten worden? Zo ja, welke en hoe heeft u ze benaderd?
13. Op welke manier hebben deze dilemma's het adaptatieproces beïnvloed?
14. Welke veranderingen denkt u dat er vanuit uw rol nodig zijn om het adaptatieproces te verbeteren?
15. Passen de voorheen genoemde veranderingen allemaal binnen de huidige benadering van het nationale en lokale klimaatadaptatie beleid?
16. *Indien nee*, Denkt u dat er radicale veranderingen nodig zijn om klimaatadaptatie effectiever te maken? Welke?

Interview guide for the academics

1. How urgent do you believe climate change adaptation to be?
2. What is your opinion on the role (e.g. facilitation, initiation) of the municipality of Groningen in regard to climate change adaptation?
3. Do you think there are unique characteristics that are interesting in relation to climate change adaptation and Groningen?
4. How do you think the municipality of Groningen is doing in adapting to climate change?
5. What would you say are the challenges to climate change adaptation in Groningen?
6. What do you believe to be the institutional challenges to climate change adaptation in the municipality of Groningen (fragmentation, responsibility, values) ?
7. What do you believe to be the causes of the institutional challenges to the adaptation process?
- 7b. Do you think these are unique to climate change adaptation and the municipality of Groningen?
8. What changes do you believe to be necessary for the municipality of Groningen to overcome the institutional challenges to climate change adaptation?
- 8b. Do you believe that the necessary changes are realistic within the current institutional context in Groningen? Is it possible that some of the challenges cannot be overcome?

9.2 Appendix 2: Codebook

Category	Code	Sub-code	Explanation
Barriers and opportunities	<i>Agency attributes</i>	Actor eligibility	What includes or excludes stakeholders in the adaptation process
		Responsibility	Unclear or clear responsibilities for adaptation
		Control	What control hampers of benefits adaptation
	<i>Interaction attributes</i>	Social connectivity	How social connectivity issues like lack of coordination influence adaptation
		Conflict	How conflicts arise and are resolved
		Social learning	The exchange of knowledge and information
		Accountability	Formal and informal accountability mechanisms
	<i>Inherent attributes</i>	Temporal and spatial scale	How time and space affect adaptation
		Adaptiveness	The degree in which institutions can adapt
		Formality	Formal and informal commitment to adaptation
Role of the planner	<i>Role of the planner</i>	Definitions	Differing definitions of adaptation
		Uncertainty	When is the planner confronted with uncertainty
		Stakeholders	How does the planner manage stakeholders
		Change	What type of change does the planner think adaptation needs
		Cooperation	How does the planner promote cooperation or not
		Urgency	How does the planner think about the sense of urgency himself and around him/her.
Dilemmas	<i>Dilemmas</i>	Intervention	The trade-off impact vs exclusion
		Regulation	The trade-off self-management vs protection against opportunism
		Investment	Supply-led development vs demand-led development
		Maladaptation	Ineffective or negative consequences to CCA.
Contextual information	<i>Contextual information</i>	Role waterboard	Their role in scenarios or explanations
		Role municipality	Their role in scenarios or explanations
		Context	Contextual knowledge